Lectures on Housing Economics

A Russian Text

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Chapter 1

Introduction

This textbook is intended to serve as an introduction into the housing economics for the higher school students and all other persons interested in this topic. It covers six major topics, which are briefly described below.

Chapter 2 provides an introduction to urban economics. It shows the mportance and main principles of the urban economics. It discusses the emergence and development of cities and describes the urbanization process. Using the theory of central places of Christaller and Lösch it explains the large differences existing between city sizes. In addition, it takes advantage of the Alonso-Mills-Muth model of land use in the city in order to explain the internal structure of cities. Finally, it presents the evidence of the population and employment density gradient.

In chapter 3, the main general and specific features of the housing market are presented: heterogeneity, immobility, and expensiveness. Moreover, a stock and flow model of the housing market is introduced that illustrates the interplay of the housing supply and demand as well as the short-run rigidity of supply. In addition, it discusses the housing vacancy and affordability. The narrative is supported by a rich evidence about the housing market in Russia and abroad.

Chapter 4 focuses on the valuation of the real estate . Alternative approaches to valuing the heterogeneous and immobile good "housing" are presented. In more detail the techniques stemming from the sales comparison method are considered, such as stratified valuation method, repeat-sales methods of Bailey and Case-Schiller, and hedonic regression. These isolate the impact of structural and locational factors on the housing price from that of the inflationary price increases. Finally, the models capturing the spatial dependence between housing prices are introduced.

In chapter 5, the issue of speculative housing price bubbles is considered. It provides the definition of speculative bubbles as large and long lasting decoupling between the actual and fundamental prices. The chapter shows the importance of the early warning systems, which are used to predict the build-up of speculative price bubbles. Alternative methods of identifying speculative housing price bubbles, such as *ad hoc*, fundamental value regressions, and explosive root tests are presented. In addition, various methods of predicting speculative housing price bubbles —signalling approach and discrete-choice models— are considered. Finally, non-linear models for identification and prediction of speculative bubbles —threshold autoregression, smooth transition autoregression, and Markov-switching regression— are discussed.

Chapter 6 concentrates on the housing tenure choice. It starts from defining the notion of tenure and describing various tenure types. Then, the focus is made on the dichotomy between the owner-occupied and tenant-occupied housing. In particular, the importance of the homeownership as shown and its advantages and disadvantages from the standpoint of individuals and society are compared. The chapter considers theoretical models explaining the choice between the owner-occupied and rental housing, which are based on the notion of the user cost. The chapter concludes with the analysis of the spatio-temporal variation of the homeownership rates.

Chapter 7 is devoted to the governmental intervention in the housing market. It thoroughly discusses objectives and tools of such intervention. In this chapter, the indices measuring the intensity of restrictive governmental housing market regulations are presented. Finally, the indices are used to trace the evolution of the rental regulation intensity worldwide during the last century.

In the end of each chapter, a set of control questions and discussion topics is presented. In addition, a list of key terms is provided.

The material presented here has been used in 2018–2019, when the author has had a nice opportunity to teach the course of housing economics by the undergraduate students at the NRU HSE in St. Petersburg. The textbook contains lots of empirical evidence to illustrate theoretical concepts. Particular weight is placed on discussing the Russian experience.

Recommended reading

English source	Russian translation
Urban and housing economics	
Brueckner (2011)	
O'Sullivan (2012)	О'Салливан (2002)
McDonald and McMillen (2011)	
Housing and real estate economics	
DiPasquale and Wheaton (1996)	
McKenzie et al. (2011)	
Urban studies	
Ellard (2015)	Эллард (2019)
Gehl (2013)	Гейл (2012)
Jacobs (2016)	Джекобс (2011)
Speck (2012)	Спек (2015)
Steel (2013)	Стил (2014)
Vuchic (2017)	Вучик (2017)

Chapter 2

Urban economics

2.1 Introduction

In this chapter, we introduce basic notions of the urban economics. The urban economics is a theory about the location choice made by firms and households. It answers the following questions:

- Why do the cities emerge?
- Why do cities differ in terms of size?
- What determines the internal structure of the cities?

The urban theory focuses on the cities, which are an important object of research, given their population and contribution to the world economic growth.

Section 2.2 defines the notion of city. In section 2.3, the origins of cities are explored. Section 2.4 illustrates the process of growth of the urban population known as urbanization. Section 2.5 uses the theory of central places in order to explain why city sizes are so different: from little towns to huge megacities. In section 2.6, the internal structure of cities and location choices made by firms and households. Section 2.7, shows the dependence between location (distance from the city center) and population and employment density.

2.2 What is a city?

The question of what makes a settlement an urban area is not an easy one. Different criteria can be employed in order to define a city. The most typical are the size of population, the population density, and the structure of economic activities carried out in the settlement.

Population size. In Russia, a settlement can be declared city, if it has population of 12,000 and more and 85% of its population are not occupied in agriculture.[1] Currently, urban settlement status is determined by the legislation of federal subjects.

[1] This definition is provided by the Decree of Sep. 12, 1957 *On attributing settlements to the category of*

In many countries, a settlement must have some minimum population in order to be treated as a city. Table 2.1 reports the minimum required population for several countries.

Table 2.1: Definition of city: country-specific population thresholds

Country	Citizens
Denmark and Sweden	250
Australia and Canada	1000
France and Israel	2000
Mexico and USA	2500
Azerbaijan and Georgia	5000
Kyrgyzstan, Moldova, Ukraine, etc.	10,000
Russia	12,000
Japan	30,000

The minimum population varies a lot: from as few as 250 persons in Denmark and Sweden to as many as 30,000 in Japan. In practice, despite the existence of the official minimum threshold, the population of the cities can be well below it. Figure 2.1 and Table 2.2 report the descriptive statistics of the distribution of the population of Russian cities and towns (*goroda*) as well as urban villages (*posyolki gorodskogo tipa*) in 2017. In general, the population in cities and towns is much larger than that of the urban villages. It also mostly exceeds 12,000. However, the lower tail of distribution lies below 1000 persons.

According to Table 2.2, there are 1112 cities or towns and 1183 urban villages in Russia. The

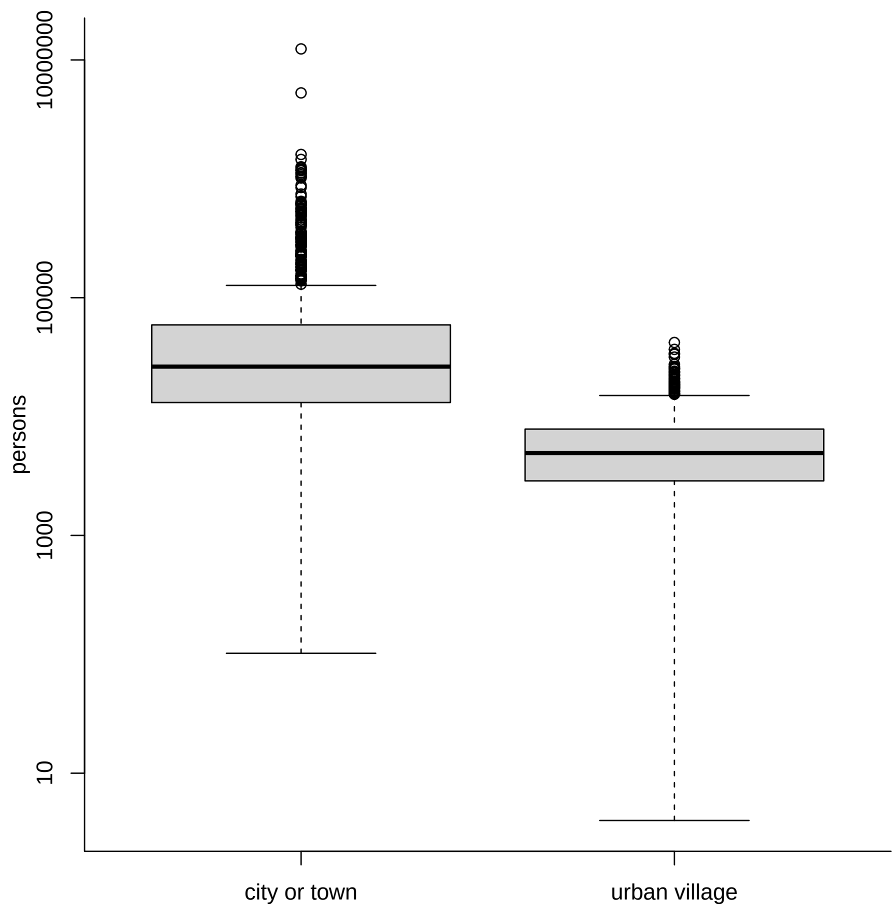
Table 2.2: Size of Russia's urban areas, 2017

Statistic	City or town	Urban village
Number of areas	1112	1183
Minimum, persons	102 (Innopolis, Tatarstan)	4 (Kozhym, Komi Republic)
1st quartile, persons	13,130	2876
Median, persons	26,300	4934
Mean, persons	91,770	6061
3rd quartile, persons	59,020	7846
Maximum, persons	12,380,000 (Moscow)	41,980 (Nakhabino, Moscow reg.)

median population of cities or towns is 26,300, which is more than twice as large as the minimum threshold. However, almost one-fourth of all cities and towns are close to or below that lower boundary. The smallest and probably the youngest town Innopolis has slightly more than 100 inhabitants, while the smallest urban village Kozhym has only four residents.

cities, worker and resort townships (О порядке отнесения населённых пунктов к категории городов, рабочих и курортных посёлков). Interestingly, its predecessor — the Decree of September 15, 1924 *General provisions on urban and rural settlements* (Общее положение о городских и сельских поселениях и посёлках) imposed similar but somewhat lower restrictions: 1000 persons and at least 75% of population occupied in the non-agricultural production. Moreover, different subjects of Russian Federation have their own definitions of a city, see Фролова (2016).

Figure 2.1: The size of Russia's urban areas, 2017

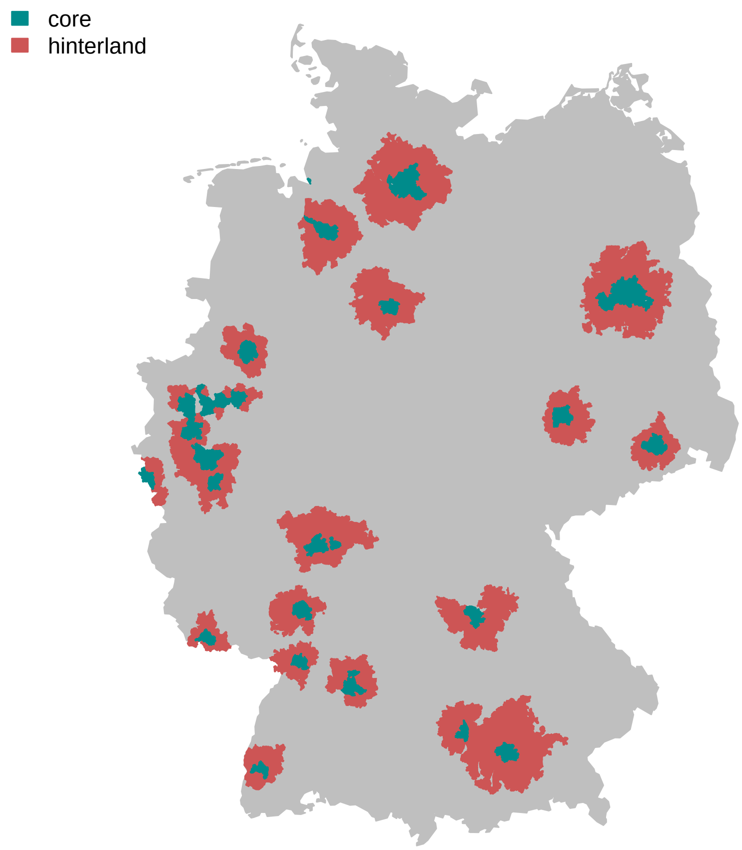


Source: Rosstat and own calculations.

Population density. Given the ambiguity of the population size as criterion for defining a city or a town, other indicators are suggested. For example, the Organisation for Economic Co-operation and Development (OECD) suggested using the population density in order to identify the so-called functional urban areas (FUA), which are its proxies for cities (OECD, 2013). The OECD uses a three-step algorithm in order to delineate the FUAs. In the first step, the urbanized areas, or "urban high-density clusters", are defined over the national territory, ignoring administrative borders. For this purpose, the national territory is divided by a continuous grid with a cell size of 1 km^2. The urban core then is identified as a high-density cluster of contiguous grid cells of 1 km^2 with a density of at least 1,500 inhabitants per km^2 (1000 in Canada and USA). In the second step, the non-contiguous cores belonging to the same functional urban area are connected. This is done in order to account for the polycentric cities. Their belonging to the same FUA is determined based on the commuting intensity between cores. If many people are commuting between the neighbor cores, then all these cores are thought to belong to the same FUA. In the third step, the urban hinterlands are identified. These are defined as all municipalities with at least 15% of their employed residents working in a certain urban core.

Figure 2.2 shows an example of the FUAs as determined by the OECD for the case of Germany. Green color denotes the urban cores of the FUAs, while the red areas stand for their hinterlands. It can be seen that the FUAs go beyond the administrative boundaries of the officially defined

Figure 2.2: Functional urban areas of OECD in Germany



Sources: OECD and own representation

cities. For example, the largest FUA in the east of Germany unifies Berlin, Potsdam, and their immediate surroundings. Its hinterland stretches for dozens of kilometers around the core. People living in these areas commute every day to the core, where the jobs are concentrated and return to their towns and villages, where the housing rents and prices are lower.

Economic activities and other criteria. Махрова and Кириллов (2015) investigate the urbanization in Russia using alternative criteria, such as the proportion of non-agricultural activities and availability of sewerage. The latter is used as a proxy for an urban life style. They find that about one-third of Russian small urban settlements are rather rural. It is concluded that Russia is a country of big cities. While smaller cities are more like big villages, the middle cities are plagued by depopulation, which leads to an increase of number of smaller towns at the expense of the middle-sized towns.

2.3 Why do cities emerge?

What are the reasons calling the cities into existence? The first known cities were founded in 8th millenium BC, that is, 10,000 years ago (Jericho in present-day Israel with a population of about 2000), in 7th millenium BC (Çatalhöyük in present-day Turkey, with a population of 5000), and in the second half of the 4th millenium BC (Uruk in Southern Mesopotamia, nowadays Irak, with a population of approximately 50,000) (O'Sullivan, 2008). Symptomatically, these cities emerged during the Agricultural revolution and in the so-called Fertile Crescent in the Middle Asia, where early transition from hunting and gathering to the agriculture took place.

One of the indispensable prerequisites for the development of cities is a surplus of agricultural production. The urban residents specialize in industrial production, trade, and other non-agricultural activities. Therefore, agricultural workers must produce enough not only to satisfy their own needs, but also to feed the inhabitants of cities. Moreover, the cities must offer economic benefits in order to offset for their evident costs: high land prices, congestion, and pollution.

Here, we will consider a purely market-based model of a city creation and growth, leaving aside all non-economic reasons. In a purely agricultural economy, no cities are expected to emerge. The model of such an economy is based on the following assumptions. First, there only two production factors: land and labor. Second, all people have identical productivity. It means that every person produces in one hour the same output as any other person. Third, there are no scale economies: the agricultural production has constant returns. In other words, if the inputs of labor and capital double, the production also doubles. Fourth, there are no other means of transportation as the one's legs. Hence, the travel time is identical for everybody, since all (healthy) people are walking with a speed of 4 km/h.

What gives rise to the emergence of cities? The cities can only appear, if some or all of the assumptions of the agricultural economy model are violated. First, thanks to the comparative advantages the trade can emerge. The economy must not be autarkic anymore — everybody can concentrate on the production of goods and services in which he has comparative advantages and exchange them for other goods and services produced by those who possess the corresponding comparative advantages. Second, the existence of scale economies contributes decisively to the formation of cities. The scale economies in transportation (e.g., invention of a wheel) allow an increase in the spatial extension of trade, while those in production (e.g., an invention of water mills) lead to the concentration of production. Thus, production is concentrated in some sites, which are for some reason beneficial for the production (proximity to a river or a sea haven, intersection of roads, availability of minerals, etc.), and can serve a large area, where agricultural products and raw materials are produced to be exchanged at the production site for the urban products. Third, if the physical proximity of producers facilitates innovation and learning (e.g., the universities, which attract many students), then individual producers will cluster together and, thus, generate a city. Fourth, a collective consumption of some public good that requires a physical proximity of consumers can also lead to a creation of cities. For example, religious practice can stimulate the development of cities as soon as the small village shrines, where earthen gods are worshiped, are replaced by large temples, where a specialized caste of priesters worship celestial gods (Mumford, 1961).

2.4 Urbanization

Urbanization is the process of an accelerated population growth in the urban areas. Urbanization rate denotes the share of population living in the urban areas.

Figure 2.3 depicts the urbanization process by countries between 1950 and 2010. The darker the color the higher the share of urban population in the country. It can be seen that at the beginning of the period the most urbanized countries were in Australia, Europe, North America, and in part in South America. Over the time, more and more countries become urbanized.

Figure 2.4 shows the growth of the world rural and urban between 1960 and 2017. Over the whole period, the urban population grew at a much higher rate than the rural one. By 2007, both populations became equal. Since then, more than a half of the world population lives in urban areas.

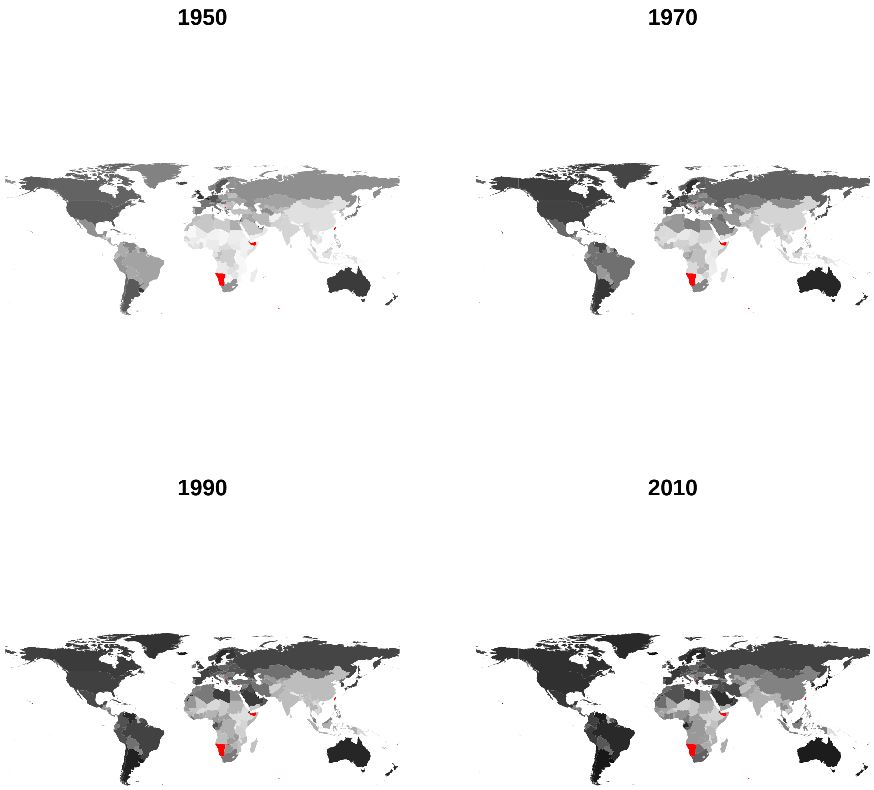
Figure 2.5 illustrates the urbanization process in Russia between 1897 and 2010. In the late 19th century, the share of urban population was about 15%. By 1939, it increased up to 35%. Only after World War II, the urban population in Russia exceeded the rural one. By the end of the Soviet period, the urbanization rate attained over 70%. Since then, it remains at the same level.

The population of individual cities, especially of the large ones, substantially increased. Figure 2.6 depicts the population change in St. Petersburg —the former capital of the Russian Empire and the second largest city of the Russian Federation— between 1764 and 2015.

The population of St. Petersburg increased from about two million at the eve of World War I to more than five million 100 years later. Due to the city's turbulent history, this evolution was not smooth. During the Russian Civil War, World War II, and in the early 1990s, the population drastically decreased. While the first two decreases were associated with large-scale war events, the last depopulation episode took place during peaceful times and can be explained by a very tough transition from the centrally planned economy to the market one.

The population growth can be decomposed into two components: growth of the population and growth of the administrative city boundaries. As seen in Figure 2.7, the territory of St.

Figure 2.3: Urbanization in the world, 1950–2010



Source: United Nations World Development Indicators.

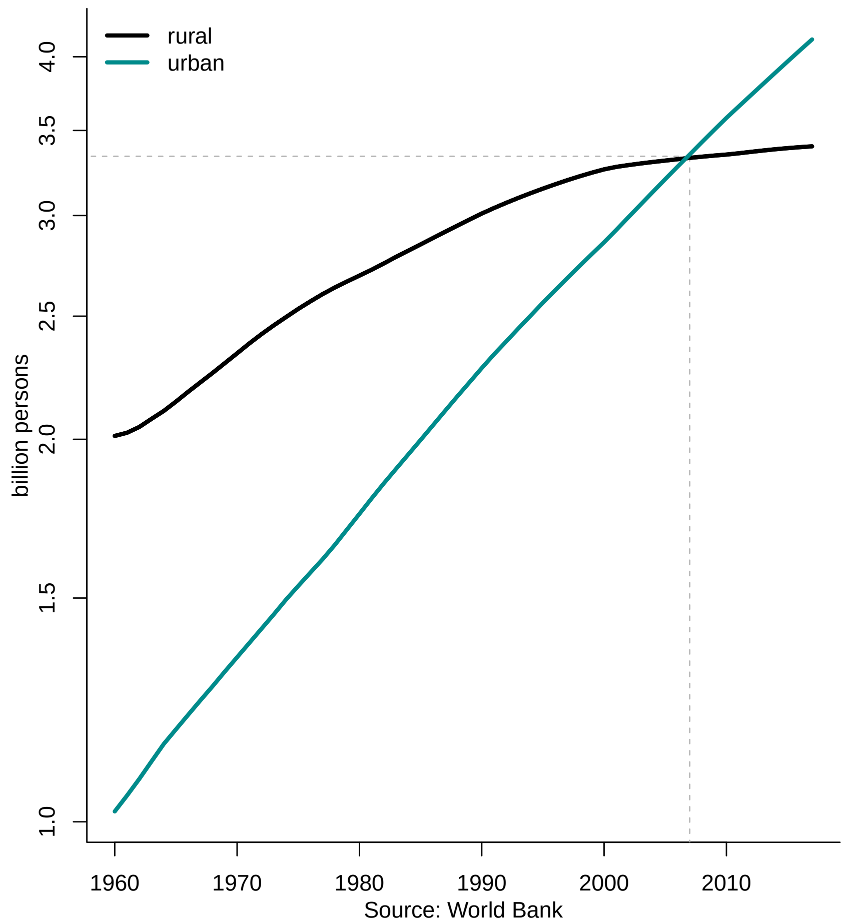
Petersburg experienced a manifold increase between 1917 and 2017. The largest expansion took place immediately after the Russian Civil War, when the nearest outskirts, mostly industrial areas, of the city were included into its administrative boundaries.

Why cities are big?

What are the factors encouraging the growth of cities? Do larger cities have more advantages than smaller ones? Indeed, there are several factors that make large cities economically more attractive and successful than their smaller counterparts.

The first factor is the economies of intra-industry agglomeration. They occur, when the firms belonging to the same industry locate next to each other. This allows them to purchase the intermediate inputs from a common supplier at a lower cost. In addition, it leads to an increased efficiency of labor market, because the cost of job search in such a case is lower. This is achieved thanks to the transmission of information on vacancies through informal channels and the fact that

Figure 2.4: Rural vs. urban population in the world, 1960–2017

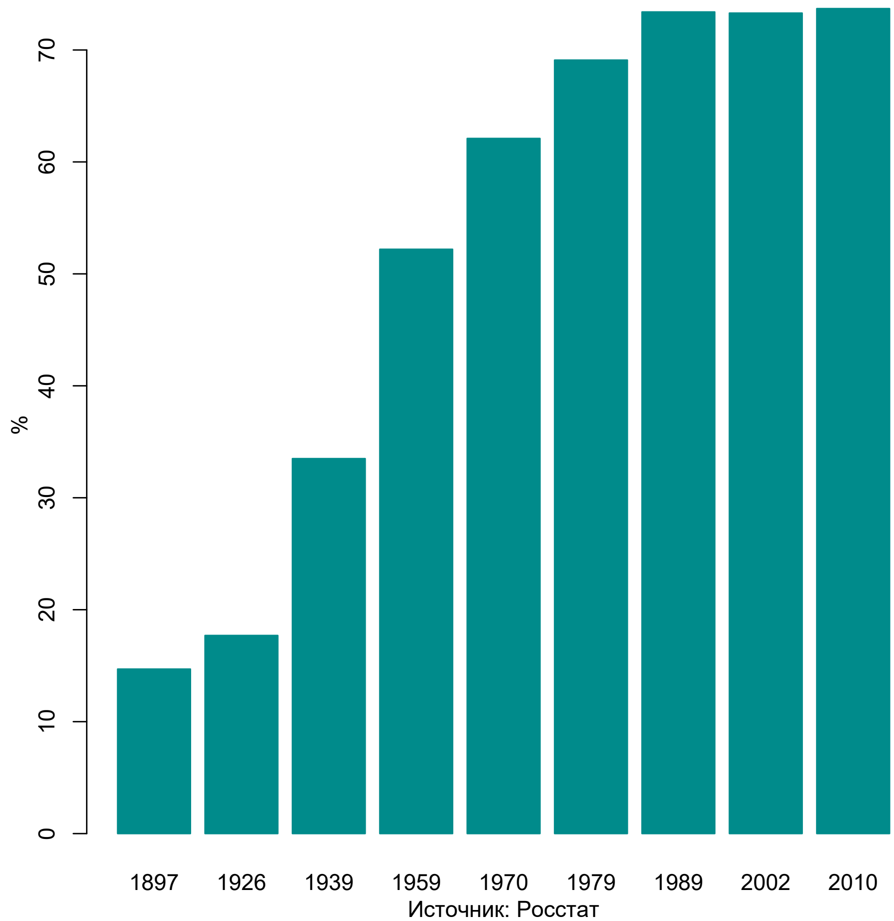


potential employers are nearby. Moreover, the intra-industry agglomeration creates communication economies, that is, a quick information exchange and technology diffusion.

The second factor is the urbanization economies, which stands for concentration in the same place of the firms belonging to the different industries. These firms can still use common suppliers (such as banks, insurance companies, hotels, transport, and publishers) and public services (such as roads, public transit, education, and health care). Provided that these common suppliers have scale economies, the concentration of various firms requiring their products creates a market, which is wide enough in order to take advantage of these economies of scale. Hence, the firms located in the same place can purchase the inputs from the common suppliers and obtain public services at a lower cost.

The third factor is the trade agglomeration, which refers to the spatial concentration of trade establishments. It rendered possible thanks to the external effects of retail trade meaning that one shop's sales are affected by those of other shops. There are two types of external effects: for complementary goods and for incomplete substitutes. Consider the case of complementary goods,

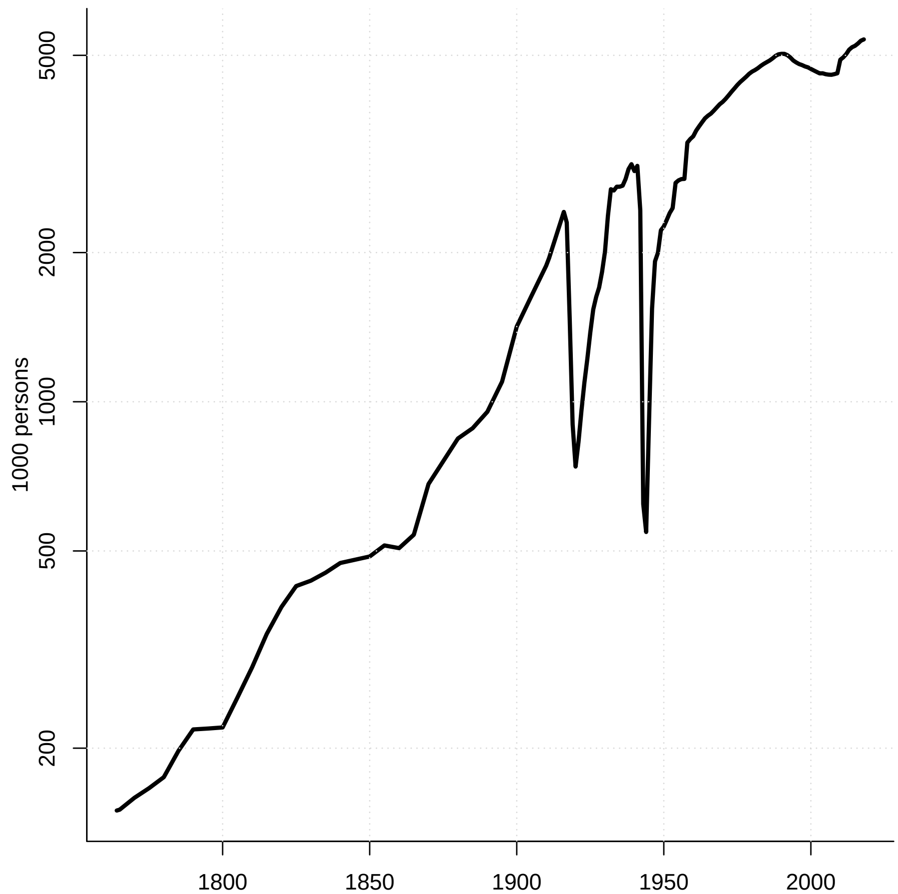
Figure 2.5: Urbanization in Russia, 1897–2010



Source: Rosstat

e.g., cloth and shoes. If there is already a shop selling cloth in the neighborhood, then it makes sense for a seller of shoes to open his shop nearby. The customers looking for clothes are likely to need shoes passing to them. Therefore, the shoes shop will be able to capture attention of some of the cloth shop customers. The case of incomplete substitutes is less evident. Indeed, why, say, two building materials or furniture stores can benefit from locating next to each other? It seems that they will compete for the each other's customers and ruin trade. And yet in many cases we observe that such stores are situated close to each other. The reason is that their products are substitutes, but are not exactly identical. Therefore, if somebody needs, say, a hammer he is more likely to travel to the place, where several building materials stores are located, than to the place, where he can find only one such store. In such a way, the customer can save time. Indeed, if he cannot find the hammer he needs in one store, he just has to walk a few meters in order to find a similar store, where he can find what he needs.

Figure 2.6: Population of St. Petersburg, 1764–2018



Sources: Demoscope, Petrostat, and Rosstat.

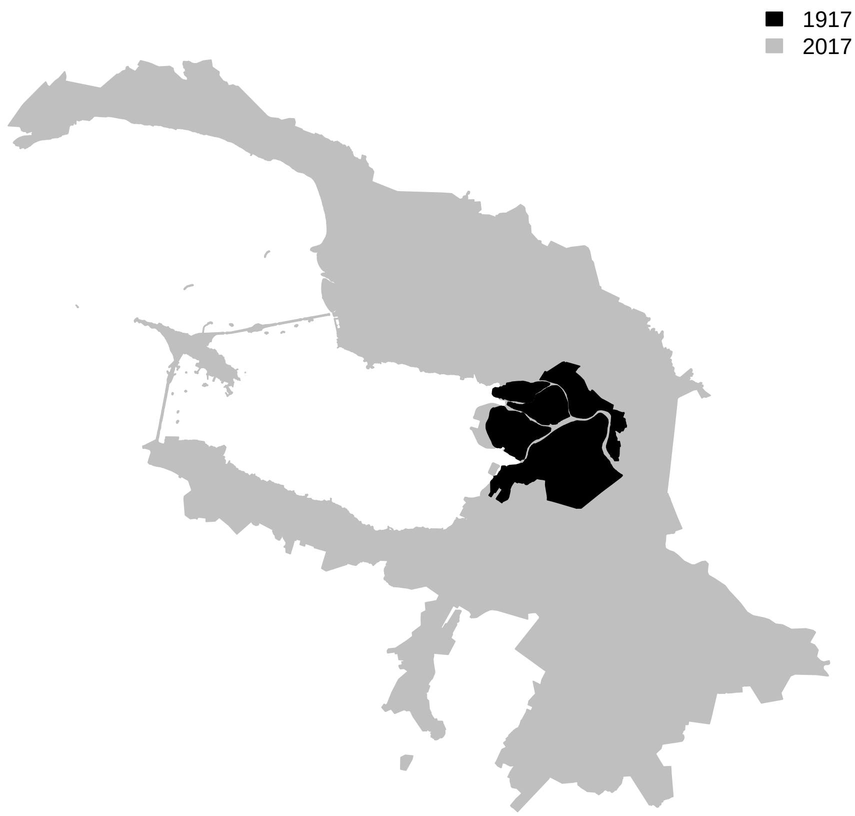
2.5 Why city sizes are different: The theory of central places

If we look at the cities and towns, we will immediately see that they vary a lot in in terms of size. As seen in Table 2.2, in Russia city sizes vary from just 102 persons to over 12 million. Half of Russian cities have a population below 26,300. In 2010, out of 1100 Russian cities, 12 had population exceeding 1 million and accounted for 28.9% of the total urban population, 25 cities had population between 0.5 and 1 million (16.2% of the total urban population). Why city sizes are so different? Why do not they converge to some "optimal size", identical for all cities? The theory of central places offers an explanation for this phenomenon. It is a land-use theory that subdivides settlements into classes, according to their importance as central places in the surrounding areas. It was developed in the 1930s by German geographers Walter Christaller (1893–1969) and August Lösch (1906–1945).[2]

For simplicity, the theory assumes that the surface is uniform and that the population is evenly distributed across it. No natural or human made obstacles exist that would hinder the movements

[2] See Christaller (1933) in German, Christaller (1966) in English translation, and Lösch (1944).

Figure 2.7: Territorial expansion of St. Petersburg, 1917–2017



Source: own representation

Table 2.3: Number and population of Russian cities, 2010

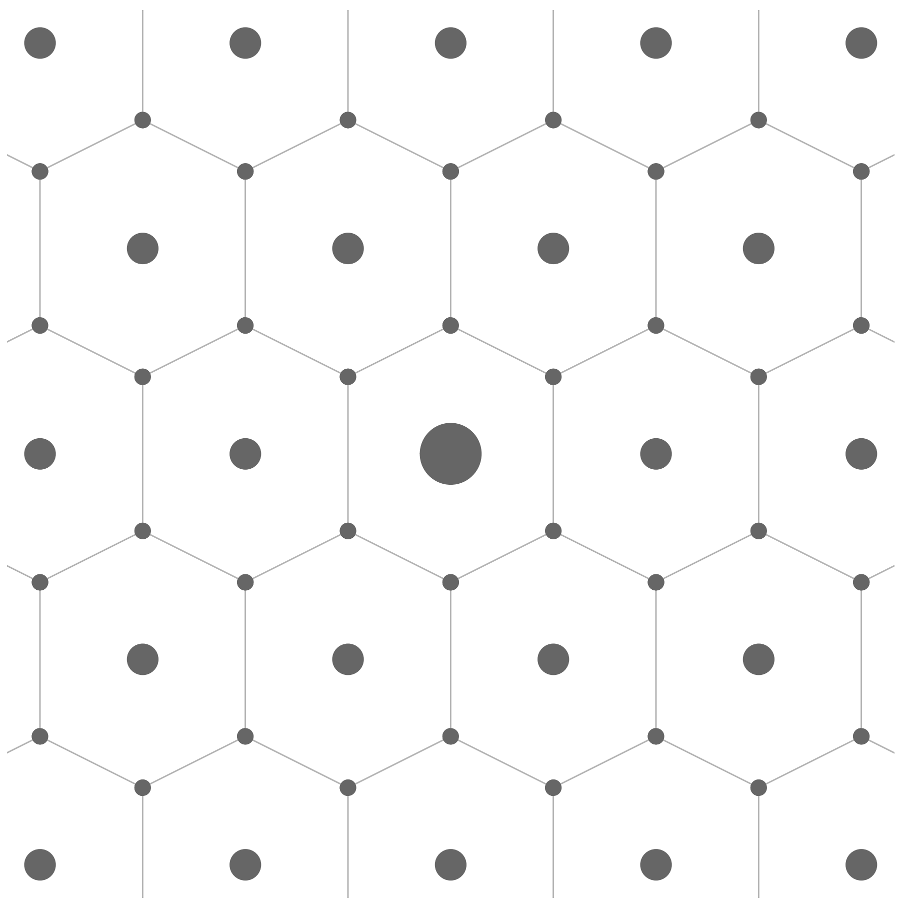
Category by population, 1000	# of cities	Population, 1000	Share of population, %
< 50	781	16,445	16.9
50–100	155	11,083	11.1
100–250	91	13,817	14.5
250–500	36	14,574	12.4
500–1000	25	12,403	16.2
≥ 1000	12	27,416	28.9
total	1100	97,527	100

Source: Росстат (2012).

from one part of the surface to another. Therefore, initially the economic agents are indifferent, where to locate their establishments.

Each establishment (or industry) has its optimal activity area. This depends on the price of the good or service, travel cost, and productivity. For example, assume that we have three establishments: a bakery, a physician's practice, and a book store. The bakery can serve an area with a radius of 1 km. People need to buy their bread every day plus the hot bread can become cold, if carried for more than 1 km. Thus, the next baker will open his establishment 2 km away from the existing bakery. Thus, the whole surface will be covered by the bakeries, which are located at 2 km from each other, see small circles in Figure 2.8. Note that the areas served by each bakery have a form of a bee cell. This turns out to be an optimal delineation of the markets. The circles would not do because they would result in either unserved regions or in intersections, where both bakers would compete. Assume that the doctor has a bigger area he can serve with profit. Let

Figure 2.8: Central places



the radius of this area be 2 km. Fortunately, most people do not need to visit a physician every day, so they can afford traveling a couple times a year up to 2 km to their physician's cabinet.

Suppose also that the doctor will choose a place for his practice next to a bakery. Maybe he likes cakes or the baker is often ill and visits the doctor. In any case, the place, where both bakery and physician's practice are located, have a larger population. So, they are denoted in Figure 2.8 by the middle-sized circles. Given a wide area served by each doctor, the next physician will open his practice 4 km away from hour doctor. Most likely the location of this new cabinet will coincide with that of some of the bakeries.

Finally, assume that the book store serves an area with a radius of 4 km. The books are not some stuff we need to buy on a daily and even on a weekly basis. Hence, the travel distance of up to 4 km will not scare away buyers. The book store will be located in a place, where already a bakery and a physician's practice exist. The resulting place will have an even larger population. That is why it will be denoted by a big circle in Figure 2.8.

Thus, the central places theory predicts an emergence of a hierarchy of cities: superior order, intermediate order, and inferior order. The bigger cities will have a higher variety of goods and services produced and sold there and, therefore, a larger population. The superior-order places will have all types of goods and services (a bakery, a doctor's cabinet, and a book store). The intermediate-order places will have less goods and services than the superior-order ones and more than the inferior-order ones, which will have only a bakery. Each place imports goods from the higher-order places and exports to the lower-order ones. The places having the same order do not interact because they have an identical supply structure.

The theory of central places is not simply an abstract concept that only theoretical economists or geographers use. It is utilized in some countries for the purposes of planning the allocation of resources. For example, Figure 2.9 shows a map of central places in Germany constructed by the BBSR.[3] This map was developed by a German research institute BBSR, which is a part of the German federal government. The red squares denote the superior-order central places, while the blue circles stand for the intermediate-order central places. The spatial pattern observed in the map does not remind the bee cells as predicted by the theory. Such a deviation of the practice from the theory can be explained by the effects of geographical, historical, and political factors.

2.6 The internal structure of cities

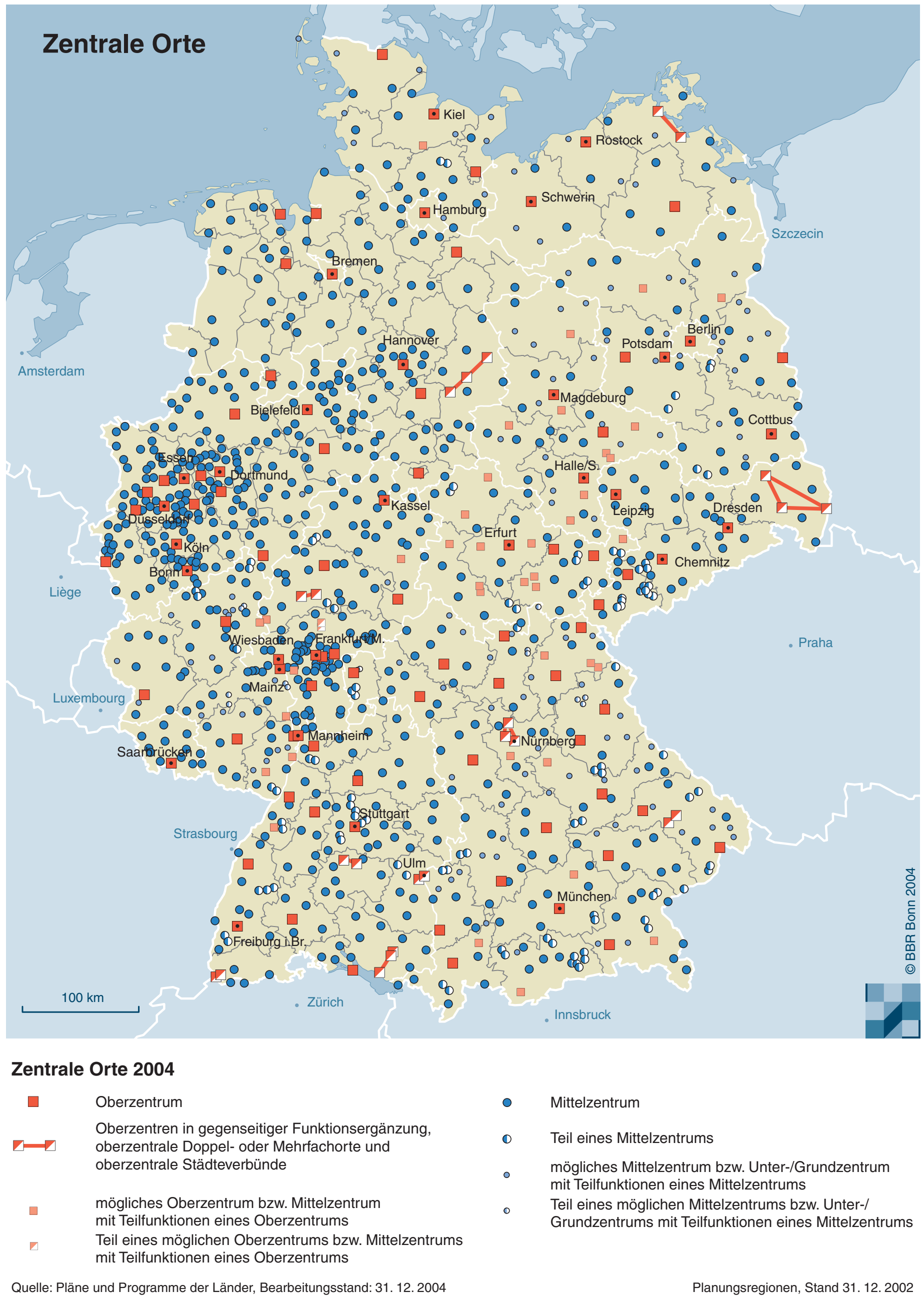
The land use model of von Thünen

The origins of the modern model of a monocentric city are in the pioneering work of Johann Heinrich von Thünen (1783–1850), who in 1842 suggested a model of land use.[4] His purpose was to identify where to locate different agricultural activities. The attraction point is the nearest

[3] Bundesinstitut für Bau-, Stadt- und Raumforschung, `http://www.bbsr.bund.de/BBSR/DE/Raumentwicklung/RaumentwicklungDeutschland/Projekte/Archiv/ZentraleOrte/03_DatenKartenGraphiken.html?nn=411742`.

[4] The original work von Thünen (1826) can be read in Google Books, while English translation is available as von Thünen (1966).

Figure 2.9: Central places in Germany



Source: BBSR

city, where the market for agricultural products is situated. Different agricultural produces have different production and transportation costs. Therefore, the questions von Thünen intended to address were: How far from the city, say, potatoes and corn be cultivated or cows raised? Although, originally, von Thünen's theory was used for agriculture. However, it can be easily extended to the urban economy.

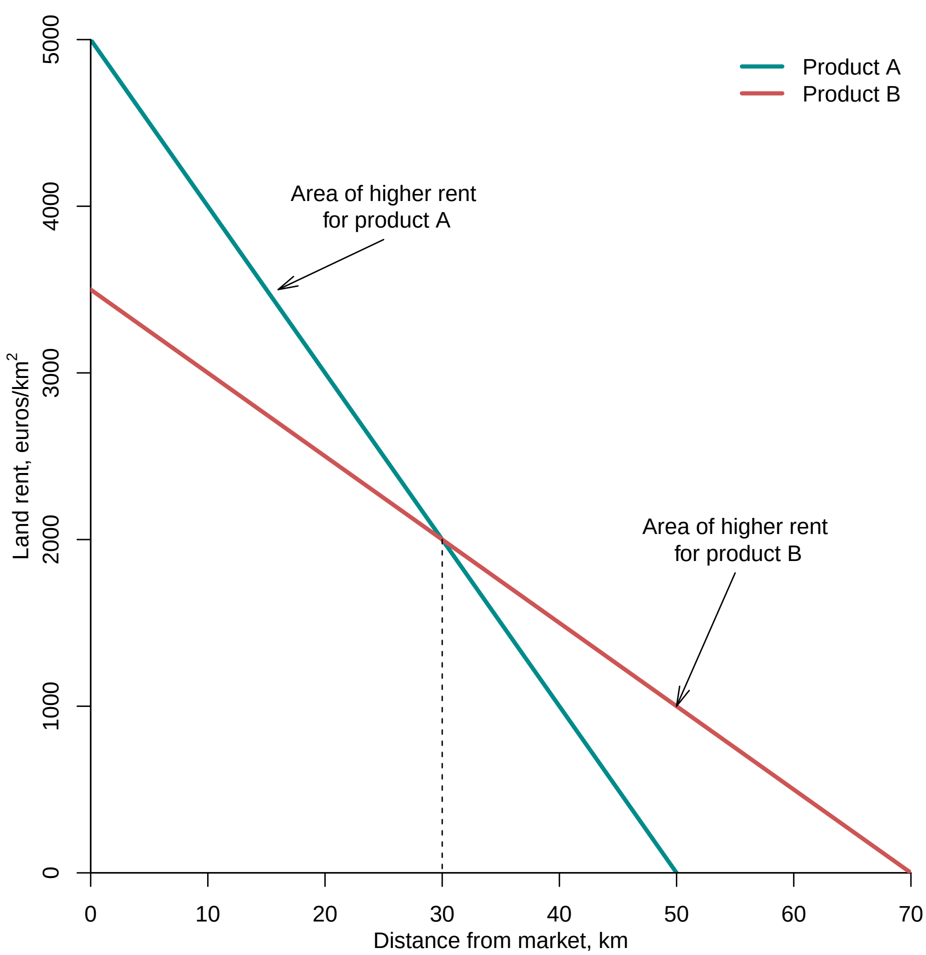
In the von Thünen's model, the land rent is the maximum possible amount that an agricultural producer can pay for the use of land.

$$R = (P - C)Q - \tau Q d \tag{2.1}$$

where R is the land rent (euros/km^2); P is the market price of the crop (euros/t); C is the production cost of the crop (euros/t); Q is the yield (t/km^2); τ is the transportation cost (euros/t/km); d is the distance from the market (city).

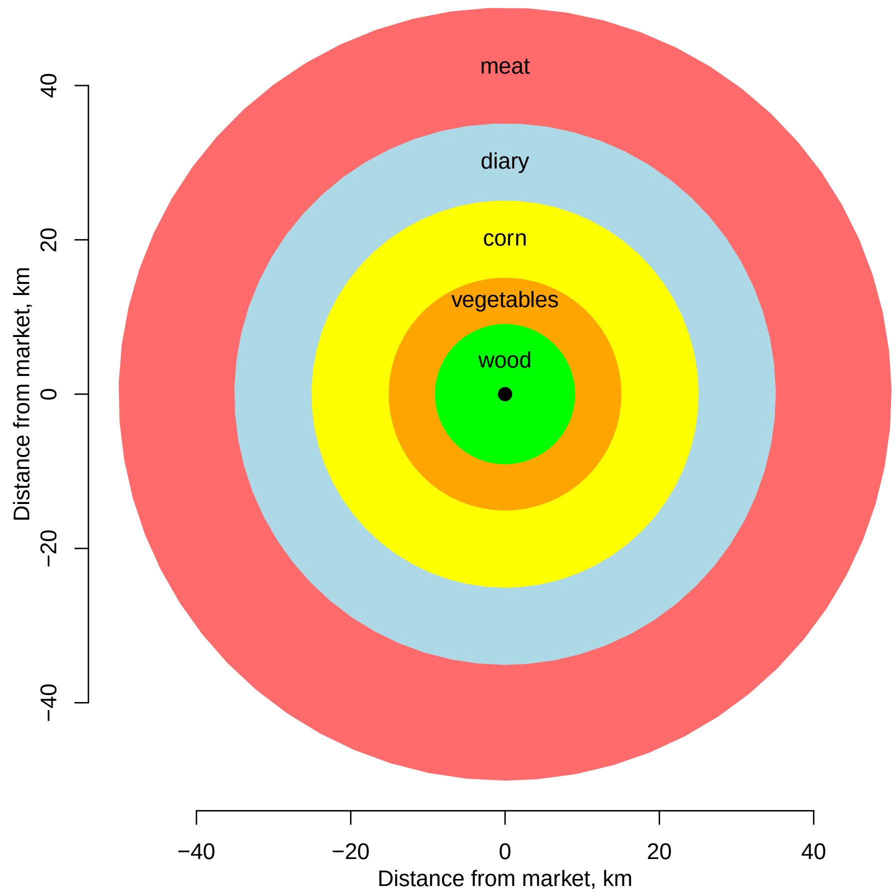
Figure 2.10 compares two land rent functions for two agricultural produces: A and B.

Figure 2.10: Land use: von Thünen's land rent



As the main factor that makes difference in space is the distance to the city (market), different agricultural activities will occupy segments at different distances from the city. Thus, they will form rings around the city, as shown in Figure 2.11.

Figure 2.11: Land use: von Thünen's product rings



Alonso-Mills-Muth model

The modern theory of monocentric city structure suggested by William Alonso (1933-1999), Edwin Mills (born in 1928), and Richard Muth (born in 1927).[5] Its aim is to explain the land use in a monocentric city, that is, a city having only one center. Below, we consider this theory from the viewpoints of production and consumption.[6]

Let us consider first the land use in a monocentric city from the production side perspective. The model is based on the following assumptions:

- all goods are produced using the land and capital;

[5] See Alonso (1964); Mills (1972); Muth (1975).

[6] The following discussion is to a large extent based on Mills (1972).

- the production function has constant returns to scale and permits substitution between the land and capital;
- the input and output markets are perfectly competitive implying that all firms are pricetakers;
- the supply of capital is perfectly elastic to the urban area, i.e., it is equally available throughout the whole city;
- the rental rate on capital, i, is the same throughout the whole urban area;
- the land rent, $R(d)$ is determined by the model and depends on distance from city center.

The production function of a firm can be formulated as follows:

$$x = f\Big(K(d), L(d)\Big) \tag{2.2}$$

where x is the non-housing output (e.g., production of consumer goods); d is the distance from production site to city center; $K(d)$ is the use of capital (say, equipment or buildings); and $L(d)$ is the use of land (i.e., the territory occupied by the factory).

Its only difference from the production function in the standard microeconomic theory is the distance, d. In such a way from the spaceless world the firm is transfered into the world, where distance matters and creates additional obstacles for the market participants.

Based on the production function in equation (2.2) the profit of the firm can be calculated:

$$\pi = px - iK(d) - R(d)L(d) - \tau xd \tag{2.3}$$

where p is the unit price of output (euros); i is the interest rate on capital; $R(d)$ is the land rent per m^2; and τ is the cost of transporting 1 product unit for 1 km.

The first-order conditions of the profit maximization problem are as follows:

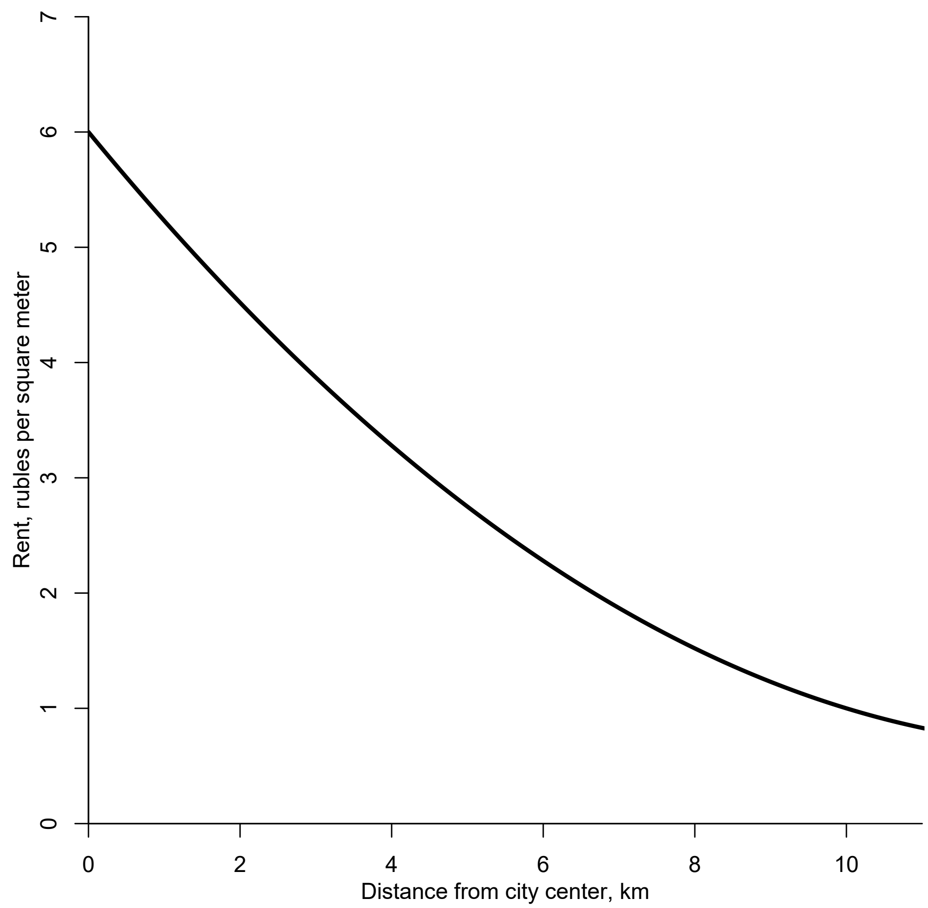
$$\begin{aligned} \frac{\partial \pi}{\partial K(d)} &= \frac{\partial x}{\partial K(d)}(p - \tau d) - i = 0 \qquad (2.4) \\ \frac{\partial \pi}{\partial L(d)} &= \frac{\partial x}{\partial L(d)}(p - \tau d) - R(d) = 0 \end{aligned}$$

The resulting rent function is:

$$R(d) = \frac{\partial x}{\partial L(d)}(p - \tau d) \tag{2.5}$$

According to the rent function, two predictions can be made. First, the land rent decreases with distance from city center: the closer to the center the higher the land rent, as shown in Figure 2.12. Second, due to the factor substitution the land rent grows faster than linear at small values of d. Indeed, when the land becomes more expensive, the firms began using it more intensively by constructing higher buildings and by offsetting in such a way lower land use by a large use of the capital.

Figure 2.12: Land use in a monocentric city: rent function



Now, let us approach the land use in a monocentric city from the consumption side. Here, we concentrate on the model of household location choice. This model is based on the following assumptions:

Household has utility function describing its tastes for housing services, h, and non-housing goods and services, x. The location choice, or the distance from center, d, affects both the utility as subjective costs of commuting (time foregone for other activities, fatigue, strain, and boredom) and the budget constraint as commuting costs. Households maximize their utility with respect to consumption of housing, goods, and commuting subject to budget constraint.

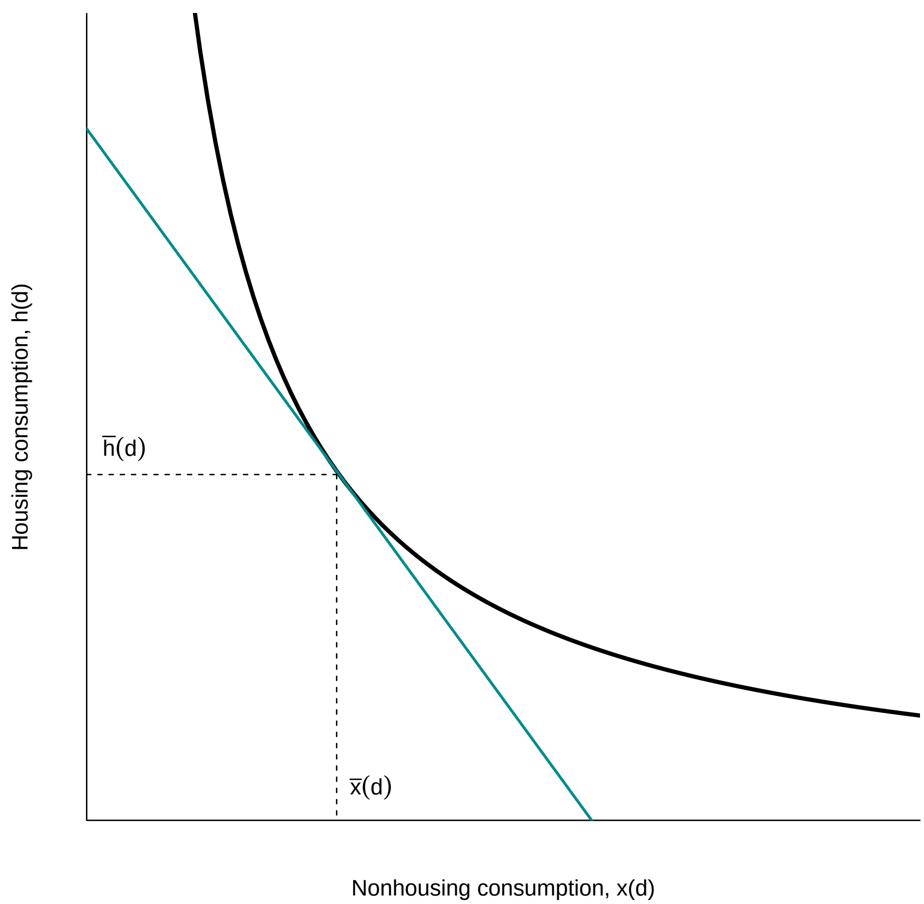
The following mathematical model of household location choice can be formulated:

$$\begin{aligned} &\text{Utility: } U = g(x, h, d) \\ &\text{Budget constraint: } px + r(d)h + \tau d = w \end{aligned} \tag{2.6}$$

where U is the household utility; p is the price of non-housing goods and services; $r(d)$ is the housing rent; τ is the commuting cost; d is the distance from city center; and w is the household's income.

Figure 2.13 shows the household indifference curve illustrating his choice between the non-housing and housing consumption.

Figure 2.13: Household location choice



In equilibrium, the rate of substituion of the housing consumption for the non-housing consumption is equal to the ratio of the non-housing price to the price of housing:

$$\frac{\Delta h}{\Delta x} = -\frac{p}{r} \Rightarrow p\Delta x(d) + \Delta r(d)h(d) = 0 \tag{2.7}$$

The budget constraint of the household:

$$px(d) + r(d)h(d) + \tau d = w \tag{2.8}$$

The effect of a small change in d:

$$p\Delta x(d) + \Delta r(d)h(d) + \Delta r(d)\Delta h(d) + r(d)\Delta h(d) + \tau\Delta d = 0 \tag{2.9}$$

$$\Delta r(d)\Delta h(d) \approx 0 \tag{2.10}$$

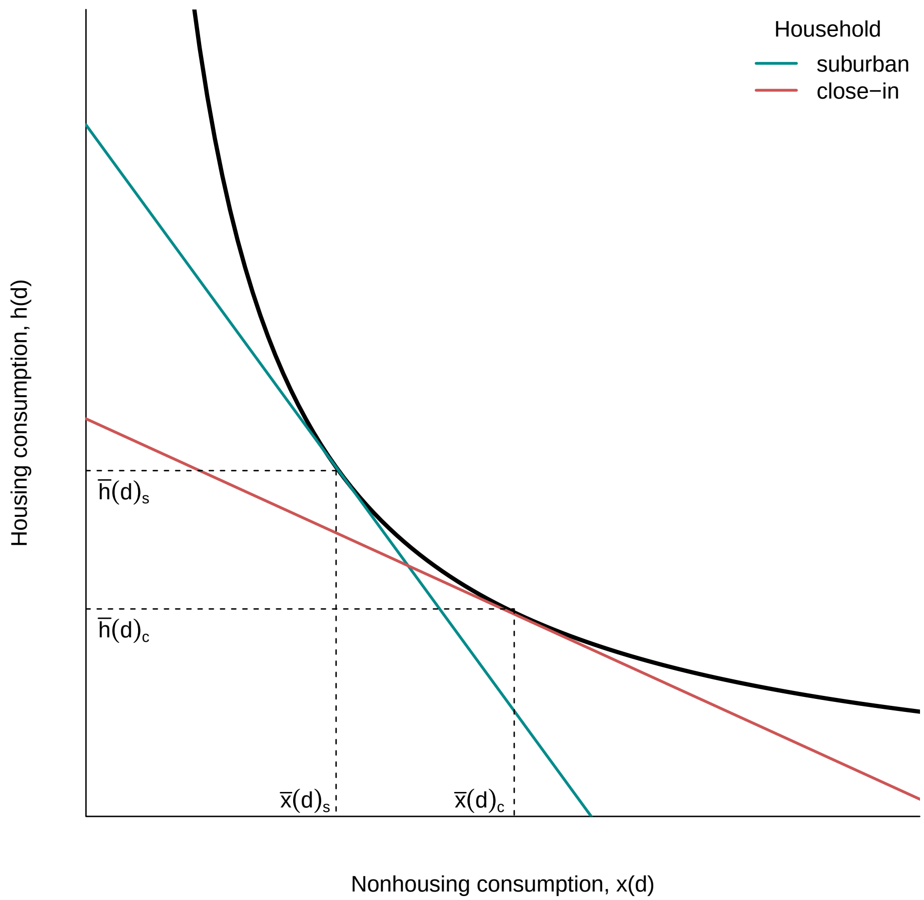
$$r(d)\Delta h(d) + \tau\Delta d = 0 \tag{2.11}$$

The resulting housing rent/price function:

$$\frac{\Delta r(d)}{\Delta d} = -\frac{\tau}{h(d)} \tag{2.12}$$

The housing rent function has negative slope. This implies that the housing is more expensive close to city center than in suburbs. Moreover, the rent function is steep wherever h is small: if suburban households consume more housing than those living in center, then the function is steeper close to city center, as shown in Figure 2.14.

Figure 2.14: Household location choice: city center vs. suburbs



The housing rent function has important implications in terms of the population density within cities. First, the suburbanites (the persons living in the suburbs of a city) consume more housing than residents living close to the city center. Second, since the land is cheaper relative to other housing inputs in suburbs than close to city center, suburban housing uses lower capital-to-land ratios. This means that, all other things being equal, we can expect that the residential buildings will be larger in the central parts of the city and smaller in the suburbs. This is a typical structure of a North American city: while in the center the residents are living in the multi-storey apartment buildings, in the suburbs they occupy spacious single-family houses. Third, in the suburbs, the population densities is predicted to be lower than near to the city center. This is closely related to the second implication: higher population density in the central districts is directly related to the higher intensity of land use there. Indeed, a plot of land occupied by an apartment building will provide more housing units than a land plot with exactly the same area but occupied by the single-family houses. More housing units means more inhabitants, even accounting for the fact that the families living in the single-family houses tend to be larger. Fourth, the model predicts a certain spatial income distribution of the households:

Let the disutility of 1 km of commuting be proportionate to wage, equally for high- and low-income workers. If income elasticity of demand for housing exceeds 1, then high-income workers will live farther from the city center; see Figure 2.15. By contrast, if income elasticity is lower than 1, then high-income workers will, nevertheless, live farther out, provided that demand for housing is not too inelastic with respect to its price.

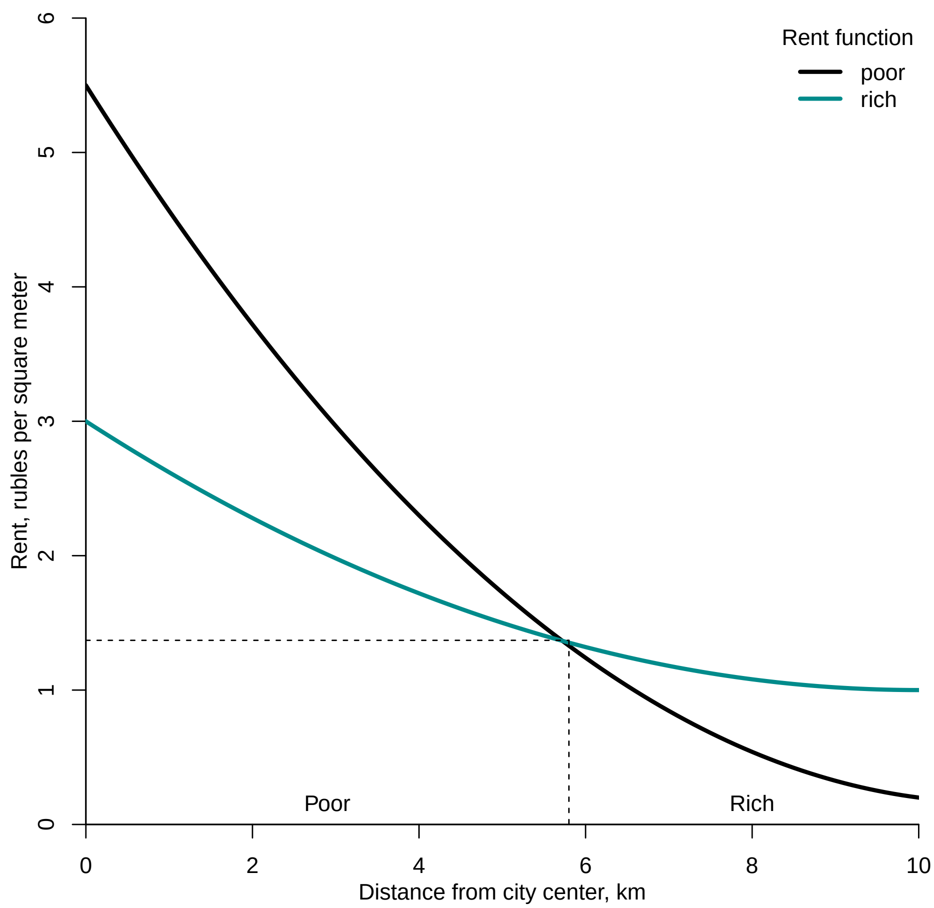
The income-specific household location choice can also have alternative explanations. According to the transport mode choice explanation, the poor cannot afford automobiles and must rely upon public transit. Unlike the suburbs, the central districts of the cities have a dense enough public transit network. Therefore, the poor must live in central cities in order to have mobility.

Another explanation is related to the age of dwellings. The rich prefer newer housing because it has higher quality corresponding to the latest standards, while poor can tolerate the old housing, which is equipped with basic utilities. In some cases, even nowadays, one can find old buildings near to the city center without bath or central heating. The newer houses are more likely to be found in suburbs, while the older ones tend to locate in the central districts.

In the USA, poor typically live close to central business district (CBD), while rich in suburbs. In European countries, often an opposite case is observed. For example, in Paris, rich live in the CBD. Brueckner et al. (1999) use the cases of Paris and Detroit in order to explain this difference in the spatial distribution of the rich and poor. Their explanation relies upon the urban amenities (historical monuments, fine architecture, etc.) and natural amenities (ocean or river front). These amenities positively affect the housing prices and rents for dwellings located nearby. Moreover, the rich value living near them more than the poor. In Paris, urban amenities are concentrated in the city center, while Detroit has no such amenities at all. This can be generalized for many old cities in Europe having a long and glorious history and the cities in the US having virtually no history.

Now, we can put together different sides of the same picture, namely production and consumption sides. Together, they deliver a stylized picture of the spatial distribution of different city

Figure 2.15: Land use in a monocentric city: rich vs. poor



activities (sectors), see Figure 2.16.

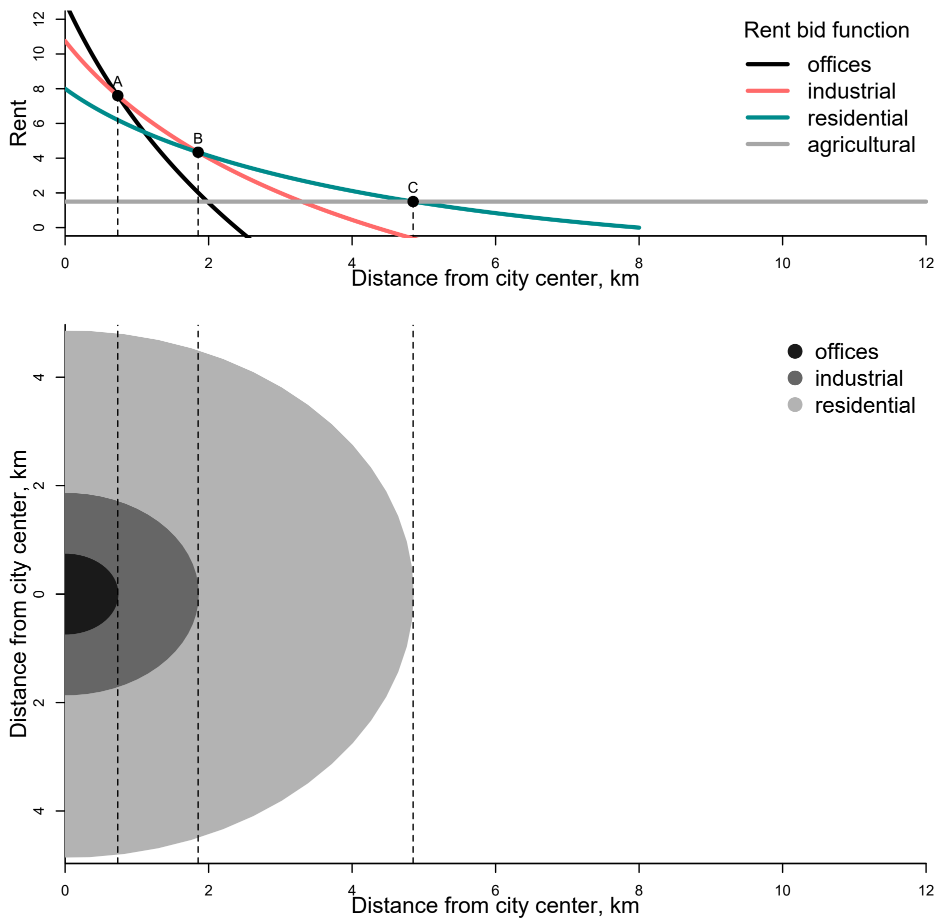
As seen, the model predictes the following spatial location of industries. The sectors are ranked by distance from city center in order in which they are ranked by steepness of their rent-bid function. In other words, the industry with the steepest rent-bid function is closest to CBD.

The manufacturing firms locate close to centrally located port or rail facilities to export their output and import inputs, because they require large amounts of raw and processed materials. The service sector firms (e.g., office activities) require demand of the entire urban area to exhaust their scale economies. Office activities entail much less rapidly diminishing returns with increases in capital-to-land ratio than manufacturing. The labor is their most important input. Moreover, the workers are much less expensive to transport vertically using elevators than materials.

An example of real land use pattern can be seen in Figure 2.17, which shows the zoning of St. Petersburg in 2003.

The industrial zones form the so-called “gray ring” around St. Petersburg’s city center. This is typical for many former Soviet cities. The residential areas are located farther outward, surrounded

Figure 2.16: Land use in a monocentric city: multiple sectors



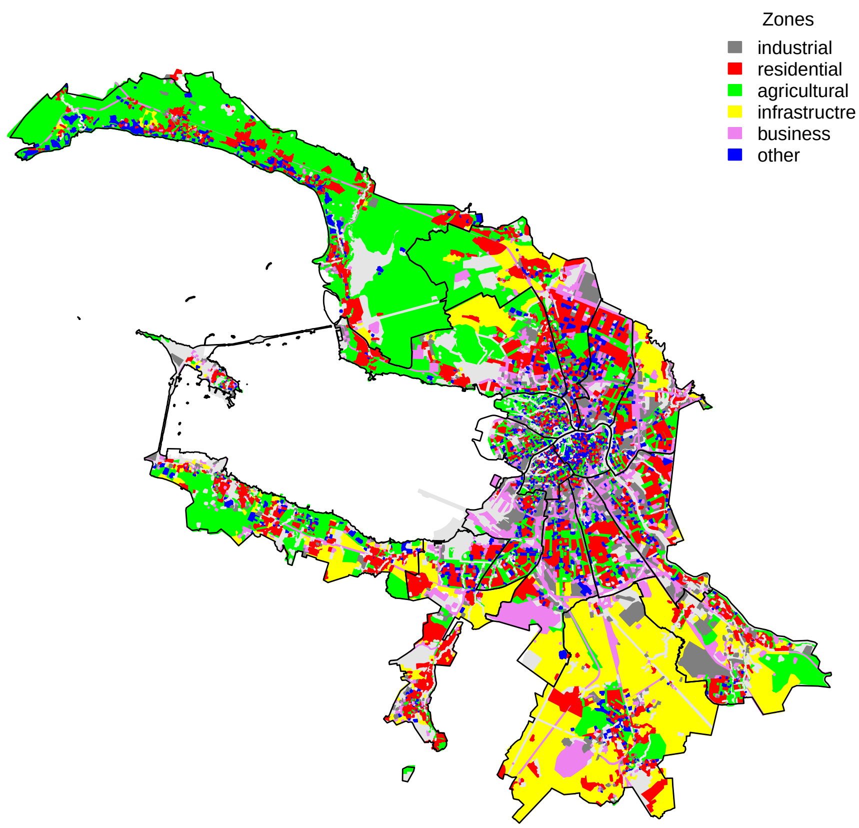
by the recreational and agricultural zones. In fact, the map reflects the vision of the city planning authorities. However, at least for 2003 it accurately reflected the spatial distribution of different sectors, which quite closely mimics the stylized picture predicted by the land use theory that we discuss here.

In urban economics, as distance from city center increases, the land prices decrease; the population and employment density go down; the social composition of population changes; and the share of rented dwellings decreases ceding place to the owner-occupied dwellings (Blanco Blanco, 2014, p. 46–50). Figure 2.18 illustrates this for London using the spatial distribution of the share of private sector tenants by wards.[7]

As seen, the highest proportions (above 40%) are attained in the central wards, while toward the periphery of the city the share of tenants declines. An inverse picture is obtained, when the proportion of homeowners is depicted. A similar spatial pattern can be observed also for Rome (Festa et al., 2019, p. 28).

[7] Ward is a local authority area, which is typically used for electoral purposes.

Figure 2.17: Land use in St. Petersburg



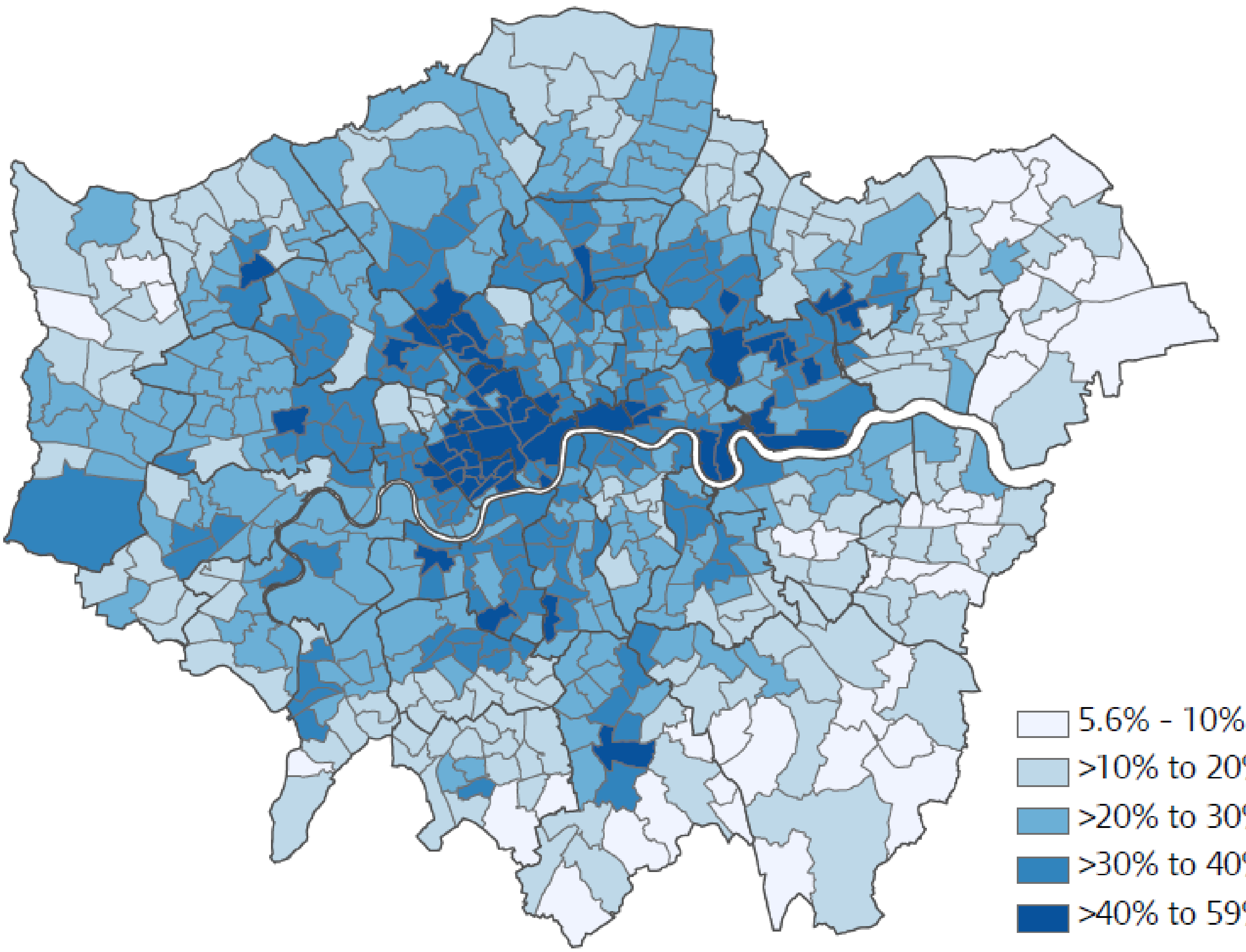
2.7 Density gradient

The city land use theory predicts the population and employment density decreasing as the distance from the city center increases. This negative dependence between the density and the distance from the city center can be described using the notion of density gradient. Formally, the density gradient can be expressed as follows:

$$p(d) = p(0)e^{-\gamma d \varepsilon} \tag{2.13}$$

where $p(d)$ is the population or employment density at d km from CBD, persons/km^2; d is the distance from city center, km; $p(0)$ is the population or employment density in the CBD, persons/km^2; γ is the density gradient; and ε is the random error. The random error is introduced in order to reflect a real situation. In the real world, the population density cannot be explained by the distance from the center alone. Moreover, the density can be measured with mistakes. Thus, the random error reflects both various factors contributing to the determination of the population density, but

Figure 2.18: Private tenants as proportion of all households in London by ward, 2011

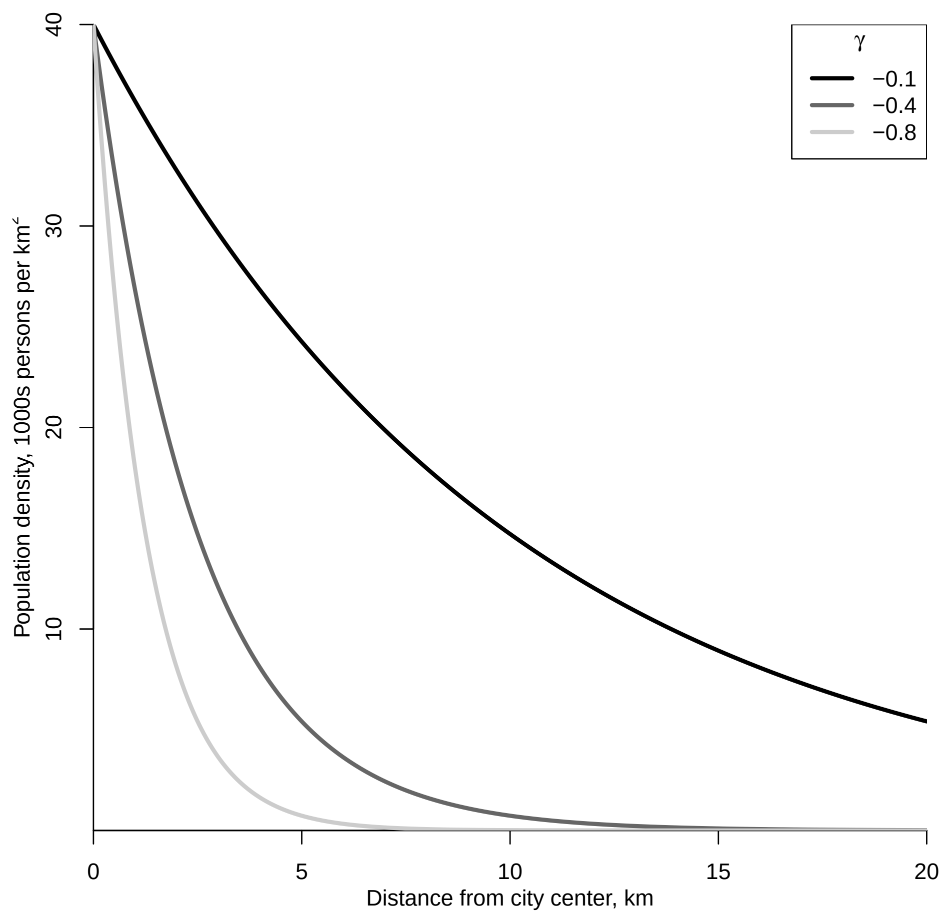


Source: (Mayor of London, 2015, p. 13).

omitted in our model, and the measurement mistakes.

Figure 2.19 compares different gradients. The larger the absolute value of γ the steeper the slope of the population density function and the quicker the density declines as the distance from the city center increases.

Figure 2.19: Alternative stylized population density gradients



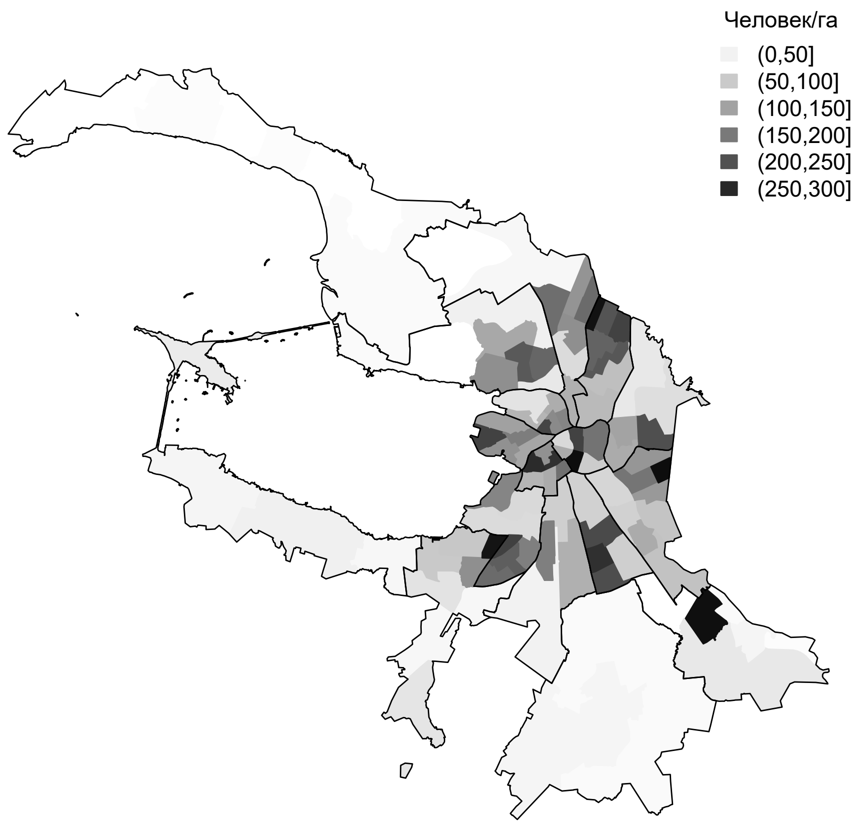
The population and employment density gradients are affected by various factors. First, the density gradients become flatter with the income: as the income per city resident increases, the residents can enjoy a higher housing consumption. Therefore, they will occupy more space, which will lead to a lower population density. Second, γ shrinks with a growing population of the city, since it leads to a denser population in the less-developed areas and to an expansion at the urban fringe (city expands its boundaries). In many cases, the population growth in the city is accompanied by the decline of the population density in the central areas of the city.

Third, the density gradient flattens as a result of improvements in transport performance. Falling transportation costs and higher speed allow more people to settle down farther from the city center and still enjoy a relatively easy access to the jobs and urban amenities located in the

CBD. As examples of such developments one can mention the advent of the electric trams and of the personal cars that permitted an extreme expansion of the city boundaries. To a large extent, the modern levels of urbanization owe to the technological progress that greatly improved human mobility.

Figure 2.20 illustrates the spatial distribution of the population density in St. Petersburg in 2015.

Figure 2.20: Population density in St. Petersburg, 2015

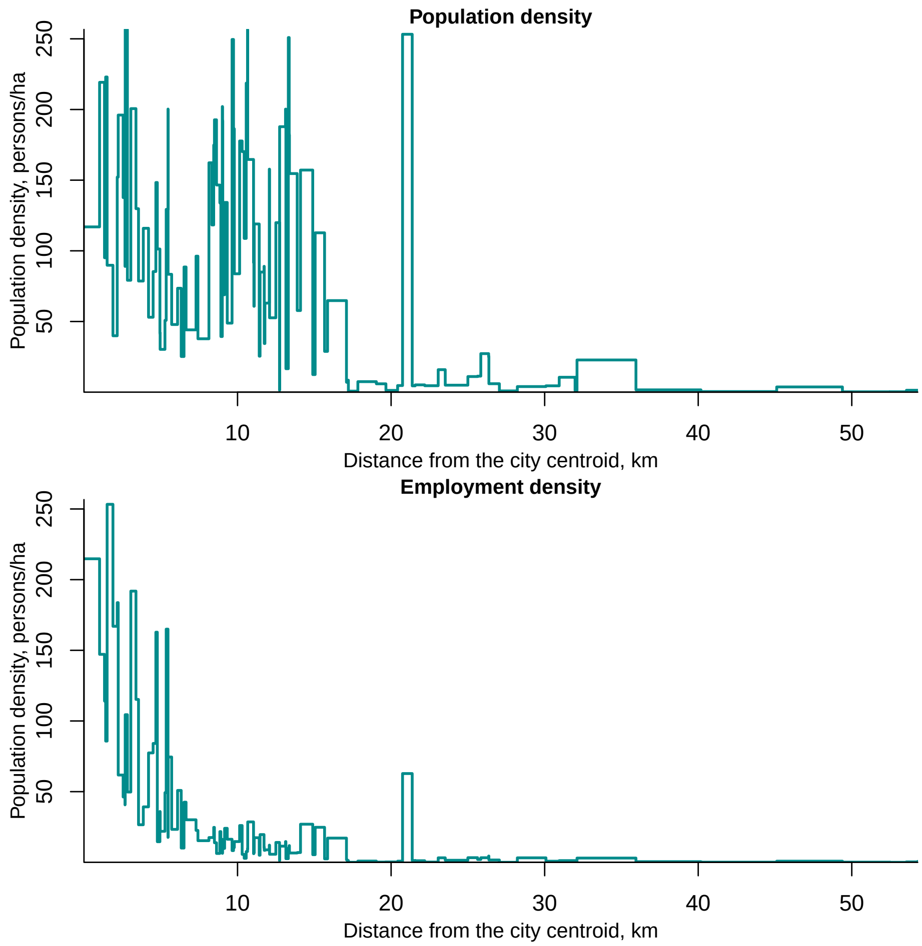


Sources: Petrostat and own representation

Contrary to the predictions of the theory of the land use in monocentric city, the central parts of St. Petersburg are not those with the highest population densities. The population density is very high in the so-called "dormitory districts", where residential high-rise building dominate the landscape. It can also be explained by governmental regulations. For example, the height restrictions prohibit erecting buildings exceeding a certain threshold in the city center. In addition, the delayed deindustrialization permitted a conservation of the "gray industrial ring" of St. Petersburg around its center, thus, preventing its conversion into higher-density residential areas.

The information contained in Figure 2.20 can be made even more visible in Figure 2.21, which shows the relation between the distance from the centroid of St. Petersburg and population and employment density. Within approximately 15 km from the city centroid, the population

Figure 2.21: Distribution of population and employment density by distance from the centroid in St. Petersburg, 2015



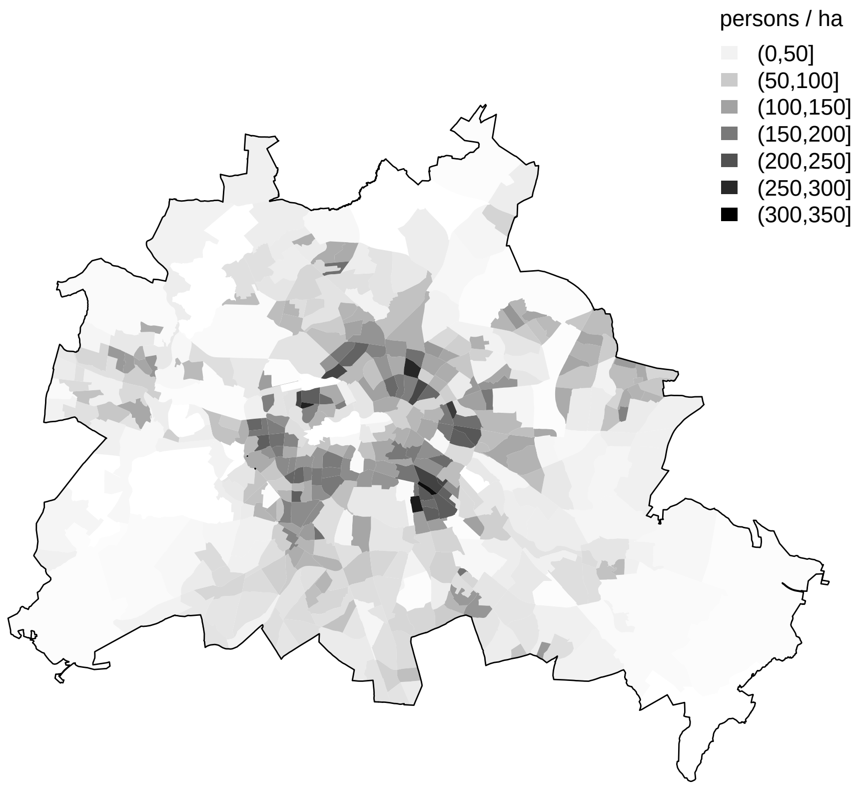
Sources: Petrostat and own representation

density remains almost unchanged, one exception being the industrial "gray ring" at around 8–9 km from the centroid of the city. A large outlier at about 23 km is an industrial town within the agglomeration of of St. Petersburg (Metallostroy). The employment density follows a pattern, which is very similar to that predicted by the theory. Once again, Metallostroy stands out as an outlier.

For comparison, consider the spatial distribution of population density in Berlin by 447 LOR (*lebensweltlich orientierte Räume*) areas, see Figure 2.22.

Berlin has a comparable population with that of St. Petersburg: 3.5 vs. 5 million, respectively.

Figure 2.22: Population density in Berlin, 2015



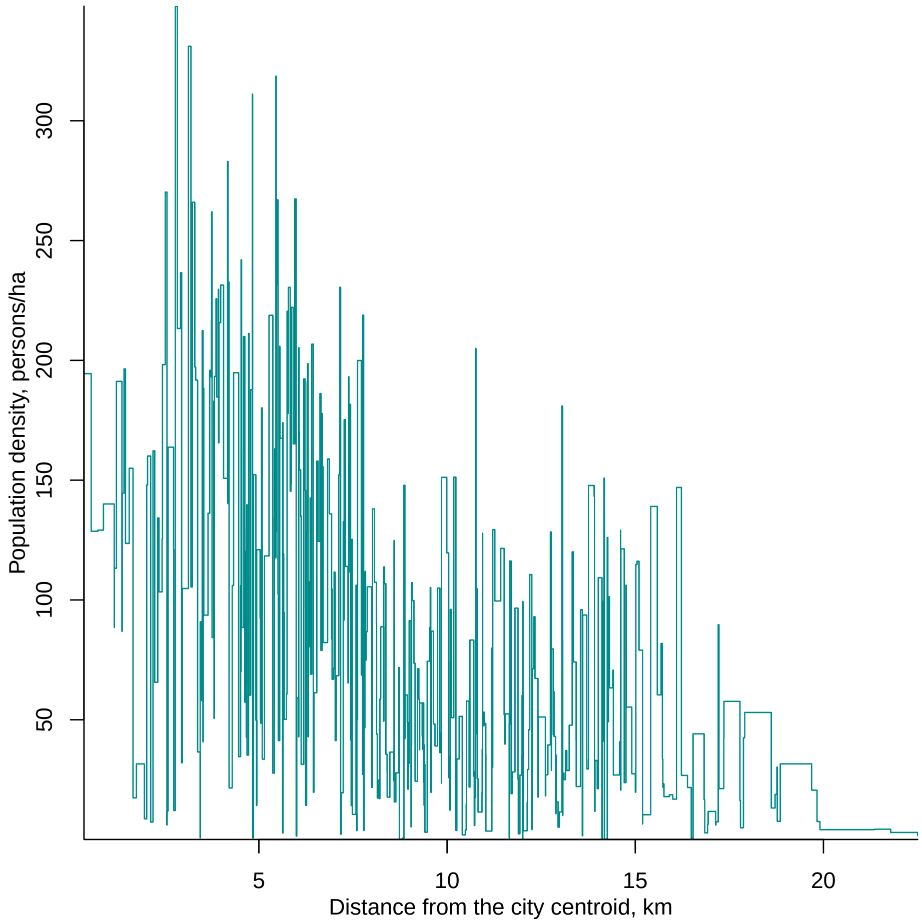
Sources: Senatsverwaltung für Stadtentwicklung und Wohnen and own representation

However, the population density patterns in both cities are very different. Berlin fits much better into the distribution predicted by the theory. Berlin experienced a large-scale deindustrialization after World War II, since many factories were relocated to West Germany.

Figure 2.23 depicts the population density as a function of distance from the centroid of Berlin. In Berlin, unlike in St. Petersburg, the population density diminishes in a more consistent way as the distance from the geographical center of the city increases. A relatively low population density within 3 km from the center is due to the fact that the central part of Berlin is occupied by large park Tiergarten.

How does the population gradient look like worldwide. Bertaud and Malpezzi (2014) investigate the empirics of population gradient for many cities and obtained a number of interesting results. The negative exponential density gradient implied by the urban model fits data well. However, in some cities, large deviations are observed. Seoul is an example of the market economy, but extremely strict land use regulations shape spatial distribution of its population density. The

Figure 2.23: Distribution of population density by distance from the centroid in Berlin, 2015



Sources: Senatsverwaltung fuer Stadtentwicklung und Wohnen and own representation

layout of Brasilia and Moscow is a result of central planning. Brasilia was built in 1960 from the scratch as the new capital of Brazil and was planned using the rationalist ideas of Charles-Edouard Le Corbusier (1887–1965), while Moscow was largely re-designed in the 1930s.[8] Capetown is a city developed under apartheid, which was divided into two cities: one for the whites and another for the colored people.

Exercises

1. What is a city?

2. What are statistical issues of identifying cities?

[8]As a matter of fact, in the early 1930s, in his "Response to Moscow" Le Corbusier sketched a plan of reconstructing the Soviet capital as a radiant city (*ville radieuse*). Fortunately, this plan was never implemented.

3. Which solutions are offered to cope with these issues?
4. What is the difference between the intra-industry and urbanization economies? Provide examples of both.
5. What does the Christaller-Lösch theory explain?
6. What and how does the theory of von Thünen explain?
7. What does Alonso-Muth-Mills model explain?
8. What are the predictions of Alonso-Muth-Mills model about firms?
9. What are the predictions of Alonso-Muth-Mills model about households?
10. What are the general predictions of urban economics about the land use in cities?

Key terms

urban economics	city	urban area
functional urban area	urban population	urbanization
population size	population density	comparative advantages
scale economies	intra-industry agglomeration	urbanization economies
trade agglomeration	external effects of trade	central places
hierarchy of cities	land use	von Thünen
land rent	Alonso-Mills-Muth	monocentric city
production function	household problem	location choice
rent-bid function	central business district	city center
density gradient	population density	employment density

Chapter 3

Housing market

3.1 Introduction

This chapter is devoted to the market of such a specific good as housing. The housing market possesses the standard elements of any market: supply, demand, and the price that equalizes them. Since the housing is a durable good, the housing market can be divided into the primary (newly built housing) and secondary (used housing) markets. In addition, due to its relative expensiveness —the purchasing price can be many times higher than the annual income of the household— not everybody can afford buying a dwelling. This leads to a distinction between the owner- and tenant-occupied housing. At the same time, the housing is not an ordinary good. It is characterized by large complexity and heterogeneity. The immobile nature of housing creates strong dependence of its value on the place, where it is situated. All in all, the specificity of housing makes it an exciting object of investigation.

This chapter is organized as follows. Section 3.2 serves as motivation for this chapter, for it demonstrates the importance of housing from the socio-economic standpoint. In section 3.3 we will focus on the specific features of housing as a good: heterogeneity, immobility, durability, and expensiveness. Sections 3.4 and 3.5 consider the housing demand and supply, respectively. In section 3.6, the housing prices and their long-term dynamics are discussed. Section 3.7 presents a stock-flow model of the housing market unifying all its aspects: the demand; the supply; and the housing price or rent that equate supply and demand. Section 3.8 is devoted to the availability of housing in various countries and compares them to Russia. In section 3.9, such measure of excess supply as housing vacancy is examined. Section 3.10 deals with the affordability of housing, that is, the ability of households to buy or rent a home.

3.2 The importance of housing

The housing represents a large share of wealth of private households. Households spend a large part of their current expenses on housing. People, especially in countries with severe climate, stay most time in buildings. In addition, housing often serves as a symbol of status.

In Russia, the housing has a particular importance. The main issue is the very insufficient availability of affordable and high-quality housing in Russia. The availability of housing (as measured by the living space per head) in Russia is two times smaller than in Western Europe and almost three times smaller than in the USA (see section 3.8). This problem is aggravated by the fact that the housing affordability (as measured by the ratio of incomes of an average household to the income it must have to purchase a standard dwelling using a mortgage loan provided at standard conditions) in Russia is, for example, four times lower than in the USA (Гусев, 2008).

This is confirmed by the results of the opinion surveys, which show that the most important problems of Russian citizens at the national level are: high housing prices, high utilities prices, and a near impossibility to buy housing.[1]

3.3 Housing market

The housing as a good has several specific features that distinguish it from other goods. First, housing is very heterogeneous — it differs a lot in terms of size, layout, equipment, state, and location. Second, the housing is immobile — it is impossible (without huge expenses) to move it in space. There some exceptions, like boat houses (e.g., in Amsterdam, Berlin, and Paris) and mobile homes (widely spread in the USA). Third, the housing is durable — normally, it can be used for decades. The exceptions include temporary housing and huts of nomad people (e.g., iglu or yurt). Fourth, the housing is very expensive — it accounts for a large share of consumption and wealth of private households. Fifth, the costs of moving are very high: large financial and socio-psychological costs are associated with changing the residence, especially if people move between for a long distance.

Heterogeneity of housing

The housing is a highly heterogeneous good — it varies a lot across different dimensions. The housing value can be represented as a combination of contributions of its features. Typically, two major types of housing characteristics are distinguished: structural and locational. The structural characteristics refer to the physical condition of the dwelling itself and the building wherein it is located. They include the size (e.g., total and living area, the number of rooms, the number of

[1] See the press release of the Russian Public Opinion Research Center of October 7, 2016: https://wciom.ru/index.php?id=236&uid=115901.

floors in the building as well as the floor in which the dwelling is located, the area of the land plot), the layout (e.g., several small rooms vs. one large room, connected or isolated rooms, joined or separate WC and bathroom, availability of balcony or loggia, etc.), the equipment (e.g., built-in kitchen, central or individual heating, air conditioning), the state (e.g., newly built vs. completely worn-out, luxury vs. poor), construction materials, and the energy consumption and type of energy.

The locational characteristics describe all features of the housing related to its geographical location. They include the accessibility (e.g., the distance or the travel time to the central business district, the proximity to roads or public transit stops and stations), the socio-economic situation in the neighborhood (the income and cultural level, the unemployment and the crime rate in the neighborhood or city district in which the dwelling is located), the natural environment (the quality of air, the availability of the green spaces, the proximity of the sources of environmental pollution, the incidence of various diseases), and the state of neighbor houses (how well the nearby houses and adjacent land plots are kept).

One related feature of the housing market is the information asymmetry between the seller and buyer of the housing. In case of such a complex and heterogeneous good, it is virtually impossible for the buyer to figure out all its relevant characteristics before he buys and starts to use it. Even then, some hidden deficiencies can be discovered only years after. These include, for example, the fungus of the walls (structural characteristics) or the fact that nearby railway station is going to be shut down in a few years (locational characteristics).

Immobility of housing

In most cases, the housing is immobile, meaning that it is prohibitively difficult and expensive to move it from one place to another. Therefore, the real estate agents often joke that the three main factors affecting house prices are: location, location, and location. However, this joke contains a big grain of truth. Indeed, in many cases the value of the dwelling can be up to a half dependent on its location.

The heterogeneity of housing implies a high degree of segmentation of housing markets. The housing submarkets are delineated by such characteristics as size, location, and quality. The local markets can be quite isolated from each other, especially if they are divided by the natural (rivers, mountains, etc.) or human made (railroads, highways, etc.) barriers. Such local isolation produces spatial heterogeneity of housing (local submarkets differ from each other, especially in terms of the price) and spatial dependence (the dwellings located next to each other are more related in terms of their values than dwellings located far apart). Section 4.6 elaborates more on these issues and how they can be tackled with in order to accurately assess the value of the real estate.

Durability of housing

The housing is a very durable good. It can serve for various decades or even centuries. However, over time, the housing wears and tears. Therefore, from time to time a refurbishment is needed.

The number of existing dwellings or their area is called housing stock. The housing stock grows mainly through the new construction. Some part of housing is removed from the market. First, dwellings are converted to non-residential uses (e.g., offices, doctor's practices). Second, the owners simply do not use it and leave vacant (empty) as a so-called “concrete purse”. This is done especially during the housing market booms, when the prices for housing increase, and the market participants expect to sell it at a later stage with a profit. In such a case, renting out of the housing is regarded as something burdensome. Third, when housing is worn out and not well maintained, it decays and becomes uninhabitable. Fourth, the housing is demolished, because it is too worn out or it is considered as an obstacle for the new developments (construction of new streets or larger buildings).

One interesting phenomenon related to the durability of housing is the so-called filtering down. It means a transition of housing from the more expensive into a cheaper segment due to wear and obsolescence. Typically, the housing market is very segmented by different dimensions. One of the dimensions is the quality of housing. The higher-quality dwellings are more expensive and, therefore, are used by the better off persons, while lower-quality dwellings are inhabited by the poor people. Often, the investors are more interested in constructing high-quality dwellings that offer higher profits than the dwellings for poor. This can create problems with availability of affordable housing, since people with lower incomes are more populous. However, the good news is that the high-quality dwellings constructed years before through the wear and tear descend into the lower-quality segment. The rich people leave these dwellings and more into the newly built ones, whereas poor people can move in these “filtered down” dwellings. This process —at least to some extent— mitigates the housing affordability issue.

Housing is expensive

Another important feature of the housing is its high price. Despite all the standardization of the building materials and streamlining of the construction process, the modern housing is very expensive.

The housing price by far and large exceeds the current income of the household. It can well be 3–4 times larger than the annual income. Therefore, the housing is mainly bought with borrowed money. This can be dangerous, if the dwelling is bought at a peak of a housing boom, which is followed by an abrupt price fall.[2] In such a case, many house buyers with low or uncertain incomes can default and lose their property. In some countries, e.g., in Germany, the liability of mortgage

[2] See more on the so-called speculative asset price bubbles in Chapter 5.

debtors does not end with the sale of the house, instead the whole their wealth must be used to pay out their debts. If many people cannot fulfill their debt obligations, then the banks, which lent them money, get into troubles. Due to a strong interdependence of the banks this can lead to a systemic crisis of the whole banking system, which, in turn, can trigger a full-fledged economic downturn. This is a scenario that took place in 2008–2009 first in the USA and then in many other countries.

The fact that the housing is very expensive generates a divide between people: some of them, who have another money to buy a dwelling, become homeowners, while the others must live in a rented housing. The choice between the own and the rental housing is known as a tenure choice. In more detail it will be considered in Chapter 6.

Finally, the housing makes up the largest part of the private wealth. This means that the assets of the private households are mainly invested in their housing and, thus, are not really diversified. For example, in Germany, it accounts for more than a half of the wealth of private households. It share is well above the proportion of other assets, including cash and securities. In China, the proportion of the housing in the total wealth is even higher, corresponding to approximately 70%[3] In Sweden, during the post-WWII period, the housing accounted for 50–75% of the wealth of private households (Berg, 1988). Figure 3.1 depicts the structure of the fixed capital of Russia in 2015.

As seen, the value of residential buildings accounts for more than 40% and is about 138.8 trillion rubles.

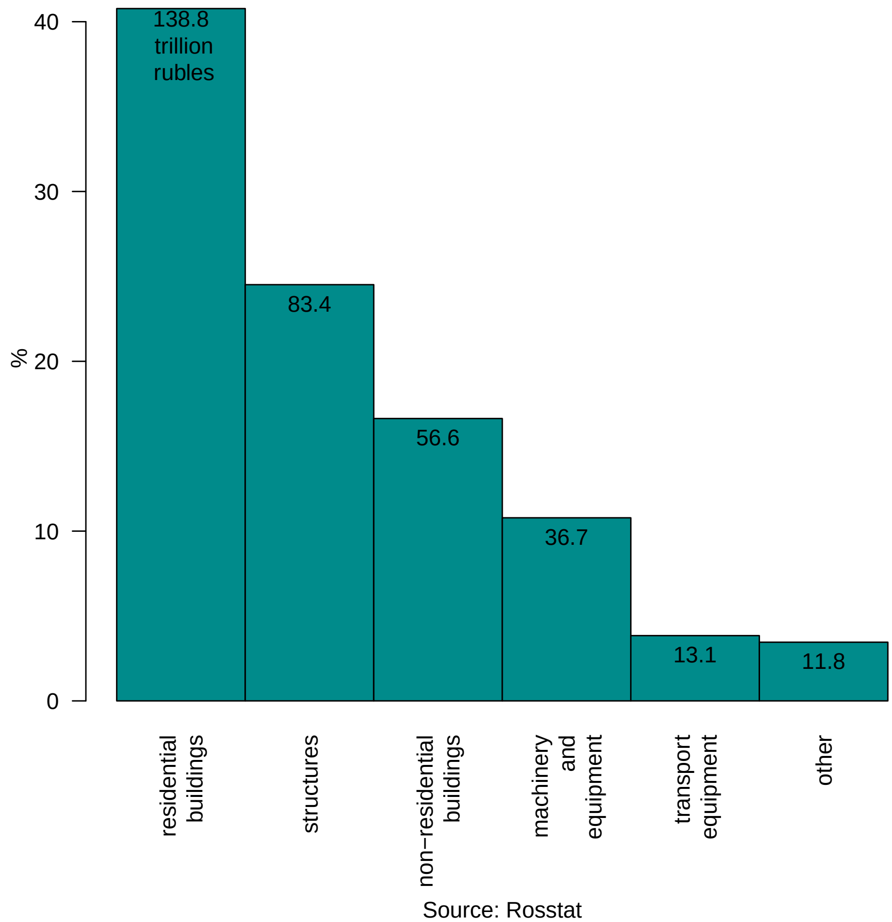
Figure 3.2 traces the evolution of the structure of the private wealth of France between 1700 and 2010. The value of four main assets (agricultural land, housing, other domestic capital, and net foreign assets) is expressed as percentage of the national income. While until the mid-19th century, the agricultural land in France used to be the largest asset, by the end of the 20th century the housing turned into the largest wealth component.

3.4 Demand for housing

As in any other market, the effective demand for housing depends on the number of individuals requiring it and on their purchasing power. In case of the housing market, the individuals requiring dwellings are households. According, for example, to the definition of Rosstat, "a household is a group of persons living in the same residential premises or part of them, who jointly provide themselves with food and all necessary stuff for their life, and completely or in part join and spend their money. These persons can can be unified by the kinship relations and relationships resulting

[3] The New York Times: China's real estate mirage: https://list.juwai.com/de/news/2017/06/why-are-chinese-so-obsessed-with-buying-property.

Figure 3.1: Structure of Russia's fixed capital, end of 2015



from marriage, or do not be relatives, or be either one or another".[4]

Therefore, the demand for housing depends basically on the demographic factors and disposable income. However, the housing is a dual good: it can be used both for consumption (as a place to live) and for investment (as a store of value and possibility to make money). Hence, the demand for housing has the following determinants: demography (population, number of households, migration); disposable income; the opportunity cost (interest rate); and the price.

Demography

The population growth leads to a rising need for housing. However, when population is constant or even declining, the demand for housing can still increase due to the growing number of households, because their size reduces. During 20th and 21st centuries, in European countries, including Russia, household sizes have been declining. Consider, for example, the population and households

[4] See definition in Russian here: http://www.gks.ru/free_doc/new_site/population/demo/micro-perepis/finish/Method-MPN-2015.pdf.

Figure 3.2: National wealth of France, 1700–2010

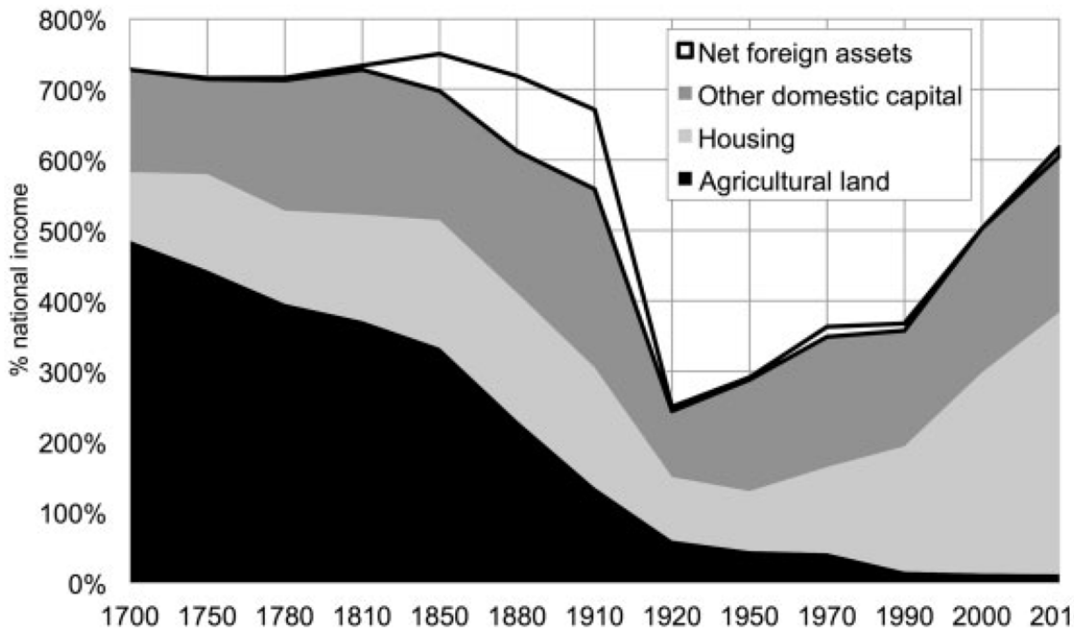


FIGURE IX

The Changing Nature of National Wealth: France, 1700–2010

National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

Source: Piketty and Zucman (2014).

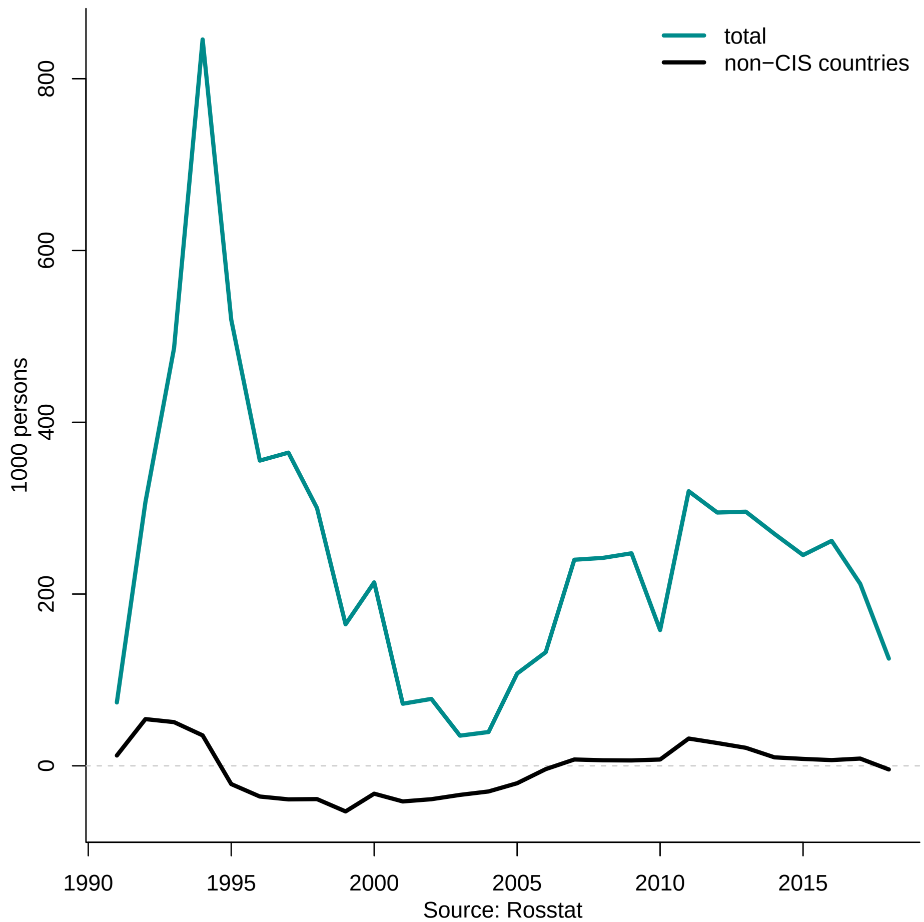
development in two countries with shrinking population: Germany and Russia in 2002–2010. In Germany, the population decreased by 1,0%, whereas number of households increased by 4,1%. In Russia, between 2002 and 2010, the average household size dropped from 2.7 to 2.6 persons, which led an increase of the number of private households from 52.7 to 54.6 million, that is, by 3.5%.[5] At the same, the number of the private household members declined from 142.8 to 141.0 million, i.e., by 1.3%. During the same period, in the Russian urban areas, the number of the private households increased by 5.1%, with their population remaining almost unchanged, while the average household size decreased from 2.7 to 2.5.

In many countries, the natural population growth is negative. It means that the number of deaths exceeds the number of births. In this case, the population growth can be achieved only through immigration. Figure 3.3 shows the net migration (immigration minus emigration) in Russia between 1991 and 2018.

As seen, the net migration in Russia has been positive, sometimes —in the early 1990s— ex-

[5]According to the results of the All-Russian population censuses of 2002 and 2009.

Figure 3.3: Net migration in Russia, 1991–2018



ceeding 800,000 persons. This inflow of foreign population in part offset the decline of population in the Russian Federation.

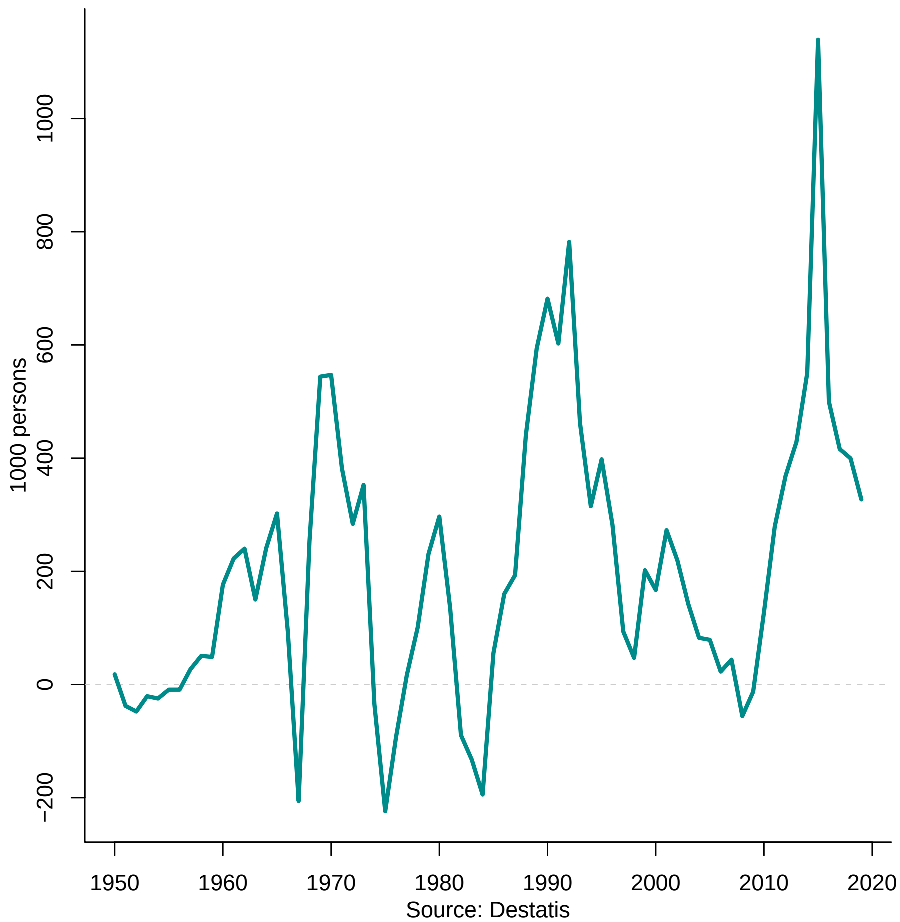
Similarly, the migration has played an important role in the population growth of Germany in 1950–2019, as Figure 3.4 shows.

The net migration to Germany underwent strong fluctuations in the post-WWII period. Two largest and the most recent surges in the net migration are related to the immigration from the former Soviet Union in the early 1990s and the refugee crisis of 2015.

Income

The rise of the purchasing power is related to the increase of the real disposable income. Even if the number of private households remains unchanged, the increase in their welfare leads to the growing demand for housing. This means that the demand for more spacious and comfortable housing increases or people start demanding additional dwellings. For example, in Spain the so-called secondary dwellings (*viviendas secundarias*) are widespread, which are typically purchased

Figure 3.4: Net migration in Germany, 1950–2019



in the recreational areas as a supplement to the principal dwelling located in the area of the permanent residence of the owner.

3.5 Housing supply

The supply of housing depends in the first place on its rate of return. Usually, the rate of return of housing is measured by the ratio of the net revenue from letting it out (rental revenue minus related expenses) to the amount of capital invested in purchasing it. The investors compare the expected rate of return of housing to the alternative forms of investment, which have the same or smaller risk. When the risk-weighted rate of return of investment in the housing market is equal to the risk-weighted rate of return of other assets, the investors are indifferent where to invest their capital. Typically, the rate of interest on bank deposits is considered as an alternative rate of return. If the interest rate increases, then, other things being equal, the willingness of investors to invest their capital in the housing market will diminish. Similar things happen when the expected rate of return on housing declines. This can be a result of a reduction of the housing price, cost increases, and rise of risk. The housing price decrease can be caused by the reduction of demand or by the saturation of the market. The costs can change as a result of the use of the new technologies (e.g., cheaper pre-engineered buildings), increasing energy saving standards (for example, the houses must have double or triple plastic windows and a special weatherization of walls), improvement of comfort (for instance, the availability of elevators or special equipment for elderly and disabled people), or shortage of the building materials and labor force (as result of construction growth or of its use for other, e.g., military purposes). The government can affect the building costs, for it is the government that introduces the norms of housing consumption, equipment, and energy saving, as well as changes the rate of return of the housing market.

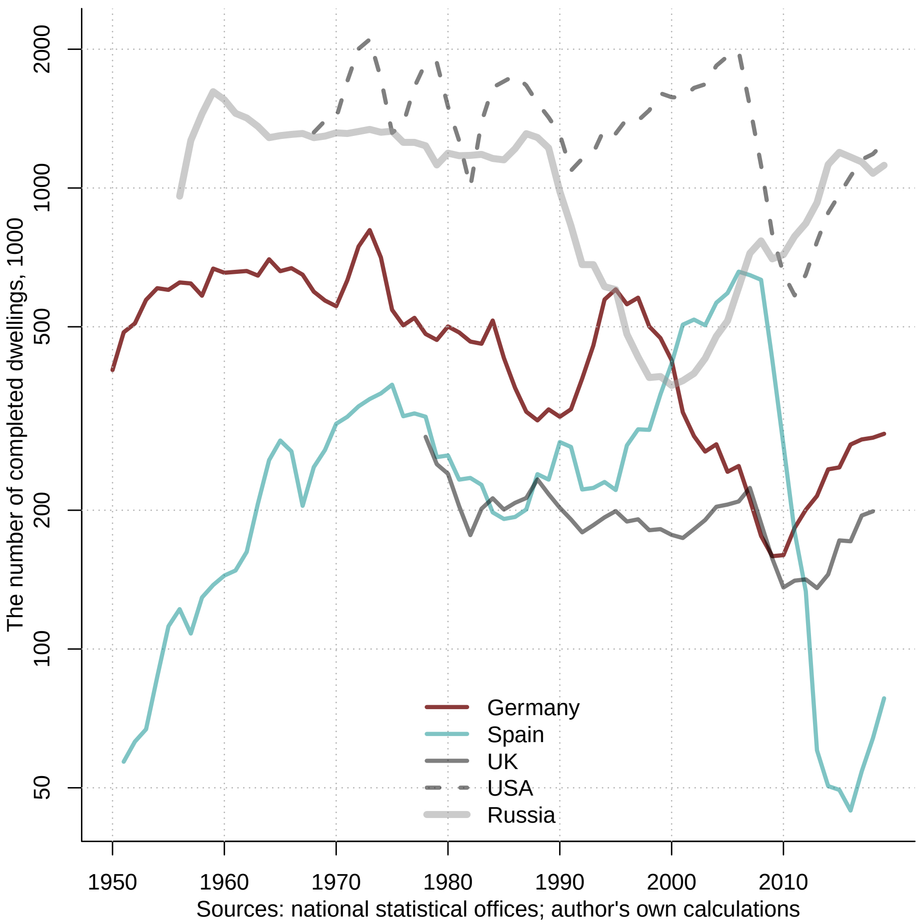
During the peacetime, the housing stock changes rather slowly. For example, in Russia, the stock of housing is large: in 2017, there were 65.9 million dwellings or 3.7 billion square meters. In comparison to the housing stock, the net increase of housing is small: between 2001 and 2017, the average annual increase of the Russian housing stock had been 1% in terms of the number of dwellings and by 1.6% in terms of the area.

Figure 3.5 depicts the housing construction dynamics in several countries. The housing construction is measured by the number of completed dwellings (flats in the apartment buildings and single-family houses).

As seen, the residential construction has underwent strong fluctuations. On the one hand, they are related to the large-scale post-war reconstruction programs, especially in Germany and Russia. On the other hand, they result from cyclicity of the housing market. A big construction boom, which preceded the Great Recession 2008–2009 is very pronounced. This in particular true in case of Spain, where in the first half of the 2000s, 3–4 times more housing had been built than in Germany, despite the fact the population of Germany is double of that of Spain. This conditioned a very destructive contraction that followed. In Russia, the residential construction declined during the "lost decade" of the 1990s, when as a result of the breakdown of the Soviet Union and badly designed policy of transition toward market economy, the nation incurred enormous material losses.

Figure 3.6 displays the average annual residential construction intensity between 1900 and 2017. In fact, it covers an unbalanced panel of 62 countries. It compares the housing construction worldwide, in the former Socialist countries, and in Russia. As seen, the residential construction rapidly fell during both world wars and then strongly increased. The highest construction intensity had been observed between 1950 and 1990. During this period, Socialist countries demonstrated particularly high intensity of residential construction. Between 1990 and 2000, a large drop in the construction can be observed, which especially hard hit the former Socialist countries that engaged during that period on the way of transition. Another substantial decrease in the construction intensity took place in the wake of the Great Recession of 2008–2009. Interestingly, since 2010, Russia demonstrates a higher than the worldwide average intensity of residential construction,

Figure 3.5: Completed dwellings, 1950–2019



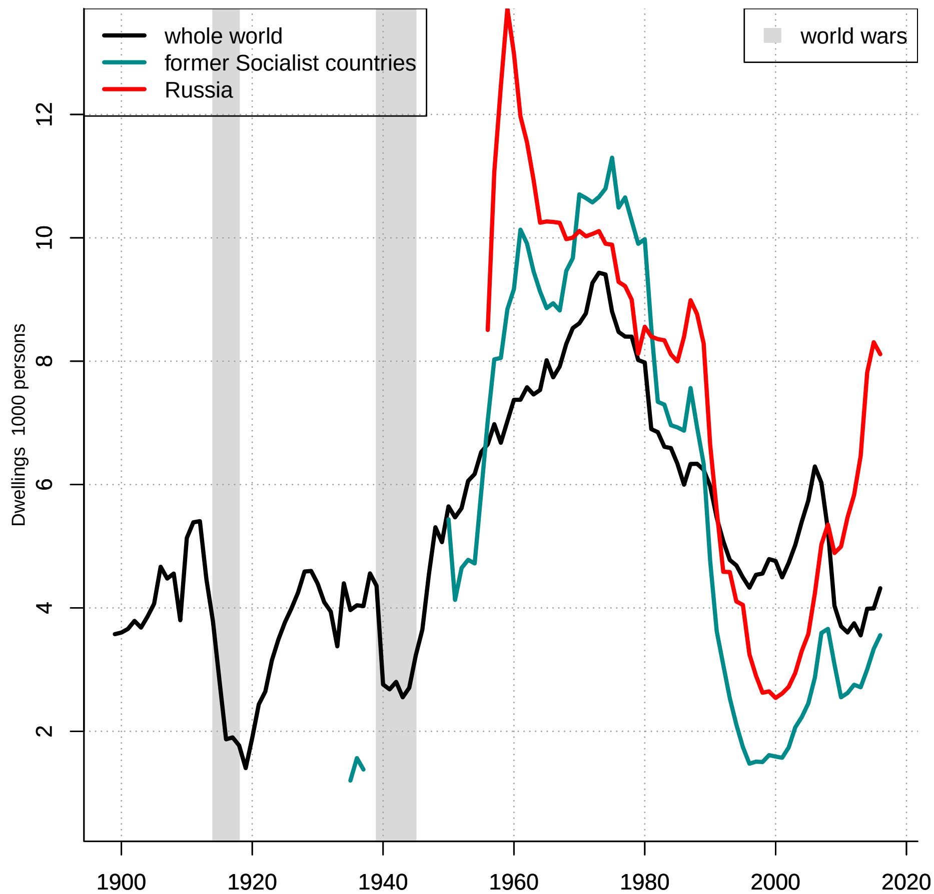
which, however, falls short of the level attained in the last years of the USSR, let alone the record levels attained in the late 1950s.

3.6 Housing prices

The housing price allows establishing an equilibrium between the supply of and demand for housing. It performs a signalling function by informing the builders, landlords, and consumers about housing shortage or excess supply.

Figure 3.7 shows the dynamics of the house prices in several OECD countries plus Russia between 1970 and 2020. All these housing price indices are set to 100% in 2015. A logarithmic scale is used in order to better see the relative increases of the prices. Germany demonstrates the lowest growth rates of housing prices over most part of the period. Russia experienced in the 1990s a very swift increase in the housing prices, which is related to the liberalization of its economy, privatization of the housing stock, and the hyperinflation. After 70 years of the centrally planned economy, where housing market was confined to a very narrow niche, virtually

Figure 3.6: Completed dwellings per 1000 persons worldwide, 1900–2017

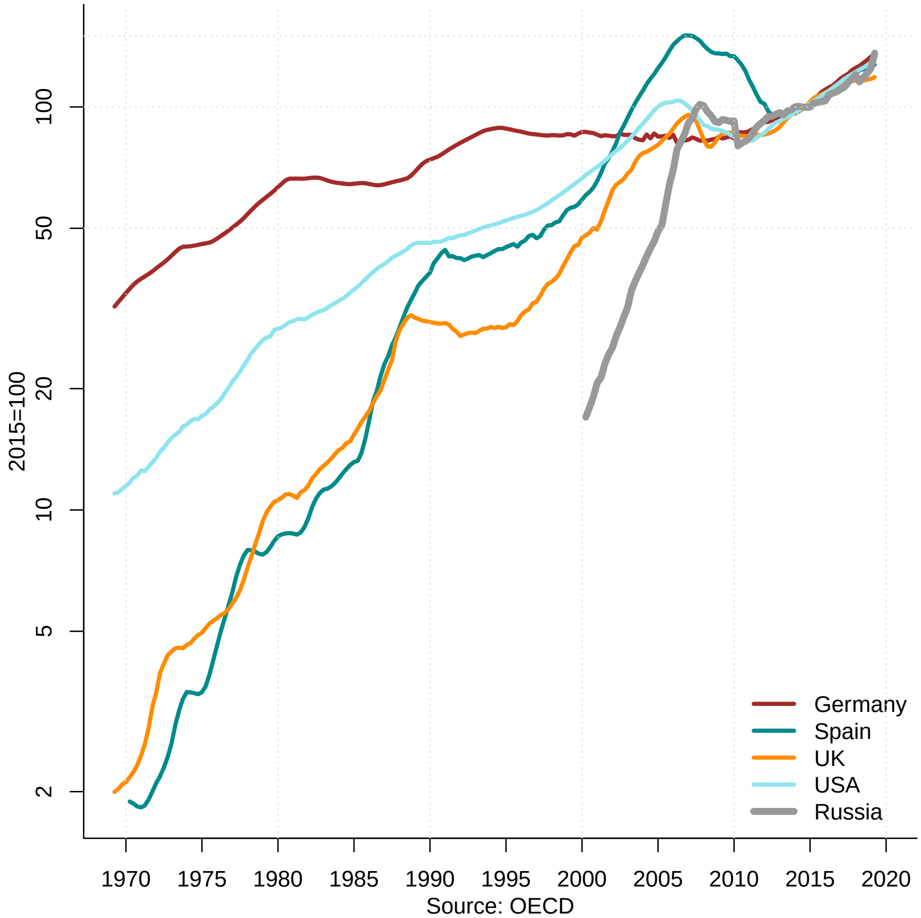


Sources: national statistical offices and own calculations.

all residential properties became an object of buying and selling. Spain and the UK also had rapid house price increases, while the USA occupied an intermediate position. Around 2008, the upward trend was broken and in all countries, except for Germany, the prices fell down. After several years of stagnation, they started to recover.

Figure 3.7 displays the nominal prices. Therefore, in part their increases can be explained by the overall inflation rates in each country. For instance, in Russia, the housing price increase in the 1990s is to a large extent due to its tremendous hyperinflation. Figure 3.8 accounts for this by presenting the real housing prices, that is, the nominal prices divided by the consumer price index and, thus, corrected for inflation. The adjustment for inflation rates makes the house price cycles more visible. They take various lengths, varying from five to ten years and sometimes synchronized between countries. The adjustment of housing prices for the overall price level growth makes also pronounced a house price decline in Germany that lasted from the mid-1990s through 2010 and the current crisis of the Russian housing market, where real prices have fallen since 2014.

Figure 3.7: Housing prices in selected countries, 1970–2020



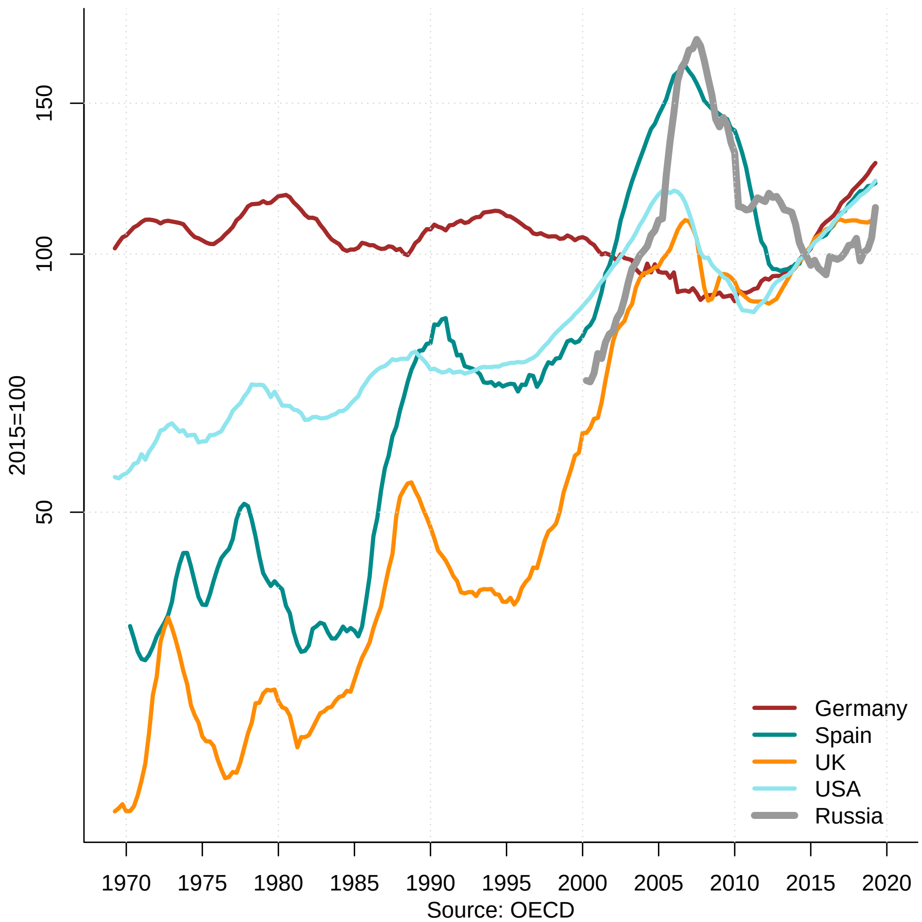
The house price data presented above cover almost 50 years, in case of Russia — about 20 years. A very long-term evolution of real house prices in 14 advanced countries can be traced thanks to a database compiled by Knoll et al. (2017); see Figure 3.9. It allows to see how strongly did the housing prices increase.

Between 1870 and 1950s, the real house prices stagnated. It is only since the 1950s, that they began to rapidly increase. The price of land plays a central role for the long-term evolution of house prices. Construction costs rose in the interwar period, increased substantially in 1950–1970, and then leveled off.

3.7 Housing market equilibrium

The establishment of the housing market equilibrium can be illustrated using Figure 3.10, which depicts the standard stock and flow model. The left panel shows the housing stock, while the right panel displays the net change (flow) of the housing stock. Along the horizontal axis, the area of housing in square meters is plotted, whereas the vertical axis shows the rent per square meter. In

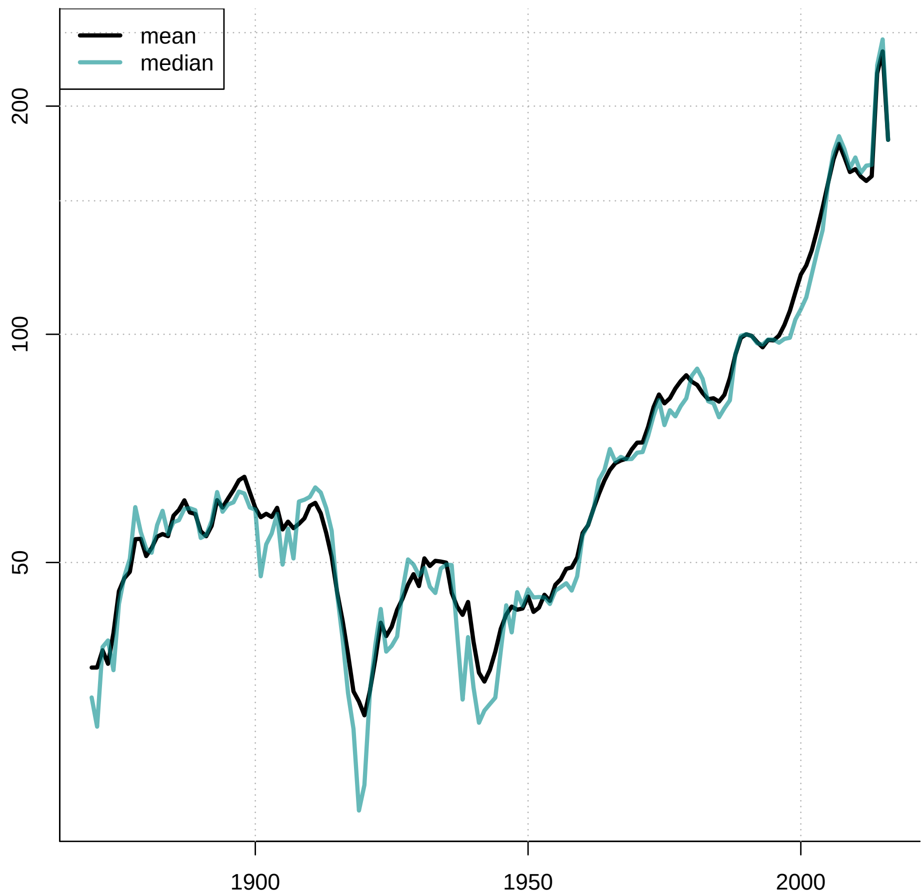
Figure 3.8: Real housing prices in selected countries, 1970–2020



the short run, the housing supply is determined by the available housing stock and is, therefore, completely inelastic. For this reason, the supply curves in the left panel are depicted as vertical straight lines.

In the right panel, the supply curve $S_{\Delta H}$ has a positive slope and denotes a net inflow of the housing into the market, ΔH. When the housing rent, r, is high, then the net inflow is positive. However, if the rent is low, then the net flow can be negative. This is related to the fact that the housing can not only appear on the market, but also disappear from it as a result of demolition, merger of several dwellings into one, etc. The net inflow of housing, ΔH, represents a difference between the newly built and eliminated housing. When the rent r is high, much new housing is built and little old housing is demolished. However, when the housing rent is low, the rental revenues of the landlords decrease, which makes the construction of new housing less attractive and can induce the housing owners to neglect maintenance and even demolish the existing housing. In this case, the net inflow of housing becomes negative. When the housing rent equals r_e, in the point, where curve $S_{\Delta H}$ intersects the vertical axis, the area of the newly built dwellings is equal to

Figure 3.9: Evolution of real house prices in 14 countries, 1870–2016, 1990=100



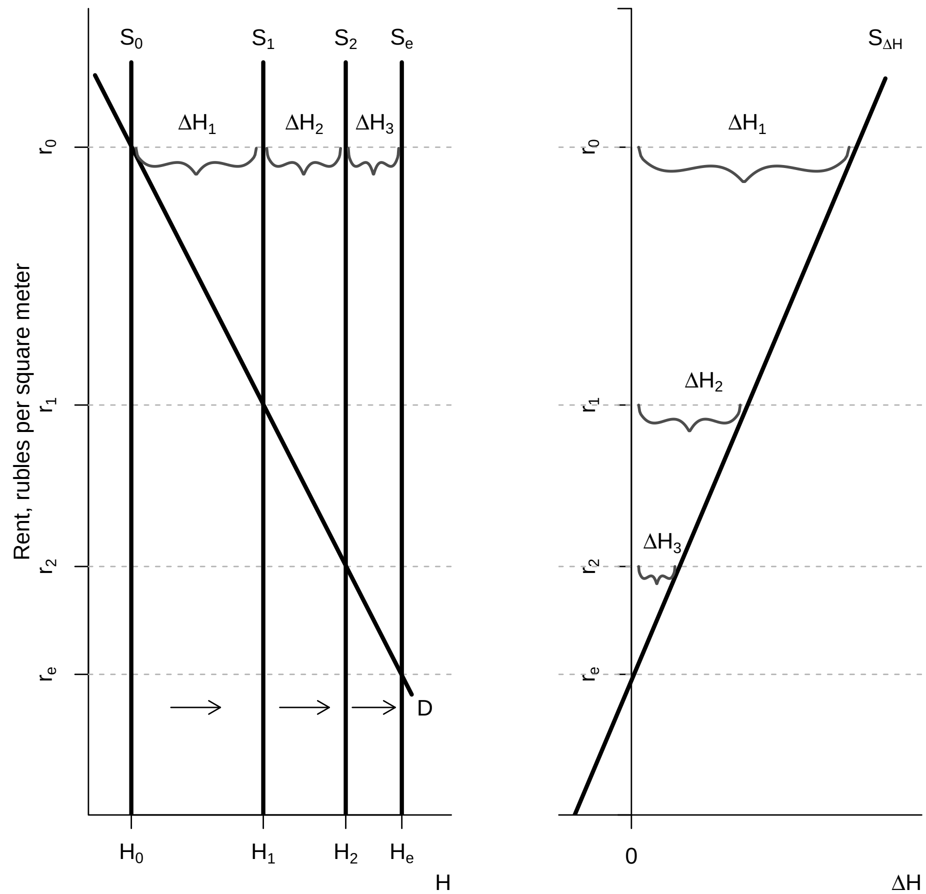
Source: Knoll et al. (2017), http://www.macrohistory.net/data/.

that of the eliminated dwellings; thus, the net inflow is zero leaving the housing stock unchanged.

Initially, the housing stock equals H_0. The demand for housing is represented by the curve D having negative slope. In the point of intersection of both lines, the housing rent is r_0. At such rental price, the investors (developers) are ready to build ΔH_1 square meters of housing. Therefore, in the next period, the supply curve will shift rightward, into the position $H_1 = H_0 + \Delta H_1$ and the rent decreased to r_1. However, event in that case, the developers are still willing to erect additional housing, albeit less than in the previous period — ΔH_2. Thus, the new residential construction will continue until the housing stock will increase up to H_e and the rental price will fall to r_e. This will be an equilibrium level. The housing market will remain in the equilibrium until it will be distorted by some supply or demand shock.

What kind of shocks can force the housing market out of its equilibrium? For example, an earthquake can destroy a part of the housing stock and, thus, cause a negative supply shock. In such a case, the long-run supply curve in the left panel will immediately shift leftward. This will

Figure 3.10: The stock-flow model



lead to a rent increase, which will induce a new housing construction and, hence, gradual expansion of the housing stock. Migration can also affect the equilibrium. In case of negative net migration (emigration), the demand for housing decreases and the demand curve shifts leftward leading to a reduction of rent. By contrast, positive net migration (immigration) will lead to a rightward shift of demand curve causing rents to rise, which, in turn, will stimulate the developers to expand the new housing construction and slow down the removal of the existing housing units.

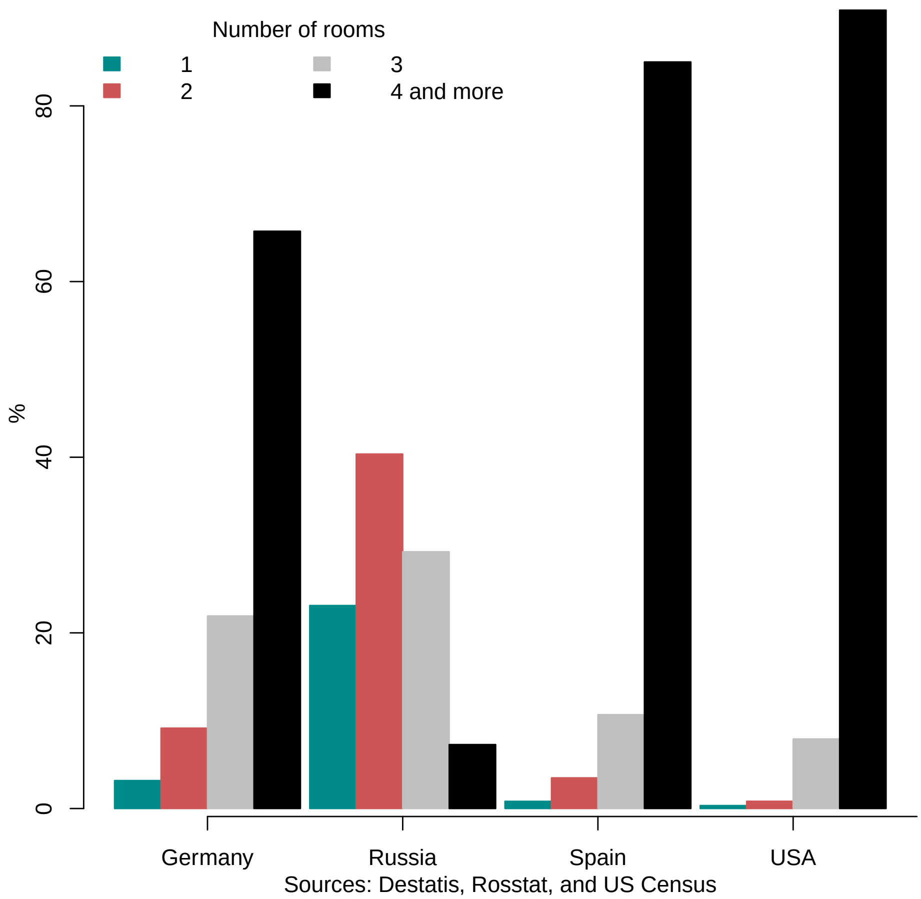
What happens if the housing price changes? Suppose that the price increases. This increases the attractiveness of supplying more housing and can lead to the new construction; a slowdown of wearing through current repairs; and housing modernization implying a change of layout and a quality improvement of the existing housing. If the price decreases, then there is less or no new construction; the (rental) dwellings are converted to other (non-residential) uses; and more buildings are demolished.

3.8 Housing availability

An important indicator of the housing market development is the availability of housing. It shows how much living space is available per person or household.

Different countries have very different levels of housing availability. Figure 3.11 shows the distribution of housing stock in four countries (Germany, Russia, Spain, and the USA) by the number of rooms. Russia differs a lot from other countries. While in Russia, most dwellings has 2

Figure 3.11: Structure of housing stock by number of rooms, 2006–2011

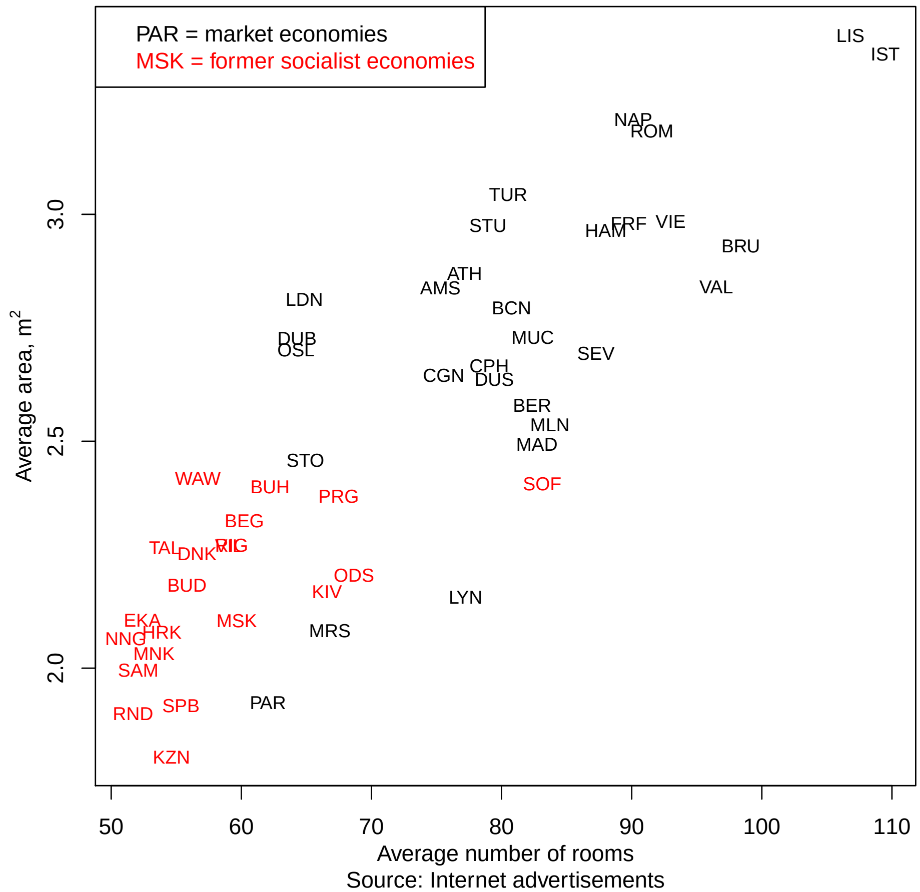


Sources: national statistical offices and own calculations.

rooms or less, in other three countries, the vast majority of dwellings have 4 rooms or more.

Figure 3.12 depicts the dwelling sizes in 49 large European cities or capitals. Since no statistical data on the city level could be found, we use the data taken from the Internet advertisements of dwellings for sale. Surely, the structure of the advertized housing must not necessarily be identical to that of the existing total housing stock. Still, it can provide some useful insights in cross-city and cross-country differences. As seen, the quality of advertised flats can vary substantially both

Figure 3.12: Size of dwellings in European cities, 2012



across cities and time. Usually, it is correlated with the welfare level, culture, and availability of the free space in each city. For example, flats in Central and Eastern Europe (CEE) are typically smaller (50–60 m^2 and 2 rooms), whereas in Western Europe they are much larger (70–90 m^2 and 3 rooms), see Figure 3.12, where the CEE cities are denoted by red color. One notable exception is Paris, where a typical flat is about 60 m^2 large and has 2 rooms. One can even find the ads of flats as small as 9 m^2, which are offered for exorbitant prices in Paris. It is difficult to imagine something like this in Berlin. The flats in cities of non-continental and Nordic countries are also relatively small. The largest flats (about 110 m^2 and more than 3 rooms) can be found in Lisbon and Istanbul.

Table 3.1 reports several indicators characterizing the housing availability in selected countries.

Table 3.1: Housing availability in selected countries

Country	Average dwelling surface, m^2	Surface per person, m^2		Years, needed for Russia to catch up
		total housing stock	newly completed dwellings[a]	
Germany	91.1	42.7	0.25	86
Russia	53.2	23.0	0.48	–
Spain	92.4	35.7	0.24	53
UK	92.3	49.3	–	–
USA	139.4	65.0	0.45	1401

[a] Average over 2010–2014.

In 2010–2014, in Russia, the average dwelling was almost two times smaller than in European countries and almost three times smaller than in the USA. The gap between Russia and other countries in terms of surface per person is even larger. However, in case of the newly built dwellings, the surface per capita in Russia is much larger than in Germany and Spain and is comparable to that in the USA. This implies that, if the difference will remain, then, as follows from equation (3.1), in 53 years the surface per capita will attain the same level as in Spain, in 86 years that of Germany, and in 1401 years that in the USA.

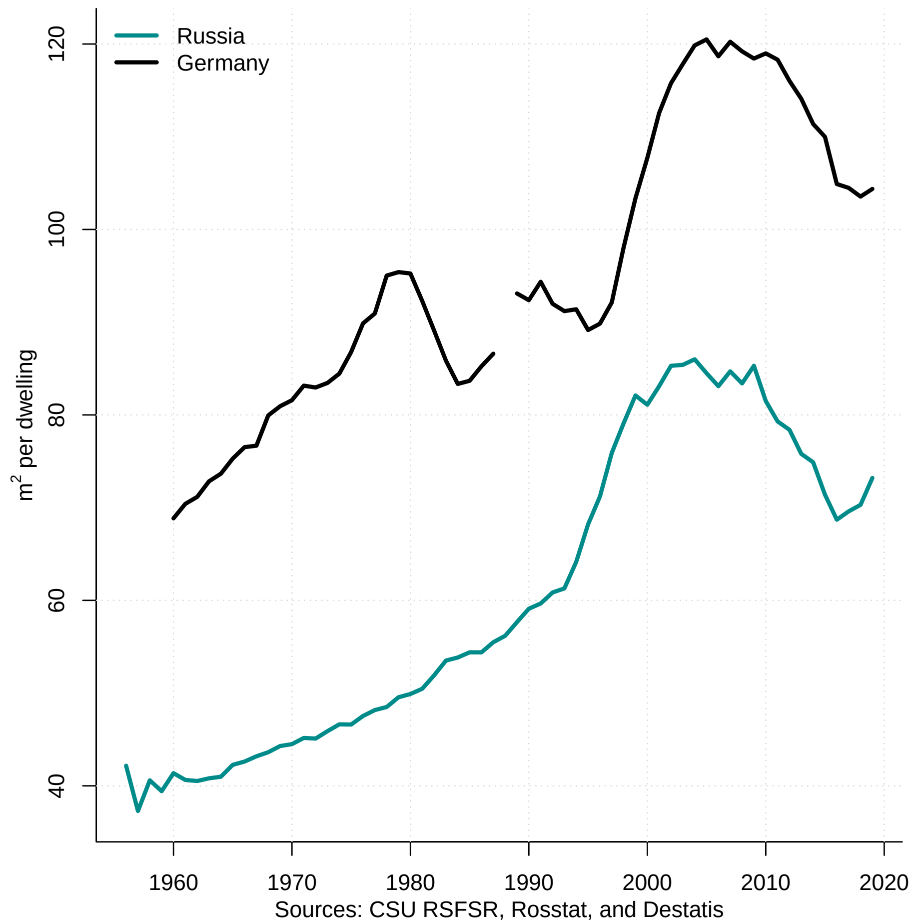
The number of years Russia would need to catch up developed countries in terms of surface per capita can be computed as follows:

$$CT_t = \frac{HS_t^i - HS_t^{RU}}{\Delta HS_t^{RU} - \Delta HS_t^i} \tag{3.1}$$

where HS_t^i is the floor area per person in country i in year t; HS_t^{RU} is the floor area per person in Russia in year t; ΔHS_t^i is the net per-capita change of floor area in country i in year t; and ΔHS_t^{RU} is the net per-capita change of floor area in Russia in year t.

Figure 3.13 compares the average surface (in m^2) of the newly built housing in Germany and Russia in 1956–2017. It can be seen that, during the last 60 years, the housing availability has improved, as reflected in the average per-capita surface. This process is characteristic for both Germany and Russia, although the housing availability in Germany was and still is much better than in Russia. The absolute gap is almost unchanged at about 30 m^2. After the Great Recession of 2008–2009, both countries has experienced a reduction of the size of the newly built dwellings. This can be explained by two factors: 1) shrinking household sizes (a small family needs a small dwelling); 2) low income levels (many Russians can only afford buying a “microapartment” of 20–30

Figure 3.13: Average surface of new dwellings in Russia and Germany, 1956–2019



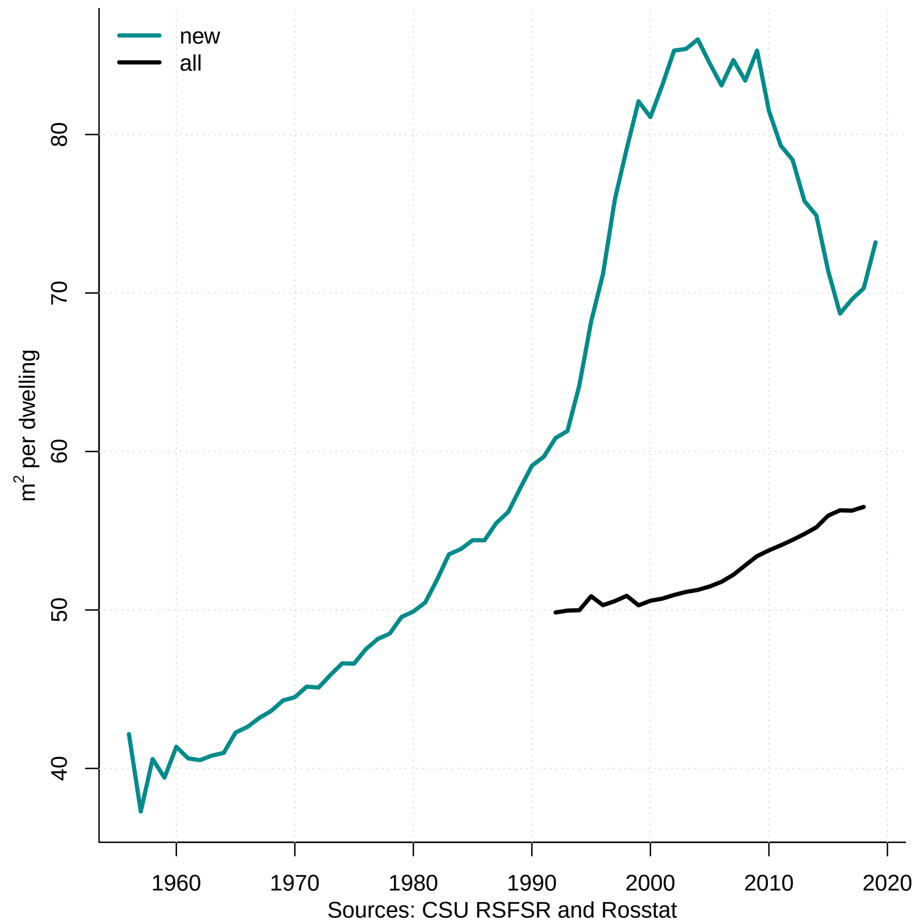
m^2, albeit it will not allow them to satisfy their housing requirements to a full extent).

Figure 3.14 displays the average surface per capita of the newly built and existing housing in Russia between 1956 and 2017. It shows that between 1991 and 2017 the average surface per capita of the existing housing stock increased from about 50 to 56 m^2. This is a result of the growing sizes of new dwellings. Moreover, the difference between the surface of the newly built and existing housing widened from about 10 to about 13 m^2.

3.9 Housing vacancy

Normally, the housing stock is not fully used. There are almost always dwellings that stay vacant. This is similar to the labor market, where some people are unemployed, or to the capital stock, where the production capacities are not fully utilized. Similarly to the labor market, the residential vacancy can be decomposed in two parts: *frictional* and *structural* vacancy. The frictional residential vacancy exists because it takes time to find a new tenant for a dwelling, which became empty after a previous tenant left it, or to find a new buyer for an owner-occupied dwelling. This is

Figure 3.14: Average surface of new and all dwellings in Russia, 1956–2019



related to the liquidity and transparency of the market. For example, the internet advertisements of dwellings for rent can stay online for a couple of months pointing out that during this period a search process takes place and that the dwelling is vacant. The structural vacancy can occur in two cases. First, the dwellings remain empty due to the different structure of demand and supply: E.g., there are many single-person households and very few small dwellings. Thus, there is no enough demand for large dwellings leading to their vacancy. Another example of structural vacancy is a dwelling in a very bad state or located in a very unpopular place (e.g., in a depressive region), so that nobody wants to live there. Second, some personal circumstances of the owners prevent them from renting or selling their dwellings. For example, the owner inherited the dwelling and did not yet decide what to do with it. The owner is ill and cannot take care of the dwelling by putting it on the market. The owner does not have any interest in undertaking efforts to place the dwelling on the market. Or he wants to speculate and, therefore, lets the dwelling empty awaiting for prices to increase. The dwelling can be also vacant because it is being renovated. In some cases, the owner can be dead or far away, so that no one knows how to contact him about the dwelling.

The housing vacancy is the part of housing stock, which is unused:

$$V = S - D \tag{3.2}$$

where V is number of vacant dwellings; S is the effective housing supply; and D is the housing demand.

The vacancy rate is defined as:

$$v = \frac{V}{S} \tag{3.3}$$

According to the natural vacancy rate hypothesis, the housing rents are driven by deviations of the vacancy rate from its equilibrium ("natural") levels (Rosen and Smith, 1983). The estimates of natural vacancy rate provide useful information for investors, lenders, etc. The comparison of natural rate, v^*, to the actual vacancy rate, v, provides indication of future rent movements. The natural vacancy rate affects the return on the property investment. In the long-run equilibrium, a falling natural vacancy rate leads to an increase of the amount of rent generated by a rental property and, thus, of the return on rental property investment.

The demand for housing can be defined as:

$$D^H = d(R, U, Y, P, Z) \tag{3.4}$$

where R is nominal rent; U is user cost of homeownership; Y is the real income; P is the housing price; and Z is a vector of demographic variables (e.g., the number and size of households, the age composition of population).

The equation for the vacancy rate can be expressed as:

$$v = \frac{V}{S} = 1 - \frac{1}{S} d(R, U, Y, P, Z) \tag{3.5}$$

The rent adjustment:

$$r = f(e, v - v^*) \tag{3.6}$$

where r is rate of change of nominal rent; e is rate of change of operating expenses; and v^* is natural vacancy rate.

The natural vacancy rate varies strongly from country to country, as seen in Table 3.2.[6] These country-specific differences must be taken into account, when forecasting rent.

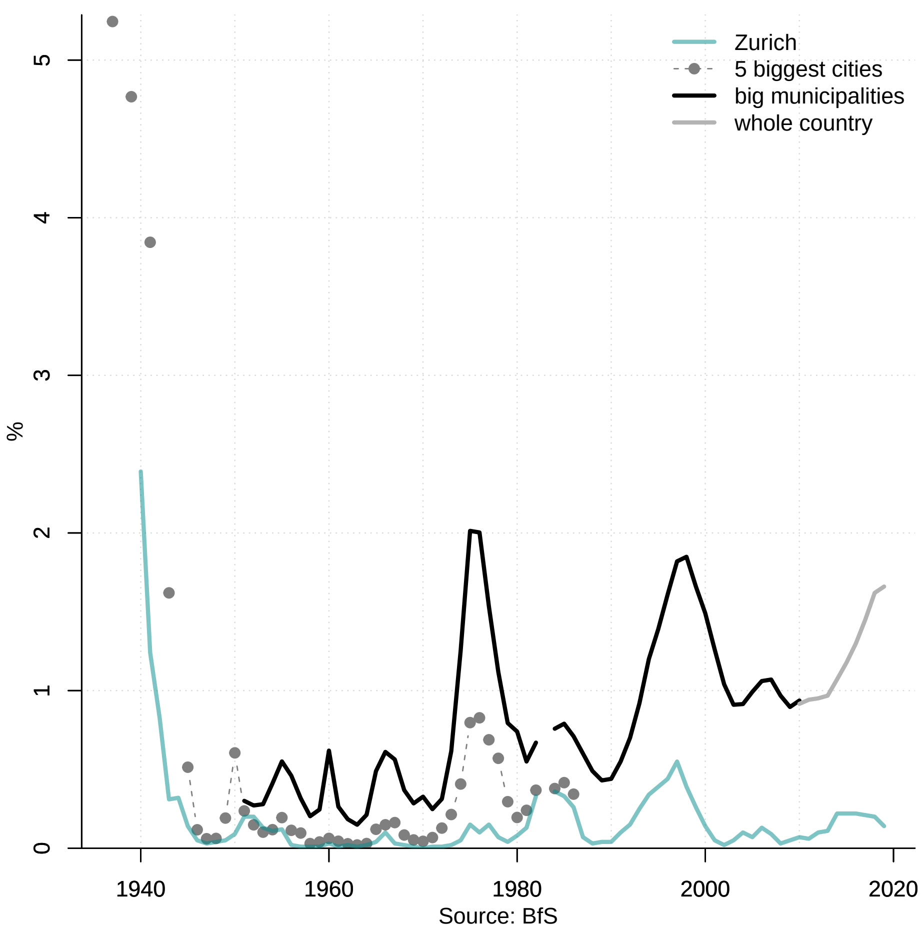
In Germany, a vacancy rate exceeding 3% is regarded as a sign of a "relaxed" housing market, where every person looking for a dwelling can without problem find it. In the USA, such a vacancy rate would point to a stressed housing market, characterized by an excessive housing demand. By the German and US standards, Switzerland appears to function at the almost full "employment" of housing for the last 80 years, as seen in Figure 3.15.

[6] See, for example, Rink and Wolff (2015) for Germany and (Wilhelmsson et al., 2011) for Sweden. In the USA, for example, according to the NYS Emergency Tenant Protection Act (1974), a housing emergency can be declared in a municipality, if the vacancy rate there surpasses the 5% threshold.

Table 3.2: Natural vacancy rate in selected countries

Country	Natural vacancy rate, %
Germany	3
Sweden	1
Switzerland	1
USA	5

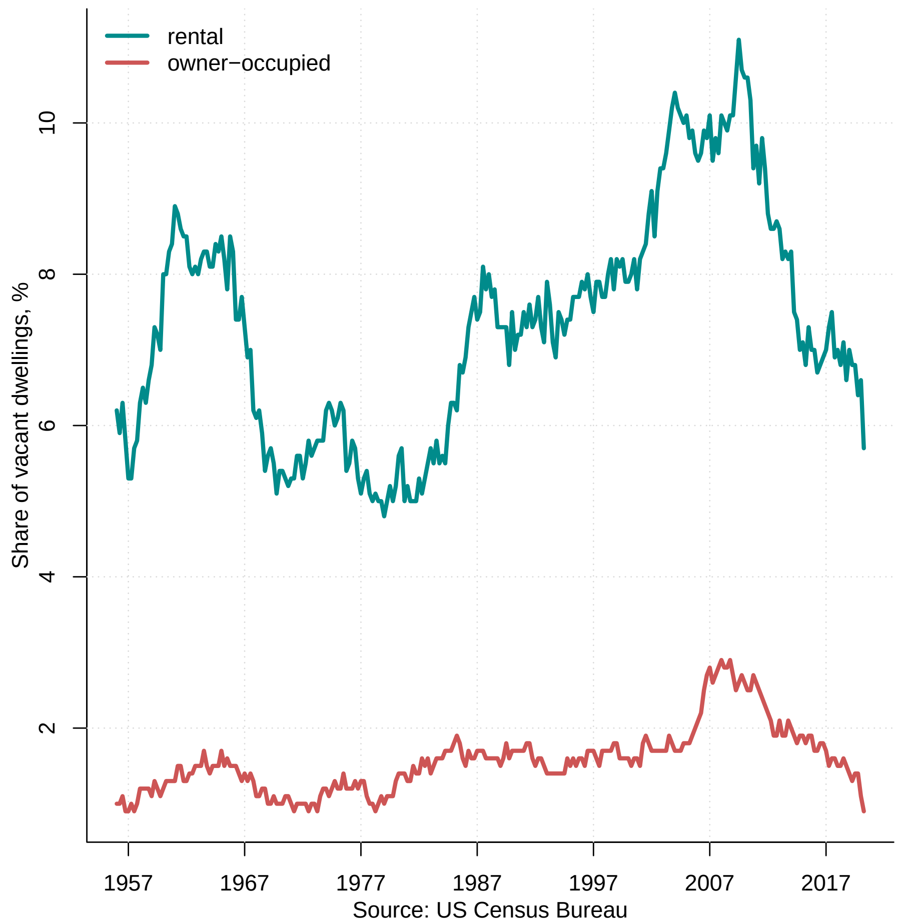
Figure 3.15: Vacancy rates in Switzerland, 1937–2019



Due to changes in the statistical definitions, several measures of vacancy rate are used. As the period between 1950 and 1990 shows, the biggest cities have the largest housing shortage.

For the USA, two vacancy rates are available: for rental and for owner-occupied dwellings; see Figure 3.16, which shows quarterly data covering the period 1956–2017. The vacancy rate for

Figure 3.16: Vacancy rates in the USA, 1956–2020



the rental dwellings substantially (by almost six percentage points) exceeds that for the owner-occupied dwellings. This can reflect the higher mobility of the tenants. Both vacancy rates have a slight upward trend and display cyclical fluctuations, which coincide with those of the real housing prices. For example, the Great Recession 2008–2009 resulted in large jump of the vacancy rate for owner-occupied dwellings. Many home buyers faced the impossibility of paying their mortgage loans and left their houses to the banks. Large-scale defaults inundated the housing market, so that many dwellings stayed empty, for the banks could not find persons willing to buy these properties. Surprisingly, in 2020, the COVID-19 crisis led to a dramatic decline in vacancy rates.

3.10 Housing affordability

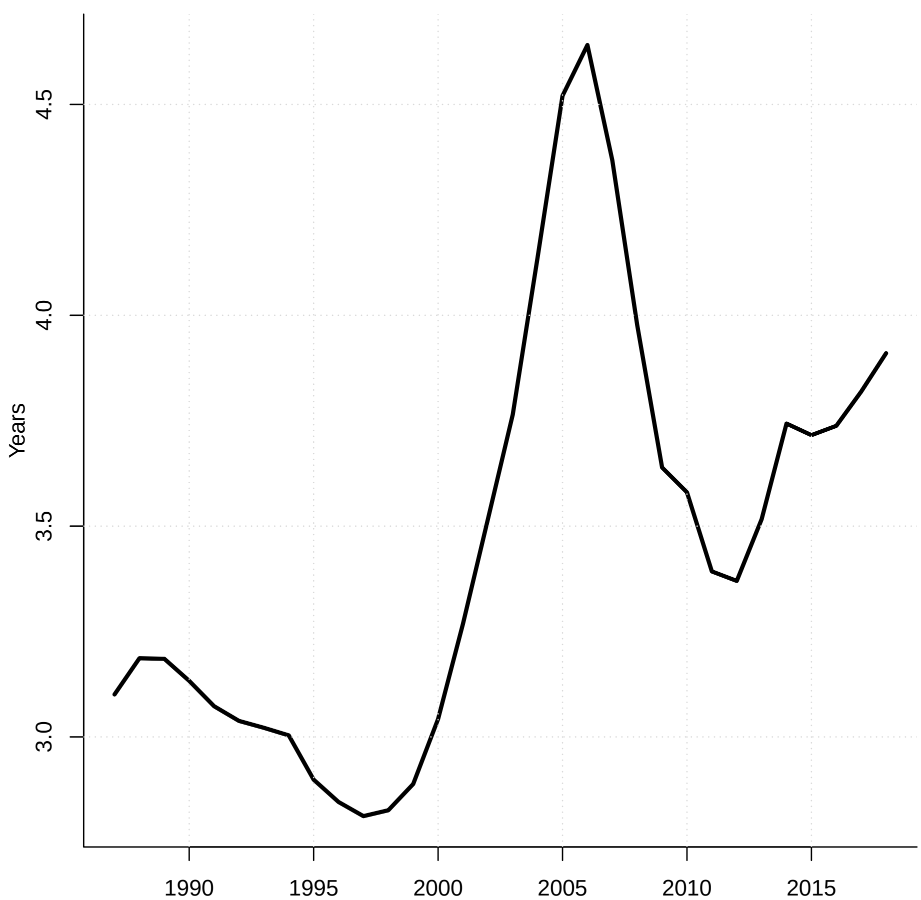
Housing is a very expensive good. Both purchasing and renting the housing costs a lot of money. The concept of housing affordability reflects the ability of market participants (above all the private households) to obtain access as owner or as tenant to the housing.

Purchasing of housing

The affordability of housing from the point of view of a home buyer, is usually measured by the price-to-income ratio. It corresponds to the number of years of (usually, median) income it would take to buy a home. Thus, the higher the ratio, the less affordable the housing.

Figure 3.17 shows the housing price-to-income ratio for the USA between 1987 and 2017. It is based on the median prices of existing single-family home and median household income. On

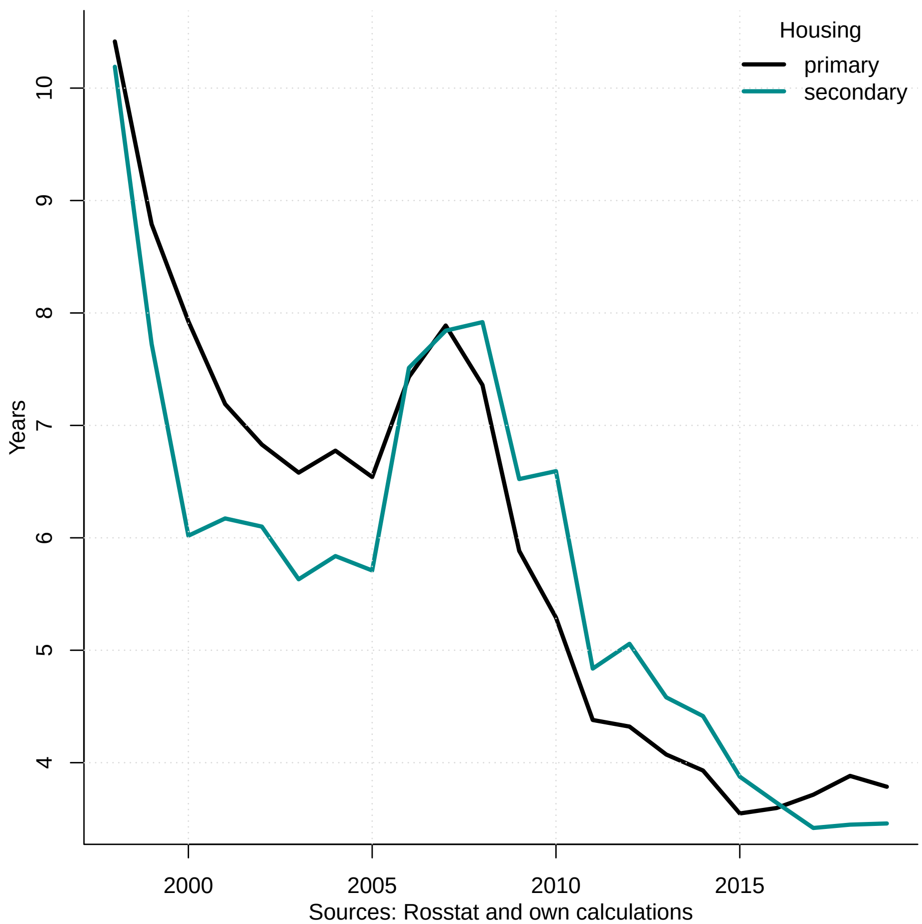
Figure 3.17: Price-to-income ratio in the USA, 1987–2018



Sources: Federal Reserve Bank of St. Louis, National Association of Realtors, and own calculations average, the price-to-rent ratio is about 3.4 years. In 2006, it achieved its maximum of 4.6 years.

Figure 3.18 depicts the evolution of the price-to-income ratio in Russia between 1998 and 2017. The price is that for the dwellings with the surface of 50 m^2 sold at the primary and secondary markets. Instead of the median income, which is typically used in computing this ratio, we use the average household income, for there are no data on the median income. Given that the average income tends to be higher than the median income, the index is underestimated. Here, we assume that two household members are working and earning the same income. In addition, it is assumed that both new and second-hand dwellings have the same size, which is not true in reality as Figure 3.14 shows. The housing price-to-income ratio in Russia used to be substantially higher than

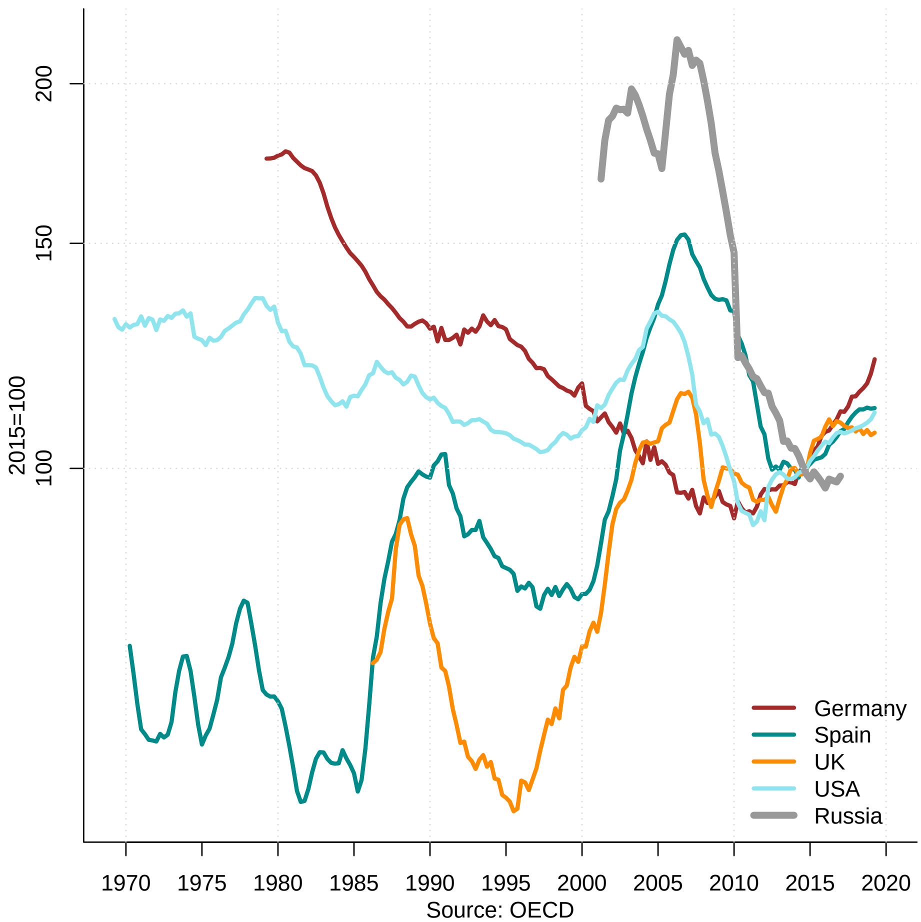
Figure 3.18: Price-to-income ratio in Russia, 1998–2019



that, say, in the USA. The good news is that the trend is declining, which means an improving affordability of housing: While in 1998, it took 10 years of income to buy a home, in 2017, it decreased to "just" 3.5 years, which is comparable with the levels observed in developed countries. To a large extent, this improvement is due to the increasing nominal income. It should also be taken into account that the dwellings in developed countries are much larger than in Russia. Thus, if we took the dwellings of identical sizes, we would have obtained a much lower affordability for Russia.

Figure 3.19 compares the indices of price-to-income ratios in several countries. The indices are

Figure 3.19: Price-to-income ratio in selected countries, 1970–2020



set to 100 in 2010. Thus, they do not allow to see the "absolute affordability", only its dynamics. In most selected countries, the ratios steadily fluctuate in accordance with housing price bubbles. In Russia, the index increased until 2008–2009, when the affordability of housing was the lowest, and since then has been decreasing, which points out to the improving affordability. In Germany, the index was declining until the same inflection point as Russia —the Great Recession— and is climbing up.

The price-to-income ratio is a simple to compute measure, which does not require too much information. Its weakness consists in ignoring the mortgage interest rate: The higher the rate the longer the payment period. An alternative measure of affordability of owner-occupied housing is the housing affordability index (HAI), which takes care of it. It is the ratio of the qualifying income (the part of income that can be spent on paying out a mortgage debt without endangering other expenses of the household) to the mortgage payment (interest and principal repayment). Formally,

$$HAI = 100\frac{qY}{P} \tag{3.7}$$

where q is the qualifying ratio for monthly mortgage loan expense to gross monthly income (for example, 25%, because typically a household can afford spending one-fourth of its income on paying out the loan); Y is the gross monthly income; and P is the monthly payment related to the mortgage loan and including interest and principal. P is computed using the annuity formula as follows:

$$P = M\frac{(1+i)^T i}{(1+i)^T - 1} \tag{3.8}$$

where M is the amount of the mortgage loan, defined as the value of property, V, minus down payment, D ($M = V - D$); i is the mortgage interest rate; and T is the maturity period of the mortgage loan (e.g., 10 or 20 years) during which the loan is completely paid out.

In 2005, according to Гусев (2008), the HAI in Russia was 28.9% for the primary housing market and 33.4% for the secondary market, while for the USA the HAI was 111.8%. What does it mean? First, in Russia, a household having an average income could not afford taking a standard mortgage loan[7] in order to purchase a home with a total surface of 54 m^2: Its income was sufficient to cover only up to one-third of the payments associated with the loan. Second, a US household earning a median income was able without any problem to serve a standard (for the USA) mortgage loan and, thus, to buy a standard home, which is likely to be much more spacious than its Russian counterpart. Third, the housing affordability in 2005 in the USA was four times higher than in Russia. Using the same assumptions[8] as Гусев (2008), we arrive at the following estimates of HAI for Russia in 2017: 54.7% for the primary and 59.5% for the secondary housing market. In 2017, the US HAI increased to about 159%.[9] Thus, the affordability improved in both countries, in Russia somewhat more. Therefore, within 12 years the gap reduced from 4 to 3 times, which is still a lot. Moreover, at least a half of the Russian households still have not enough income to afford buying an average size dwelling even with a borrowed money.

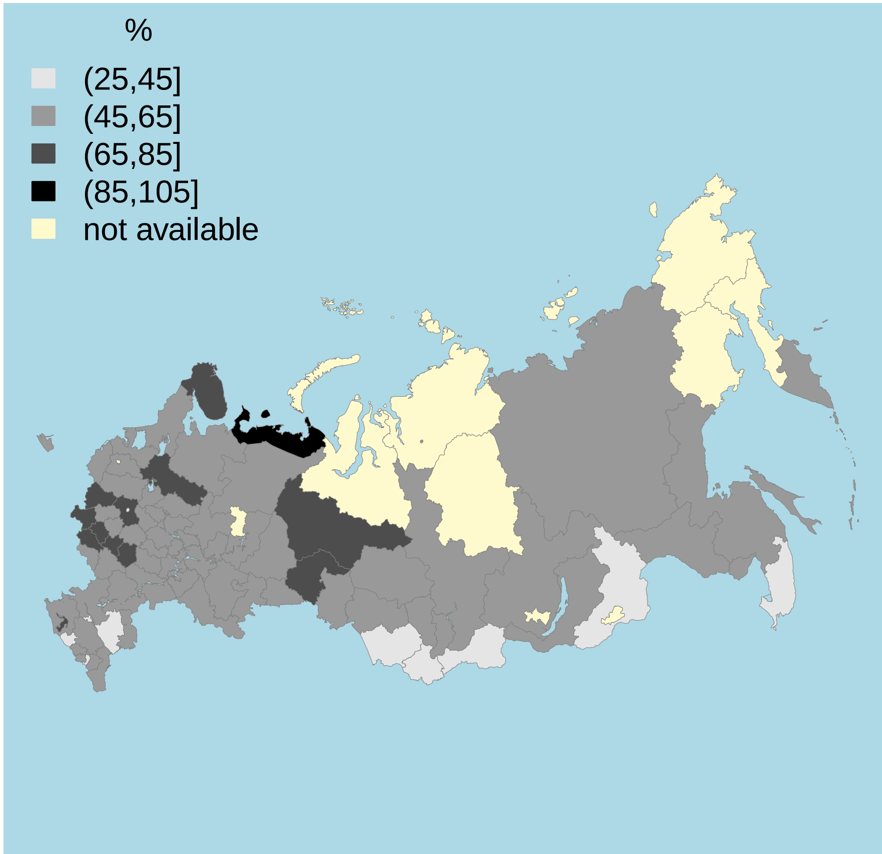
Figure 3.20 displays the spatial distribution of the housing affordability index by regions of the Russian Federation in 2017. It is computed for the same dwelling surface (54 m^2), down payment ratio (20%), and qualifying ratio (25%), whereas mortgage interest rates, housing prices, and money incomes are region specific. The HAI in Russia varies between 25 and 101%. It is the

[7]The following assumptions are made: $q = 0.25$, $T = 15$ years, the annual interest rate $i = 15\%$, and the down payment makes up 20% of the total value of the dwelling.

[8]The only difference is the lower annual interest rate: $i = 11.5\%$. Of course, both the housing prices and income are larger in 2017 than in 2005.

[9]According to the estimations of the National Association of Realtors; https://www.nar.realtor/research-and-statistics/housing-statistics/housing-affordability-index.

Figure 3.20: Housing affordability index by regions of Russia, 2017



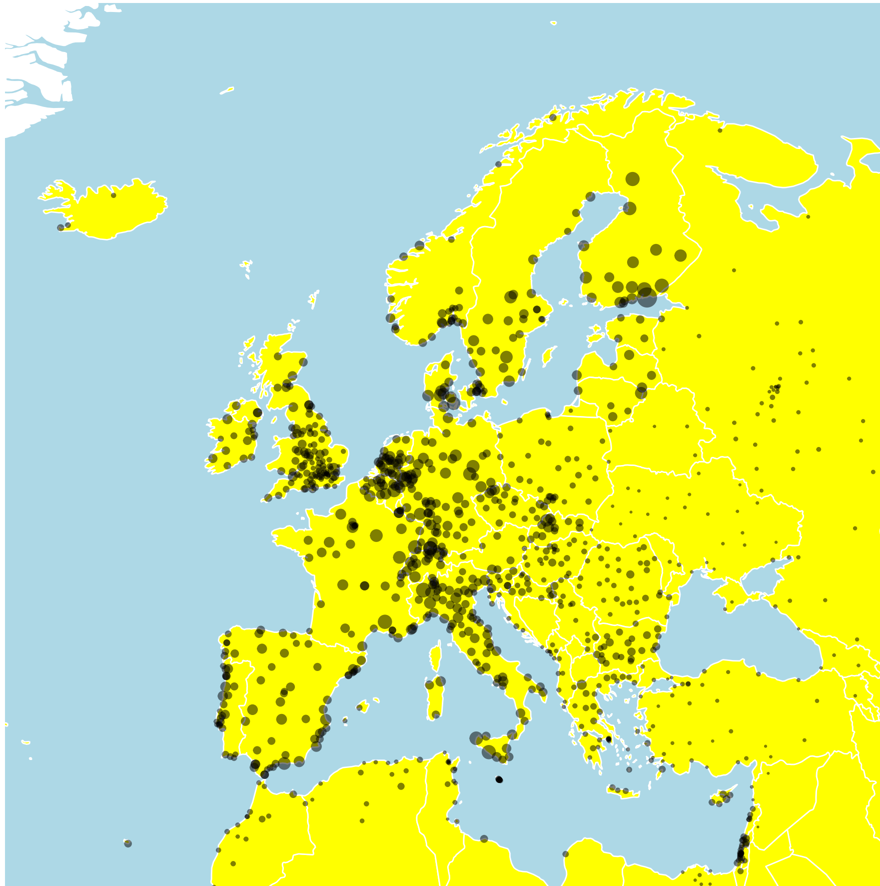
Sources: Central Bank of Russia, Rosstat, and own calculations

highest in Nenets autonomous okrug — a northern region, where income levels are high, while the mortgage interest rate is the lowest. In most regions, the HAI lies between 45 and 65%.

Figure 3.21 shows the housing affordability index in European cities. The index is computed using the Numbeo cost-of-living data.[10] The HAI is calculated for an apartment having a total surface of 70 m^2 and located outside of city center. In addition, the Numbeo database contains data on an average monthly net salary (after tax) and a mortgage interest rate, which are taken advantage of in our calculations. The loan maturity is 20 years, the down payment ratio is 20%, and servicing share is 25%. A clear divide between Eastern and Western Europe can be seen: while in the East, the affordability of housing is very low, it is much higher in the West. The most affordable housing is to be found in Finland, Germany, The Netherlands, and Switzerland. To a large extent this can be explained by higher incomes and much lower interest rates in the West.

[10]The Numbeo database is maintained by its users who supply data on the costs of different consumption items; see `https://www.numbeo.com/cost-of-living/`. The data were downloaded in January 2020.

Figure 3.21: Housing affordability index in European cities, 2020



Sources: Numbeo and own calculations

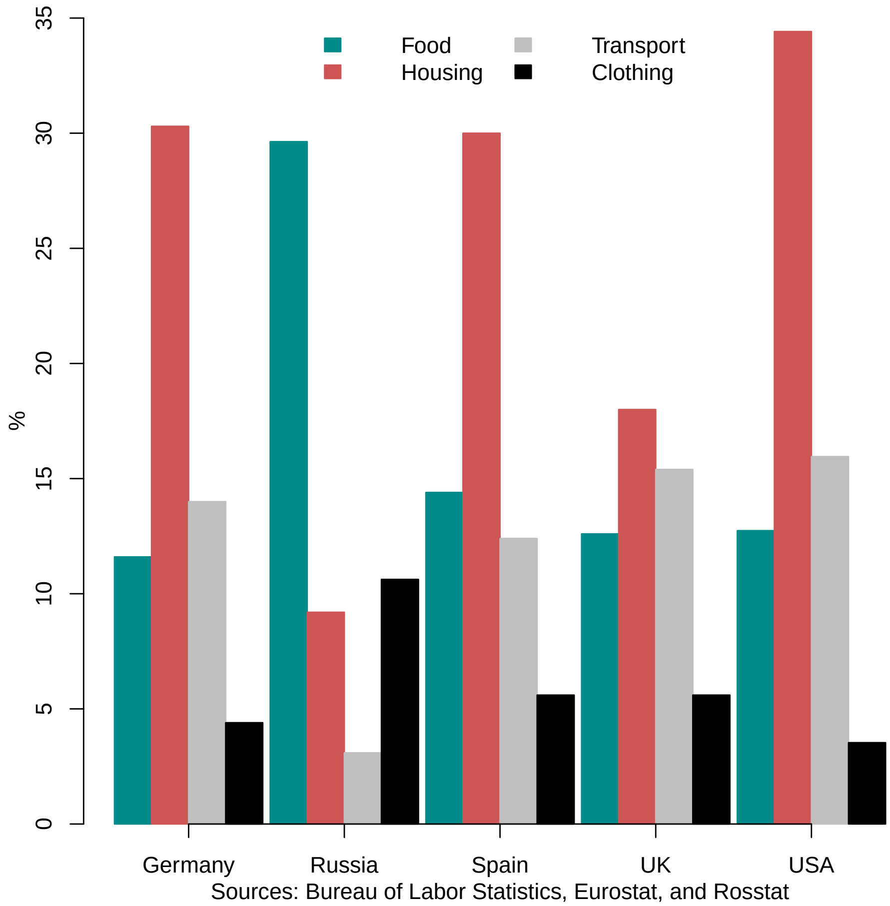
Renting of housing

The housing expenditure is one of the largest, if not the largest, components of the consumption of private households. During the 20st century in many countries, the housing expenses have taken over the first place in the ranking of consumption expenditure, which was previously occupied by the food expenses.

Figure 3.22 shows the structure of the household consumption expenditure by the main items in 2010.

In the Western countries, the share of housing expenditure, which along with the housing rent includes utilities payments (water, electricity, heating, etc.), represents the largest component of the private household budget. In Russia, it occupies the third position, while the food and clothing expenditures are on the first and the second positions, respectively. While in the Western countries, the share of housing expenses varies between 20 and 35% (the share of housing rent, also denoted

Figure 3.22: Main consumption expenditures of households 2010, %

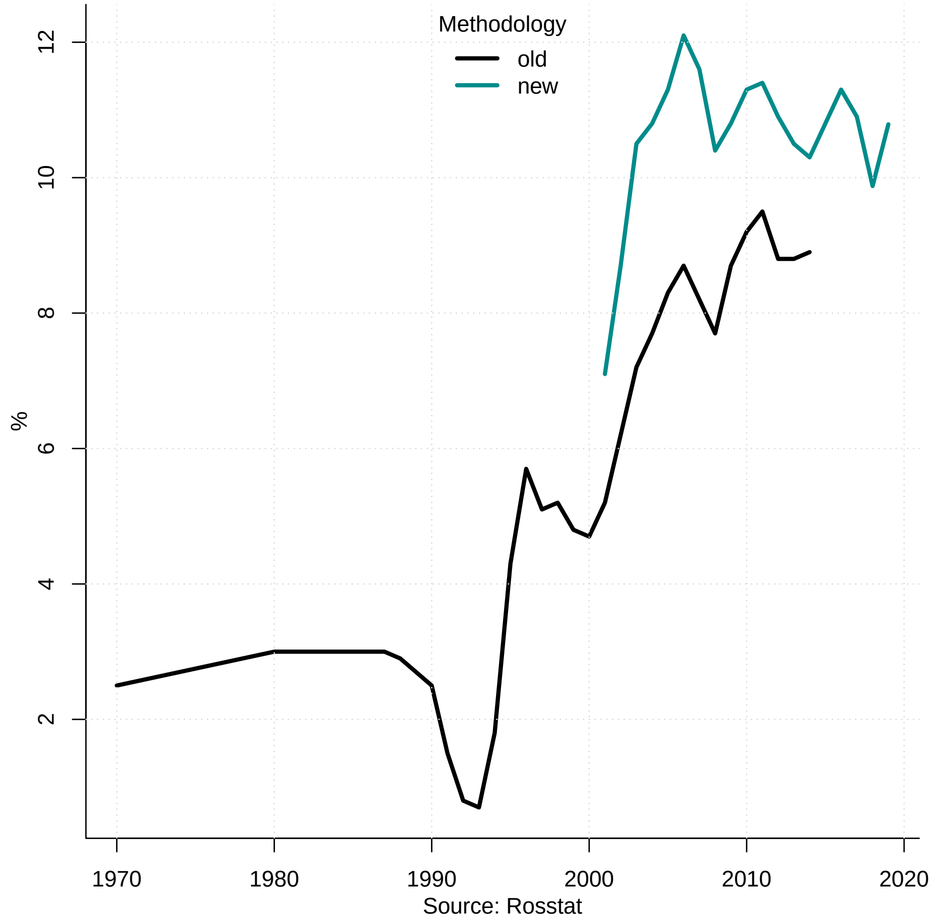


as rent burden, is lower), in Russia it is below 10%. Note that the inverse of the price-to-rent ratio is the gross rental yield, that is, the rate of return on housing.

Figure 3.23 displays the evolution of the share of housing expenditure in Russia between 1970 and 2015. During the late Soviet period, most Russian citizens lived in the cities in the rental dwellings. At that time, the main landlord was the state and the rents were controlled at an artificially low levels. This explains a very low and stagnating rent burden between 1970 and 1990. In the early 1990s, most part of the housing stock was in the municipal ownership and the rents for the municipal dwellings were fixed in order to prevent the social turmoil. By contrast, other consumer prices were liberalized and rose enormously during the hyperinflation period. This explains the plummeting rent burden in the first half of the 1990s. Since then, the rental share significantly increases, although it still does not attain the levels observed in the Western countries.

Using the so-called Schwabe's law (*Schwabesches Gesetz*) the economists describe a negative relation between the income and the rent burden often observed in the empirical studies: the poorer

Figure 3.23: Share of housing expenditure in Russia, 1970–2019, %



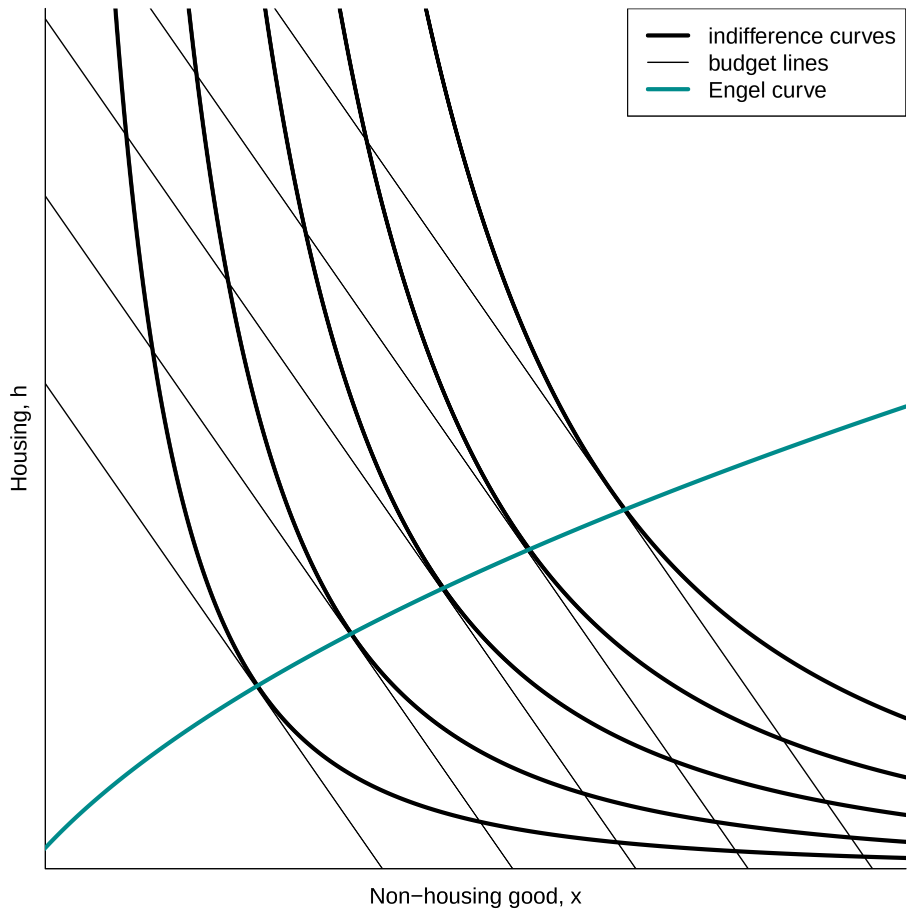
the person (household) the larger the share of housing expenditure in his total expenditure.[11] This is similar to the so-called Engel law, according to which the share of food expenditure diminishes as the income increases. Figure 3.24 depicts an Engel curve for housing.

The thick lines are the indifference curves defined for housing, h, and some non-housing good, x. The thin straight lines denote the budget lines: $y = p_x x + p_h h$, where y is the household's income; p_x is the price of an aggregate consumer good; and p_h is the rental price of housing. For simplicity, let us normalize the rental price of housing to $p_h = 1$. The tangency points of the indifference curves and budget lines denote the combinations of h and x the household can afford at the respective budget constraints (income levels). The thick green line that goes through the tangency points is the Engel curve. It demonstrates that at the higher income levels, the household can buy more of both h and x. However, the share of rental expenditure in the total expenditure, $\frac{h}{h+p_x x}$, diminishes as the income increases.

Why should the rent burden decline with the increasing income? One explanation is that

[11] This empirical regularity was observed by a German statistician Hermann Schwabe (1830–1874); see Schwabe (1868).

Figure 3.24: Engel curve for housing



housing is one of the basic needs (warmth, rest, and safety), in accordance with the Maslow's hierarchy of needs. As income gets higher, the individual satisfies his basic needs and starts spending more on the higher-level needs. Therefore, the share of rental expenses decreases. An important objection to this logic is that the dwelling can also satisfy higher needs (e.g., prestige). Indeed, the rich people tend to buy dwellings that are qualitatively much better than those the poor people can afford. This can lead to the violations of the Schwabe's law.

Exercises

1. Draw the stock-flow model diagrammatically. What happens, if the income decreases? Illustrate this graphically.

2. Which of the following characteristics are structural and which are locational: poverty rate, number of floors in the building, central heating, noise level, number of trees, spatial density of hairdressers, travel time to the city center?

Table 3.3: Assumptions to compute housing affordability index

Assumptions	Variant 1	Variant 2	Variant 3
Housing price, ruble per m^2	60,000	100,000	60,000
Surface, m^2	50	50	100
Share of down payment, %	20	20	20
Maturity period, years	15	15	30
Qualifying ratio, %	25	25	25
Household monthly income	60,000	60,000	60,000
HAI			

3. Find the data on housing prices and household income for three countries, compute the price-to-income ratios, and interpret your results.

4. Compute the housing affordability index using assumptions in Table 3.3 and interpret your results.

5. Collect data on rent burden in several countries. Compare and interpret the indicators.

Key terms

housing market	heterogeneity of housing	immobility of housing
durability of housing	structural characteristics	locational characteristics
demand for housing	supply of housing	housing price
housing market equilibrium	stock and flow model	completed dwellings
residential construction	housing availability	housing vacancy
natural vacancy rate	housing affordability	mortgage loan
interest	principal	maturity
annuity	price-to-income ratio	housing affordability index
rent burden	Engel curve	

Chapter 4

Housing valuation

4.1 Introduction

This chapter is devoted to the assessment of the real estate. Section 4.2 explains, why we need to assess the value of properties. In section 4.4, the hedonic approach to the valuation of the real estate is introduced. Section 4.5 discusses an alternative valuation method, which is known as the repeated-measures index. In this section, we will talk about the standard approach and about the weighted, or the Case-Shiller approach. In section 4.6, we describe the spatial econometric tools that can be useful for analyzing the property value, given its immovable nature and importance of locational characterstics.

4.2 Real estate valuation

Motivation

Why valuation of the real estates is needed? There are several reasons why people should bother assessing the value of the property, which are thoroughly discussed below.

First, it is important to evaluate the just compensation in compulsory acquisition. Even in the free market economies, the authorities sometimes confiscate the property of the citizens. This can be related, for example, to the construction of a new road or a hydroelectric plant. Typically, the owners receive compensation for the real estate they lose. However, is this compensation fair? Or is the price offered by the authorities far below what your property is worth?

Second, the knowledge about the property value is necessary for the fair taxation. In most countries, the owners of the real estate pay property taxes on the annual basis. In Russia, for instance, the value of each property is registered in the cadastre. The authorities using certain methodology and information about characteristics of the real estate estimate its taxable value. Is this value fair or is it set too high, since it does not take into account some important factors reducing the true value of the property?

Third, the information about the value of the real estate is needed for the market transactions. For example, you want to buy or sell a dwelling. In that case, you have to know its fair market price. If you buy the dwelling, you do not want to pay a price that is too high. In case you sell it, you have to be sure that the price you are paid is not too low.

Fourth, property can be bought using borrowed money or used as security in order to obtain a mortgage loan. Both the bank lending money and the borrower need to know the fair value of the property. What happens, if the assessment was wrong? In case of bank, this can lead to the impossibility to recover the lent money, if the borrower defaults. In case of the borrower, the failure to assess the real estate correctly can lead to a lower amount of loan.

Who can be interested in the real estate valuation? The preceding discussion shed already some light on this question. The agents who are interested in assessing the real estate are sellers, buyers, investors, banks, and state. In other words, the assessment of property is important for the major market players.

Valuation methods

There are three main methods of assessing the value of the real estate: Sales comparison method; income, or investment, method; and cost method. In what follows, we will discuss each method using the same framework. First, we will briefly summarize the essence of the method. Second, we will show in which areas the method is mostly used. Third, we will show how each method can be derived.

Sales comparison method

Essence of the method. The market value of real estate is related to prices of comparable, competitive properties. The method derives the value from direct comparison with sales of similar or comparable properties in the market.

Popularity. The method is regarded as the most valid indicator of market value. It is the most widely used valuation method in practice.

Derivation. The derivation of the sales comparison method is based on the following principles: utility; supply and demand; and substitution.

Utility: The value of each property depends on a bundle of utility-forming characteristics associated with it. For example, its size; location; physical condition, etc. Supply and demand: Market prices arise from interactions between buyers and sellers. Substitution: the housing price is the price paid to acquire a substitute property having similar utility within a reasonable amount of time. Thus, in order to obtain a housing price estimate, one needs to take a sample of dwellings containing data on their characteristics and prices and to take into account the contribution of each relevant characteristic to the observed price.

According to the sales comparison method, the price of a property can be decomposed into contributions of different characteristics:

$$p_i^{SCM} = \sum_{j=1}^{J} \alpha_j x_{ij} \tag{4.1}$$

where p_i^{SCM} is the assessed price of a dwelling; x_{ij} is the value of characteristic j of dwelling i; and α_j is the "shadow price", or value contribution of characteristic j.

The problems related to the sales comparison method. The sales comparison requires sufficiently competitive markets to work well. This implies that the following conditions must be met. First, there must be many buyers and sellers in active competition. Second, no individual should be able to influence prices, i.e., all market agents are price takers. Third, the product traded at the market (e.g., dwelling) should be fairly homogeneous. Fourth, the prices represent equilibrium between supply and demand.

As a rule, the market price is used as proxy for fundamental value. However, it can largely deviate from the fundamental value. For example, the equivalence between the market price and the fundamental value does not hold during the buildup of speculative bubbles. In thin markets, where few transactions take place, the method can lead to invalid results.

Investment, or income, method

Essence of the method. This method is based on the stream of income related to the real estate, which needs to be assessed. In case of the real estate, the income is the rent paid periodically for the right to use the property. Then, the value of income-producing property is function of the amount of rent achievable and return required by investor.

Popularity. The method is mainly used for the valuation of commercial real estate. It is less often used for the valuation of the residential properties.

Derivation. In order to assess the value, two pieces of information are needed: the magnitude of rent, or cash flow; and the required rate of return, or discount rate. The method has two basic variants: the direct capitalization method and the discounted cash flow (DCF).

According to the investment, or income, method, the price of a property is the discounted flow of net rental revenue:

$$p_i^{IM} = \sum_{t=1}^{T} \frac{r_{it}}{(1+\tau)^t} \tag{4.2}$$

where p_i^{IM} is the assessed price of a dwelling; r_{it} is the net rental revenue for dwelling i in year t; τ is some discount rate; and T is the planning horizon over which the cash flow is expected (e.g., in Germany, $T = 20$ years). The net rental revenue is a difference between the rental revenue (rents paid by the tenants to the owner) minus all costs related to the property (current maintenance costs, expenses for larger refurbishments, property taxes).

Problems related to the investment, or income, method: The method requires the agents to be rational. This means that they must have full information about the market (discount rates, market rents, operational expenses, etc.). In addition, the rental housing and capital markets must be in equilibrium. Otherwise, the valuer cannot be sure that the input information is valid. The method provides a proxy of the investment value, instead of the market value. The DCF approach requires making assumptions about revenues, expenses, and discount rates, many of which cannot be observed empirically. Forecasting cash flows and discount rates for over 10 years in the future presents serious challenges.

Cost method

Essence of the method. A rational purchaser of the real estate will not pay more for it than the cost of constructing an equally desirable substitute less depreciation. Therefore, the value of the property corresponds to the cost of building the existing structure and of making improvements (direct cost plus indirect costs plus entrepreneurial profit) minus all accrued depreciation as of effective date of valuation plus the value of land.

Popularity. Unlike the previous two valuation methods (sales comparison and investment method), the cost method is considered to be the method of last resort. Many valuers do not accept it as a legitimate valuation method. It is mainly used in the cases, where there is no reliable market activity (schools, hospitals, churches, public libraries, etc.).

Derivation. This method is derived based on the following principles: substitution; contribution; externalities; as well as the highest and best use.

Substitution: It is assumed that a prudent buyer would pay no more for a property than the cost to acquire a similar site and construct improvements of equivalent utility. Contribution: The property components (land and structural improvements) must be in proper proportion, if optimum value is to be achieved. Externalities: There are factors that are outside of the property but which also affect its market value: crime; pollution; noise; and degrading neighborhoods. The valuer should try to take these factors into account. Highest and best use: The assessed value should have as a reference the optimum market related use of real estate.

According to the cost method, the price of a property can be represented as a sum of expenses made to build or reconstruct the property (land, building, refurbishment):

$$p_i^{CM} = \sum_{j=1}^{J}(c_j - d_j) + p_i^L \tag{4.3}$$

where p_i^{CM} is the assessed price of a dwelling; c_j is the cost of item j; d_j is its depreciation; and p_i^L is the value of the land plot.

Problems related to the cost method. Typically, when the cost method must be used, there is no full knowledge of all relevant information. The cost sunk in constructing the building may not be realizable in prices, at least not in the short run. A mere summation of land and structure costs may not generate results in accordance with actual transaction prices. The additive approach is not in accordance with market behavior: in the market, properties are transacted as wholes. The depreciation calculations are relatively arbitrary, which diminish credibility of the method. The value of land is supposed to be established by means of comparable sales of similar vacant land. However, such sales are likely to be absent in built-up areas.

4.3 Stratified valuation

How to assess the value of real estate practically? The most evident approach is to compute median or mean prices of a subsample of property objects. However, this approach can be misleading. The composition of the sample can change from year to year. For example, in one year more high quality dwellings are offered for sale than in the next one. Since high quality dwellings are worth more, the average price in the first year will be higher than in the second one, although the price for comparable dwellings remained unchanged. In general, the quality of new dwellings increases and, hence, the quality of the whole housing stock improves. However, the price increases related to the quality improvement must be separated from the overall market price increases that are not related to the characteristics of dwellings.

Price changes must be decomposed in inflationary and quality changes. There are three approaches that can solve this problem: stratified valuation; hedonic model, which uses data on different dwellings and multiple regression method; and repeat sales approach, which takes advantage of dwellings sold more than once during the sample period.

The stratified valuation method is probably the simplest and the most intuitive approach to assessing the real estate. It consists in collecting a subset of objects (e.g., dwellings) that have as much as possible similar structural and locational characteristics and computing an average or median price for them. For instance, a proxy for the price of i-th dwelling in period t can be computed as:

$$p_{it} = \frac{\sum_{j=1}^{J} p_{jt}}{J} \tag{4.4}$$

where p_{jt} is the price of j-th dwelling in period t, which has similar characteristics as the dwelling i, that is, comparable area, number of rooms, floor, building, construction materials, district, etc. If the dwellings that are used in order to compute the average price are chosen carefully and have a very large degree of similarity with dwelling i, then the proxy will be very accurate. It is the method that many people intuitively use when looking at the Internet advertisements and selecting a subsample thereof to gauge the value of a dwelling they have in mind.

However, this approach has an evident disadvantage: There is a tradeoff between the similarity of comparable dwellings and their number, J. The more similar dwellings are chosen, the fewer they are. And if the market is not active, the valuer risks not to find a sufficiently large number of dwellings to compare with. The hedonic approach that we are going to discuss next is not subject to this limitation.

4.4 Hedonic approach

According to the hedonic approach to real estate valuation, each dwelling or any other real estate object can be considered as a set of features. Each of these feature has its value. Therefore, the total value of the dwelling is the sum of the values of its features.

The original purpose of the hedonic approach is the construction of the price index. How can the inflationary price increase can be identified? There are at least to possibilities to do it.

The first option is to use the period-specific regressions. In this case, a separate regression is run on data from each time period. The estimated equations can be used to predict the value of a "standard unit" in each period. The characteristics of the unit being valued, thus, do not change over the estimating period. The price index results from dividing the predicted value of the standard unit in period t over that in period $t-1$. Formally, the period-specific regression can be expressed:

$$p_{it} = f_t(S_i, L_i) \tag{4.5}$$

where p_{it} is the price of the i-th dwelling in period t; $f_t(\cdot)$ is the functional form linking price of housing to its features; S_i is a set of structural features; and L_i is a set of locational features.

The second option, consists in estimating a single regression, which is run on the pooled data from sales in all time periods. This regression must include time dummies: for T periods, $T-1$ dummies are needed. Each of them takes value 1, if the dwelling is sold in the corresponding period, and 0, if the dwelling is sold in different period. The intercept will reflect the average value of a benchmark dwelling in some basis period. Then, the series comprised of the estimates of the intercept and of the coefficients of time dummies will reflect the movement in prices, which is not related to their characteristics. The single regression can take the following linear form:

$$p_{it} = f(S_i, L_i, T_i) \tag{4.6}$$

where T_i is the time dummy.

However, the relationships between the dependent and explanatory variables must not necessarily be linear. The Box-Cox transformation offers a way to flexibly model the non-linear hedonic regression. It is formulated as follows:

$$\frac{p_i^{\lambda} - 1}{\lambda} = \alpha + \beta' S_i + \gamma' L_i + \delta' T_i + \varepsilon_i \tag{4.7}$$

where λ is a non-linearity parameter. Depending on it, the hedonic regression takes different forms (if $\lambda = 1$, then Box-Cox model turns into linear equation; if $\lambda = 0$, then the model turns to the semilogarithmic equation); α is the constant; β, γ, δ are parameters measuring contribution of characteristics; and ε_i is the random disturbance.

Another way to model the non-linearity in the hedonic regression is to use the logarithm. This transformation can be applied to either dependent variable, or explanatory variables, or both. Below, all four possible transformations are considered.

The linear regression:

$$p_i = \beta' S_i + \gamma' L_i + \delta' T_i + \varepsilon_i \tag{4.8}$$

The log-linear (semilogarithmic) regression:

$$\log(p_i) = \beta' S_i + \gamma' L_i + \delta' T_i + \varepsilon_i \tag{4.9}$$

The linear-log regression:

$$p_i = \beta' \log(S_i) + \gamma' \log(L_i) + \delta' T_i + \varepsilon_i \tag{4.10}$$

The log-log regression:

$$\log(p_i) = \beta' \log(S_i) + \gamma' \log(L_i) + \delta' T_i + \varepsilon_i \tag{4.11}$$

The parameter estimates for different logarithmic transformations have different interpretation. Table 4.1 reports these interpretations. For example, in case of the linear model, a change of the

Table 4.1: Interpretations of parameter estimates of logarithmic transformations

Specification	Δx	Δy
Linear	1 unit	β
Log-linear	1 unit	$100 \cdot \beta\%$
Linear-log	1%	$0.01 \cdot \beta$
Log-log	1%	1%

explanatory variable by one unit leads to the change of the dependent variable by β units. If the dependent variable is the purchasing price per square meter in rubles and the explanatory variable in question is the number of rooms and $\beta = 2000$, then the increase of this number by one will result in the increase of the square-meter price by 2000 rubles.

4.5 Repeated-measures index

The hedonic approach employs information on large number of heterogeneous dwellings and estimates the coefficients that measure the contribution of different characteristics of dwellings to their value. However, the accuracy of these coefficients is not perfect, given the uncertainties related to the statistical estimates. Bailey et al. (1963) suggested to take advantage of information on the same dwellings sold more than once. Therefore, their method is called the repeated-measures index, or repeat-sales index. A good housing price index must capture price increase unrelated to change in quality. This increase can be best isolated by comparing similar dwellings and nothing is more similar than the same dwellings.

The repeated-measures method has two main advantages. First, it more accurately accounts for characteristics of properties. Second, it does not require the measurement of quality. The method has the following two disadvantages. First, it implies a waste of data, since in most data sets only a small proportion of all housing transactions reappear and are used in the repeated-measures method. Second, such observations are possibly not representative of general population.

According to the methodology of the repeated-measures index, the price of i-th dwelling in period t can be decomposed as:

$$p_{it} = \alpha_i + \beta_t + \varepsilon_{it} \tag{4.12}$$

where p_{it} is logarithm of price; α_i is the underlying value and, hence, quality, of dwelling; β_t is the value of the log price index; and ε_{it} is the noise, $\varepsilon_{it} \sim N(0, \sigma^2)$.

For any two periods, t_1 and t_0, difference of log prices of dwelling i:

$$p_{it_1} - p_{it_0} = \beta_{t_1} - \beta_{t_0} + \varepsilon_{it_1} - \varepsilon_{it_0} \tag{4.13}$$

If generalized for all time periods, this yields a regression equation:

$$p_{it_1} - p_{it_0} = \sum_{t=1}^{T} \beta_t D_{it} + \varepsilon_{it_1} - \varepsilon_{it_0} \tag{4.14}$$

where D_{it} is a set of dummy variables, such that:

$$D_{it} = \begin{cases} 1, \text{ if } t = t_1 \\ -1, \text{ if } t = t_0 \end{cases}$$

The OLS regression of the ratio of log prices on D_{it} produces predicted values $\hat{\beta}_t$ for each year, which correspond to the growth rate of the index relative to the base year. Finally, the house price index is obtained as:

$$\hat{P}_t = 100 \times \exp(\hat{\beta}_t) \tag{4.15}$$

As a further development of the repeated-measures index, Case and Shiller (1987) suggested a weighted repeat sales index (WRS). Their index has the following motivation. The standard repeat sales index relies upon two assumptions: first, the noise term, ε_{it}, is uncorrelated across houses and through time; and, second, its variance, σ_ε^2, is constant. However, the variance of error term is not constant across houses. It is likely to be related to the interval of time between sales. Thus, homes sold after long time intervals have great influence on the index relative to homes sold over short time intervals. Therefore, such long time interval observations should be given less weight.

The drift through time of individual house values occurs due to random differences in the amount of upkeep expended across houses or to random changes in neighborhood quality.

Formally, the Case-Shiller WRS index can be expressed as:

$$p_{it} = a_{it} + b_t + \varepsilon_{it} \tag{4.16}$$

where p_i is the log price of i-th dwelling in period t; a_{it} is the individual value drift such that $a_{it} = a_{it-1} + u_{it}$ ($u_{it} \sim N(0, \sigma_u^2)$); and b_t is the city-wide level of housing prices at time t. The purpose of the WRS is to estimate b_t.

The WRS index is estimated in three stages. In stage 1, a standard repeat sales regression is estimated:

$$p_{it_1} - p_{it_0} = \sum_{t=1}^{T} \beta_t D_{it} + \varepsilon_{it_1} - \varepsilon_{it_0} \tag{4.17}$$

In stage 2, a regression for squared errors from stage 1 is estimated:

$$\tilde{\varepsilon}_{it}^2 = c + \gamma(t_1 - t_0) + \eta_{it} \tag{4.18}$$

where dependent variable is defined as $\tilde{\varepsilon}_{it} = \varepsilon_{it_1} - \varepsilon_{it_0}$; constant c is an estimate of $2\sigma_\varepsilon^2$; slope γ is an estimate of σ_u^2.

In stage 3, the following weighted regression is estimated:

$$\frac{p_{it_1} - p_{it_0}}{\hat{\varepsilon}_{it}} = \sum_{t=1}^{T} \delta_t D_{it} + \epsilon_{it_1} - \epsilon_{it_0} \tag{4.19}$$

4.6 Spatial dependence

One of the most important properties of the real estate is its immobility. Therefore, the space matters. Spatial effects take two forms: spatial heterogeneity and spatial dependence. Spatial heterogeneity means that the objects differ in space. For example, there are rich and poor neighborhoods, there are central and peripheric districts of the city, which differ in terms of their location and their characteristics. Formally, spatial heterogeneity can be expressed as follows:

$$p_i = f_k(X_i\beta + \varepsilon_i) \quad i = 1, \ldots, N \tag{4.20}$$

where p_i is the price for dwelling i; k is the index denoting some location; $f_k(\cdot)$ is the location-specific function relating the price of the dwelling to its characteristics, X_i; β is the vector of parameters to estimate, and N is the number of dwellings. Thus, the elasticities of the dwelling's value to its characteristics can vary as a function of space. The price of the centrally located dwellings can react differently to the proximity to some urban amenities or to the public transit than the dwellings located in the outskirts of the city. If the spatial heterogeneity is not taken into account in our hedonic model, this can lead to the inefficiency and/or biasedness and inconsistency of the parameter estimates.

The spatial dependence means that the closer the objects are to each other the stronger they are correlated. Why this may be the case? The objects located next to each other tend to be subject to the same influences. For example, two dwellings situated in the same building depend on its state and, hence, are more closely related to each other than to the dwellings in a different building. Two dwellings located in the same neighborhood are subject to the impact of pretty the same socio-economic, demographic, climatic, ecological, and other characteristics of the neighborhood. The farther the two dwellings are from each other the less common impacts they share and, therefore, the less they are dependent on each other. For example, this dependence can be reflected in the values of dwellings.

In mathematical terms:

$$p_i = f(p_j) \quad i = 1, \ldots, N \quad j \neq i \tag{4.21}$$

Thus, the price of dwelling i depends on the price of dwelling j. Moreover, this dependence gets stronger the closer dwelling i to the dwelling j. The proximity between dwellings can be measured using different means. One example is the direct distance between them. The failure to account for the spatial dependence can lead to the inefficiency and/or biasedness and inconsistency of the parameter estimates.

The general spatial model can be formulated as follows:

$$\begin{aligned} p &= \rho W_1 p + X\beta + \varepsilon \\ \varepsilon &= \lambda W_2 \varepsilon + u \\ u &\sim N(0, \sigma^2 I_N) \end{aligned} \tag{4.22}$$

where p is the vector of housing prices; X is the matrix of explanatory variables; W_1 and W_2 are the $N \times N$ spatial weight matrices; ρ and λ are the coefficients of spatial dependence; and u is the serially and spatially uncorrelated disturbance term.

There are several special cases of the general model in equation (4.22) that often used in the literature. The first is the spatial autoregressive (SAR) model:

$$\begin{aligned} p &= \rho W_1 p + X\beta + u \\ u &\sim N(0, \sigma^2 I_N) \end{aligned}$$

The second is the spatial error (SEM) model:

$$\begin{aligned} p &= X\beta + \varepsilon \\ \varepsilon &= \lambda W_2 \varepsilon + u \\ u &\sim N(0, \sigma^2 I_N) \end{aligned}$$

An important element of each model with spatial dependence is the spatial weight matrix. Usually, it takes the following form:

$$\begin{pmatrix} w_{11} & w_{12} & \dots & w_{1N} \\ w_{21} & w_{22} & \dots & w_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ w_{N1} & w_{N2} & \dots & w_{NN} \end{pmatrix}$$

where w_{ij} is the measure of proximity between i and j, such that $w_{ii} = 0$ for all $i = 1, \dots, N$.

Typically, spatial weights are inverse functions of distances between objects i and j, d_{ij}:

$$w_{ij} = d_{ij}^{-\delta}, \text{ where } \delta > 0 \tag{4.23}$$

Often very distant observations are discarded, since they have no noteworthy impact, while their exclusion would simplify estimations. This can be done using two options. The first option is to set a cutoff distance, c:

$$d_{ij} = \begin{cases} d_{ij}, \text{ if } d_{ij} < d \\ 0, \text{ otherwise.} \end{cases}$$

The second option is to keep only K nearest neighbors and discard all the other.

The elements of spatial weight matrix are usually (not always) row-standardized:

$$\tilde{w}_{ij} = \frac{w_{ij}}{\sum_{k=1}^{K} w_{ik}} \tag{4.24}$$

Therefore, the i-th element of vector Wp, $\sum_{j=1}^{J} \tilde{w}_{ij} p_j$, can be interpreted as a weighted average of the neighbors of dwelling i.

Geographically weighted regression

As pointed out in the previous section, the housing markets are localized and, hence, characterized by spatial dependence and spatial heterogeneity. The spatial dependence is accounted for in the models with spatial dependence. The geographically weighted regression (GWR) provides a means for modelling the spatial heterogeneity by allowing relationships between the explanatory and dependent variables to vary in space. The utility of GWR consists in that it can be used to look for localized exceptions or deviations from global trends.

The standard OLS regression:

$$p_i = \beta_0 + \sum_{k=1}^{K} \beta_k x_{ik} + \varepsilon_i \tag{4.25}$$

The geographically weighted regression:

$$p_i = \beta_0(u_i, v_i) + \sum_{k=1}^{K} \beta_k(u_i, v_i) x_{ik} + \varepsilon_i \tag{4.26}$$

where (u_i, v_i) are the coordinates of dwelling i; and $\beta_k(u_i, v_i)$ is the realization of continuous function $\beta_k(u, v)$ at point i.

The standard OLS estimator of parameters:

$$\beta = (X'X)^{-1}X'y \tag{4.27}$$

The GWR estimator of parameters:

$$\beta(u_i, v_i) = (X'W(u_i, v_i)X)^{-1}X'W(u_i, v_i)y \tag{4.28}$$

where $W(u_i, v_i)$ — $N \times N$ weight matrix, whose diagonal elements, w_{ij}, are the geographical weighting of observed data for point i and off-diagonal elements, $w_{jl} = 0$ s.t. $j \neq l$.

Recommended literature

Topic	Source
Real estate valuation	Mooya (2016)
Hedonic approach	Malpezzi (2003)
Repeated-measures index	Bailey et al. (1963)
Case-Shiller approach	Case and Shiller (1987)
Spatial dependence	LeSage and Kelley Pace (2009)
Geographically weighted regression	Grose et al. (2008)

Exercises

1. Assume that you estimated a hedonic regression for housing rent (rubles per month for dwelling) and obtained the following results:

Variable	Estimated coefficient
Constant	10,000
Number of rooms	500
Availability of elevator (1 = yes, 0 = no)	300
Distance from the city center, km	-200
Building material: brick	3000
Building material: concrete	-1000

   a) How much will be the rent for a 2-room flat in a building with walls of brick, having an elevator, and located at 1 km from the city center?

   b) How much will be the rent for a similar flat in a building made of concrete, having an elevator, and located at 10 km from the city center?

   c) How big will be the difference in the rents of both flats and what will be the contribution into this difference due to the distance to the city center?

2. Assume that you would like to buy a residential building. You know that the building has 20 apartments, the monthly rent paid by the tenant of each apartment to the landlord is 20,000 rubles, the banking long-term interest rate is 10%, and your planning horizon is 10 years. Assume also that the maintenance cost is 800,000 rubles per year per whole building. Will you buy the building, if the owner offers it for 30 million rubles? Will your decision change, if the interest rate declines to 7, 6, or 5%?

3. Suppose that there is a non-residential building constructed 20 years ago that you would like to transform into a hospital. Are you ready to pay for this building 15 million rubles, given that the initial construction cost was 10 million rubles; depreciation rate is 2%; the land is worth 3 million rubles; and the transformation cost is 4 million rubles? Which valuation method do you need to use in this case?

4. Explain why the prices of dwellings located in the same neighborhood can be correlated?

Key terms

sales comparison method	investment or income method	cost method
hedonic approach	stratified valuation	repeated-measures index
Case-Shiller approach	spatial dependence	geographically weighted regression

Chapter 5

Speculative asset price bubbles

5.1 Introduction

This chapter is devoted to such an important economic phenomenon as the speculative price bubbles. In section 5.2, we will define the speculative bubbles and discuss their importance for the society. In section 5.3, a typology of the early warning systems is presented. In section 5.4, the techniques, which allow dating the periods of expansions (bubbles) and recessions (no bubbles) are presented. Sections 5.5 and 5.6 show the ways how to timely recognize signs of the building-up speculative bubbles using the early warning systems with exogenous and endogenous bubble chronologies, correspondingly.

5.2 Speculative bubbles

The trajectory of the market economy is not smooth. From time to time, the economy experiences booms and crises. The examples of large crises include the Great Depression 1929–1932 that took place worldwide and to some extent was responsible for the outbreak of World War II; the Lost Decade (1991–2000 or even 1991–2010) in Japan; as well as the Great Recession, or Financial Crisis, 2008–2009 and the COVID-19 sanitary and economic crisis of 2019 that shook virtually entire world.

In many cases, the economic crises are triggered by the speculations. The speculation can be defined as purchasing an asset not for own use but with an expectation that its price will increase further and that the asset can be sold at a later stage in order to realize capital gains. Speculations arise because financial capital is looking for ways of earning profit. It cannot lie idle, so the capital holders are always screening various markets in order to find those having the highest profit margin. So, speculations can emerge in virtually any market. From the early economic history, we know examples of speculating with tulip bulbs —the so-called “tulip mania”— in The Netherlands in the 1630s. Speculations with stocks are also known at least from the early 18th century, such as the

Mississippi Bubble 1718–1720 and the South Sea bubble of 1719–1720.[1] In 2001, a large crisis occured at the stock market, which was related to the speculations with stocks of the nascent Internet companies and, therefore, was nicknamed the DotCom crisis. The housing also often becomes an object for speculations. For example, the Great Recession 2008–2009 was mainly triggered by the speculations with subprime mortgage loans in the USA.

The speculative asset price bubble is defined as "large, sustained mispricings of financial or real assets" (Brunnermeier and Oehmke, 2013). Alternatively, the speculative bubbles refer to the periods in which the price of an asset exceeds its fundamental value due to investors' beliefs that they can sell the asset at a higher price in the future. The fundamental value of an asset is its value determined by its dividend stream. By contrast, the speculative component of the asset's value is that based on the expectations of reselling it at a higher price.

How do the economists explain the emergence of speculative price bubbles? There are several well-established theories that explain seemingly unsustainable developments by rational behavior of agents (Brunnermeier, 2008; Brunnermeier and Oehmke, 2013; Glaeser and Nathanson, 2015). Brunnermeier and Oehmke (2013) provide a classification of the existing approaches to explaining the buildup of asset price bubbles. They distinguish between five types of theories.

The first explanation is the rational bubbles theory. It is argued that investors hold bubble assets since they expect the price of the asset to grow under the assumption that any investor in the future also expects asset price increases, even if the bubble may burst with a certain probability. Price increases then become self-fulfilling prophecies, which implies explosive growth of asset valuations (Blanchard and Watson, 1982).

Second, overlapping generations models allow the existence of bubbles, because they can restore efficiency of an economy, which is inherently not Pareto optimal (Tirole, 1985). The idea is that even fiat money —which has no intrinsic value— can have a positive price because it is a store of value. Storing value, and thus increasing the price of money, might be a rational option in situations of over-accumulation of private capital, i.e., when capital accumulation exceeds the "golden rule." Then, transferring capital to future generations and giving fiat money a positive price (which is then a bubble asset) can increase economic efficiency.

Third, the persistence of bubbles can be explained in the framework of the informational frictions theory. In this type of model, two sources of risk are introduced that encourage traders to invest in bubble assets. On the one hand, the fundamental risk arises from uncertainty of an unexpected jump of the fundamental value. In this case, investors who bet against a bubble lose money. On the other hand, risk-neutral traders, who are aware of the bubble, can still trade in order to benefit from speculative price increases, as long as they weigh the risk of a bursting bubble less than the chances of price increases (Abreu and Brunnermeier, 2003). In both cases, investors

[1] See, for example, Garber (1990).

delay the bursting of the bubble and allow it to grow even larger.

Fourth, according to the delegated investment theory, most households delegate the management of their assets to the fund managers, who often are concerned only about short-run price movements (Shleifer and Vishny, 1997) and may have incentives to buy overpriced assets (Allen and Gorton, 1993).

Fifth, the theory of the heterogeneous-beliefs bubbles implies that investors, possibly due to psychological biases, have different beliefs about the future. These beliefs when combined—with short-sale constraints—can lead to overpricing when optimists push up prices, while pessimists are unable to counteract this (Miller, 1977). Regardless of the driving forces behind a bubble, house price bubbles can be defined as periods in which housing prices run well above their fundamental values, i.e., the development of rents. In addition, as pointed out by Brunnermeier and Oehmke (2013), asset values grow explosively during speculative bubble periods. While the notion "well above" is rather open to interpretation, an explosive house price growth can be formally tested using statistical methods.

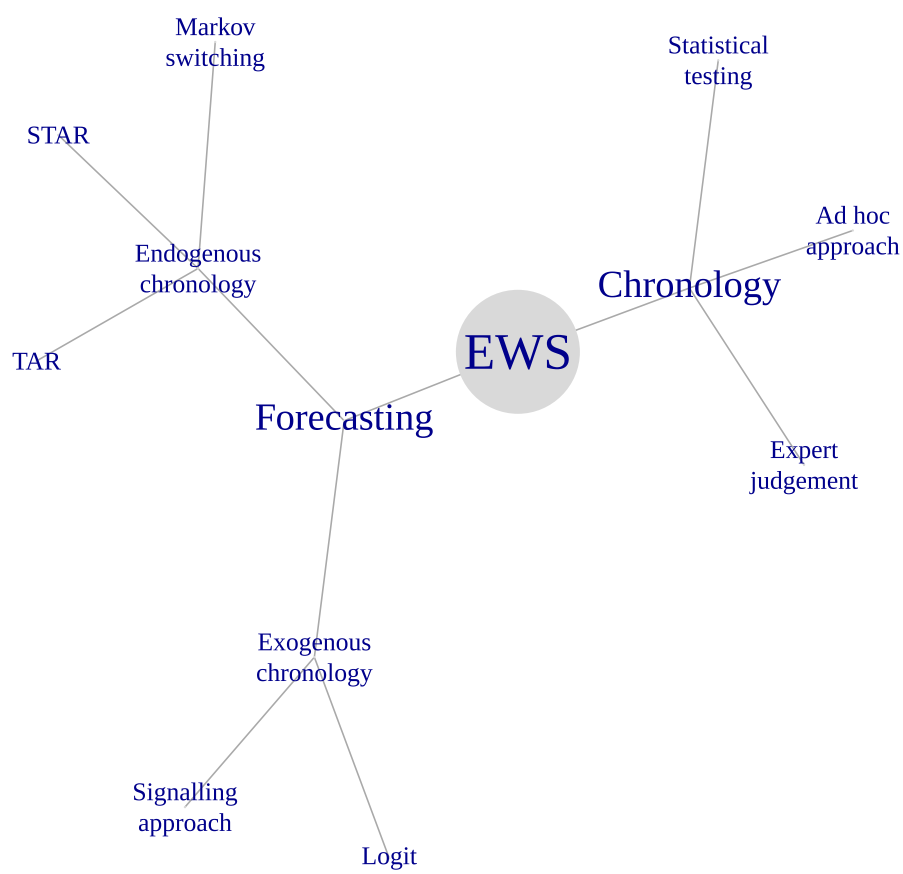
An important role in the formation of speculative asset price bubbles is played by the financialization. The financialization can be defined as a way of capital accumulation, when profit-making takes place increasingly through financial channels rather than through trade and production (Aalbers, 2016). Due to the slowdown of economic growth, the capital accumulation becomes more and more focused on the growth of finance, benefiting the financial markets agents (investors) rather than the real economy. The financialization embraces increasingly the non-financial firms (Internet, car industry, real estate sector, etc.) and households forcing them to accept risks and act as capitalists. It became a means of the capital switching in the sense of Harvey (1985), which channels the capital from the primary circuit (production, manufacturing, industrial sector), secondary (built environment for production, e.g., infrastructure, and for consumption, e.g., housing), or tertiary circuit (social infrastructure, i.e., investment in technology, science, conditions of employees, health and education) to the quaternary circuit of capital (Aalbers, 2016). This capital switching inevitably leads to over-accumulation and to crises.

The crises are costly — they destroy jobs and wealth. The bursting bubbles and resulting crises lead to huge GDP losses, increases in unemployment, bankruptcies of firms and private households, and other negative consequences for the whole society or its important parts. Therefore, it is important to be able to foresee them. If we will be able to identify timely the arrival of crises, then we can hope to mitigate their negative consequences.

5.3 Early warning system

An early warning system is a tool for forecasting the booms and crises. It has two main elements: 1) an expansion/recession (boom/bust) dates, or bubble chronology; and a forecasting model. In the first step, the periods of bubbles and no bubbles, or expansions and recessions are established. In the second, step a forecasting model is estimated, which allows predicting the bubbles. Figure 5.1 depicts a typology of different early warning systems.

Figure 5.1: Early warning system



It distinguishes between the early warning systems with exogenous and endogenous chronologies. In the EWS with exogenous chronology, the determination of the bubble chronology step is done separately and independently on the forecasting step, while in the EWS with endogenous endogenous both these steps are carried out simultaneously. Figure 5.1 displays three families of methods used in order to establish the bubble chronology (*ad hoc* approach, expert judgment, and statistical testing), two families of forecasting techniques requiring exogenous chronologies (signalling approach and discrete-choice models), and three forecasting methods with endogenous chronology (TAR, STAR, and Markov switching). Below we will discuss each of these methods in more detail.

5.4 Dating the speculative bubbles

Nobody knows when exactly do the speculative bubbles (or expansions and recessions in case of business cycles) start and end. In fact, what we observe are periodic declines and increases of asset prices or economic performance. However, without special techniques it is impossible to tell apart small short-lived fluctuations from the cyclical movements. Therefore, some algorithm is needed in order to establish the chronology of bubbles or business cycles. As shown in Figure 5.1, there are three families of methods establishing bubble chronologies: 1) expert judgment; 2) *ad hoc* dating; and 3) formal statistical tests.

Expert judgment

A group of experts decides on the dates of beginning and ending of booms and busts. The most known such a group is the NBER's Business Cycle Dating Committee.[2] It maintains a chronology of the U.S. business cycle. The chronology comprises alternating dates of peaks and troughs in economic activity. The way the experts make their dating decisions is perfectly described by the NBER itself:

> The Committee applies its judgment... and has no fixed rule to determine whether a contraction is only a short interruption of an expansion, or an expansion is only a short interruption of a contraction.

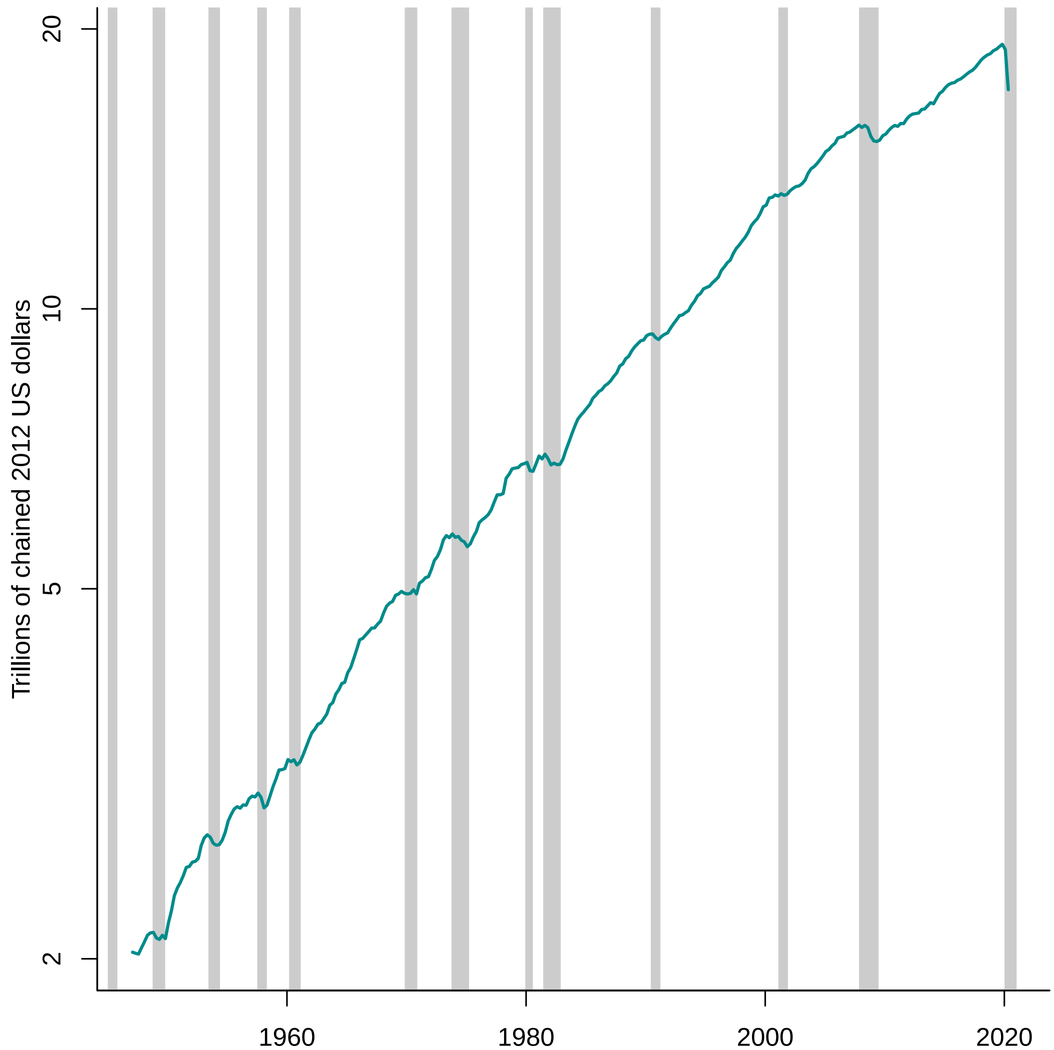
The NBER does not have a fixed definition of economic activity. It examines and compares the behavior of various measures of broad activity: real GDP, economy-wide employment, and real income. The NBER also can consider indicators that do not cover the entire economy, such as real sales and the Fed's index of industrial production. A well-defined peak or trough in real sales or industrial production helps to determine overall peak or trough dates, particularly if the economy-wide indicators are in conflict or do not have well-defined peaks or troughs.

Figure 5.2 plots the US real GDP together with the NBER business cycle chronology (shaded areas). It can be seen that the NBER chronology accurately picks up the declines in the real GDP. An especially deep and protracted decline is observed in 2008–2009, the episode known as the Great Recession.

The NBER is an established authority and its chronology is a widely recognized one. Other countries have no such expert committee at the national level. Fortunately, there is an interna-

[2] The dates of the peaks and troughs of the US business cycle can be found here: `http://www.nber.org/cycles/recessions.html`.

Figure 5.2: US real GDP vs. NBER chronology, 1947–2020



Sources: FRED, NBER, and own representation

tional organization — Economic Cycle Research Institute (ECRI), which produces business cycle chronologies for various countries.[3]

Each technique has its advantages and disadvantages. What are the strengths and weaknesses of the expert judgment approach? It has the following advantages:

- Experts make use of different sources of information;
- The wise judgment can be superior to a thoughtless use of sophisticated techniques.

The disadvantages of the expert judgment approach to dating the bubbles are as follows:

- The expert's procedure is not transparent;

[3]This is the website of the ECRI: https://www.businesscycle.com/.

- It is impossible to replicate;
- It is a very time consuming process: it takes many months or even years to identify the cyclical phases.

Ad hoc dating methods

The simplest method of dating business cycles and speculative asset price bubble is the rule of thumb using the two-quarter definition. According to this rule, recession is defined as two consecutive quarters of decline in real GDP.

A more sophisticated technique is the procedure developed by Bry and Boschan (1971). It tries to emulate the decision making process of the NBER using the monthly series of industrial production. The Bry-Boschan technique does not use any formal statistical framework to do the dating. Instead it translates the NBER method into a set of simple decision rules. It basically comprises two stages:

1. selecting the candidates for turning points and
2. applying a censoring rule to eliminate the turning points, which don't satisfy some criteria (e.g., minimum duration).

A quarterly version of Bry-Boschan technique was developed by Harding and Pagan (2001). Each point in the sample is checked for being a local maximum or minimum:

$$y_t = \begin{cases} \text{peak, if } y_t = \max\left(y_{t-K}, \ldots, y_{t+L}\right) \\ \text{trough, if } y_t = \min\left(y_{t-K}, \ldots, y_{t+L}\right) \\ \text{neither peak nor trough, otherwise} \end{cases} \tag{5.1}$$

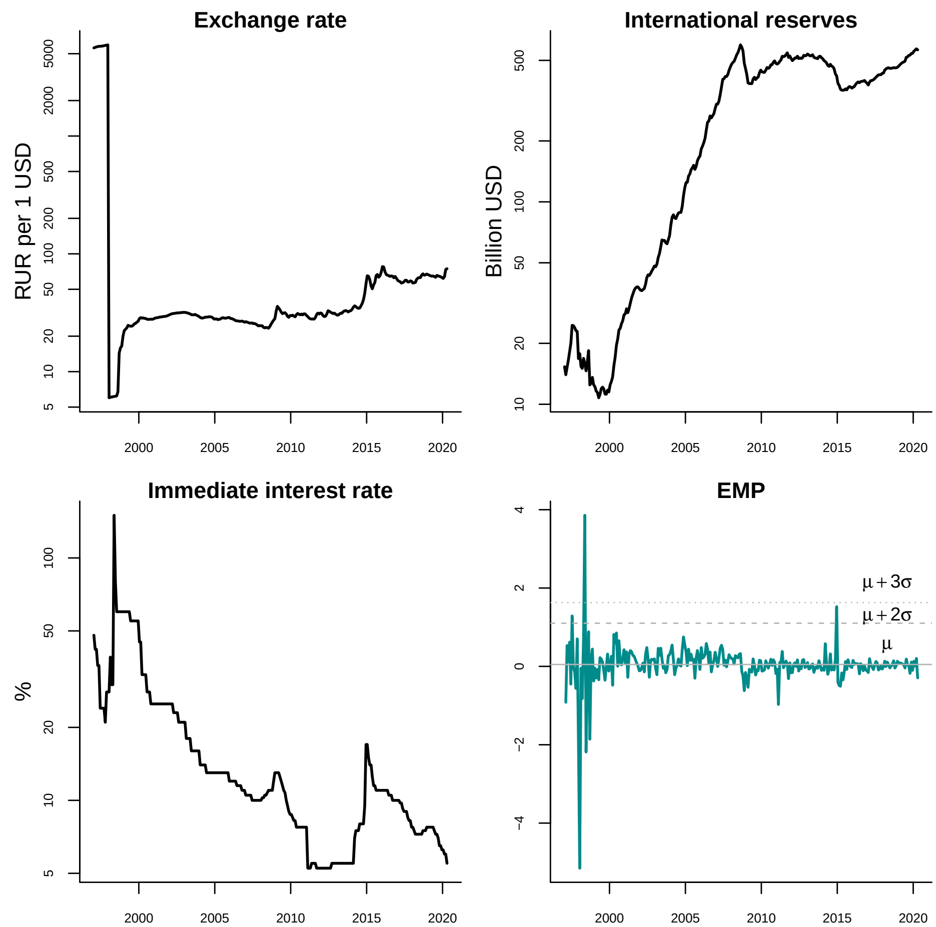
Normally, one takes $K = L = 2$ for quarterly data (6 for monthly data). Eliminate candidate peaks and troughs, which do not satisfy two restrictions: 1) minimum phase duration should be 6 months (2 quarters) and 2) complete cycle must last at least 15 months (5 quarters).

The most important appeal of the Bry-Boschan technique is its simplicity and transparency. It is also very robust in the sense that changing the sample will not affect the dates. Although it is sensitive to the choice of criteria and censoring rules. Arbitrariness is the major problem related to the *ad hoc* techniques.

Crises occurring at the currency markets have their specific features and, therefore, require somewhat different tools in order to identify them. A currency crisis is defined as speculative pressures in foreign exchange markets. In order to identify the periods of a currency crisis, constructed crisis indices need to reflect both successful and unsuccessful speculative attacks on domestic currency. Following Eichengreen et al. (1994) recent studies use as crisis indicator the speculative exchange market pressure (EMP), which is a weighed average of depreciation rate of nominal exchange rates, percentage change in international reserves, and change in interest rate. Different weighting schemes are possible. For example, it is reasonable to use for this purpose the inverse of the standard deviations of the component variables ($\frac{1}{\sigma_i}$, where $i = \{\text{exchange rate}, \text{reserves}, \text{interest rate}\}$) in order to equalize their volatilities.

Currency crisis is identified when the EMP index exceeds a particular threshold, such as 2 or 3 standard deviations (σ) above its mean (μ). Figure 5.3 illustrates this approach using the monthly Russian financial data over the period 1997–2018.

Figure 5.3: Detecting currency crises in Russia



Sources: Central Bank of Russia, Federal Reserve Bank of St. Louis (FRED), and own calculations.

Three panels show the dynamics of the exchange rate of ruble, international official reserves of Russia, and short-term interest rate (immediate Rates: less than 24 hours). The lower right panel displays the EMP index calculated using these three series. The dashed (dotted) line reflects the mean plus two (three) standard deviations. The periods, when the EMP index intersects these lines, are treated as currency crises. In this case, it happens twice: in 1998, when a large economic crisis occured in Russia, and 2014, when oil prices went down, Crimean crisis started, and anti-

Russian sanctions were introduced by the Western countries. However, in the second case, the EMP crossed only the $\mu + 2\sigma$ line, but not the $\mu + 3\sigma$ line. Thus, no currency crisis would be detected, if we used the stricter criterion.

Formal statistical tests

Formal statistical tests are free from arbitrariness of both the expert judgment and *ad hoc* methods. Recently, they have been increasingly used to detect the asset price speculative bubbles for stock prices, house prices, and commodity prices.

Here, we will discuss the so-called explosive root test developed by Phillips et al. (2015) in order to identify multiple speculative bubbles. The test is based on the idea that house prices are fundamentally determined by future rents in the period of ownership and, moreover, by future asset price increases. Under the assumption of perfectly informed and rational agents, price increases are again solely determined by dividends earned in the period after the next sale.

In the real estate context, this implies that house prices are —in the long run— tied to the development of rents. Under the standard no arbitrage condition, the house price can thus be expressed as

$$P_t = \frac{E_t[P_{t+1} + R_{t+1}]}{1+i} \tag{5.2}$$

where P_t is the real estate price, R_t denotes the rental income, t is the current time period, i is the risk-free interest rate, and $E[\cdot]$ is the rational expectation, conditional on the information available (Homm and Breitung, 2012). The fundamental price, P^F, can be determined by forward iteration of equation (5.2):

$$P_t^F = \sum_{n=1}^{\infty} \frac{1}{(1+i)^n} E_t[R_{t+n}] \tag{5.3}$$

However, there is a unique solution for equation (5.3) under the transversality condition, according to which the present value of a payment occurring infinitely far in the future must be zero,

$$\lim_{k\to\infty} E_t\Big[\frac{1}{(1+i)^k} P_{t+k}\Big] = 0 \tag{5.4}$$

If the actual price process contains additional elements, like a bubble component B, the pricing equation becomes

$$P_t = \lim_{k\to\infty} E_t\Big[\frac{1}{(1+i)^k}\Big(\hat{P}_{t+k} + (1+i)^k B_t\Big)\Big] + P_t^F \tag{5.5}$$

In this case, there are infinitely many solutions. Today's house price can be decomposed in two elements —one covering the fundamental value, determined by future rental income and another that is related to potentially speculative motivations. In case of a speculative bubble, any rational investors should expect the house price to increase at rate i. Because all rational investors expect other investors to pay a price $P_{t+1}^F + B_{t+1}$, they are willing to pay $P_t^F + B_t$ in period t.

The fundamental component in equation (5.5) cannot be observed. Hence, assumptions have to be made in order to characterize the time series properties of the fundamental price, P_t^F. One can impose a plausible assumption that housing rent, R_t, follows a random walk with drift:

$$R_t = \mu + R_{t-1} + u_t \tag{5.6}$$

where μ is the drift and u_t is a white noise process. Under this assumption the fundamental price can be expressed as

$$P_t^F = \frac{1+i}{i^2}\mu + \frac{1}{i}R_t \tag{5.7}$$

where i is the risk-free rate (Homm and Breitung, 2012). As a result, if R_t follows a random walk with drift, so does the fundamental component of the housing price, P_t^F. This permits distinguishing the fundamental price from the speculative bubble that can be described as an explosive autoregressive process. Thus, a test procedure boils down to testing the null hypothesis of a random walk against the alternative of an explosive process.

The basic idea of the test is to analyze the roots of an autoregressive process. The explosive root is tested against the alternative of a unit root (random walk). The latter reflects the rational expectations hypothesis.

Figure 5.4 compares two artificially generated time series: a random walk and an explosive process. It can be seen that at some point the explosive process rapidly at an ever increasing rate diverges into infinity.

The test is based on the rolling regression model of the following form:

$$\Delta y_t = \alpha_{r_1,r_2} + \beta_{r_1,r_2} y_{t-1} + \sum_{k=1}^{K} \phi_{r_1,r_2} + \varepsilon_t \tag{5.8}$$

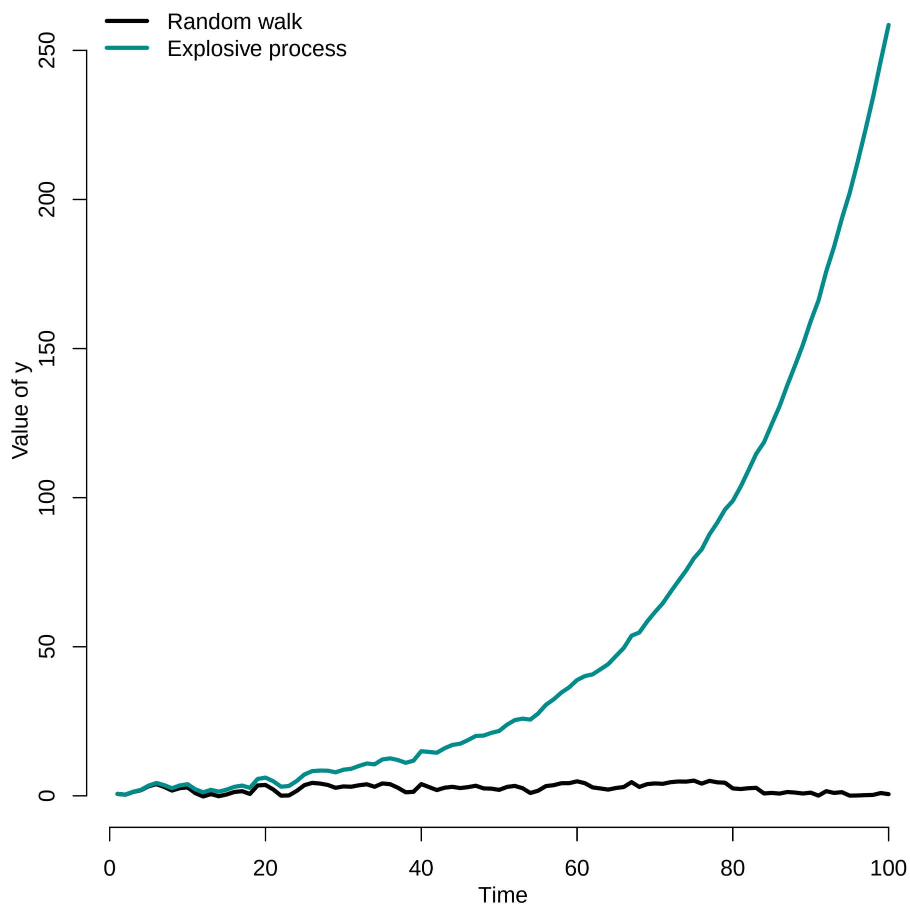
where y_t is the variable to be tested for explosive roots; k is the lag order; α, β, ϕ are parameters to be estimated; and ε_t is the disturbance term. Under the null hypothesis (random walk), $\beta_{r_1,r_2} = 0$, while under the alternative hypothesis (explosive process), $\beta_{r_1,r_2} > 0$.

The sample of this rolling-window regression starts from the r_1-th fraction and ends at the r_2-th fraction of the total sample (T): $r_2 = r_1 + r_w$ and $r_w > 0$ is the (fractional) window size of the regression.

Based on this regression, an augmented Dickey-Fuller (ADF) test is conducted on a forward expanding sample sequence. Phillips et al. (2015) test is the supremum value of the ADF statistic sequence:

$$SADF(r_0) = \sup_{r_2 \in [r_0,1]} ADF_0^{r_2} \tag{5.9}$$

Figure 5.4: Random walk vs. explosive process



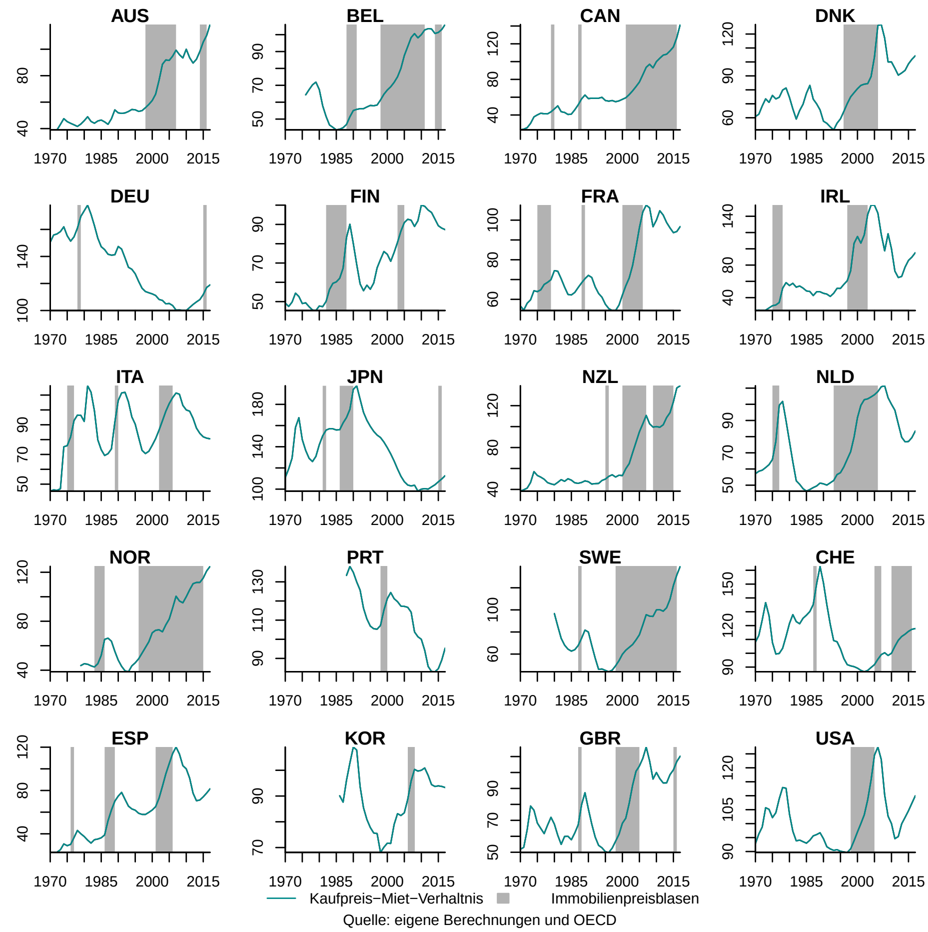
where $ADF_0^{r_2}$ is the ADF statistic for a sample running from 0 to r_2.

Figure 5.5 shows the house price-to-rent ratios in various countries and the corresponding speculative bubbles detected using this time series and the explosive root test of Phillips et al. (2015). The bubble episodes are quite rare events. However, they can last for 10 years or more, as the example of many countries in the early 2000s and of Scandinavian countries in the 2010s shows.

5.5 Early warning systems with exogenous chronology

As pointed out in section 5.3, the two main elements of an early warning system are: a cycle or bubble chronology and a forecasting model. The chronology can be exogenous, when it is not a part of the forecasting model; or endogenous, when it is obtained when estimating the forecasting model. Here, we will consider the early warning systems with exogenous chronology. While the procedure used in order to detect speculative bubbles or business cycle turning points were discussed in the previous section, in this section we will concentrate on the prediction of bubbles and turning points.

Figure 5.5: House price-to-rent ratios vs. Phillips et al. (2015) chronology



The EWS with exogenous chronology can use the following forecasting approaches: signalling approach and discrete-choice models — see Figure 5.1.

Signalling approach

The signalling approach was suggested by Kaminsky et al. (1998) and Reinhart and Kaminsky (1999). The idea behind this approach is to find indicators that allow the best prediction of crises. The main criterion used to choose the indicators is their behavior: a good indicator tends to deviate from its "normal" path prior to a crisis. Every time an indicator exceeds certain threshold value (e.g., mean plus several standard deviations), it is interpreted as a warning signal that a crisis can take place within several periods.

The threshold values are calculated in such a way as to strike the balance between the risk of producing too many false alarms and the risk of missing the crisis altogether. A reasonable lead between the signal and the crisis must be defined: any signal given within some period (window) before the beginning of the crisis is labeled a good signal, while any other signal sent outside that window is labeled a false alarm or noise. Thus, a designer of a bubble prediction model based on the signalling approach needs leading indicators that are highly correlated with the speculative bubble chronology. The examples of economic indicators: business confidence indicators, stock exchange indices, interest spreads (difference between the long-term and short-term interest rates), etc.

The forecasting performance of each indicator can be measured and compared in order to identify the best indicators, that is, indicators, which allow the most precise predictions of speculative price bubbles or business cycle turning points.

Table 5.1 describes the four possible forecasting situations. The correct signal takes place, if

Table 5.1: Crisis detection: signals vs. crises

	Crisis	No crisis
Signal sent	correct signal, A	false alarm, B
Signal not sent	missing signal, C	correct signal, D

the signal is sent and the crisis occurs or if the signal is not sent and there is no crisis. Otherwise, when the signal is sent, but no crisis occurs, we talk about a false alarm; whereas when no signal is sent and the crisis occurs, we call it missing signal. The forecast accuracy tests are based on this classification of cases.

For example, Kuipers score uses this classification in the following way:

$$KS = \frac{N_A}{N_A + N_C} - \frac{N_B}{N_B + N_D} \tag{5.10}$$

where N_A and N_D are the number of correct identifications; N_B is the number of false alarms; and N_C is the number of missing signals. The Kuipers score, KS, varies between -1 (all false) and 1 (all correct).

The individual indicators can be combined to a composite indicator using their KS measures as weights. The signalling approach is typically used to predict the currency crises. However, there are also studies that use it in order to forecast stock and house price bubbles (Gerdesmeier et al., 2010 and Dreger and Kholodilin, 2013).

Discrete-choice models

An alternative to signals approach uses the crisis chronology as dependent variable. The chronology is defined as binary, or discrete-choice, variable:

$$C_t = \begin{cases} 1 & \text{if crisis in period } t \\ 0 & \text{otherwise} \end{cases} \tag{5.11}$$

In such cases, the discrete-choice models are used such as linear probability model as well as logit and probit models.

Linear probability model

The probability of being in the period of recession or of speculative bubble is defined as:

$$\begin{aligned} \Pr(C_t = 1|x_t) &= F(x_t, \beta) \\ \Pr(C_t = 0|x_t) &= 1 - F(x_t, \beta) \end{aligned} \tag{5.12}$$

where x_t is a vector of indicators at time t $(t = 1, \ldots, T)$; and β is $k \times 1$ parameter vector.

The problem at this point is to devise a suitable model for the r.h.s. of equation. One possibility is to retain the familiar linear regression:

$$F(x_t, \beta) = x_t'\beta \tag{5.13}$$

In that case, we have a linear probability model, which is the multiple linear regression model when the dependent variable, y, is binary rather than continuous:

$$C_t = \beta_0 + \beta_1 x_{1t} + \ldots + \beta_K x_{Kt} + \varepsilon_t \tag{5.14}$$

where C_t is a binary crisis variable.

Because dependent variable is binary,

$$E(C_t|x_{1t}, \ldots, x_{Kt}) = \Pr(C|x_{1t}, \ldots, x_{Kt}) \tag{5.15}$$

So, for the linear probability model:

$$\Pr(C_t|x_{1t}, \ldots, x_{Kt}) = \beta_0 + \beta_1 x_{1t} + \ldots + \beta_K x_{Kt} \tag{5.16}$$

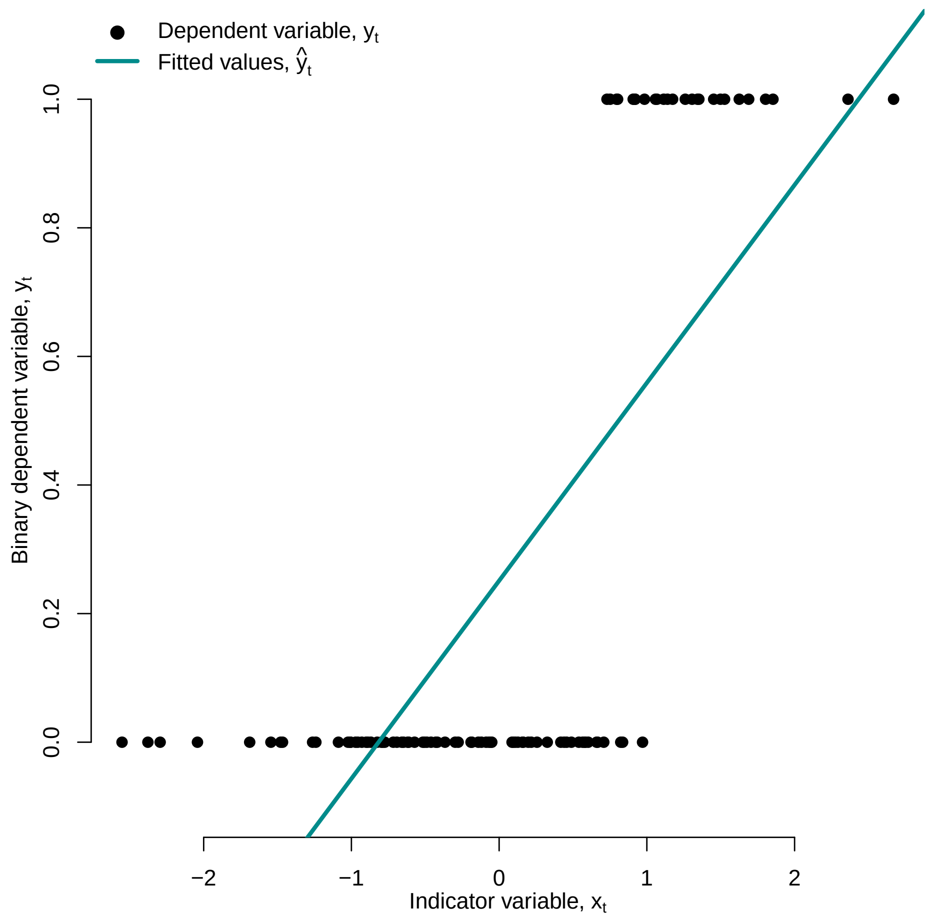
Regression coefficient β_k on a regressor x_{kt} is the change in the probability that $C_t = 1$ associated with a unit change in x_{kt}.

Regression coefficients of linear probability model can be estimated by OLS. The usual (heteroskedastic robust) OLS standard errors can be used for confidence intervals and hypothesis tests. The usual goodness-of-fit measure, R^2, used for the linear models makes no sense for a linear probability model. When dependent variable is continuous, it is possible to imagine a situation, in which $R^2 = 1$: All the data lie exactly on the regression line. However, this is impossible, when the dependent variable is binary, unless the regressors are also binary.

Figure 5.6 shows an example of a LPM estimated for the artificially generated data.

The LPM is a simple and yet powerful model. Nevertheless, it also has shortcomings. First, the linearity that makes the linear probability model easy to use is also its major flaw. Because probabilities cannot be less than 0 or exceed 1, the effect on the probability that $C_t = 1$ of a given change in x_t must be nonlinear. Second, in the linear probability model, the effect of a given change in income is constant, which leads to predicted probabilities that drop below 0 or exceed 1. But this is a nonsense!

Figure 5.6: Linear probability model



Logit and probit models

The logit and probit regressions are nonlinear regression models specifically designed for binary dependent variables. Because a regression with a binary dependent variable C_t models the probability that $C_t = 1$, it makes sense to adopt a nonlinear formulation that forces the predicted values to lie between 0 and 1. Because cumulative probability distribution (c.d.f.) functions produce probabilities between 0 and 1, they are used in logit and probit regressions. The probit regression uses the standard normal c.d.f., while the logit regression uses the logistic c.d.f.

The probit model uses the standard normal c.d.f.:

$$\Pr(C_t = 1|x_t) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x_t'\beta} \exp^{-\frac{z^2}{2}} dz = \Phi(x_t'\beta) \tag{5.17}$$

where Φ is the standard normal distribution function.

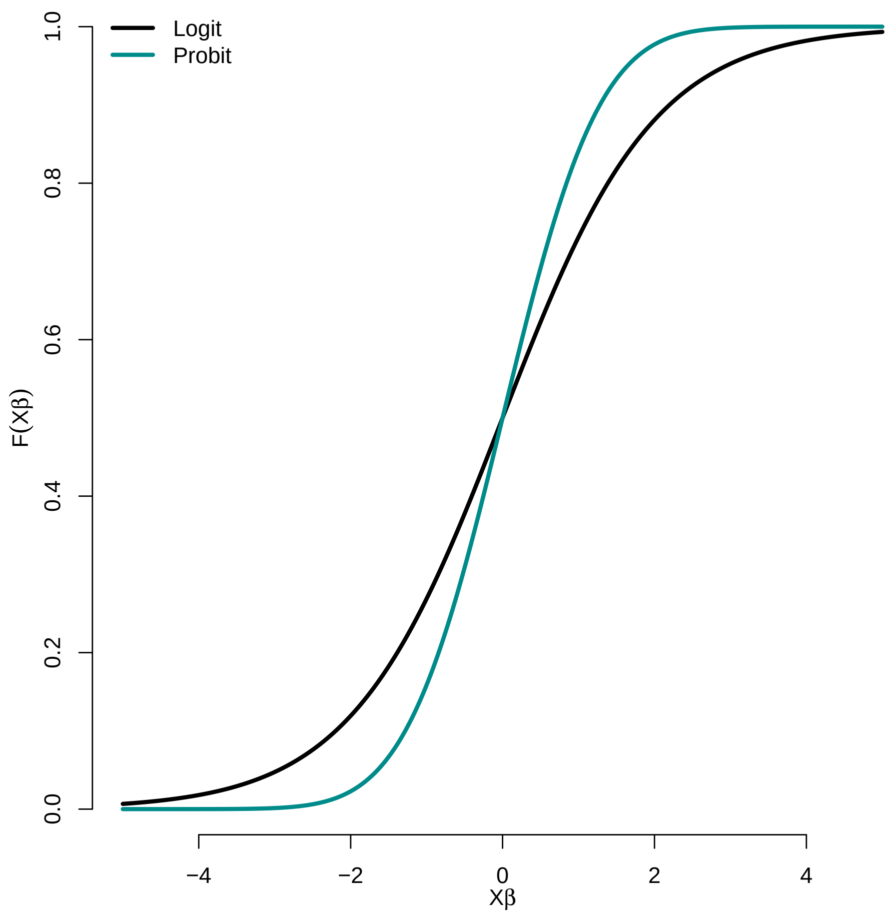
The logit regression uses the logistic c.d.f.:

$$\Pr(C_t = 1|x_t) = \frac{\exp(x_t'\beta)}{1 + \exp(x_t'\beta)} = \Lambda(x_t'\beta) \tag{5.18}$$

where Λ is the logistic distribution function.

Figure 5.7 compares transition functions of logit and probit models.

Figure 5.7: Logit and probit functions



The logit transition function has heavier tails than the probit one.

The question, which distribution (logistic or exponential) to use, is a natural one. The logistic distribution is similar to the normal, except in tails, which are considerably heavier. It closely resembles a Student distribution with 7 degrees of freedom. Therefore, for intermediate values of $x_t'\beta$ (say, between -1.2 and +1.2), the two distributions tend to give similar probabilities. The logistic distribution tends to give larger probabilities to $C_t = 1$ when $x_t'\beta$ is extremely small (and smaller probabilities to $C_t = 1$ when $x_t'\beta$ is very large) than the normal distribution.

We should expect different predictions from the two models, if the sample contains

(1) very few responses (C_t's equal to 1) or very few nonresponses (C_t's equal to 0);

(2) very wide variation in an important independent variable, particularly if (1) is also true.

It is virtually impossible to justify the choice of one distribution or another on theoretical grounds.

All three models — linear probability, logit, and probit — are just approximations to the unknown population regression function $F(C_t|x_t) = \Pr(C_t = 1|x_t)$. The linear probability model is the easiest to use and to interpret, but it cannot capture the nonlinear nature of the true population regression function. Logit and probit regressions model this nonlinearity in probabilities, but their regression coefficients are more difficult to interpret. So which should be used in practice? There is no one right answer, and different researchers use different methods.

Table 5.2 reports the estimation results of three models: LPM, logit, and probit.

Table 5.2: Estimation results of LPM, logit, and probit

	Dependent variable:		
	NBER recession/expansion chronology		
	LPM	Logit	Probit
	(1)	(2)	(3)
Constant	6.146*** (0.507)	87.420*** (11.480)	41.838*** (5.432)
Build_permits	−0.0004*** (0.00004)	−0.006*** (0.001)	−0.003*** (0.0004)
Tsec_10year	−0.007 (0.009)	−0.051 (0.136)	−0.046 (0.071)
URate	−0.168*** (0.018)	−2.602*** (0.380)	−1.256*** (0.181)
TCU	−0.061*** (0.005)	−0.913*** (0.123)	−0.433*** (0.058)
Div_yield	18.258*** (2.033)	234.106*** (41.701)	119.487*** (20.002)
Observations	468	468	468
Log Likelihood	−52.974	−82.122	−85.157
Akaike Inf. Crit.	117.948	176.244	182.313
Note:			*p<0.1; **p<0.05; ***p<0.01

These models are estimated for the US data, using the NBER business cycle chronology as the dependent variable.

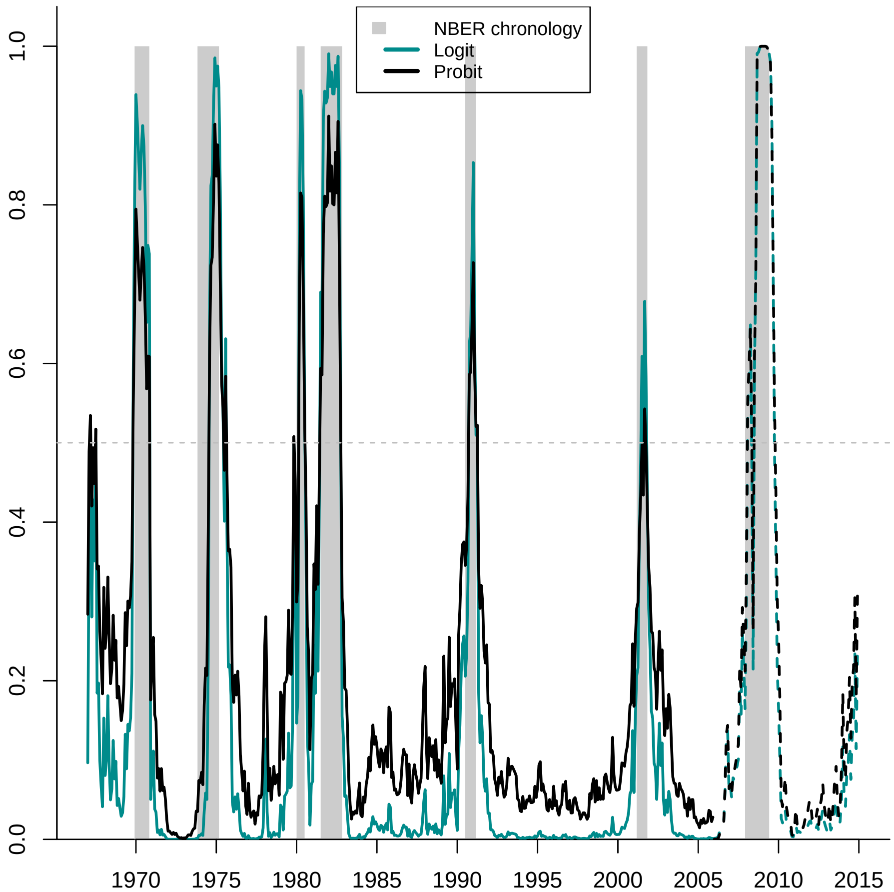
Figure 5.8 compares conditional probabilities of recession obtained using logit and probit models to the NBER business cycle chronology.

Both models produce quite accurate forecasts of the NBER recession dates. The logit model appears to be slightly more accurate than the probit model: it has higher recession probabilities during the recession phases of the NBER and lower probabilities during the NBER expansion phases.

5.6 Early warning systems with endogenous chronology

This class of models allows moving away from *a priori* dating of crises. Here, three forecasting model classes will be considered: TAR, STAR, and Markov switching; see Figure 5.1. These are non-linear models, which permit identifying crises in an endogenous way, as switches between the alternating regimes of crises and non-crises are conditioned upon some variable. While in TAR

Figure 5.8: Prediction of the US recessions using logit and probit



and STAR models, the transition variable is observable and must be somewhat arbitrarily chosen by the forecaster, in the Markov-switching models, it is unobservable.

The models considered in this section have their advantages and disadvantages. Their advantage is that they reduce arbitrariness in defining crisis periods. They do not need any separately established bubble chronology, since it is estimated simultaneously with other parameters of these models. The models with endogenous chronology have two disadvantages: 1) they are more computation-intensive and unstable compared to the EWS with exogenous chronology and 2) their data requirements are higher (for example, more observations are needed).

Threshold autoregression

We start from the simplest non-linear model, which allows simultaneously detecting and predicting speculative bubbles. It is known as threshold autoregressive model (TAR) and was suggested by Tong (1978) and Tong (1990). In this model, the regime shifts (from expansion to recession or from bubble to no-bubble) in the dependent variable, y_t, are triggered by an observable transition variable, x_t, crossing a threshold c:

$$y_t = \left(\alpha_0 + \sum_{p=1}^{P} \alpha_p y_{t-p}\right) I(x_t; c) + \left(\beta_0 + \sum_{p=1}^{P} \beta_p y_{t-p}\right)\left(1 - I(x_t; c)\right) + \varepsilon_t \tag{5.19}$$

where y_t is the dependent variable of interest (e.g., real GDP growth rates or price-to-rent ratio); α's and β's are the regime-dependent parameters; ε_t is the error term, $\varepsilon_t \sim IID(0, \sigma^2)$; and $I(\cdot)$ is the indicator function.

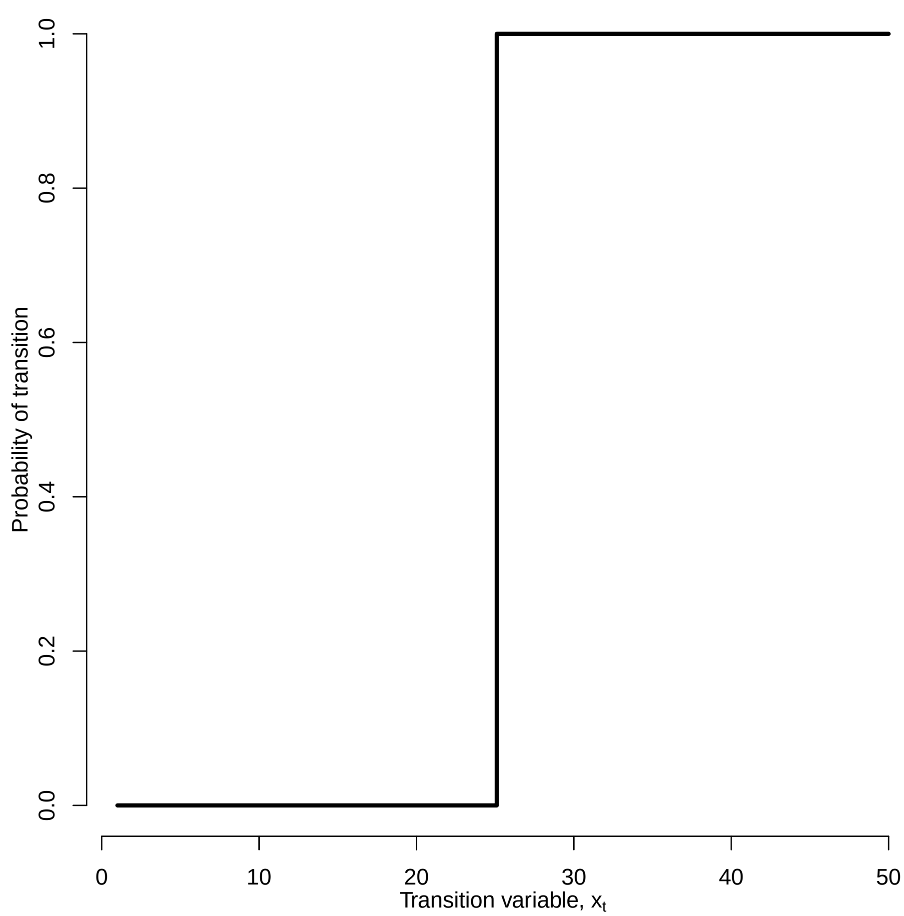
The indicator function, $I(x_t; c)$, is defined as:

$$I(x; c) = \begin{cases} 1, & \text{if} \quad g(x_t) > c \\ 0, & \text{if} \quad g(x_t) \leq c \end{cases} \tag{5.20}$$

If the indicator function of transition variable exceeds certain threshold, then economy is in one regime (e.g., crisis), otherwise economy is in another regime (e.g., no crisis).

Figure 5.9 illustrates the indicator (or transition) function of the TAR model:

Figure 5.9: TAR indicator function



The switch between two regimes is discontinuous: an infinitely small change in the transition variable is enough to jump into another regime. One may argue that the economy is seldom confronted with such a situation. There can be many different types of transition variable, x_t. For $x_t = t$ a model with a structural break at time $t = c$ occurs. For the purposes of analysis of currency and financial crises other transition variables may be more useful.

In Table 5.3, we present an example of the estimation output of a TAR model. It was estimated for the US data, the dependent variable being the growth rate of the real industrial production and the transition variable being the log of building permits. In fact, the TAR model separately

Table 5.3: Estimation results of TAR

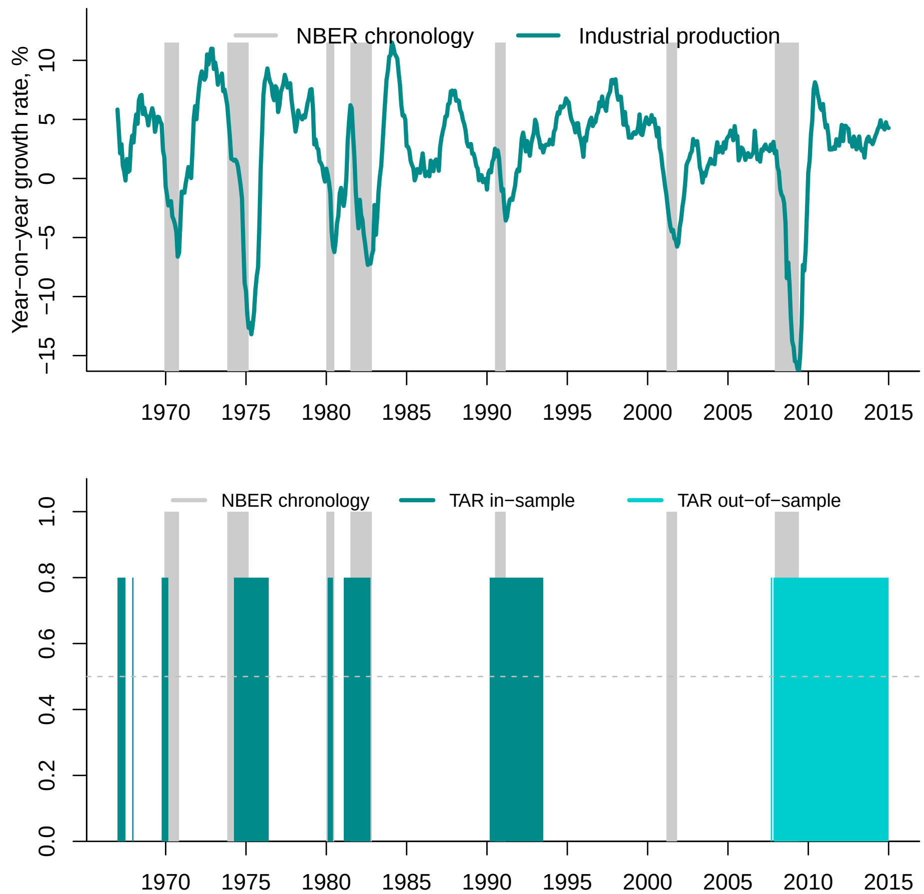
	Dependent variable:	
	Growth rate of industrial production	
	Recession	Expansion
	(1)	(2)
Constant	-29.316^{***} (5.904)	-11.793^{***} (3.385)
D12LIP_1	0.954^{***} (0.024)	0.917^{***} (0.017)
LBuild_permits	2.853^{***} (0.545)	0.635^{**} (0.314)
Tsec_10year	-0.111^{***} (0.032)	-0.091^{***} (0.031)
URate	0.611^{***} (0.124)	0.279^{***} (0.059)
TCU	0.077 (0.059)	0.079^{***} (0.021)
Observations	190	387
R^2	0.953	0.945
Adjusted R^2	0.952	0.945
Residual Std. Error	1.228 (df = 184)	0.837 (df = 381)
F Statistic	749.851^{***} (df = 5; 184)	$1,317.770^{***}$ (df = 5; 381)
Note:		*p<0.1; **p<0.05; ***p<0.01

estimates two linear models for two different subsamples, depending on the threshold value of the transition variable. The recession subsample is two times shorter than the expansion subsample. In both regimes, the intercept is negative. However, in the recession regime, is almost three times larger in absolute value than that in the expansion regime. The parameter estimates of different explanatory variables are different across regimes.

Figure 5.10 shows the conditional probabilities of recession resulting from the TAR model presented above. The upper panel depicts the growth rates of the real industrial production and the NBER business cycle chronology, where recessions are denoted by the shaded areas. The lower panel compares the conditional recession probabilities to the NBER chronology. The TAR recession probabilities in most cases coincide with the NBER dates, but predict much longer recessions than really observed. This means that the TAR model in this particular case produces many false alarms.

If the transition variable is a lagged endogenous variable, y_{t-d}, with delay $d > 0$, self-exciting

Figure 5.10: TAR recession probabilities vs. NBER chronology



threshold autoregressive (SETAR) model results:

$$y_t = \left(\alpha_0 + \sum_{i=1}^{p} \alpha_p y_{t-i}\right) I(y_{t-d}; c) + \left(\beta_0 + \sum_{i=1}^{p} \beta_p y_{t-i}\right)\left(1 - I(y_{t-d}; c)\right) + \varepsilon_t \qquad (5.21)$$

where $\varepsilon_t \sim IID(0, \sigma^2)$.

In SETAR model, regime-generating process is not assumed to be exogenous but directly linked to the lagged endogenous variable y_{t-d}.

Smooth transition autoregression

Smooth transition autoregressive model (STAR), was first suggested in Teräsvirta and Anderson (1992) and van Dijk et al. (2002). It has the following form:

$$y_t = \left(\alpha_0 + \sum_{i=1}^{p} \alpha_p y_{t-i}\right) F(x_t; \gamma, c) + \left(\beta_0 + \sum_{i=1}^{p} \beta_p y_{t-i}\right)\left(1 - F(x_t; \gamma, c)\right) + \varepsilon_t \qquad (5.22)$$

where y_t is a dependent variable (e.g., real GDP growth rates or price-to-rent ratio); x_t is the transition variable; and $F(x_t; \gamma, c)$ is a transition function, which, unlike the abrupt step-wise indicator function in TAR, is smooth. It is a continuous function bounded between 0 and 1.

As transition variable one can use either a lagged dependent variable y_{t-d} taken with some delay $d > 0$, or an exogenous observed variable, x_t; or (possibly nonlinear) function of lagged exogenous variable $g(x_t)$;

There are two main types of STAR transition function: logistic and exponential functions.

Logistic function:

$$F(x_t; \gamma, c) = \frac{1}{1+\exp[-\gamma(x_t - c)]}, \quad \gamma > 0 \tag{5.23}$$

Exponential function:

$$F(x_t; \gamma, c) = 1 - \exp[-\gamma(x_t - c)^2], \quad \gamma > 0 \tag{5.24}$$

where c is the threshold between the regimes; and γ is the smoothness parameter: the smaller γ the smoother transition between regimes.

Note that when $\gamma \longrightarrow \infty$, STAR transition function $F(x_t; \gamma, c)$ becomes indicator function of TAR, $I(x_t; c)$. When $\gamma \longrightarrow 0$, STAR model converges to a linear AR(p).

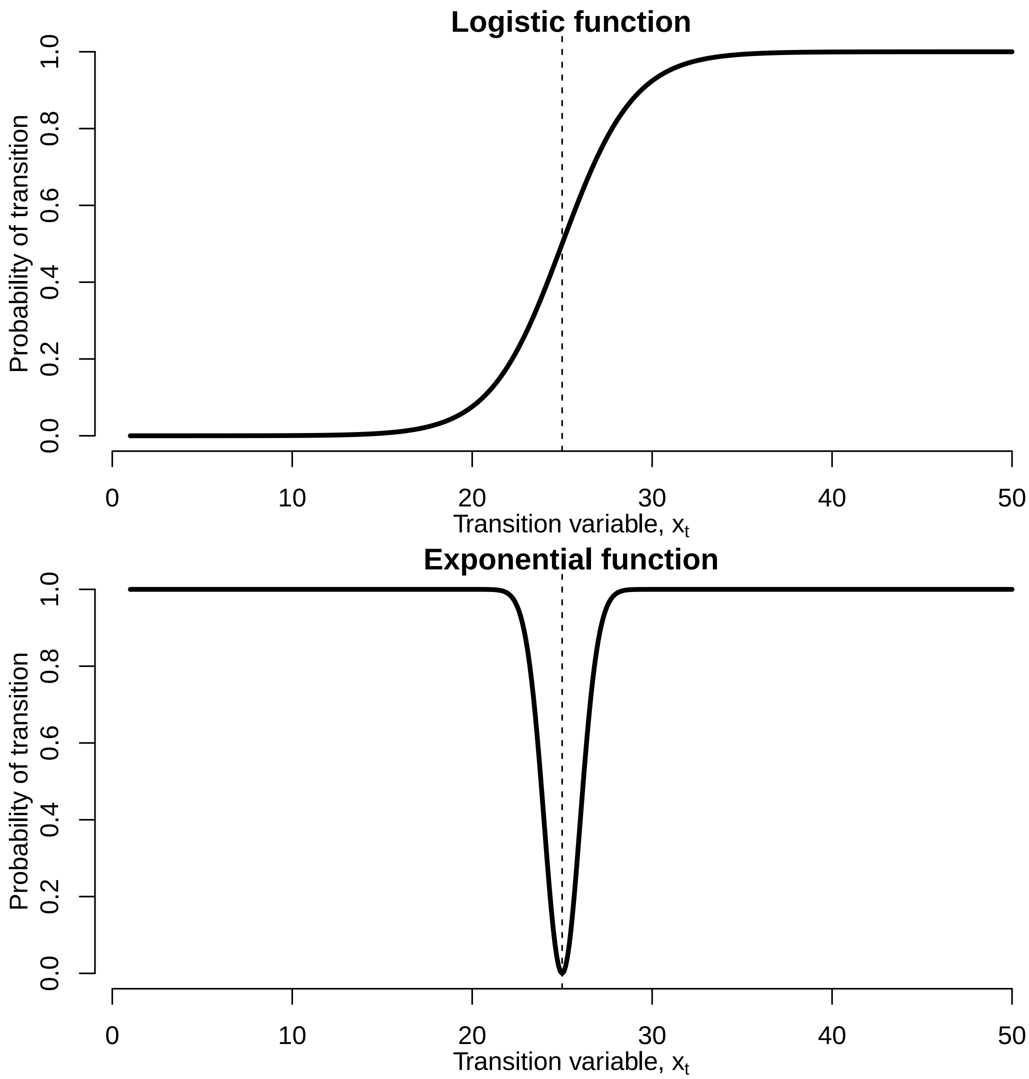
STAR model with logistic transition function is called logistic STAR (LSTAR). The model with exponential transition function is known as exponential STAR (ESTAR). There is no economic theory allowing to distinguish between LSTAR and ESTAR. The choice of transition function as well as of delay parameter d and lag structure of the model should be based on the data.

The STAR model can be interpreted as a regime-switching model that allows for two regimes associated with the extreme values of the transition function, $F(x_t; \gamma, c) = 0$ and $F(x_t; \gamma, c) = 1$, where the transition from one regime to the other is smooth. The regime that occurs at t can be determined by observed variable x_t and corresponding value of $F(x_t; \gamma, c)$. Figure 5.11 displays the LSTAR and ESTAR transition functions.

These transition functions are very different. While LSTAR transition function is low at low values of the transition variable, x_t, relative to the threshold value c, it gets higher at the higher values of the transition variable. Such a trajectory corresponds very well to the business cycles and asset price bubbles: during expansions (bubbles), the transition variable is higher, while during recessions (no-bubbles), it is lower. In the ESTAR model, regimes are associated with small and large absolute deviations of transition variable from threshold c: when x_t is either too small or too high ($|x_t - c|$ is large), regime 1 occurs, while when x_t is close to the threshold ($|x_t - c|$ is small), regime 2 takes place. Thus, the ESTAR transition variable is high at the extreme values of the transition variable and low at its middle values. Such a trajectory is more appropriate for the currency crises: when the exchange rate is extremely under- or overvalued, that is, it violates upper/lower limit of a specified band of fluctuations, the economy is in the crisis regime, while the exchange rate takes intermediate values, the economy is in no-crisis regime.

Figure 5.12 shows the effect the smoothness parameter, γ, exerts on the smoothness of the transition function. Smaller values of γ produce smoother transition. Recall that at very high

Figure 5.11: Logistic and exponential transition functions



values of γ the transition function converges to the TAR stepwise transition function.

Figure 5.13 shows the effects exerted by the change in the threshold parameter, c, on the LSTAR and ESTAR transition functions. Larger c values shift the transition function rightward without changing the form of the function.

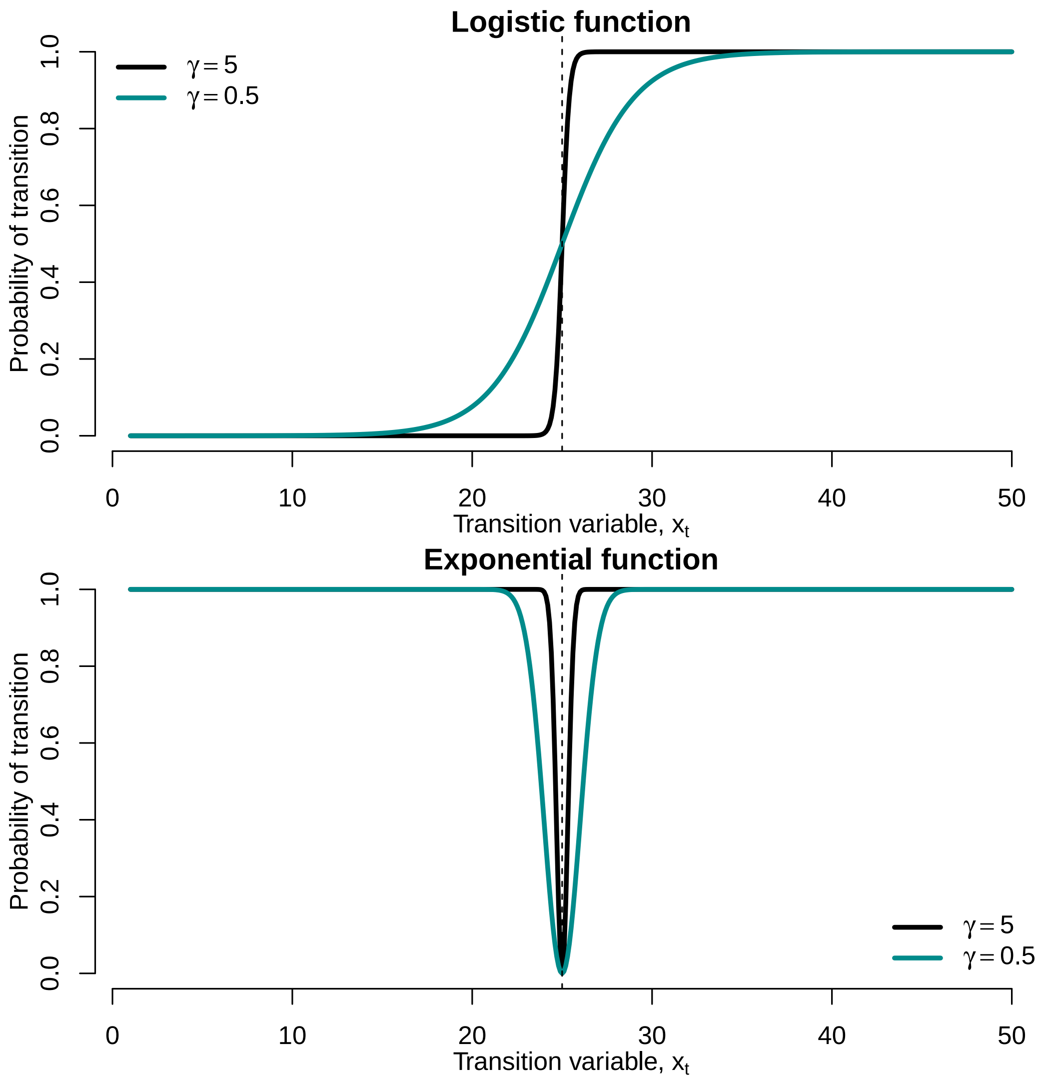
One useful output of the STAR models are the conditional probabilities of recessions or bubbles, depending on how we define the regime of interest. These are computed using equations (5.23) and (5.24).

Conditional probabilities for the LSTAR model:

$$\hat{F}(x_t) = \frac{1}{1 + \exp[-\hat{\gamma}(x_t - \hat{c})]} \tag{5.25}$$

where $\hat{\gamma}$ and $\hat{c}$ denote the estimated parameter values.

Figure 5.12: Smoothness parameter γ



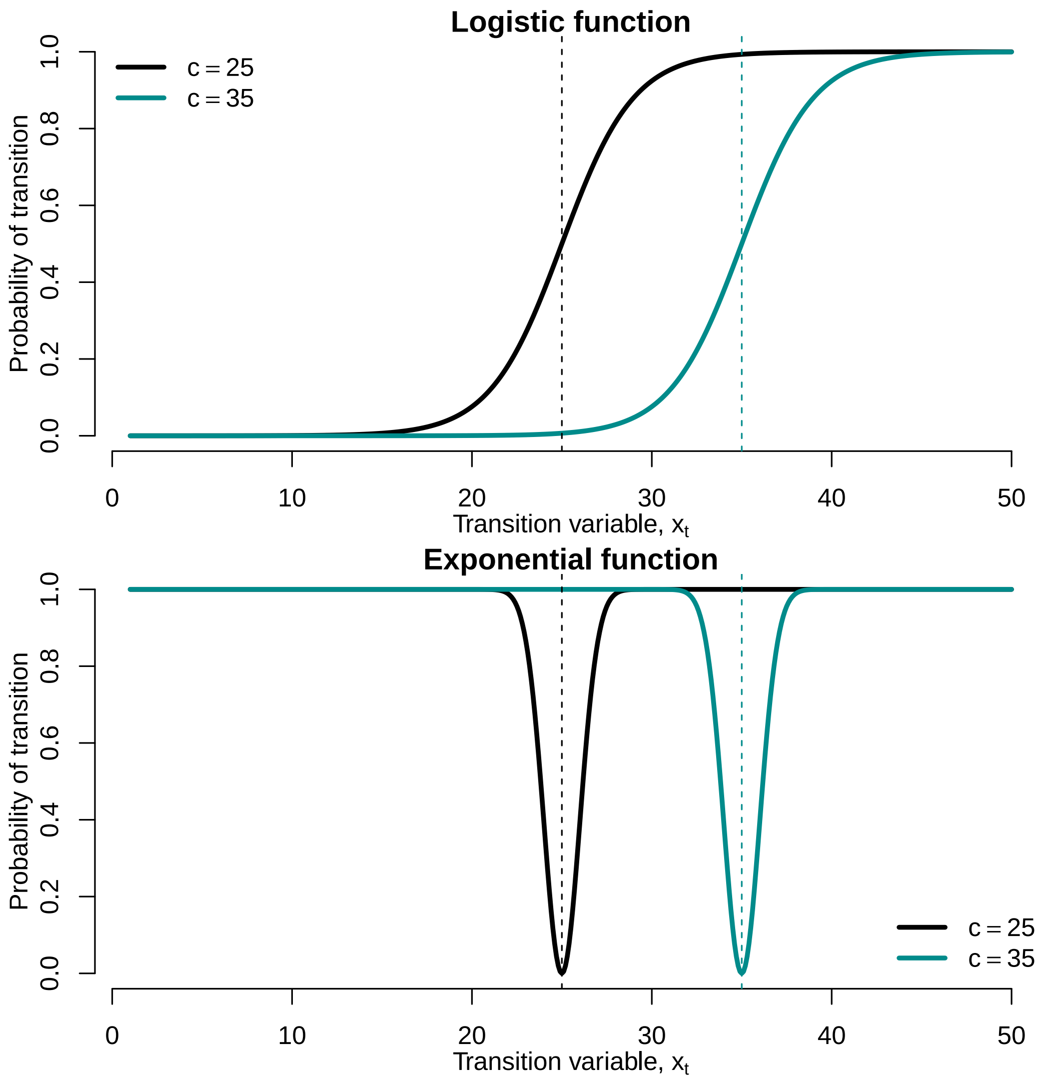
Conditional probabilities for the ESTAR model:

$$\hat{F}(x_t) = 1 - \exp[-\hat{\gamma}(x_t - \hat{c})^2] \tag{5.26}$$

Figure 5.14 compares the conditional probabilities of recessions obtained using the LSTAR model to the NBER business cycle chronology. The LSTAR-based recession probabilities quite accurately depict the NBER recession phases (shaded areas): the probabilities approaching 1 almost always precede or coincide with the NBER recession periods.

The STAR approach is very flexible. It allows for some useful and interesting extensions. For example, in the previous examples we considered the models with only two regimes: expansions vs. recessions or bubbles vs. no-bubbles. However, other STAR models can be constructed, which have more than two regimes. For instance, the model can contain three regimes: expansions, mild recessions, and deep recessions (depressions). This is especially useful, when some recessions are

Figure 5.13: Threshold parameter c



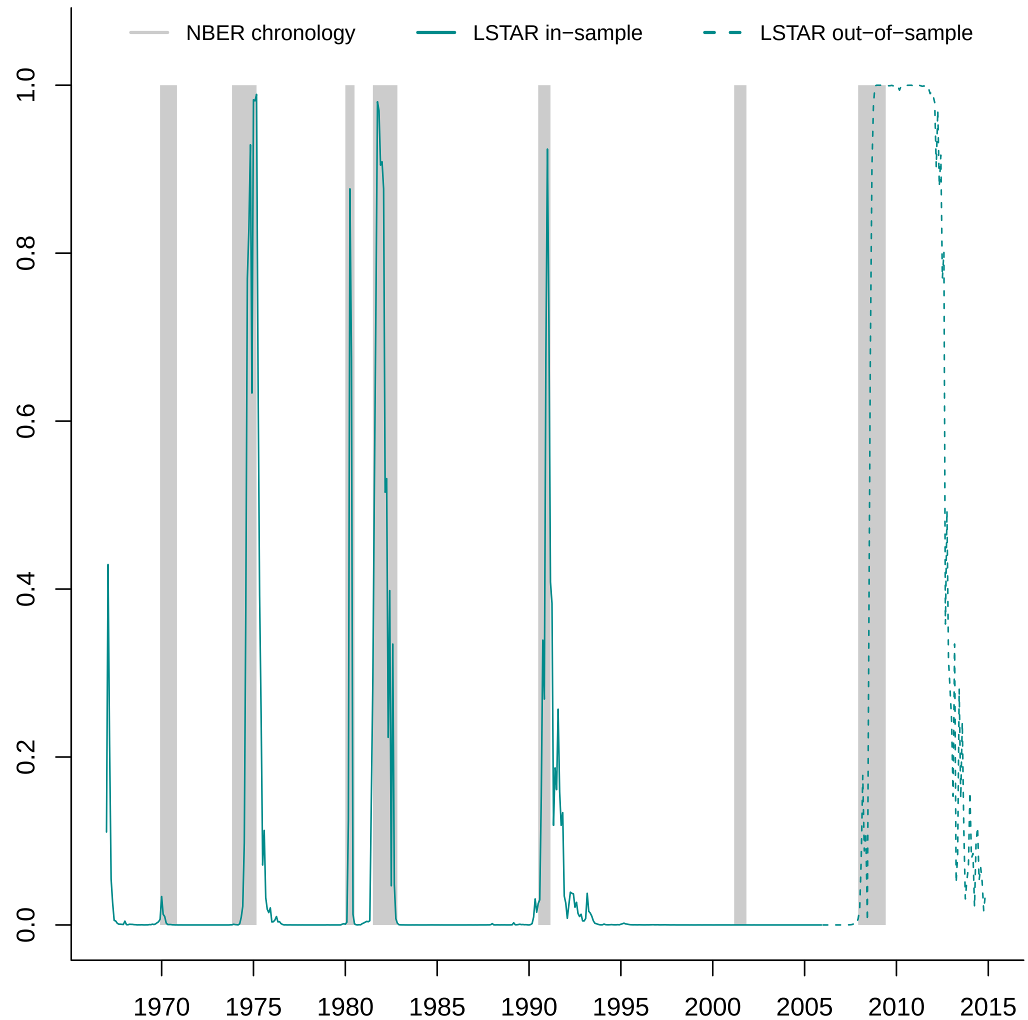
very deep (like the Great Recession or COVID-19 crisis) compared to other economic downturns. The STAR models with multiple regimes were elaborated by van Dijk and Franses (1999).

Another extension is the STAR model with an asymmetric transition function. In such a model, the switch between regimes can be different depending on the starting point. For example, during recession the economy declines swiftly, while during expansion the recovery can be slow. The STAR model with asymmetric transition was introduced by Siliverstovs (2005).

Markov switching

Markov-switching models (MS), like TAR and STAR, allow to diminish the degree of arbitrariness by estimating the crisis chronology and not relying on the *ad hoc* definitions. Unlike in TAR and STAR, however, the Markov switching implies the existence of an unobserved state variable, which

Figure 5.14: STAR recession probabilities vs. NBER chronology



governs switches between regimes. The regimes can be expansions vs. recessions or bubbles vs. no-bubbles.

One of the first MS models was suggested by Hamilton (1989). It fostered a great interest in Markov switching models as a tool to characterize macroeconomic fluctuations. There is a large number of extensions and refinements of the original model (see Krolzig 1997). The basic Markov-switching model can be formulated as follows:

$$y_t = \mu(s_t) + \sum_{p=1}^{P} \alpha_p y_{t-p} + \varepsilon_t \tag{5.27}$$

where y_t is some dependent variable (e.g., real GDP growth or price-to-rent ratio); $\varepsilon_t \sim NID(0, \sigma^2)$; and $\mu(s_t)$ is the regime-specific intercept that switches between two states:

$$\mu(s_t) = \begin{cases} \mu_1 < 0, & \text{if} \quad s_t = 1 \quad (\text{“expansion”}) \\ \mu_2 > 0, & \text{if} \quad s_t = 2 \quad (\text{“recession”}) \end{cases} \tag{5.28}$$

In this simple model, the variance of the disturbance term, σ_ε^2, is assumed to be identical in both regimes. In more sophisticated models, all parameters can be regime-dependent: intercept (or mean), $\mu(s_t)$; autoregressive coefficients, $\alpha_p(s_t)$; and residual variance, $\sigma_\varepsilon^2(s_t)$. Thus, during the bubble periods, the growth rate of the price-to-rent ratio, $\frac{\mu(s_t=1)}{1-\sum_{p=1}^{P}\alpha_p(s_t=1)}$, can be higher than during the no-bubble periods, $\frac{\mu(s_t=0)}{1-\sum_{p=1}^{P}\alpha_p(s_t=0)}$. In addition, bubble regimes can have higher volatility than the no-bubble ones: $\sigma_\varepsilon^2(s_t = 1) > \sigma_\varepsilon^2(s_t = 0)$.

When the financial and currency crises are considered, the two states may be defined differently. Stock market: for a stock exchange index the low values of the intercept $\mu(s_t)$ can represent “crashes", while high values — the “booms. In the foreign exchange market, the “high volatiliy" regime is associated with crises, while the “low volatility" regime is associated with normal times. Consecutively, when modelling currency crises, a Markov-switching model with state-dependent residual variance $\sigma_\varepsilon^2(s_t)$ is needed.

5.7 Forecast performance measures

In this chapter, we presented a wide range of alternative indicators and models that can be used in order to detect and forecast the episodes like crises or speculative bubbles. How to determine which of the models has the best forecast accuracy? There are several alternative measures of forecast accuracy. They measure how well an indicator or model allow forecasting speculative bubbles or turning points of business cycles.

Fraction correctly predicted, or Ben-Akiva and Lerman' measure of fit, is computed as the average proportion of correct predictions made by the forecasting model:

$$FCP = \frac{\sum_{t=1}^{T}\left(C_t\hat{F}_t + (1 - C_t)(1 - \hat{F}_t)\right)}{T} \tag{5.29}$$

where C_t is the binary dependent variable (e.g., recessions or bubbles); $\hat{F}_t$ is the predicted probability of crisis. The difficulty in this computation is that in unbalanced samples, the less frequent outcome will usually be predicted very badly by the standard procedure, and this measure does not pick up that point.

Cramer (1999) proposed an alternative measure that directly measures this failure:

$$\begin{aligned} \lambda &= E(\hat{F}_t|C_t = 1) - E(\hat{F}_t|C_t = 0) \\ &= \frac{\sum_{t=1}^{T} C_t\hat{F}_t}{T_1} - \frac{\sum_{t=1}^{T}(1 - C_t)\hat{F}_t}{T_0} \end{aligned} \tag{5.30}$$

where T_1 is number of periods, for which $C_t = 1$, T_0 is number of observations, for which $C_t = 0$. Thus, the first r.h.s. term is the average $\hat{F}_t$ for $C_t = 1$, while the second r.h.s. term is the average $\hat{F}_t$ for $C_t = 0$. The Cramer's measure heavily penalizes the incorrect predictions and, since each proportion is taken within the subsample, it is not unduly influenced by large size of the group of more frequent outcomes.

The next two measures of forecast accuracy are widely used by the practitioners.

Log probability score:

$$LPS = -\frac{1}{T}\sum_{t=1}^{T}\Big[(1-\hat{F}_t)\ln(1-C_t) + \hat{F}_t\ln(C_t)\Big] \tag{5.31}$$

Quadratic probability score:

$$QPS = \frac{1}{T}\sum_{t=1}^{T}(\hat{F}_t - C_t)^2 \tag{5.32}$$

The QPS varies between 0 (perfect performance) and 1 (bad performance).

Finally, for the sake of completeness, we should mention the Kuipers score, which was already introduced in section 5.5:

$$KS = \frac{N_A}{N_A+N_C} - \frac{N_B}{N_B+N_D} \tag{5.33}$$

The Kuipers score can take values between -1 (all false) and 1 (all correct).

Exercises

1. Which of the approaches to determining the turning points of housing cycles is the best one: *ad hoc*, expert judgement, or statistical tests? Explain your reasoning.

2. Assume that the actual housing price is 50,000 rubles per m^2 and that, according to your estimations, the fundamental price is 40,000 rubles per m^2. What can you conclude?

Key terms

speculative asset price bubbles	booms and crises	early warning system
expert judgment	NBER	ECRI
ad hoc dating	recession chronology	peaks and troughs
currency crisis	exchange market pressure	volatility
formal statistical tests	multiple bubbles test	random walk
explosive root	fundamental price	exogenous chronology
endogenous chronology	signalling approach	discrete-choice model
linear probability model	logit model	probit model
threshold autoregression	smooth transition autoregression	Markov switching
structural break	forecast accuracy measures	fraction correctly predicted
Kuipers score	log probability score	quadratic probability score

Chapter 6

Housing tenure

6.1 Introduction

In this chapter, we will introduce the notion of housing tenure and will present several tenure types and forms. Then, in section 6.3, we will concentrate on the homeownership and discuss its importance, advantages and disadvantages. In section 6.4, a formal model will be formulated, which tries to explain why and how many people choose to become homeowners and other — tenants. Finally, in section 6.5, we will show the spatio-temporal variation of the homeownership rate across the world.

6.2 Types of tenure

The housing tenure is defined as institutional forms by which possession of housing is accommodated with ownership of housing. Possession is the entitlement to hold a resource, for a term or indefinitely, as well as to control it and benefit from its use. The ownership includes possession and a right to transfer all or some of the rights over resource (holding, controlling, and benefiting from its use).

The national systems of housing tenure are very different. For example, a study conducted in nine European countries distinguished 42 kinds of tenures (Siskiö, 1990).

In modern societies, there are two major institutions through which possession of housing is accommodated with rights of ownership: 1) the ownership implies that consumer has ownership rights over his dwelling and, thus, the right of possession and of disposal; and the renting, or leasing means that consumer acquires the right of possession by renting the dwelling from the owner. A subform of letting is the subletting, when the tenant rents out a part of the dwelling he himself occupies. The crucial difference between the ownership and letting lies in the right of disposal.

Sometimes, apart from these two major types, a third tenure type is identified. It is known as *excluded tenures*, when the households have no ownership or legal tenancy over housing. These include homelessness; temporary accommodation; squatting; as well as illegally built housing and unauthorized encampments.

Some authors further subdivide the tenure types into subtypes. For example, Ruonavaara (1993) suggests the following classification of tenure subtypes. *Ownership* has three subtypes:

- individual owner-occupation = individual households hold exclusive rights of ownership on the housing unit;
- shared-equity owner-occupation = equity is split in to two distinct parts: one owned individually and the other owned collectively (e.g. condominium or cooperative);
- collective owner-occupation = several households form a community holding collectively the rights of ownership so that no single household holds individual ownership rights over the dwellings (e.g., cooperative).

Renting can be subdivided into two subtypes:

- private renting = dwellings are owned by private firms and individuals;
- public or social renting = dwellings are owned by public organizations (local authorities) or non-profit landlord organizations (e.g., trade unions).

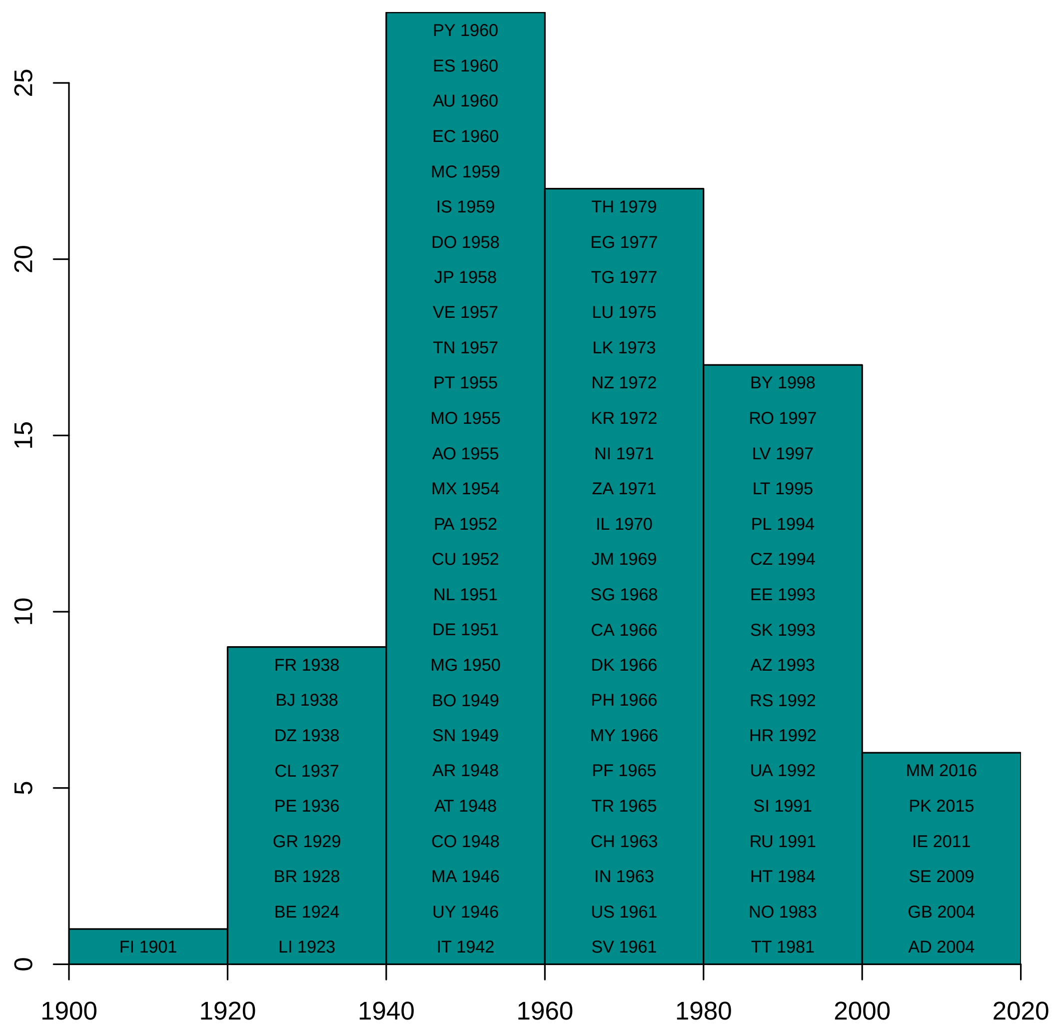
The condominium property, that is, the right to own an individual apartment in an multi-family apartment house is a relatively recent phenomenon. In most countries, it was introduced in the 1950–1960s, while in the former Socialist countries, it emerged in the early 1990s; Figure 6.1. The height of each bar shows the number of countries that issued their condominium acts in the respective decade. A two-digit ISO-alpha 2 code denotes country and the number after it is the year of publication of the act. The introduction of the condominium property paved the way for the expansion of the homeownership rates in the urban areas, where apartment buildings account for a large part of the housing stock.

Figure 6.2 depicts the housing ownership structure in Germany in 2011. About 60% of housing units belong to the private persons, these are single-family and semi-terraced houses, which are mostly located in the country side and in the periphery of the cities. The dwellings in the condominium property make up somewhat over 20% of the housing stock. The remaining 30% are more or less evenly distributed between the dwellings in the ownership of local authorities, private firms managing large stocks of housing, and cooperatives.

6.3 The importance of homeownership

The homeownership plays an important role in the wealth accumulation — more than half of the private households' wealth is the real estate. Worldwide, over 60% of all private households are the owners of the dwellings where they live.

Figure 6.1: Expansion of condominium ownership

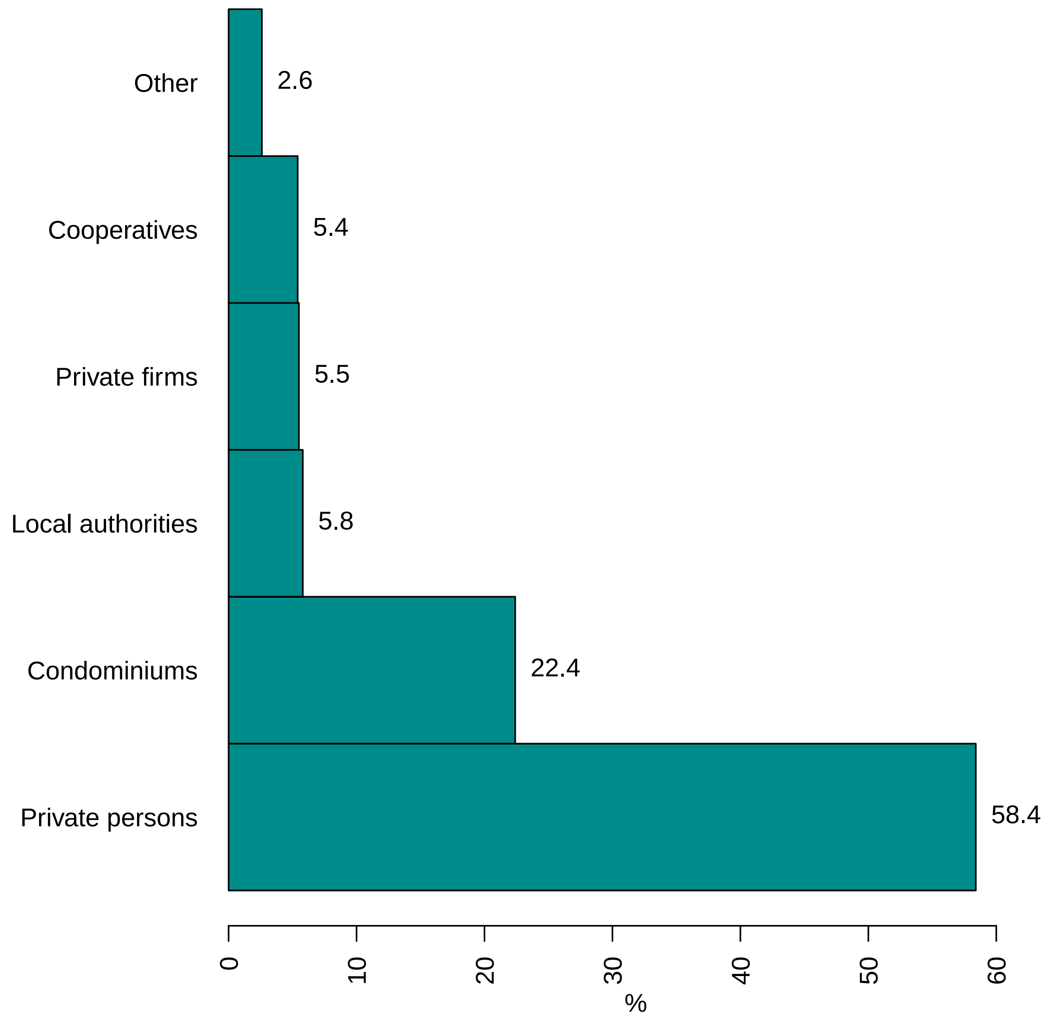


Source: own representation.

Many governments strive to maximize the homeownership. They encourage mortgage finance and offer financial incentives for people to buy private housing. For example, in the UK, the government helps tenants to buy dwellings they rent by offering 50% subsidy on market price. In the USA, where being a homeowner is a part of the American Dream, the authorities spend each year about \$195 billion (this corresponds to $\approx 1\%$ of GDP) in tax deductions for mortgage interest for wealthy and middle class homeowners and only \$46 billion a year on affordable housing, which supports affordable housing investments for low-income Americans (Collinson et al., 2015). Thus, the lion's share of government support is directed toward wealthier layers of society.

Why do the governments decide to spend so much money on stimulating the homeownership? The motivation of governments evolved over time and can be different across countries. Here, we

Figure 6.2: Housing stock structure by ownership, Germany 2011



Source: Destatis (2014), p. 14.

summarize the main motives making the government stimulate the expansion of the class of the homeowners.

Support of families. Families with children are more likely to become homeowners, especially of the single-family houses. Their motivation is often to raise their children in green, where they will have more opportunities to play outside in a nice and healthier environment. Inversely, it has been long thought that owning such a dwelling will stimulate people to have larger families.

The opposition to left-wing political trends. After World War II, many countries chose the socialist way of development. In Europe, the capitalist and socialist countries co-existed next to each other. Initially, the idea of socialism seemed to be very attractive. Therefore, the governments of the countries with market economy tried to gain more loyalty from their citizens. They thought that the owners, in particular, those possessing the real estate, would be more resistant against the charms of socialism and left-wing movements disseminating the socialist ideas.

The old-age care. Owning the housing is regarded as a good hedge against inflation. Therefore, it is thought to be a supplement to the pension or even substitute, when no pension is provided. After retirement, older people can, for example, sell their dwelling, buy another smaller one, which is worth less, and consume the difference between the value of their previous and new dwellings. Alternatively, they can also borrow money against the value of their dwelling. Some retired persons opt also for the life-time pension paid by a bank or some other organization against the promise that it will inherit the dwelling after these persons' death. Yet another expectation is to save money in the old age, because there will be no need to pay the rent. This motivation becomes especially important at the background of the aging population, a phenomenon observed in many European countries, including Russia. However, such expectations can be disappointed. First, the relative price of an existing owner-occupied dwelling may fall, if the demand for it decreases due to improvements in the design of the new dwellings. Second, flats located in large apartment buildings —where the ratio of total surface to the area of the land plot occupied by the building is very big— can depreciate even more. The reason is that the supply of land is inelastic, while that of building materials and labor is not. Therefore, the properties endowed with land, which is a non-depreciable input, may on average appreciate in real value over time (Ching and Tyabji, 1991).

The homeownership is a complex phenomenon, having its advantages and disadvantages, which are discussed below.

Homeownership and speculative bubbles. The homeownership is associated with speculative bubbles.[1] For example, after World War II, the expansion of mortgage credit related to the growth of the homeownership became a driver of financial instability in advanced economies (Jordà et al., 2016). High-homeownership countries are more prone to volatile house prices and credit cycles (Rünstler, 2016). Moreover, the policies promoting homeownership also stimulate speculative bubbles (Catte et al., 2004).

Homeownership and mobility. Homeownership can reduce the residential mobility, since it is associated to higher transaction costs than the renting (Stein, 1995; Cameron and Muellbauer, 1998; Glaeser and Shapiro, 2003; Blanchflower and Oswald, 2013). According to the hypothesis, known as the Oswald conjecture, the homeownership is positively correlated with the unemployment (Oswald, 1996). If the unemployment rate in certain region increases, people could move to other regions with lower unemployment. However, the homeowners are less likely to move due to the transaction costs. Therefore, they stay in their region. This has a negative impact on the efficiency of the labor market. This hypothesis has been tested in many studies. The findings of Lerbs (2011)

[1] More on speculative asset price bubbles see in Chapter 5.

for German regions and those of Blanchflower and Oswald (2013) for the US states support the Oswald hypothesis. Several studies found mixed evidence (Lerbs and Oberst, 2014). By contrast, Huber et al. (2017), who investigate the relation between the homeownership and unemployment as well as mobility in 10 CEE countries (including three former USSR republics), find no evidence that homeownership has detrimental impact on individuals' unemployment risks and only weak evidence that homeownership limits mobility.

Homeownership and individual effects. The homeownership is found to produce beneficial individual effects (Megbolugbe and Linneman, 1993). According to this research, the homeowners tend to have higher life satisfaction; neighborhood stability; better children's performance at school; and less divorces. The children of homeowners are more likely to complete their secondary education (less dropouts) and are less likely to become pregnant as teenagers than the children of tenants (Green and White, 1997). Homeowners tend to save more than tenants, even when their investment in purchasing their home are controlled for (Krumm and Kelly, 1989).

Homeownership and civil society. The homeowners are found to participate more actively in the social activities related to their neighborhoods (Glaeser and Shapiro, 2003). For example, homeowners are more likely to be involved in joining non-professional organizations, gardening, and in investing in social capital in comparison to renters (DiPasquale and Glaeser, 1999). In the USA, renter communities have significantly worse civic environments than homeowner ones (Hoff and Sen, 2005). By contrast, Kortelainen and Saarimaa (2015) using a hedonic house price model where neighborhood homeownership rate is included as an explanatory variable find no evidence of positive externalities from neighborhood homeownership rate. Homeowners are found to invest more in the maintenance of their houses (Galster, 1983; Rohe and Stewart, 1996).

The literature also points out other possibly detrimental effects of the high homeownership. Lo (2012) using Taiwan data finds out that higher homeownership leads to lower fertility rates. The homeownership can exert adverse effects on the propensity to the enterpreneurship. As shown in Bracke et al. (2012), purchasing house reduces the probability of starting business by 20–25%. This result is driven by households with mortgages and persists for several years after entering in the homeownership.

Summing up, the homeownership has many merits, although the corresponding findings of the empirical research are not always unambiguous. It also has serious drawbacks. Nevertheless, it is not clear whether the net effects of the homeownership are positive or negative.

6.4 Tenure choice

User cost

The tenure choice refers to the decision the household makes whether to become a homeowner or tenant (or renter). This choice depends on the user costs of housing. The user costs of housing vary depending on the type of tenure. The tenant's (renter's) costs is the rental price he pays to the landlord. Typically, the homeowner has the following costs and benefits:

- mortgage payment;
- property taxes;
- depreciation on the dwelling;
- housing capital gains.

Let us consider a simple model of tenant choice. This model is based on a set of simplifying assumptions which refer to each of the costs and benefits.

The mortgage payment. Assume that the consumer buys the house using a 100% mortgage without no down payment. Assume also that this is an interest-only mortgage, i.e., the buyer does not pay the principal amount, only interest accrued on the mortgage debt. Let us denote the mortgage interest cost iV, where i is the mortgage interest rate and V is the value of the house.

Property taxes. The owner of a house must pay property taxes. The two most widespread taxes are the *stamp duty*, which is paid only once, at the moment of purchasing the house, and the *land tax*, which is paid every year. Here, when talking about property tax we will always refer to the land tax, unless the opposite is not indicated. The property tax is defined as hV, where h is the property tax rate.

Depreciation on the dwelling. The depreciation denotes the annual decline in the value of the house as it wears out. It is denoted as dV, where d is the depreciation rate. The depreciation rate is typically 1–2% per year.

Housing capital gains. The only financial benefit related to the housing is its capital gains, which reflect the general appreciation of housing values. It can be either positive, if the price of the dwelling increases, or negative, when it decreases. The housing capital gains are denoted as gV, where g is the rate of capital gains (annual percentage change in house value).

Now, we can formally express the annual costs incurred by homeowner:

$$(i + h + d - g)V = (i + h + d - g)vq \tag{6.1}$$

where q is the amount of housing consumption (e.g., total area in m^2). Note that the costs of maintenance and insurance are omitted.

Then, the annual homeowner's costs per unit of housing consumption are:

$$(i + h + d - g)v \tag{6.2}$$

In many countries, the tax treatment of housing depends on whether the owner himself occupies it or let its out as a landlord. Tables 6.1 and 6.2 presents the tax treatment of housing-related costs and benefits, correspondingly.

Table 6.1: Tax treatment of housing costs

Cost item	Deductible for owner-occupier?	Deductible for landlord?
Mortgage interest	yes	yes
Property taxes	yes	yes
Depreciation	no	yes

The treatment is just a stylized example. It corresponds more to the case of the USA and can be different in other countries. In Germany, for example, the mortgage interest is not deductible for the owner-occupiers.

Table 6.2: Tax treatment of housing benefits

Cost item	Deductible for owner-occupier?	Deductible for landlord?
Rental income or imputed rent	no	yes
Capital gains	no	yes

User cost of owner-occupied housing

The user cost of owner-occupied housing is different from that of the tenant. It can be expressed as follows:

$$\Big((1 - \tau)(i + h) + d - g\Big)v \tag{6.3}$$

where τ is the owner-occupier's income-tax rate.

The inflation can substantially affect the user cost. In particular, it can reduce it. Assume that all nominal values increase to equal extent. This means that all prices, including those of the housing, and nominal interest rate grow at the same rate. Let the interest rate grow at Δi, so that in the next period the interest rate will be $i + \Delta i$. Similarly, the market value of dwelling grows at Δg, increasing the capital gains up to $g + \Delta g$. Assume that both the interest rate and the value of housing grow at the same rate of 1% per year: $\Delta i = \Delta g = 0.01$. Then, as equation (6.4) shows, the user cost will decrease:

$$\Big((1 - \tau)\Delta i - \Delta g\Big)v = \Big((1 - \tau)0.01 - 0.01\Big)v = -0.01\tau v < 0 \tag{6.4}$$

Thus, inflation makes the owner-occupied housing more attractive. The effect is even stronger in case of a building-up speculative housing price bubble. In that case, the interest rate remains unchanged, $\Delta i = 0$, while the market value of housing increases $\Delta g > 0$. As a result, the user cost decreases by $-0.01v$. Given that the tax rate $\tau < 1$, the user cost reduction under speculative price bubble will be larger than in case of inflation. Thus, speculative price increases generate strong incentives to become homeowners.

User cost of tenant-occupied housing

In order to find the user cost of the rental housing we need to compute the landlord's profit. The landlord's after-tax cost of unit of housing is:

$$(1-\lambda)(i+h+d)v \tag{6.5}$$

where λ is the landlord's income-tax rate. We assume that all costs are tax deductible. Then, the landlord's after-tax capital gain: $(1-\lambda)gv$. The landlord's profit can be calculated as:

$$\begin{aligned}(1-\lambda)p - \Big((1-\lambda)(i+h+d)v - (1-\lambda)gv\Big) \qquad (6.6)\\ = (1-\lambda)\Big(p-(i+h+d-g)v\Big) \qquad (6.7)\end{aligned}$$

where p is the rental price.

As a rule, despite its heterogeneity, the housing market is characterized by a very high degree of competition. This implies that the competition drives landlord's (and developer's) profit to 0:

$$(1-\lambda)\Big(p-(i+h+d-g)v\Big) = 0 \tag{6.8}$$

Of course, it does not mean that the landlord earns no profit at all. As usual in the microeconomic analysis, some *fair profit* is included in the cost. Therefore, the user cost of rental housing is:

$$p = (i+h+d-g)v \tag{6.9}$$

This represents the cost borne by the tenant. As can be seen, it does not contain income tax term. Indeed, the user cost of the housing for the tenant does not depend on his income. Here, we consider the housing provided at the market conditions. In chapter 7, we will briefly discuss the social housing provided to the poor households at special conditions.

Tenure choice in the simple model

In deciding whether to rent or to own, the household will choose the cheaper tenure mode. In the basic model,

$$\Big((1-\tau)(i+h)+d-g\Big)v < (i+h+d-g)v \tag{6.10}$$

since

$$(1-\tau)(i+h) < i+h \tag{6.11}$$

given that $\tau \in [0,1)$. Hence, household will always choose to be owner-occupier. However, we know that, on average, worldwide 30–40% of households are renters. It means that the simple model that we consider here cannot adequately explain the real-life phenomena, since it misses some important points.

One way to model the tenure choice in accordance with facts is to use a more realistic assumption on the depreciation deduction. Depreciation rate, d, represents economic depreciation, that is, the actual wearing out of buildings. In many countries, however, tax codes allow landlords to deduct accelerated depreciation. In this case, the buildings are treated as wearing out faster than they really do. Such accelerated depreciation allowed for tax purposes can be expressed as $d+e$, where e is the rate of excess depreciation over the rate of economic depreciation. Under this assumption, the profit of landlord will look like:

$$(1-\lambda)p - \Big((1-\lambda)(i+h+d)v - \lambda ev - (1-\lambda)gv\Big) \tag{6.12}$$

$$= (1-\lambda)\Big(p - (i+h+d-g)v\Big) + \lambda ev \tag{6.13}$$

Again, in a free competitive market, the landlord's profit must equal 0. Hence, new renter's user cost (rental price) is:

$$p = (i+h+d-g)v - \frac{\lambda ev}{1-\lambda} \tag{6.14}$$

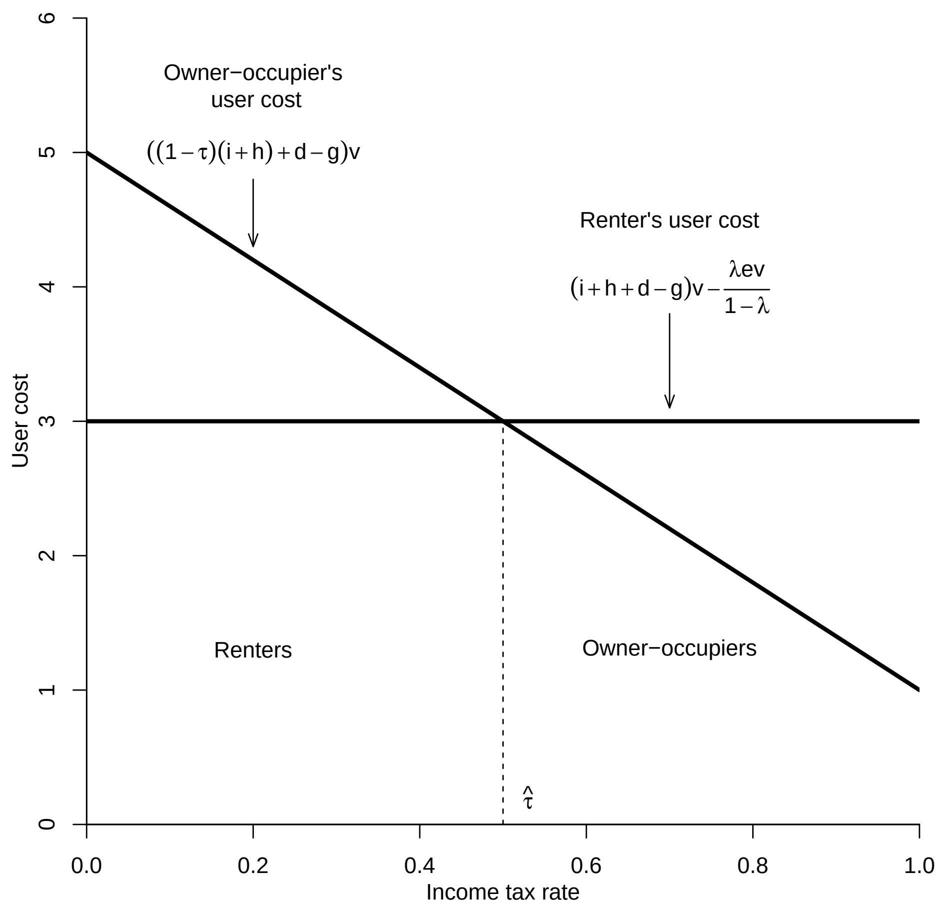
Thus, the new renter's user cost is smaller than the previous one by $\frac{\lambda ev}{1-\lambda}$. The presence of subtracted term reduces the renter's user cost. It makes unclear which user-cost expression is smaller. Recall that owner-occupier's user cost depends on income tax rate τ. This tax rate will differ across households, provided that the country uses a progressive income tax, when tax rate increases as a function of the income.[2] Under progressive schedule, τ will be low (high) for low-income (high-income) households. Hence, user cost will be lower for higher-income households. By contrast, renter's user cost does not depend on the household's income-tax rate.

Figure 6.3 displays predictions of the model. The horizontal thick line corresponds to the user cost of homeowner, while the thick line with negative slope reflects the user cost of tenant. They intersect at the tax rate $\hat{\tau}$. The households with income tax rate lower than $\hat{\tau}$ will opt for being renters, whereas those with higher income will be homeowners. Thus, the society is divided into tenants and homeowners by the income criterion.

Not all countries have progressive income tax rate. Still, there exist renter households. How to explain their existence? There are several other factors that can create incentives for being tenants.

[2] In Russia, the income tax has a constant rate. Is this probably a reason for a very high homeownership rate in Russia, see Figure 6.12.

Figure 6.3: Housing tenure choice

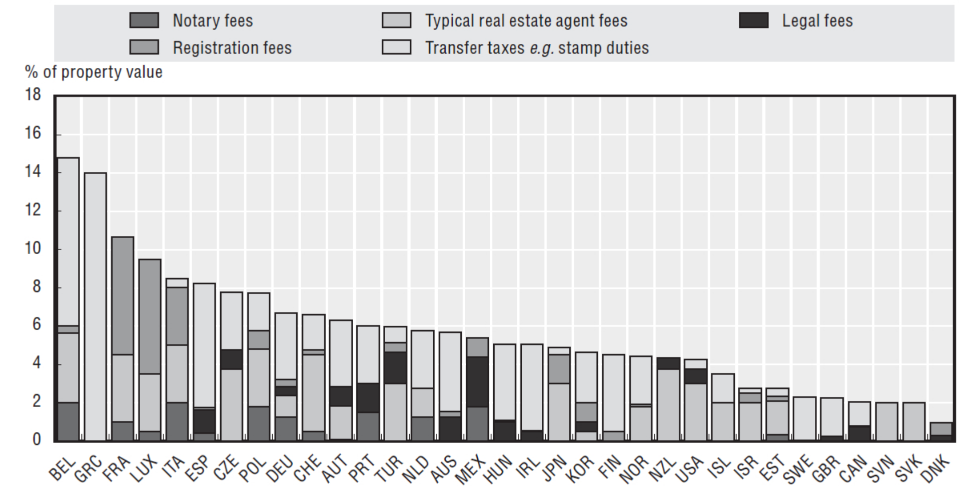


The expected mobility of homeowner is lower than that of the renters. The reason for this are the substantial transaction costs of buying/selling dwellings. Typically, these costs comprise various fees (for the services of notary, real estate agent, and registration) and taxes (e.g., stamp duty). Figure 6.4 shows that transaction costs can account for more than 14% of the purchasing price of a dwelling. Assume that the dwelling is sold for 200,000 euros. In addition to that, the buyer must expend 28,000 euros as transaction costs, the value of a good car. Thus, each time you buy a new house, you give up buying a car. By contrast, the tenant must only pay the costs of moving to a new house plus guarantee, which will be returned to him, and sometimes the real estate agent fee for finding the new dwelling. However, these expenses are negligible in comparison to the transaction costs incurred by the homeowner.

The pride of ownership. Consumers often take pride in being able to own rather than rent. In many countries, being a homeowner, especially when it is a single-family house, is a matter of prestige. In the USA, it is a part of the American Dream. In Russia, after generations of Soviet citizens had lived in the shared apartments (*kommunalki*) in the very squeezed conditions, many

Figure 6.4: Transaction costs on buyer in OECD countries, 2009

Figure 3. **Transaction costs on buyer by type, 2009**[1]



1. Transaction costs refer to average costs. See Johansson (2011) for details.

Source: Calculations based on the OECD Housing Market questionnaire.

Source: Sánchez and Andrews 2011, p. 192.

people strive of having their own dwelling, even if it is a tiny cell in a 30-storeys building, where a couple of thousand other people live.

The risk. Despite the common belief that the real estate is a very safe investment, the real life shows that is not the case. First, the value of the housing can decline as a result of some external event. For example, if a highway or starkly polluting factory is build next to the house. Second, the risk of investing in homeownership is magnified when consumer's wage is positively correlated with housing prices in his city (e.g., monocity). Assume that you own a dwelling in a town like Pikalyovo, where the major and almost the only employer is a cement factory. Assume also that you work at this factory. What will happen, if the owner decides to shut it down? You will lose your job. But, more than that, your dwelling will become worthless. If you will decide to start a new life elsewhere, you will have to start from zero, since you lost your major asset.

Dislike of home-maintenance tasks. Living in your own house means that you have to do a lot of home maintenance: make little repairing, paint the walls, mow the lawn, if you have one, etc. Therefore, the people who dislike home-maintenance tasks will rather choose to rent.

The down payment. Typically, a home buyer is required to make a substantial down payment. This is the own capital invested by the home buyer. The banks often, although not always, are not eager to finance the full value of the dwelling, because they do not want to bear additional risks. If the home buyer cannot pay his mortgage loan and the value of the house goes down, the bank will be unable to recover its money lent to the home buyer. The household lacking the funds for down payment will not be able to become homeowner. In the previous simpler model, it was assumed that no down payment was needed. Now, we will modify the tenure choice model in the following way: the consumers with income-tax rates below $\hat{\tau}$ will still be renters, while the consumers with income-tax rates above $\hat{\tau}$ would like to be owners, but only patient ones will be able to accumulate the required down payment. Thus, down payment requirement reduces the number of homeowners.

In order to illustrate the impact of the down payment on the tenure choice, we introduce the notion of the loan-to-value ratio, which is the ratio of mortgage loan to the value of the dwelling. Formally, the loan-to-value (LTV) ratio is:

$$LTV = \frac{M}{V} = \frac{1 - D}{V} \tag{6.15}$$

where M is the amount of mortgage loan; V is the value of the dwelling; D is the down payment, or home buyer's own capital.

Table 6.3 reports the LTVs and other housing finance features in some advanced economies.

Table 6.3: Housing finance features in advanced economies, 2008

Country	Predominant interest rate type	Maximum LTV on new loans (%)	Typical loan term (years)
Australia	variable	90–100	25
Austria	fixed	80	25–30
Belgium	fixed	100	20
Canada	mixed	80 (95)	25–35
Denmark	mixed	80	30
France	fixed	100	15–20
Germany	fixed	80	20–30
Ireland	variable	100+	21–35
Italy	mixed	80	20
Japan	mixed	70–80	20–30
Netherlands	fixed	125	30
Portugal	variable	90	25–35
Spain	variable	100	30
Sweden	variable	80–95	30–45
USA	fixed	100+	30

Source: IMF 2011, p. 117.

It shows that the LTV varies from 70 to 125%. This implies that in some countries (e.g., Japan), the home buyer must invest at least 30% of his own capital, in other countries (e.g., Ireland and The Netherlands), the home buyer does not need any own capital and even receives from the bank additional money in excess of the dwelling's value. With this money the home buyer can make a world tour of buy furniture or even a car.

6.5 Spatio-temporal variation of the homeownership rates

The homeownership rate characterizes how widespread is the homeownership. In the international statistical practice, there are three definitions of the homeownership rate. The homeownership rate is defined as the

- share of dwellings occupied by their owners;
- share of households living in their own dwellings (e.g., Germany and USA);
- share of persons living in their own dwellings (e.g., Eurostat).

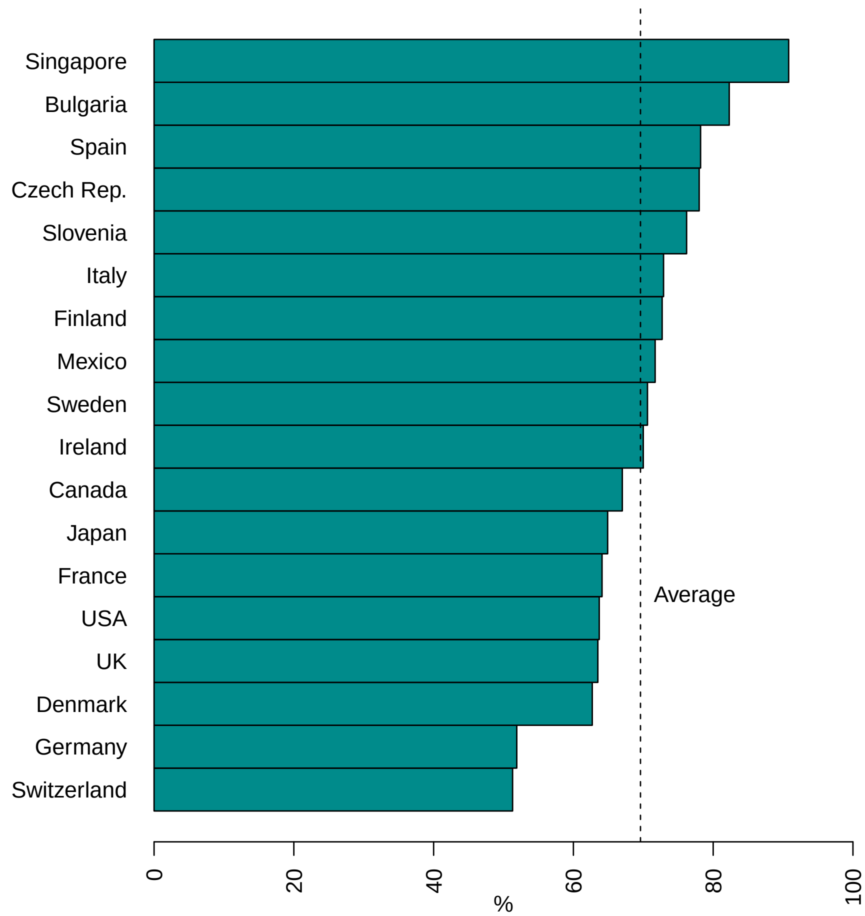
In Russia, the official statistics does not provide a measure of the homeownership. It only reports the square meters of the housing, which are in the personal private property. Based on these figures, one can compute the share of housing surface in the personal property with respect to the total housing surface. This is not entirely compatible with the homeownership rates computed by other countries. First, the surface does not perfectly correlate with the number of dwellings or households. Larger dwellings are more likely to be owner occupied. Therefore, the surface-based measure tends to overestimate the homeownership. Second, the property status of a dwelling convey no information on its tenure: it can be own-occupied, rented out, or stay vacant. Hence, the surface-based measure tends to underestimate the homeownership rate. In part, these opposite effects cancel out. This is probably why the surface-based indicator produces the values similar to the homeownership rates computed using the international methodology and the survey data collected for Russia, for example, within the Life in Transition Survey (LITS) conducted by the European Bank for Reconstruction and Development and The Russia Longitudinal Monitoring Survey — Higher School of Economics (RLMS-HSE). Similar estimates are obtained also by other institutions: according to a survey conducted by a Russian analytical center NAFI, in 2017, only 9% of Russians rented their dwellings.[3]

Figure 6.5 shows the homeownership rates in 18, mostly developed, countries in 2015. It varies from about 50% in Switzerland to approximately 90% in Singapore. The average homeownership rate for these countries is about 70%, which corresponds roughly to the world average value.

Figure 6.6 provides more insights into the housing tenure structure in 37 OECD member states in 2014. It does not simply divide the whole housing stock into owner- and tenant-occupied housing. Instead, it subdivides the owner-occupied tenure between the own outright and owner with mortgage (owners, who did not pay yet their mortgage debt) and distinguishes between the private and subsidized (social) rental housing. The country with the lowest homeownership rate is again Switzerland, while that with the highest rate is Romania. Note that three German speaking countries have the lowest homeownership rates. In most countries, the share of the own outright

[3] Аналитический центр НАФИ, «Спрос на съёмное жилье не растёт», 29.03.2017; https://nafi.ru/analytics/spros-na-semnoe-zhile-ne-rastet/.

Figure 6.5: International homeownership rates, 2015



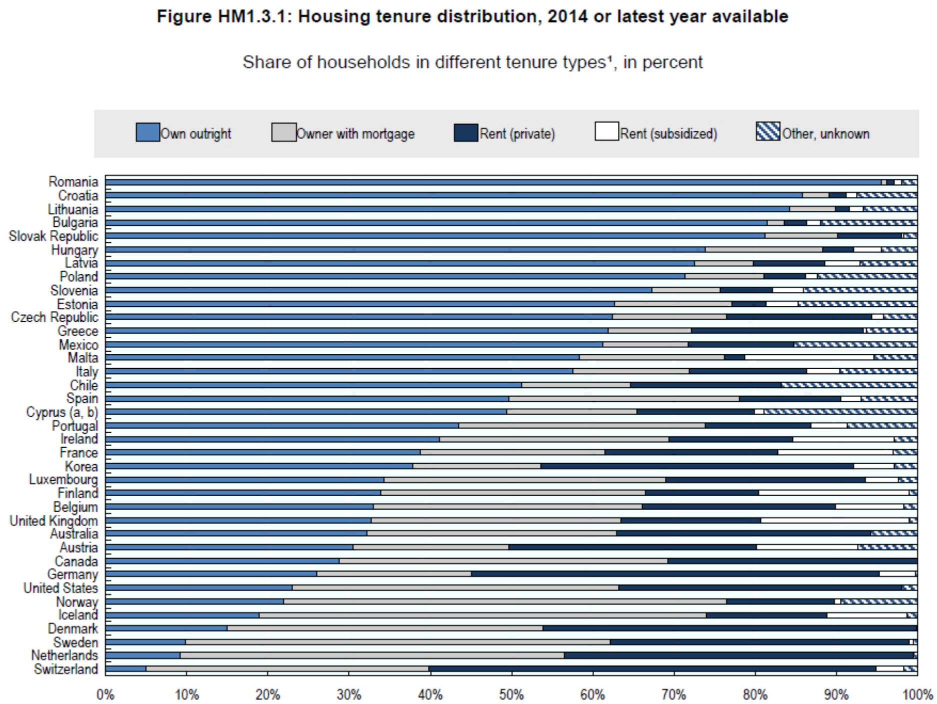
Source: Goodman and Mayer (2018).

occupancy is much higher than that with mortgage. The notable exceptions are the Scandinavian countries and in The Netherlands. For example, in Sweden many households take interest-only loans, where they do not repay the principal of the debt. Also in most cases, the proportion of the private rental housing stock is significantly larger than that of the subsidized rental. By contrast, in Malta the subsidized rental is several times larger than the private one. Large shares of subsidized rental housing are also in Finland, Ireland, France, and the UK. Surprisingly, according to the diagram, The Netherlands has no subsidized rental housing, which contradicts other evidence and, in particular, Figure 7.4.

Figure 6.7 shows the geographical distribution of the homeownership rates in the European Union at the NUTS2 regions level,[4] which corresponds, for example to the *Regierungsbezirke* in Germany and *Comunidades autónomas* in Spain. As seen in the map, the highest homeownership

[4]The abbreviation NUTS stands for the Nomenclature of Territorial Units for Statistics (from French: Nomenclature des unités territoriales statistiques) and is a geocode standard for referencing the subdivisions of the EU countries for statistical purposes.

Figure 6.6: Housing tenure distribution, 2014



Source: OECD Affordable Housing Database, http://www.oecd.org/social/affordable-housing-database.htm.

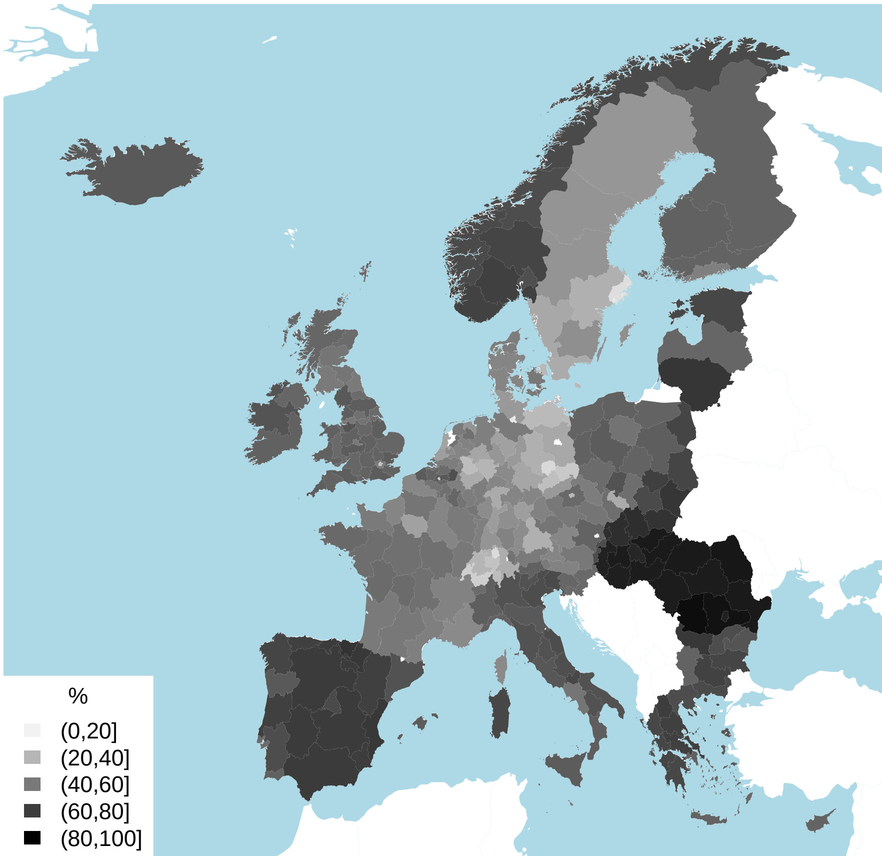
rates are observed in the periphery of the EU, while the lowest ones in its central regions.

However, the actual homeownership rates are just a snapshot, they have little to do with the rates observed several decades ago. The homeownership rates have changed dramatically. Figure 6.8 illustrates the evolution of homeownership rates in West Germany and England between 1950 and 2019. In 1950, the homeownership rates in both countries were below 40%. Interestingly, in the UK, the HOR was substantially lower than in West Germany. Over the next 60 years, the homeownership rate in the UK more than doubled, whereas in West Germany it increased by slightly more than 10 percentage points. Thus, HORs in different countries have evolved differently: in some cases the changes were large, while in other countries only mild changes took place.

The differences are even more prominent when observed at the city level, as seen in Figure 6.9, which shows the evolution of the HORs in Berlin, Madrid, and Zürich between 1900 and 2019. In Berlin, since the beginning of the 20th century, the homeownership rate increased from about 5 to 17%. In Zürich, between 1950 and 1990, the HOR even increased. By contrast, in Madrid a huge surge in the HOR took place, which reversed the relationship between the tenant and homeowners: if in 1950 the vast majority of Madrid households were renting their dwellings, by 2000 almost 80% the dwellings were owner-occupied.

Historically, private tenancy has dominated large parts of the 20th century: homeownership

Figure 6.7: Homeownership rates in the EU NUTS2 regions, 2011

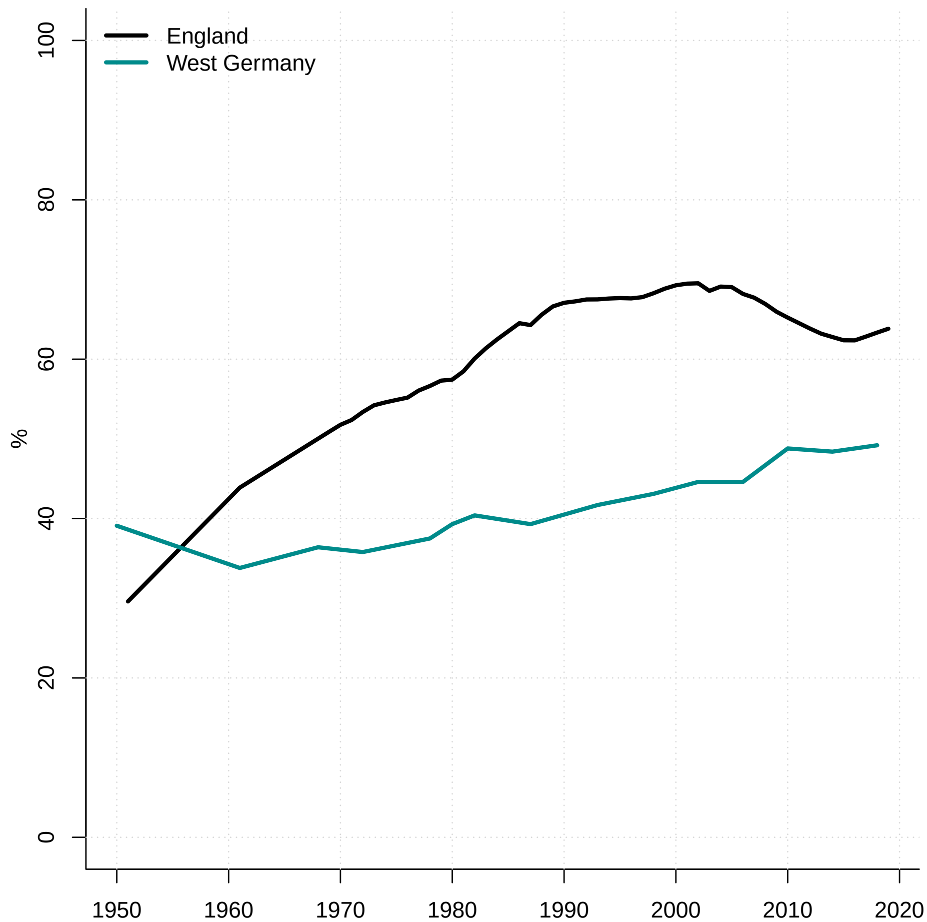


Source: Eurostat, own representation

rates crossed the 50% threshold as early as 1955 in Spain, in 1968 in Portugal, in 1970 in Great Britain, 1982 in France, and 1998 in the Netherlands. Even if the remainder is partially public or municipal housing, private tenancy is not negligible, as public housing has been declining in most countries since the 1970s (Kohl, 2017). In general, after World War II and until the Great Recession of 2008–2009, the homeownership rates had been increasing. In the 2010s, they stabilized and even appear to be declining; see Figure 6.10, which shows the distribution of the HORs worldwide by decades between 1900 and 2010. The width of each boxplots represents the number of countries for which HORs in the corresponding decade are available: we have data on very few countries in the first half of the 20th century, and many more for the more recent decades. The thick horizontal line in each box corresponds to the median HOR, while between the lower and upper borders of each box, half of the observations (countries) are contained.

After we saw how the HORs evolved worldwide, it would be interesting to look at several country cases. Let us first examine the homeownership rates of German regions (*Kreise*, an analog of Russian municipal districts, *rayony*) between 1950 and 2011, see Figure 6.11. This is a scatter

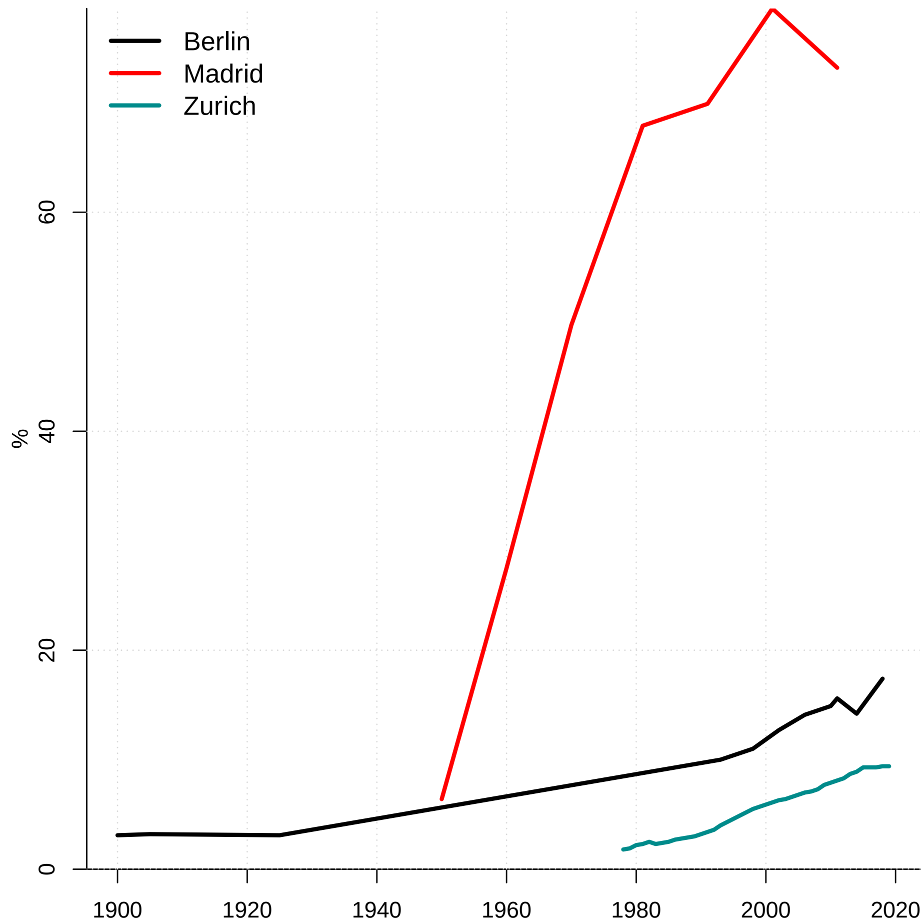
Figure 6.8: Homeownership rates in West Germany vs. England, 1950–2019



Sources: Gov.uk, Destatis, and own representation.

diagram comparing the HORs in two nearest periods, the horizontal axis corresponding to the earliest period, while the vertical axis corresponding to the latest period. Each circle denotes a region: bigger circles are urban regions (*kreisfreie Städte*), whereas smaller circles are rural regions (*Landkreise*). For example, black circles depict the HORs in 1950 and 1961. The dotted line is drawn at 45^0. If a point lies on this line, then the HOR did not change, say, between 1950 and 1961. If it lies below (above) this line, then the HOR decreased (increased) between 1950 and 1961. From this diagram several conclusions can be drawn. First, the HORs in the rural areas are substantially higher than HORs in the urban areas: the borderline is somewher at 40%. Second, the HORs decreased only during one period — between 1950 and 1961, which was related to a massive construction of the social rental housing. During all other periods, the HORs increased. A particularly strong increase took place between 1987 and 2011. Third, a tendency toward convergence of the HORs between urban and rural regions can be observed: while urban HORs increased, the rural ones declined.

Figure 6.9: Homeownership rate in Berlin, Madrid and Zürich, 1900–2019

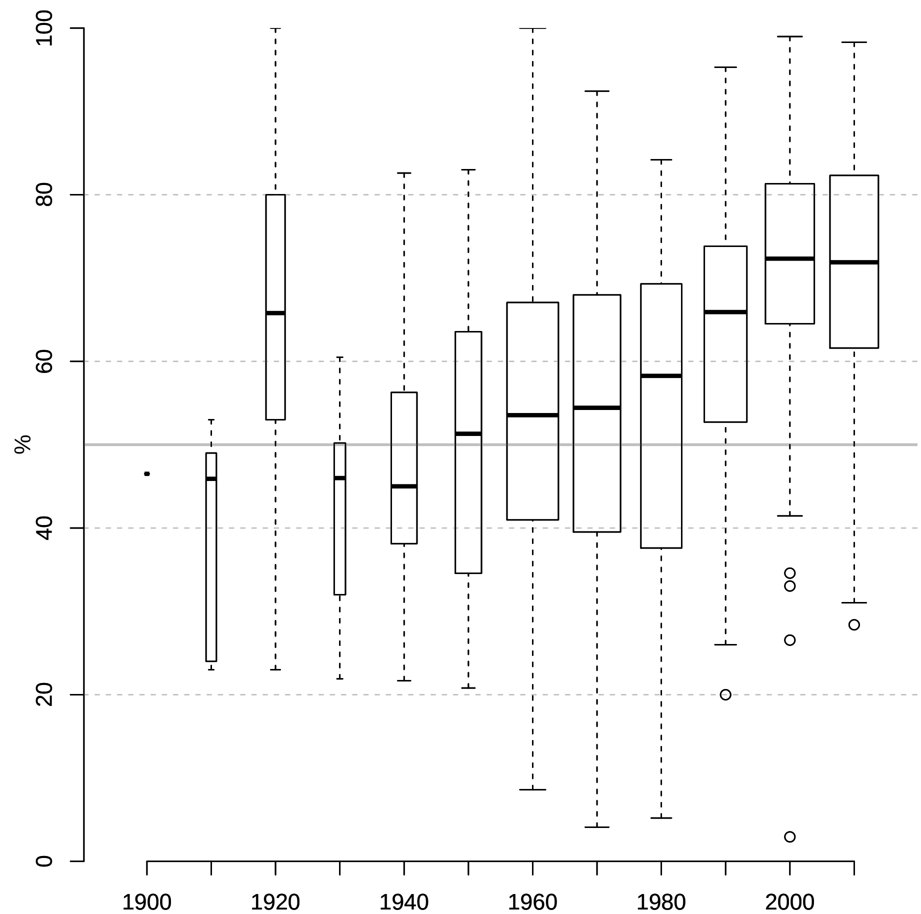


Sources: 1) Berlin: Statistisches Amt der Stadt Berlin (1902); Statistisches Amt der Stadt Berlin (1910); Statistisches Amt der Stadt Berlin (1925); Statistisches Bundesamt (2000); Statistisches Bundesamt (2013); Destatis; Blanco Artola (2012); 2) Madrid: Instituto Nacional de Estadística de España; 3) Zurich: Statistik Stadt Zürich, GWZ; 4) own representation.

Now, let us look at the case of Russia. There is only little obstacle that complicates this task. As mentioned above, the Russian official statistics does not compute the homeownership rate. However, we have seen that the surface-based measure can be a satisfactory approximate for the HOR. Figure 6.12 shows the evolution of this measure in Russia between 1940 and 2017. It shows two HORs: in the urban areas and in the whole country.

In 1940, the surface-based proxy for the homeownership rate was at around 30%, which is similar to the HOR in the United Kingdom at that time. During the following 50 years, with an exception of a short period in the late 1950s, the HOR in Russia declined. How can it be explained? First, the Soviet system was ideologically opposed to any form of the private property, in particular, for housing. For example, the Civil code of 1964 imposed various restrictions on the transfer of the

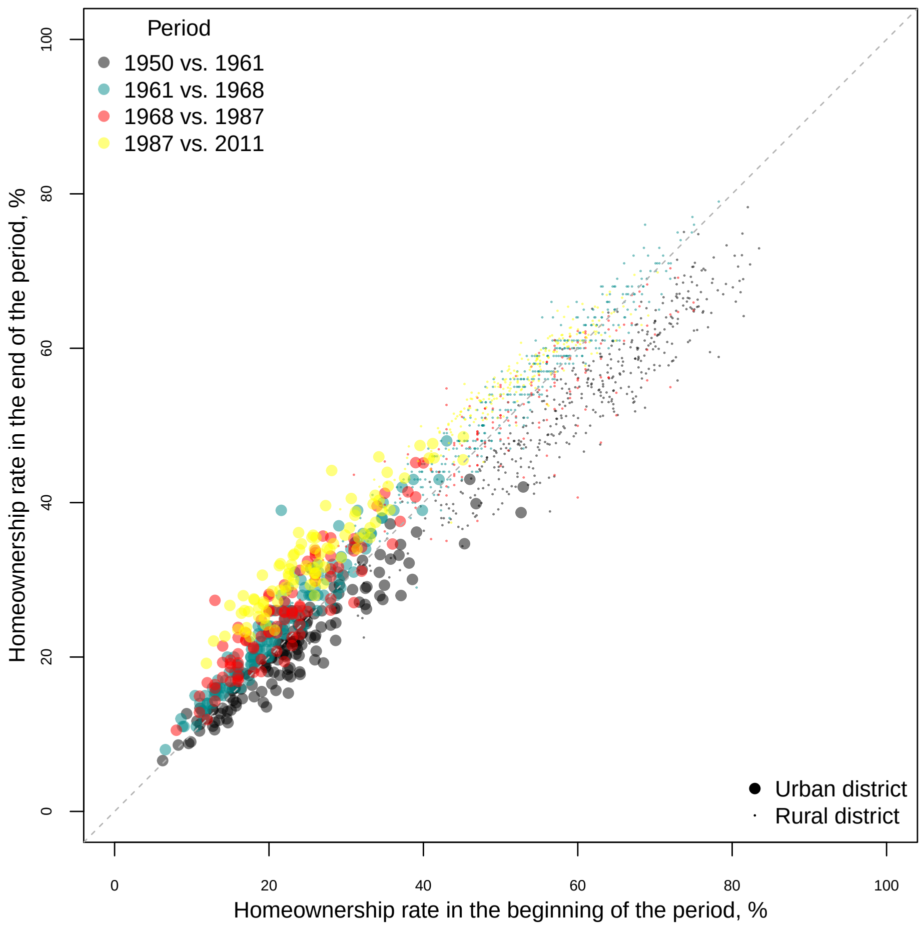
Figure 6.10: Evolution of homeownership rate in the world, 1940–2010s



Sources: CEPAL, Eurostat, UNSD, and national statistical offices

privately owned housing. Typically, only small houses with total area not exceeding 60 m^2 could be privately owned. Secondly, since the end of the 1950s, a large-scale housing construction program had been implemented, when predominantly large apartment buildings were erected. Thirdly, as seen in Figure 2.5, in 1959 the parity between the urban and rural population was attained. After that, the majority of the Russian population started to be the urban dwellers. This contributed to the further decrease of the HOR, since homeownership in the cities tends to be smaller than in the country side. After the collapse of the Soviet Union, the opposite trend began. In the early 1990s, Russia, together with many other countries from Eastern and Central Europe, chose the "American way of development" and opted for expansion of its homeowner class. In the 1990s, this objective was attained mainly through a mass privatization of the existing housing stock. People were allowed to privatize for free the housing they occupied at the moment of the reform. Since many people were occupying rooms in the shared apartments, they privatized rooms, not entire dwellings. Thus, a unique roomwise homeownership institution emerged. In the 2000s, when the most part of the housing was already privatized, the further expansion of the homeownership

Figure 6.11: Evolution of HOR in German Kreise, 1950–2011

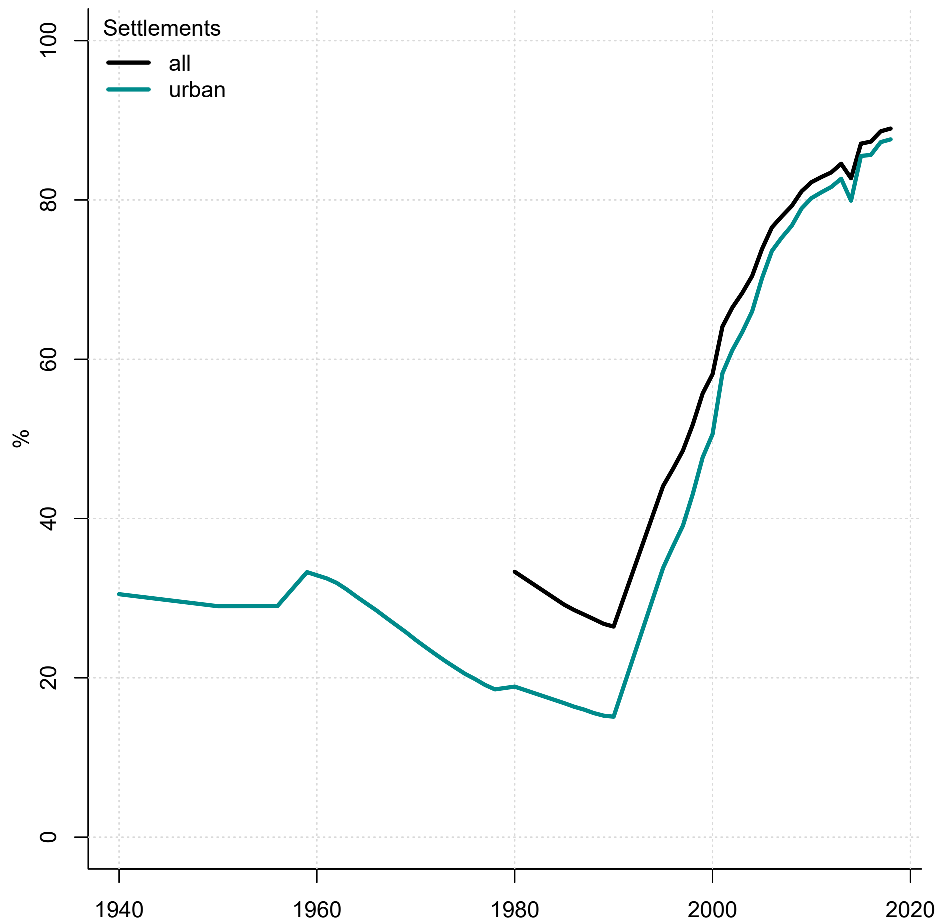


started to be fed by the development of the mortgage financing. As a result, the vast majority of Russian population became homeowners. In 2017, the HOR is about 86% in the urban areas and 87% in the whole country. In the rural areas, where single-family houses dominate, the HOR is slightly higher than in the cities. However, between 1980 and 2017 this gap has almost disappeared: it decreased from approximately 14 to 1 percentage point.

The interregional differences of the HOR in Russia are quite big, as Figure 6.13 shows. It displays the surface-based HOR proxy at the subject of federation (oblasts and autonomous republics) level.

In some regions (for example, in Vologodskaya and Kaliningradskaya oblasts), the HOR is below 50%, while in other regions, especially in the South and in Caucasus, it approaches 100%. The higher homeownership rates in the South can be explained by a larger proportion of the rural population there, becauses these regions are characterized by a larger role played by the agricultural production. And it is known that the rural areas have higher HORs than the urban ones.

Figure 6.12: HOR (share of personally owned space) in Russia, 1940–2018



Sources: CSU RSFSR and Rosstat.

Exercises

1. What of the following does not belong to the transaction cost:

   a) the notary fee;

   b) the income tax;

   c) the land stamp duty;

   d) the real estate agent commission;

   e) the land tax.

2. The homeownership rate is one of the following:

   a) The ratio of the housing surface in the private property to the surface of the rental housing;

   b) The ratio of the number of dwellings occupied by their owners to the total surface of all dwellings;

Figure 6.13: HOR (share of personally owned space) in Russian regions, 2013

c) The ratio of the number of households owning the housing to the total surface of all dwellings;

d) The ratio of the number of households owning the housing to the number of dwellings they occupy;

e) The ratio of the number of dwellings occupied by their owners to the total number of dwellings.

3. Assume that the down payment is 500,000 rubles and that the dwelling is worth 4 million ruble. What is the loan-to-value ratio in this case? How will the LTV change if

   a) the interest rate will increase from 10 to 12%?

   b) the dwelling is sold at a discount of 10%?

   c) the income of the buyer decreases by 5%?

4. What happens to the homeownership rate, according to the model of housing tenure choice, if

a) the homeowner's income tax rate increases?

b) the homeowner's income tax rate decreases?

c) the landlord's income tax rate decreases?

d) the landlord's income tax rate increases?

5. How is the homeownership affected by the change in the housing price?

Key terms

housing tenure	possession	ownership
homeownership	owner occupied	tenant occupied
individual owner occupation	shared-equity owner occupation	collective owner occupation
private renting	public or social renting	condominium property
user cost	mortgage payment	property taxes
depreciation	capital gains	economic depreciation
accelerated depreciation	transaction cost	tenant or renter
landlord	down payment	loan-to-value ratio
homeownership rate		

Chapter 7

Housing policy

7.1 Introduction

Housing is one of the most important aspects of the human life.[1] It is also one of the heavily regulated sectors. Since World War I, in most countries, the government actively intervenes in the housing market trying to correct the really existing or imaginary market failures. For example, as seen in Figure 7.1, virtually all countries of the world had or still have rent controls.

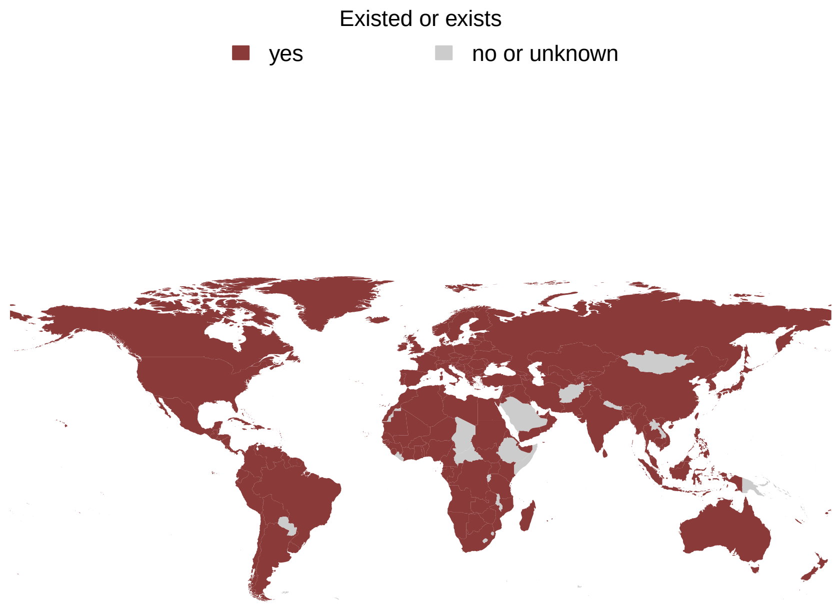
By 2017, the number of countries that still use rent control substantially reduced; Figure 7.2.

However, a renaissance of rent control is now observable in many countries. For example, limitations on rent setting were imposed in Paris and Lyon (France) in July 2019 and March 2020, respectively; state-wide rent growth restrictions were introduced in California in January 2020 and are to remain in force until January 2031; and in Berlin (Germany) rents were frozen for 5 years starting in February 2020, to name just a few examples. The outbreak of the COVID-19 pandemic has increased the importance of such measures. After the majority of countries imposed sanitary restrictions, such as lockdowns, in March 2020, the resulting loss of income led to a worldwide wave of eviction bans and rent freezes (Kholodilin, 2020a). Thus, not only historically housing market regulations played an important role, they are far from being dead nowadays.

The purpose of the chapter is to make the readers acquainted with a toolkit of policies that has been applied to the housing market in many countries across the world. We carry out a critical analysis of these housing policies. In addition, we discuss the evolution of the restrictive policies (such as rent control, protection of tenants from eviction, and housing rationing) by continents and worldwide between 1910 and 2018.

[1] A detailed account in Russian language on rental housing policies worldwide and, in particular, in Germany, Russia, and the USA can be found in Холодилин (2019).

Figure 7.1: Countries that used or are still using rent control

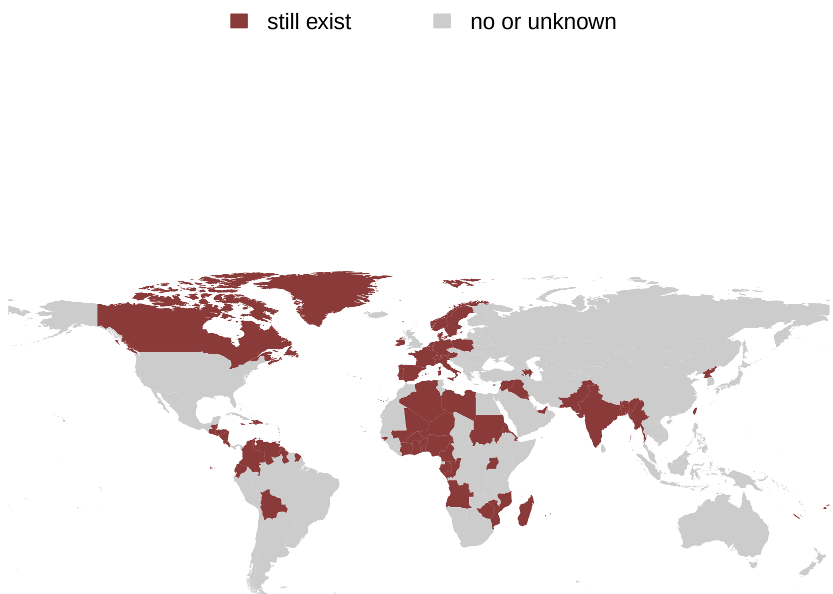


7.2 Housing policy: definitions

Housing policy, in a wide sense, can be defined as the set of all measures applied by a government in order to affect housing market performance. The main purpose of such interventions is to provide people with affordable housing that simultaneously must satisfy certain quality standards. Apart from this, the government can pursue additional purposes: political stability, competitiveness of the domestic economy, and even stimulation of the industrialization. For instance, during the interwar period, housing rents in Germany were restricted in order to moderate the workers' wage increase requests and to make, as a result, domestic products less expensive. In the 1920s, the Brazilian authorities sought to increase investments in manufacturing by discouraging real estate investments, which were highly profitable at that time. Eventually, through rent control, authorities managed to reduce this profitability, thus making investments in the manufacturing sector relatively more profitable (Bonduki, 1994, p. 717).

Governments can take advantage of a large variety of tools in order to regulate housing markets; see Figure 7.3 for a schematic representation of housing policies. The instruments of housing policy,

Figure 7.2: Countries that are still using rent control, 2017



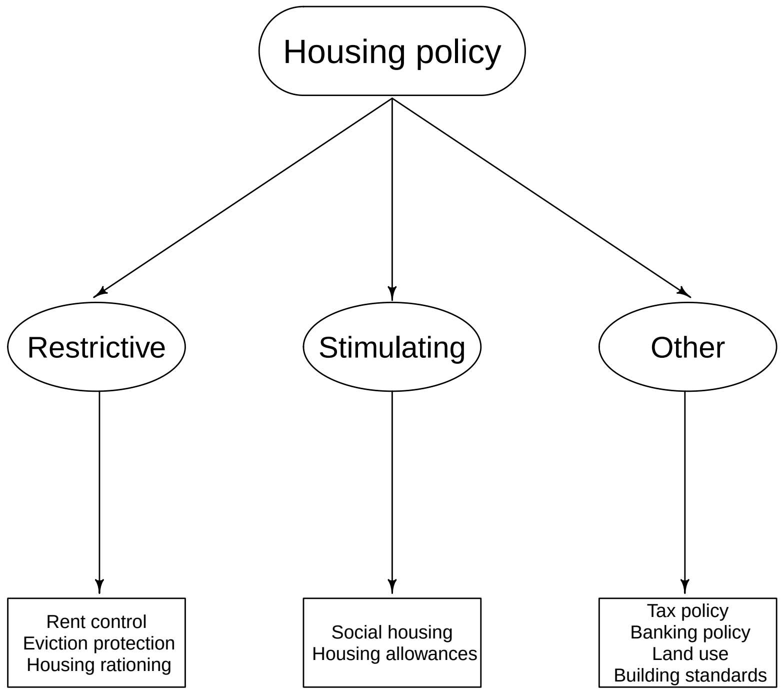
in a narrow sense, can be classified as either stimulating or restrictive. Stimulating housing policies come in two forms: object help, which helps with residential (social) construction, and object help, which assists the tenants through housing allowances. The restrictive measures encompass rent control, protection of tenants from eviction, and housing rationing. Each of these tools is examined in more detail below.

7.3 Stimulating tools of housing policy

Stimulation of residential construction

The main purpose of the stimulation of residential construction policy is to expand the supply of housing, in particular cheap homes. The rising supply should make housing more affordable. Other purposes are also pursued. It is, for example, a creation of a strong class of owners who are resistant against the communist propaganda. Especially in aging societies, the purpose of simulating policies is often the accumulation of wealth to provide for old age. Support of families, improvement of

Figure 7.3: Housing policy tools: wide and narrow sense



housing conditions, and fostering the economy through construction industry, among others, are also the goals of stimulating housing policy (Haas, 2018). The policy of stimulating residential construction includes the following instruments:

- provision of state aid in form of construction subsidies and low or zero interest loans;
- provision of the state credit guarantees;
- reduction of the taxes and fees (particularly, land stamp duty); and
- provision of building land at lower prices or in form of a long-term leasing.

Using such instruments, the state intends to foster residential building and provide in the first place the low-income households with an affordable housing. This housing —sometimes called social housing— can be both rental and owner-occupied. Sometimes (for example, in Spain in the 1940–1970s) the state builds the rental housing that is later to be purchased by the tenants afterward. In Iceland in the 1930–1970s, social workers' houses were predominantly built as owner-occupied ones

(Sveinsson, 2004). The rent in social housing is subject to restrictions and is typically set at the level of the construction and operation costs plus a moderate markup representing a "fair profit" for the landlord. Admittance as a tenant in social housing requires proving that you have a low enough income. However, once moved in, tenant income is practically never tested. As a result, households with increased income keep occupying social housing, even though they are formally no longer eligible for it, because their income exceeded the admittance threshold. For this reason, many low-income persons cannot gain access to social housing. The problem is that both verifying the income levels of households living in social housing and carrying out evictions are too costly. By decreasing its efficiency, this is one of the main disadvantages of social rental housing.

Here are just a few figures illustrating this inefficiency. For example, in Germany, in some regions, 25% of social dwellings are unlawfully occupied (Deutscher Bundestag, 2016). In the UK, a union boss occupied social housing, despite earning £145,000.[2] In Amsterdam in 2007, the waiting time for starters on the social housing market was 5–10 years (van Heelsum, 2007). The reasons for such inefficiencies is that both verifying the income levels of households living in social housing and carrying out evictions are too costly.

Figure 7.4 depicts the share of the social rental housing in the member states of the European Union. As seen, the highest proportions of social housing are observed in The Netherlands (30% of the total housing stock) and Austria (24%), while the lowest are in Cyprus and Greece (0%). Germany, for example, is in the lower tail of the distribution with its 4.8%.

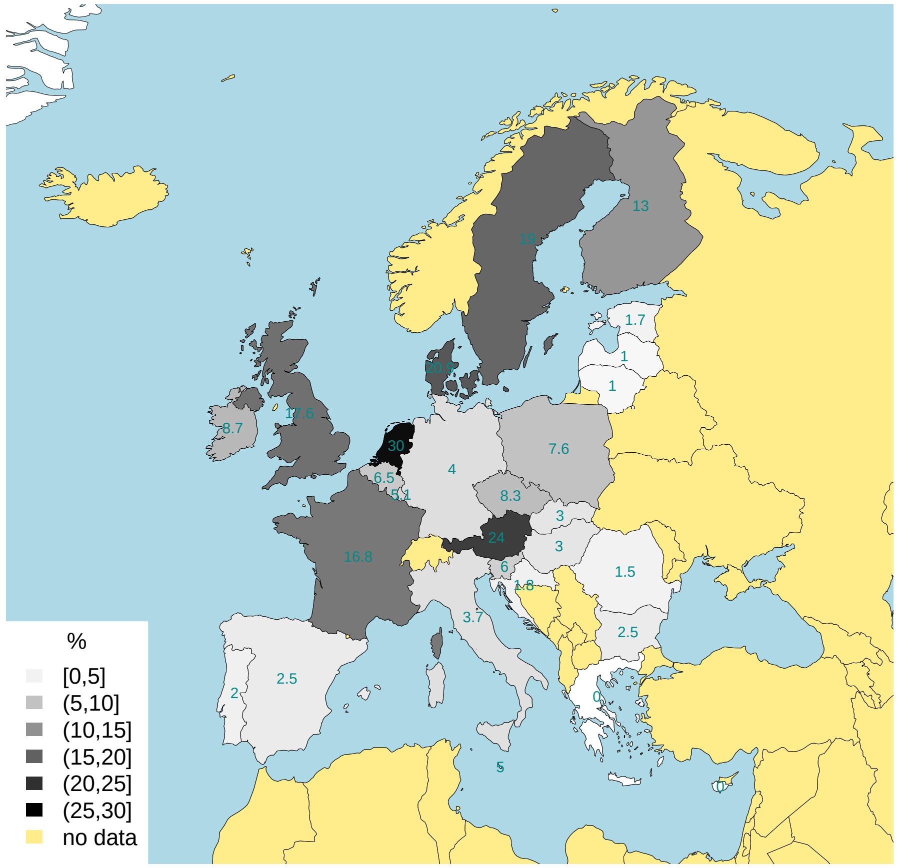
Figure 7.5 displays the scale of total and social housing construction in Germany and Spain between 1940 and 2020. The total residential construction is measured as completed dwellings, while for social housing construction the number of approved dwellings is used. During certain periods, for instance, in the 1950–1960s, the social housing construction made up more than a half of total residential building. These were the times of intensive restrictive regulations that often hindered the private initiative. Therefore, the state had to intervene in order to guarantee the necessary level of housing construction.

Housing allowances

Housing allowances are state subsidies paid to low-income households or, sometimes, directly to their landlords (for example, in the USA, where this aid is known as housing vouchers). The idea is to cover a part of the housing costs of such households in order to permit them to live in appropriate conditions. This policy can be considered to be an alternative or a complement to social housing policy. In this case, the means testing can be conducted on a continuous basis, with housing allowances adjusted in accordance with the changing income of the household. It is also a more flexible form of aid, since it allows the households to choose the dwelling where they would

[2] https://www.dailymail.co.uk/news/article-2513521/Bob-Crow-says-moral-duty-leave-council-house-despite-generous-salary.html.

Figure 7.4: Social rental housing as percentage of total housing stock in the EU, 2017

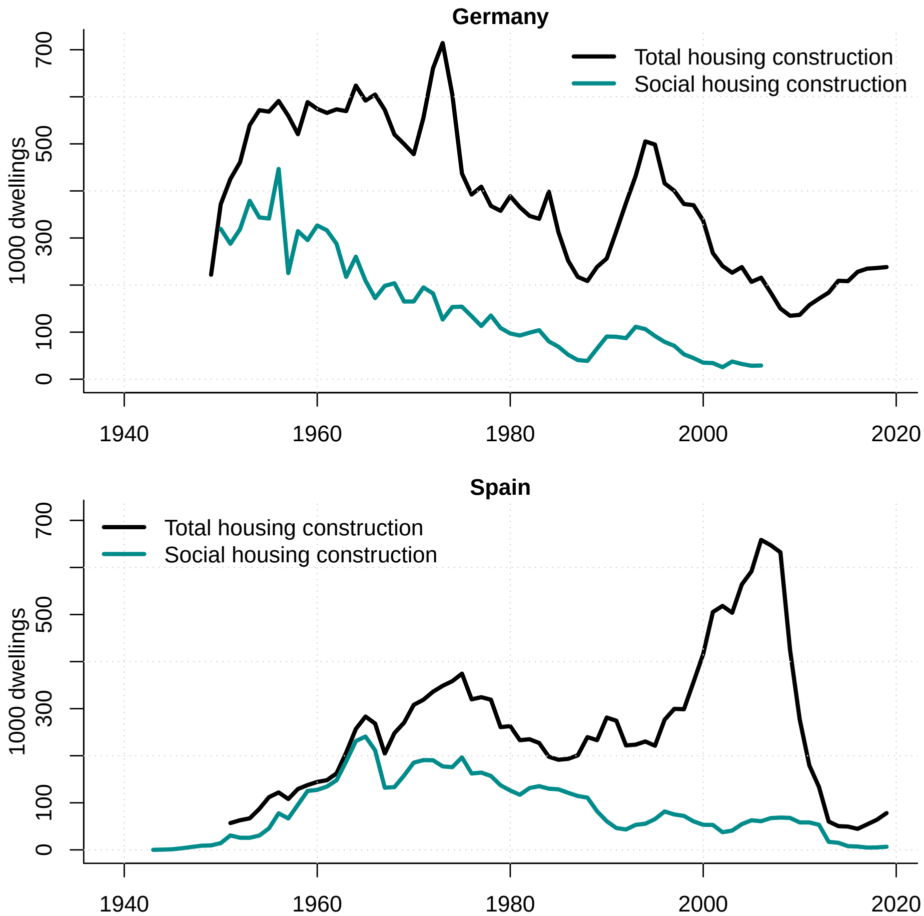


Source: Housing Europe (2017).

like to live more freely. A big disadvantage of such a policy is its inflationary effect: especially in the housing market, with its rigid short-run supply, an increase in demand will immediately lead to rising rents and prices.

For instance, in Germany in 1965, the social housing made up 18% of total housing stock, while in 2014 it was 3.5%. In the USA, in 1970, social housing was 1.8% of total housing stock, while in 2016 it made up merely 0.8%. In 2015, 11% of German households received housing allowances. In 2015 in the USA, 2.2 million households, or about 1.9% of all households got allowances. In Russia in 2015-2016, 6% of families were housing allowance receivers.

Figure 7.5: Overall vs. social housing construction in Germany and Spain, 1940–2020



7.4 Restrictive tools of housing policy

Protection of tenants from eviction

The purpose of the protection of tenants from eviction policy is to reduce eviction risks for the tenants. Prior to World War I, in most countries the corresponding legislation was very liberal. The relations between landlord and tenants were regulated mainly by their rental contract. The contracts could have a definite or indefinite duration. If the contract duration was definite, then after it was over, the landlord could evict the tenant without any formalities. During the contract term, the eviction could normally happen only if the tenant violated certain conditions indicated in the contract or in the civil code. One such eviction reason could be a delayed payment of rent.

At that time, contracts, as a rule, were short term, typically up to one year. Under normal conditions, this did not cause too many problems for the tenants. However, in the extraordinary situations, such as wars, revolutions, natural catastrophes, etc., which led to an acute housing shortage, a loss of housing due to eviction could result in homelessness. Therefore, when faced with such situations, almost everywhere policy makers started introducing the following limitations to make the eviction of tenants more difficult: 1) automatic prolongation of the existing contracts upon their expiration, sometimes indefinitely, sometimes for a short period, which was, however, steadily extended in each new legal act; 2) prohibition for the landlords to break rental contracts, except for a more or less clearly identified set of reasons: e.g., non-payment of rent; urgent need of the landlord or his relatives to move into the dwelling occupied by the tenant; negligent treatment of the housing by the tenant; his unacceptable behavior with respect to other tenants or the owner; 3) setting the minimum duration of finite contracts; and 4) prohibition of short-term (less than 1 year) letting.

Among all housing policy instruments, the protection of tenants from eviction turned out to be the most durable. During the first decades after its introduction, it was considered an emergency measure called into existence by extreme circumstances. However, it later became strongly rooted in legislation and in people's mind. In part, it is related to the fact that it does not require any direct manipulation of market prices, unlike rent control policy. An important advantage of this policy is that it makes the rental relation more stable. Its pitfall is that it makes it more difficult to evict bad-faith tenants, thereby decreasing the attractiveness of investments in the housing sector. Therefore, for example, in Germany with its strong eviction protection, a tenant-occupied dwelling offered for sale is worth substantially less than an identical vacant dwelling (Kholodilin et al., 2017).

Rent control

The main purpose of the rent control policy is the protection of tenants from rental increases. When housing becomes scarce, rents start growing because, in the short run, which can last several years, it is impossible to extend housing supply quickly. As rent is one of the most important components of household expenditures (in different countries, the share of the housing expenses varies around 15–30%), its increases strongly affect the purchasing power of the population. Like many other instruments of the modern housing policy, rent control originated during World War I. By the beginning of the war, the vast majority of urban populations in Europe and North America were tenants. Mass mobilization converted them into a powerful force, meaning that the authorities had to respect their interests. Therefore, in order to avoid social turmoil, governments froze prices for basic consumption goods and services, including housing rents. Initially, this policy was thought to serve as an interim emergency measure, which could be removed as soon as the housing market returned to normality. Nevertheless, once put in place, rent control was prolonged many times, thus remaining in effect for many decades.

Rent control includes: 1) rules regulating the setting of rent in newly concluded rental contracts (either for the very first time after the dwelling was completed or after the previous contract was over); 2) rules regulating updating rent within the existing rental contracts; 3) exceptions, which specify either housing not subject to the regulations or the segments of the housing market subject to stricter controls.

Researchers distinguish between first- and second-generation rent controls; see, for example, Arnott (1995, 2003). First-generation rent control implies a rent freeze, when the rent is fixed at some basic level. There are different ways of determining basic rent: 1) rent for this or similar dwellings at some date; typically, prior to some crucial event (e.g., a war) or at the date of enactment of the corresponding legal act (e.g., in Germany, Poland, and Spain after WWI as well as on the territory of the former Russian Empire during WWI and Russian Civil War); 2) certain percentage of the taxable (book) value of the dwelling (for instance, in Chile and Portugal); 3) absolute value (for example, in Italy and the USSR); or 4) value calculated by the local authorities depending on the structural and locational characteristics of the dwelling (e.g., in the USSR). Only governments could change the basic rent from time to time. It could not only be raised in order to cover at least a part of the growing expenses of the landlords, but also decreased in reaction to political or economic crises. The basic rent was reduced, for instance, in Chile in 1925 in reaction to a tenants strike, in Italy in 1927 and 1934, in Germany in 1931 as a result of the Great Depression, as well as in Poland in 1935. First-generation rent controls emerged during World War I and remained in force as late as the 1970s, when they started being replaced with second-generation rent controls; however, rent freezes are still used in some countries, especially developing ones. Second-generation rent control implies a more or less free setting of rent when new contracts are concluded, but imposition of upper bounds on its growth rate within the existing contracts. The upper bound of rent growth can be the rate of increase of the consumer prices during the preceding year (e.g., in Colombia, Czech Republic, France, Italy, Poland, and Spain), mortgage interest rate (in Switzerland), or an index of government bonds (in Brazil). Sometimes, even under second-generation rent controls, the rent in the newly concluded contracts can be subject to limitations. For example, since 2015, in areas with an acute housing shortage in Germany, new rent cannot exceed the average market rent for similar dwellings in the same neighborhood by more than 10

Rent control has both pros and cons. On the positive side, it makes dwellings more affordable for sitting tenants and exerts some anti-inflationary impact. The list of its pitfalls is longer. First, in case of a positive demand shock on the housing market, rent control slows the transition to the new equilibrium, as shown in (Brueckner, 2011, p. 141-143). Second, rent control causes the inefficient allocation of housing when sitting tenants stay put, even if their housing needs no longer match the quality and quantity of their present dwelling. Therefore, frequently there are large dwellings in inner cities that are occupied by older individuals who rent them cheaply, while big families occupy small, crowded dwellings and pay astronomical rents. Third, since it is impossible to legally raise rents, landlords look for workarounds. One widespread practice is, for instance, to force tenants to buy furniture left by the landlord or previous tenant for exorbitant prices. In some countries (for example, in Portugal prior to World War II), rent can be charged in a foreign currency and, being frozen nominally, can grow at the pace of devaluation of the domestic currency. Fourth, for the same reason, landlords can make repairs less frequently in an attempt to restore their rate of return by cutting their expenses. Fifth, keeping the rents artificially low also diminishes the incentives to invest in housing construction, as its rate of return decreases, given the constant rents against the background of other (consumer) prices rising almost without a limit. As a result, investors stop investing either into the housing sector in general, thus, accentuating the housing shortage, or, specifically, in the rental housing segment, which is replaced with owner-occupied housing. A conversion of dwellings into nonresidential premises (e.g., medical practices or lawyer offices) can also happen. Sixth, the wrongly shaped incentives can lead to paradoxical reactions. For example, in Chile in 1925, the owners of unhealthy dwellings were ordered to reduce the rent by 50% and freeze it at that level. As a result, some tenants started consciously degrading their dwellings in order to achieve an unhealthy state in order to obtain rent reductions! Finally, the prohibitions to freely increase rent not only reduce the revenue of the landlords, they also reduce tax revenues for the government.

Housing rationing

When there is an acute housing shortage, the government can impose measures like compulsory disposal of the housing in order to use fully the available housing stock. These measures include:

- registration of both dwellings and tenants in order to create a register of the available and becoming vacant dwellings as well as the creation of a waiting list for potential tenants;
- preservation of housing by banning the demolishment of it or conversion of its use to non-residential purposes (for example, as office space or holiday dwellings for tourists);
- redistribution of housing by putting new tenants into unused or underutilized housing;
- setting the maximum housing consumption norms (for instance, the maximum floor area or number of rooms per person);
- mobility restrictions meaning the creation of obstacles to move into areas with an especially acute housing shortage, while facilitating migration to other areas;
- nationalization of private housing by transferring it into state property.

As shown, the rationing of housing implies that the government intends to manipulate both its supply and demand. The supply is protected or, to some extent, increased through a mobilization of the available premises (including non-residential ones that are appropriate for lodging) for their use as housing. At the same time, demand is reduced by limiting the freedom of mobility freedom and by setting low norms of housing consumption.

In its most extensive form, housing rationing was extensively employed in centrally planned economies, such as Czechoslovakia, Poland, and the USSR. However, it was also used in market economies, for example, in Germany, Italy, Luxemburg, Spain, Switzerland, and even the USA. Most frequently, such measures are used in extraordinary circumstances, when the housing stock is destroyed (e.g., due to the bombardments, earthquakes, or hurricanes) and cannot be quickly restored. After the market has stabilized, these measures are typically abrogated. Nevertheless, even during peaceful times, housing rationing can still be applied. One example is the interdiction against using dwellings for non-residential purposes or holiday dwellings (e.g., recent restrictions on the letting apartments through Airbnb[3]). In North America, prohibitions to demolish or convert rental residential properties into condominiums are also quite widespread. Such policies diminish the attractiveness of the housing sector for investors by increasing their risks. Hence, it can be expected that it will negatively affect housing supply.

The housing policy instruments described here are not usually applied individually, but rather in various combinations. Combined their effects are sometimes offset and sometimes mutually strengthen. For example, a simultaneous application of eviction and rent controls can substantially reduce incentives to increase the housing supply. Therefore, in order to compensate for this, the government can use housing rationing, which counteracts the reductions in housing supply to some extent. It can also apply measures that stimulate residential building, thus extending the housing stock through new construction.

7.5 Housing policy in a wide sense

The above list is far from exhaustive. It represents only the housing policy in narrow sense. The decisions of economic agents concerning construction, as well as the choice between own and rented housing, are also affected by many other governmental regulations, including, for example, property taxation, city planning, environmental, and banking regulations.

Tax treatment of homeownership

Through tax policy, the state sets various property taxes and exemptions therefrom. In this way, it changes the relative cost of both own and rented housing, thus affecting the choice of a particular tenure form by making it more or less attractive from a financial point of view. In many countries, tax policy is biased toward homeownership. For example, in the Netherlands and the USA, interest payments are subtracted from taxable income; thus, making the purchase of own housing using

[3] See, for example, Lee (2016).

borrowed money very attractive. This can lead to the emergence of speculative price bubbles in real estate markets (Figari et al., 2017). As an offsetting measure, taxation of imputed rent can be used. However, this instrument is rarely used: for example, it is primarily found in The Netherlands, where it applies to all dwellings, and Greece, where it only applies to large dwellings.

What are the main taxes imposed on the property? The most important types of property taxes or tax exemptions include the land stamp duty, the tax on imputed rent, the interest deductibility, the capital gains tax, and the value added tax (VAT) on new homes as on other durables.

The tax on imputed rent is a tax that is imposed on the financial user value of an owner-occupied dwelling. The basic idea is that the homeowner obtains an additional income inflow, since he, unlike a tenant, does not pay housing rent. Therefore, this additional income must be taxed in order to restore the equal treatment relative to other incomes. Moreover, in case the mortgage interest is deductible, the imposition of the tax on imputed rent means that the tax neutrality with respect to tenure security is guaranteed. The tax on imputed rent tends to have a negative impact on the incentives to buy a home. Thus, it removal can have an incentivizing influence on the homeownership formation.

The mortgage interest deductibility is often accompanied by the tax on imputed rent. The logic is that the the income-related costs, which are incurred when earning the corresponding income, should be deductible. For example, in case of car production, the state taxes not the total revenue, but the profit, which is a difference between the total revenue and total cost. Mortgage interests are treated as a part of costs. In some cases, the mortgage interests can be deductible in absence of the tax on imputed rent. The interest deductibility makes the purchase of an own home more attractive. This can, however, foster a build-up of speculative price bubbles; see Chapter 5.

The capital gains tax is a tax, which is imposed on the capital gains, that is, the difference between the purchase and the sale price. Therefore, it is sometimes also called a speculation tax, for it should reduce the incentives to buy real estate with a single purpose of reselling it at higher prices, which can lead to speculative bubbles. However, likewise, the capital gains tax makes the purchase of homes to live in less attractive. Therefore, this tax is often designed in such a way as to hinder speculations without negatively affecting the purchases made with the own-occupation motive. For example, in Germany, the capital tax must be paid, if the dwelling is resold within 10 years after the purchase date, but only within 2 years, if the owner really resided there for this period.

The VAT on new homes is a tax imposed on the purchase price of a new dwelling. This tax makes the dwelling more expensive and, hence, its purchase less attractive. On the other hand, it has a similar logic as the tax on imputed rent: if the real estate is to be treated equally with other goods, it must be subject to the VAT. The absence of the VAT on new homes can be considered as a kind of subsidy targeted to the buyers of new homes.

Land use regulations

The city planning policy imposes constraints on the spatial distribution and density of housing construction. Land use regulation establishes zoning of cities, which determines the use of each zone (residential, industrial, recreational, etc.). Moreover, within specific zones additional restrictions can be imposed, for example, those concerning the height of buildings and housing density (total surface of housing per surface of the land plot). This regulation can reduce the price elasticity of housing supply (Hilber and Vermeulen, 2016). The reason is that As a result, there will be lower supply at higher prices.

Banking regulations

The banking regulation generally restricts the supply of mortgage loans, in some cases to specific individuals based on their income and debt. After the Great Recession of 2008–2009, many countries introduced *macroprudential regulations* —defined as a prudential tool that is designed to tackle systemic risk— in order to avoid the buildup of speculative house price bubbles by limiting the mortgage loans provision. The opponents of this policy argue that it leads to a widening of the gap between the rich and poor, since the latter have a lower purchasing capacity and, hence, are subject to the restraints imposed on the mortgage crediting to a larger extent.

Environmental policies

Environmental policies pursue the purpose of reducing the harmful emissions and combatting the global warming. Therefore, they impose stricter requirements on the newly built housing (for example, an obligatory use of solar batteries, heat insulation, and so on), which can cause construction cost increases. This can lead, in turn, to higher house prices or smaller number of dwelling completions.

7.6 Enforceability of governmental regulations

It should be noted that legal acts often do not work, remaining a dead letter. Firstly, laws that are very inconvenient for market participants tend to be avoided through various loopholes. The imagination of many people, who are motivated to find loopholes, is much richer than that of the handful of the lawmakers, attempting to close these loopholes. Secondly, in order to make the laws effective, mechanisms to uncover violations of the laws are needed. The state is unable to provide each dwelling or building with a policeman who enforces compliance with the law. Most frequently, it is an interested party, i.e., tenants, who report violations of the law. However, they are not always willing to do so, because, even if they win the process, they still remain tenants of the landlord with whom the relationship is then strained. Thirdly, law enforcement is inhibited by ignorance of the laws by the people. For instance, Franco Ubeda (2016), based on a survey of lawyers, landlords, and tenants in Ecuador's capital Quito, showed that only 1% of landlords and tenants are aware of the legislation regulating rental housing market. Similarly, in Bogotá (Colombia) only 10.4% of low-income tenants are informed about the tenant protection (CENAC, 2007) and in several Zambian cities about 30% of the respondents "had some idea about the existence of some rent controls" (Nzonzo, 2005, p. 28).

7.7 Evolution of restrictive housing policies worldwide

In this section, we discuss the worldwide evolution of restrictive housing market regulations between 1910 and 2018. These are measured using indices developed and thoroughly described in Kholodilin (2020b); Kholodilin et al. (2018).

Regulation intensity measures are based on the textual summaries of legal acts, which are then mapped into numeric values. Using a set of questions concerning the restrictions imposed on the rental housing, binary variables are constructed that equal one, if regulation is more stringent, and zero, otherwise:

$$I_{jt}^{k} = \begin{cases} 1, & \text{if restriction } j \text{ of type } k \text{ is present in period } t \\ 0, & \text{otherwise} \end{cases}$$

For each regulation type, k, a composite index is computed as a simple average of binary variables:

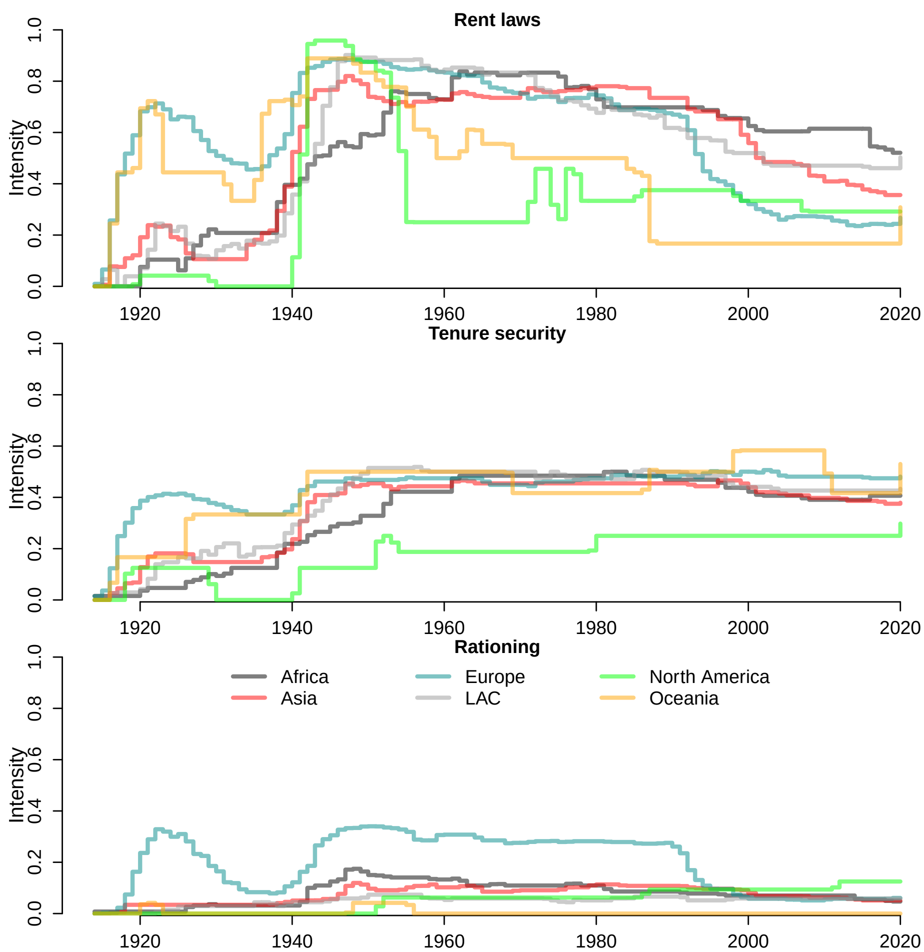
$$I_{t}^{k} = \frac{1}{N_k} \sum_{j=1}^{N_k} I_{jt}^{k}$$

where $k = \{\text{Rent laws}, \text{Tenure security}, \text{Housing rationing}\}$.

Rent control. The first regulation type to be considered here are rent laws, or rent control. The intensity of rent control by continents (as measured by an average of rent law binary indices) is shown in the upper panel of Figure 7.6. In all the cases, the intensity increases up to a peak and then stabilizes or decreases. The peaks take place in different times: in Europe, North America, and Oceania the highest rent control intensity is attained in the 1940s, in Latin America and Caribbean (LAC) it is achieved in the 1950s, while in Africa and Asia is observed in the 1970s. Moreover, Europe and Oceania experienced higher than the world average intensity in the first half of the 20th century, LAC between 1950 and 1980 and then again from the late 1990s, Africa between 1960s and now, whereas Asia between 1980 and 2000s. Thus, Europe was the first to introduce rent control and to relax it, while Africa and LAC lag behind other continents. This is especially true for Africa, where rent control still has a very high intensity. This is related to the transition from the first-generation rent control to either the second-generation rent control or complete removal of it. The evolution of two generations of rent control is shown Figure 7.7, where the shares of countries having either first- or second-generation controls are displayed by continent. The sum of the shares of first- and second-generation rent controls is not always equal to 1, for some countries lift all restrictions on rent setting. Europe was the first to introduce the more flexible second generation of rent control in the early 1970s. In the early 1990s, the number of European countries with second-generation rent control exceeded that of the countries with first-generation rent control. To some extent, this was helped by the transition of the former socialist countries to the market economy. In the late 1970s, the second-generation rent control was introduced in LAC, in the late 1990s in Asia, and only in the 2010s in Africa. Oceania did not have second-generation rent control and went directly to a free market, while in Africa and LAC there are still more countries with first-generation rent control than those with second generation.

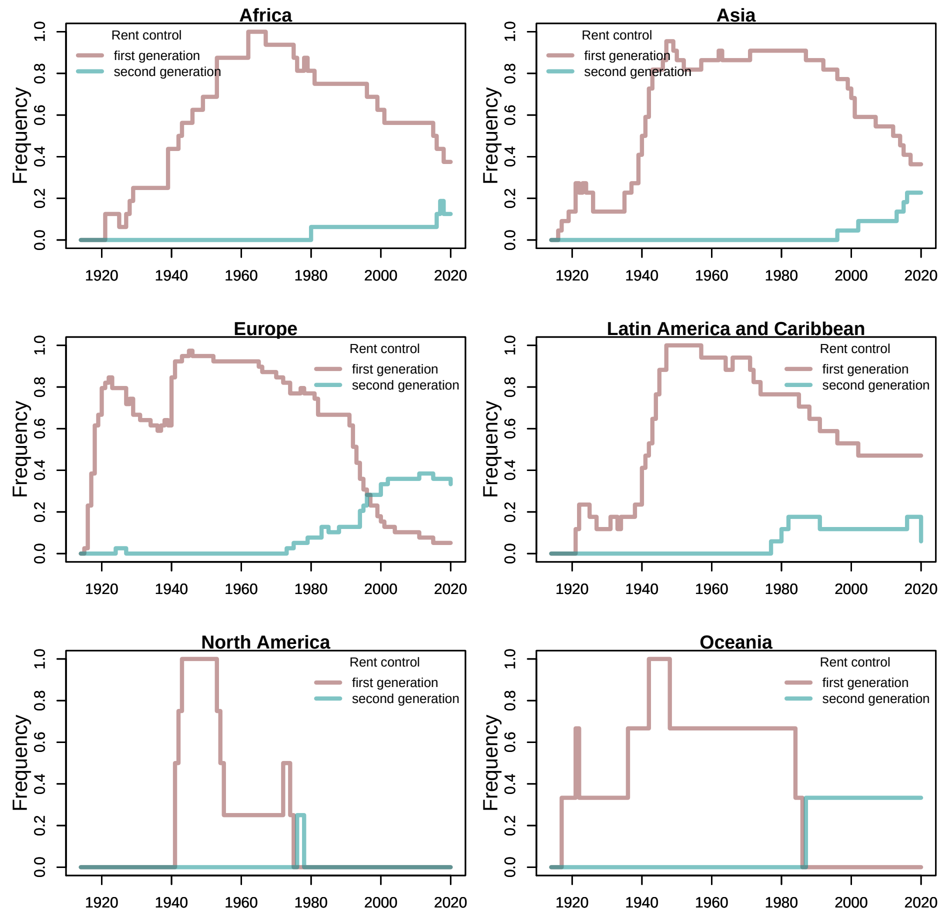
Figure 7.8 shows that currently the majority of countries have no rent control. The developed countries maintain mostly a soft —second-generation— form of rent restrictions. The first-generation rent control is mainly to be found in Africa and India.

Figure 7.6: Rental regulation indices by continents



Tenure security. Another group of laws is tenure security laws. The composite tenure security index averaged by continents is displayed in the middle panel of Figure 7.6. Unlike rent control

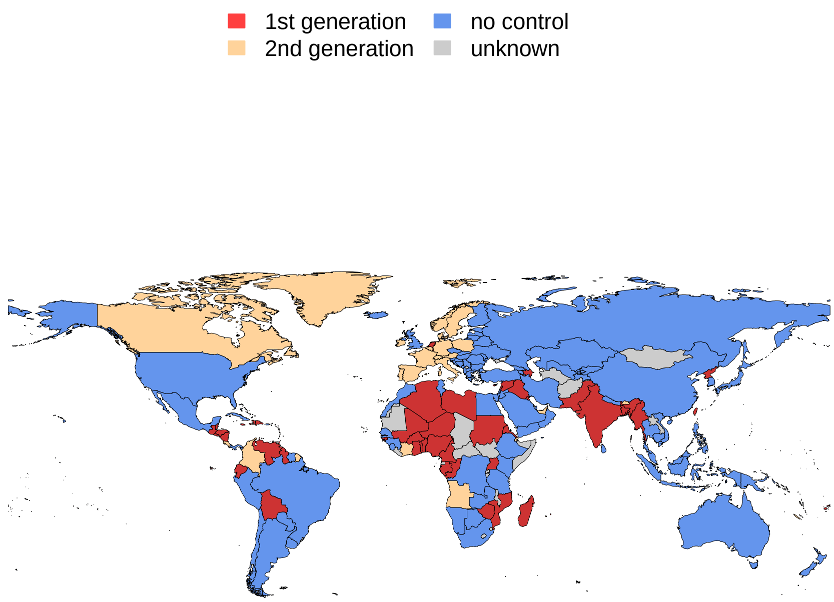
Figure 7.7: Rent control generations by continent



that tends to decrease since the second half of the 20th century, tenure security worldwide displays an almost monotonic upward trend and starting from the turn of the 21st century stabilizes at a high level. Only in North America and Oceania its intensity diminishes after World War II. At the end of our sample period, tenure security is the highest in Europe and the lowest in Oceania. In Asia, it is substantially lower than the worldwide average, while in Africa and LAC it almost coincides with this average.

Housing rationing. The third group includes laws regarding housing rationing. Although this policy attired little attention in the literature, it appears to be quite widely used: more than three-fourths out of 81 countries/provinces in our sample used or still use it. The intensity of housing rationing by continent over 100 years is shown in the lower panel Figure 7.6. The measures of forceful redistribution of housing and tenants are almost omnipresent across the world. Only North America appears to have escaped such a policy at large scale. It is known, though, that some US cities, e.g., Santa Monica (California) employed such forms of housing rationing as obligatory registration of vacant housing and prohibition to use dwellings to non-residential purposes (Keating,

Figure 7.8: Rent control worldwide, 2017



1983). The continent that most actively took advantage of housing rationing is Europe. The two periods of the most extensive use of such policies coincide with both world wars and their aftermath. Nevertheless, with the passage of time, European countries, although markedly reduced the application of housing rationing, did not dismantle them completely. Even new forms of housing rationing were introduced, such as protection of social composition areas in Germany (Kholodilin, 2017). Latin America and Caribbean had similar, but somewhat lower intensity of housing rationing than Europe. Africa and Asia had some episodes in their history (1950s and 2010s), when their intensity of housing rationing exceeded the worldwide average. Oceania used such policies only in the 1950s.

Exercises

1. What are the pros and cons of stimulating tools of the governmental housing policy?

2. What is the main purpose of governmental housing policy? Variants of answers:

a) improvement of the competitiveness of the domestic economy;

b) provision of the population by an affordable housing;

c) creation of a powerful class of owners;

d) elimination of slums;

e) support of the performance of the domestic economy.

3. Which of the following statements is correct? Answer: The second-generation rent control implies

   a) a free setting of the initial rent and its unlimited upward adjustment during the contract term;

   b) a free setting of the initial rent and pegging its increases to the dynamics of the cost of living;

   c) reduction of the initial rent and unlimited upward adjustment during the contract term;

   d) limitation of the initial rent and prohibition to increase it during the contract term;

   e) a free setting of the initial rent and prohibition to increase it during the contract term.

4. What is enforceability of a regulation? What factors can affect the enforceability?

5. What are the advantages and disadvantages of a macroprudential policy?

Key terms

housing policy	housing affordability	stimulation of residential construction
credit guarantees	land stamp duty	housing allowances
protection from eviction	rent control	first-generation rent control
second-generation rent control	housing rationing	tax policy
tax on imputed rent	interest deductibility	capital gains tax
VAT on new homes	environmental policy	city planning
banking policy	macroprudential regulations	law enforceability
rental regulation indices		

Chapter 8

Appendix

8.1 Business game "Spatial distribution of activities in a monocentric city"

Purpose

The purpose of the game is to illustrate the Alsonso-Mills-Muth theory of spatial distribution of different economic activities in monocentric cities. The students should understand the notion of land rent gradient pointing to a declining rental price for land as a function of distance from the city center.

Course of game

The game is conducted in form of an auction. Each student chooses the industry he is going to represent: offices, restaurants, manufacturing, housing, or agriculture. Then, a discussion is conducted, how in each industry the price is set — how does it depend on the distance from the city center. The rent each agent can pay for land plot is described by the following formula:

$$R_i = (P_i - t_i \times d) \times Q_i$$

where R_i is the land rent an agent is of industry i is ready to pay; P_i is the unit price for the products or services of i-th industry; t_i is the cost of transporting one unit of product for 1 km; d is the distance from the city center; and Q_i is the output. For simplicity, other cost than resulting from transportation can be set to 0.

The coefficients for each industry and calculation formulae are given in Table 8.1.

It is assumed that all the commodities must be transported to the city center (parcel 0) for sale. All the parcels, from 0 to the n-th, are offered for sale. For each parcel, each participants computes his expected revenue and sets his bid price. The closer the bid price to the revenue, the lower the profit. The higher the bid price, the higher the chance to obtain the parcel. After all

Table 8.1: Production parameters

Sector	Unit price, P_i	Output, Q_i	Transportation cost, t_i
Offices	50	10	5
Restaurants	40	10	3
Manufacturing	30	10	2
Housing	20	10	1
Agriculture	10	10	0

parcels are sold, the profit of each participant is calculated. The winner is the person who obtained the highest profit.

8.2 Business game "Rental housing market"

Purpose

The purpose of the game is to show the students the functioning of a rental housing market. They can observe in a simplified way the factors governing the rent setting. Moreover, they learn how the society can change the rules of game and what are the possible outcomes of such changes. Preparation. The students are divided into two groups: landlords (about 40% of all students in the group) and tenants (about 60%). Every person has a minimum subsistence level of 50 RUR per period. The only source of income of landlors is renting out one of their two apartments. They bear 20 RUR of costs for the rental dwelling. Their own dwelling is available to them for free. Tenants, in turn, are divided into two subgroups: poor (150 RUR) and rich (300 RUR).

Course of game

The game is made up of several rounds. During each round, the tenants negotiate with the landlords to rent a dwelling. Those, who become homeless, are threatened by the death of cold. Those, who pay too high a rent, can starve, if the remaining income after deduction of rent is lower than 50 RUR. There can be at most two tenants per dwelling. Thus, subletting and shared renting are allowed. After each round, the negotiated rental price is written on the whiteboard in front of each dwellings's number. Based on this price several performance measures for each game participant can be computed:

After this, a new round begins. The participants are advised to change their negotiation partners, so that the pairs landlord-tenant are not always the same. Needless to say, the game participants are allowed to move across the class during the game.

Scenarios

Several scenarios can be considered:

Table 8.2: Results of game round ***

Dwelling number	Rent, RUR	Tenant's income, RUR	Rental burden, %	Net rental revenue of landlord, RUR
1	80	150	53.3	60
2	75	150	50.0	55
3	100	300	33.3	80
Average rent	85			

- Landlord's cost increase due
  - to change in the mortgage interest rate
  - or real estate tax rate.
- Incomes of poor increase.
- Some dwellings are destroyed.

After each change in conditions, a new round of game is carried out. Its results are put on the whiteboard and discussed with the game participants.

Government policy

When conditions become unbearable for the tenants, the game participants are reminded that they are a society and can adopt various social policies based on a majority vote. The alternative bills are discussed and voted. The corresponding policy is applied and its impact on rents, rental burden, and income distribution are analyzed.

Bibliography

Махрова, А. Г. and П. Л. Кириллов (2015). Российская урбанизация и жильё горожан. *Демоскоп Weekly 645-646*, 1–6.

Джекобс, Д. (2011). *Смерть и жизнь больших американских городов.* М.: Новое издательство.

Гейл, Я. (2012). *Города для людей.* М.: Концерн «КРОСТ».

Спек, Д. (2015). *Город для пешехода.* М.: Искусство-XXI век.

Вучик, В. (2017). *Транспорт в городах, удобных для жизни.* Litres.

Росстат (2012). *Социально-демографический портрет России. По итогам Всероссийской переписи населения 2010 года.* Москва: ИИЦ «Статистика России».

Стил, К. (2014). *Голодный город: как еда определяет нашу жизнь.* М.: StrelkaPress.

Эллард, К. (2019). *Среда обитания. Как архитектура влияет на наше поведение и самочувствие.* Альпина Паблишер.

Холодилин, К. А. (2019). Мировые тенденции государственной жилищной политики. *Жилищные стратегии 6*(1).

Фролова, Т. А. (2016). Понятие «Город» в законодательстве субъектов Российской Федерации об административно-территориальном делении. *Пролог: журнал о праве* (3).

Aalbers, M. B. (2016). The financialization of home and the mortgage market crisis. In *The Financialization of Housing*, pp. 40–63. Routledge.

Abreu, D. and M. K. Brunnermeier (2003). Bubbles and crashes. *Econometrica 71*(1), 173–204.

Allen, F. and G. Gorton (1993). Churning bubbles. *The Review of Economic Studies 60*(4), 813–836.

Alonso, W. (1964). *Location and land use: Toward a general theory of land rent.* Harvard University Press Cambridge, MA.

Arnott, R. (1995). Time for revisionism on rent control? *Journal of Economic Perspectives 9*(1), 99–120.

Arnott, R. (2003). Tenancy rent control. *Swedish Economic Policy Review 10*(1), 89–134.

Bailey, M. J., R. F. Muth, and H. O. Nourse (1963). A regression method for real estate price index construction. *Journal of the American Statistical Association 58*, 933–942.

Berg, L. (1988). Hushållens sparande och konsumtion (Household saving and consumption). Expertrapport till Sparutredningen.

Bertaud, A. and S. Malpezzi (2014). The spatial distribution of population in 57 world cities: The role of markets, planning, and topography.

Blanchard, O. J. and M. W. Watson (1982). Bubbles, rational expectations and financial markets. In P. Wachtel (Ed.), *Crises in the economic and financial structure: bubbles, bursts, and shocks*. D.C.Heath and Company, Lexington.

Blanchflower, D. G. and A. J. Oswald (2013). Does high home-ownership impair the labor market? Technical report, National Bureau of Economic Research.

Blanco Artola, M. (2012). La transformación del mercado de alquiler de fincas urbanas en España (1920–1960). *Revista bibliográfica de geografía y ciencias sociales 17*(988).

Blanco Blanco, A. G. (2014). La realidad del alquiler en América Latina y el Caribe. In A. G. Blanco, V. Fretes Cibils, and A. F. Muñoz (Eds.), *Busco casa en arriendo. Promover el alquiler tiene sentido*. Banco Interamericano de Desarrollo.

Bonduki, N. G. (1994). Origens da habitação social no Brasil. *Análise social XXIX*(127), 711–732.

Bracke, P., C. Hilber, and O. Silva (2012). Homeownerhip and entrepreneurship. Spatial Economics Research Centre (SERC), London School of Economics and Political Science.

Brueckner, J. K. (2011). *Lectures on urban economics*. MIT Press.

Brueckner, J. K., J.-F. Thisse, and Y. Zenou (1999). Why is central Paris rich and downtown Detroit poor?: An amenity-based theory. *European economic review 43*(1), 91–107.

Brunnermeier, M. K. (2008). Bubbles. In S. N. Durlauf and L. E. Blume (Eds.), *The New Palgrave Dictionary of Economics: Volume 1–8*, Volume 2, pp. 578–583. Springer.

Brunnermeier, M. K. and M. Oehmke (2013). Bubbles, financial crises, and systemic risk. In *Handbook of the Economics of Finance*, Volume 2, pp. 1221–1288. Elsevier.

Bry, G. and C. Boschan (1971). *Cyclical analysis of time series: Selected procedures and computer programs.* NBER Books. National Bureau of Economic Research, Inc.

Cameron, G. and J. Muellbauer (1998). The housing market and regional commuting and migration choices. *Scottish Journal of Political Economy 45*(4), 420–446.

Case, K. E. and R. J. Shiller (1987). Prices of single family homes since 1970: New indexes for four cities. *New England Economic Review 5*, 45–56.

Catte, P., N. Girouard, R. W. Price, and C. André (2004). Housing markets, wealth and the business cycle. OECD Economics Department Working Papers No. 394.

CENAC (2007). Caracterización del mercado de arrendamientos urbanos para el segmento de la población de bajos ingresos. Trabajo realizado para MAVDT-UN HÁBITAT-First Initiative. Bogotá: CENAC (Centro de Estudios de la Construcción y el Desarrollo Urbano y Regional).

Ching, L. K. and A. Tyabji (1991). Home ownership policy in Singapore: an assessment. *Housing Studies 6*(1), 15–28.

Christaller, W. (1933). *Die zentralen Orte in Süddeutschland.* Jena: Gustav Fischer.

Christaller, W. (1966). *Central Places in Southern Germany.* Englewood Cliffs, NJ: Prentice-Hall.

Collinson, R., I. Gould Ellen, and J. Ludwig (2015). Low-income housing policy. NBER Working Paper No. 21071.

Cramer, J. S. (1999). Predictive performance of the binary logit model in unbalanced samples. *Journal of the Royal Statistical Society: Series D (The Statistician) 48*(1), 85–94.

Destatis (2014). Gebäude- und Wohnungsbestand in Deutschland: Erste Ergebnisse der Gebäude- und Wohnungszählung 2011. Statistische Ämter des Bundes und der Länder.

Deutscher Bundestag (2016). Sozialer Wohnungsbau in Deutschland — Entwicklung, Bestand, Perspektive. Drucksache 18/8855. 18. Wahlperiode.

DiPasquale, D. and E. L. Glaeser (1999). Incentives and social capital: Are homeowners better citizens? *Journal of urban Economics 45*(2), 354–384.

DiPasquale, D. and W. C. Wheaton (1996). *Urban economics and real estate markets.* Upper Saddle River: Prentice Hall.

Dreger, C. and K. A. Kholodilin (2013). An early warning system to predict speculative house price bubbles. *Economics — The Open-Access, Open-Assessment E-Journal 7*, 1–26.

Eichengreen, B., A. K. Rose, and C. Wyplosz (1994). Speculative attacks on pegged exchange rates: An empirical exploration with special reference to the European monetary system. NBER Working Papers 4898, National Bureau of Economic Research, Inc.

Ellard, C. (2015). *Places of the heart: The psychogeography of everyday life*. Bellevue Literary Press.

Festa, M., E. Ghiraldo, S. Serafini, I. Barbaccia, M. Carotenuto, D. Carullo, G. A. Di Fazio, M. Salvatori, D. Tellone, and G. Bottone (2019). Gli immobili in Italia 2019 – Ricchezza, reddito e fiscalità immobiliare. Agenzia delle Entrate and il Dipartimento delle Finanze del Ministero dell'Economia.

Figari, F., A. Paulus, H. Sutherland, P. Tsakloglou, G. Verbist, and F. Zantomio (2017). Removing homeownership bias in taxation: The distributional effects of including net imputed rent in taxable income. *Fiscal Studies 38*(4), 525–557.

Franco Ubeda, E. D. (2016). Las relaciones de carácter legal entre propietarios y arrendatarios, y su comportamiento al margen de la ley, provocando perdidas económicas y detrimento de la propiedad. Universidad Laica Vicente Rocafuerte de Guayaquil.

Galster, G. C. (1983). Empirical evidence on cross-tenure differences in home maintenance and conditions. *Land Economics 59*(1), 107–113.

Garber, P. M. (1990). Famous first bubbles. *Journal of Economic perspectives 4*(2), 35–54.

Gehl, J. (2013). *Cities for people*. Island press.

Gerdesmeier, D., H.-E. Reimers, and B. Roffia (2010). Asset price misalignments and the role of money and credit. *International Finance 13*(3), 377–407.

Glaeser, E. L. and C. G. Nathanson (2015). Housing bubbles. In *Handbook of regional and urban economics*, Volume 5, pp. 701–751. Elsevier.

Glaeser, E. L. and J. M. Shapiro (2003). The benefits of the home mortgage interest deduction. *Tax policy and the economy 17*, 37–82.

Goodman, L. S. and C. Mayer (2018). Homeownership and the American Dream. *Journal of Economic Perspectives 32*(1), 31–58.

Green, R. K. and M. J. White (1997). Measuring the benefits of homeowning: Effects on children. *Journal of urban economics 41*(3), 441–461.

Grose, D., C. Brunsdon, and R. Harris (2008). Introduction to geographically weighted regression (GWR) and to grid enabled GWR. http://csiss.org/GISPopSci/workshops/2011/PSU/readings/Grose-Brunsdon-Harris-GWR.pdf.

Haas, H. (2018). Paradigms of home ownership promotion: The changing role of economists in the knowledge production for housing politics in Germany.

Hamilton, J. D. (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica 57*(2), 357–84.

Harding, D. and A. Pagan (2001). Extracting, using and analysing cyclical information. MPRA Paper 15, University Library of Munich, Germany.

Harvey, D. (1985). *The Urbanization of Capital*. The Johns Hopkins University Press.

Hilber, C. A. L. and W. Vermeulen (2016). The impact of supply constraints on house prices in England. *Economic Journal 126*(591), 358–405.

Hoff, K. and A. Sen (2005). Homeownership, community interactions, and segregation. *American Economic Review 95*(4), 1167–1189.

Homm, U. and J. Breitung (2012). Testing for speculative bubbles in stock markets: a comparison of alternative methods. *Journal of Financial Econometrics 10*(1), 198–231.

Housing Europe (2017). The state of housing in the EU 2017. European Federation of Public, Cooperative and Social Housing.

Huber, P., J. Montag, H. M. Smrčková, and P. Sunega (2017). Homeownership, mobility, and unemployment: Evidence from privatization in transition countries. mimeo.

IMF (2011). Global financial stability report durable financial stability getting there from here. International Monetary Fund Washington DC.

Jacobs, J. (2016). *The economy of cities*. Vintage.

Jordà, Ò., M. Schularick, and A. M. Taylor (2016). The great mortgaging: housing finance, crises and business cycles. *Economic Policy 31*(85), 107–152.

Kaminsky, G., S. Lizondo, and C. M. Reinhart (1998). Leading indicators of currency crises. *IMF Staff Papers 45*(1), 1–48.

Keating, W. D. (1983). Rent control in California: Responding to the rental housing crisis. Institute of Governmental Studies, University of California, Berkeley.

Kholodilin, K. (2017). Quantifying a century of state intervention in rental housing in Germany. *Urban Research and Practice 10*(3), 267–328.

Kholodilin, K., J. P. Weber, and S. Sebastian (2018). Rental market regulation over the last 100 years in an international comparison. *DIW Weekly Report 8*(45), 453–464.

Kholodilin, K. A. (2020a). Housing policies worldwide during coronavirus crisis: Challenges and solutions. DIW focus 2.

Kholodilin, K. A. (2020b). Long-term, multi-country perspective on rental market regulations. *Housing Policy Debate forthcoming*.

Kholodilin, K. A., A. Mense, and C. Michelsen (2017). The market value of energy efficiency in buildings and the mode of tenure. *Urban Studies 54*(14), 3218–3238.

Knoll, K., M. Schularick, and T. Steger (2017). No price like home: global house prices, 1870–2012. *American Economic Review 107*(2), 331–353.

Kohl, S. (2017). *Homeownership, Renting and Society: Historical and Comparative Perspectives*. London: Routledge.

Kortelainen, M. and T. Saarimaa (2015). Do urban neighborhoods benefit from homeowners? Evidence from housing prices. *The Scandinavian Journal of Economics 117*(1), 28–56.

Krolzig, H.-M. (1997). *Markov-switching vector autoregressions. Modelling, statistical inference and application to business cycle analysis*. Springer Verlag.

Krumm, R. and A. Kelly (1989). Effects of homeownership on household savings. *Journal of Urban Economics 26*(3), 281–294.

Lee, D. (2016). How Airbnb short-term rentals exacerbate Los Angeles's affordable housing crisis: Analysis and policy recommendations. *Harvard Law and Policy Review 10*, 229–253.

Lerbs, O. (2011). Is there a link between homeownership and unemployment? Evidence from German regional data. *International Economics and Economic Policy 8*(4), 407–426.

Lerbs, O. and C. Oberst (2014). Explaining the spatial variation in homeownership rates: Results for German regions. *Regional Studies 48*(5), 844–865.

LeSage, J. and R. Kelley Pace (2009). *Introduction to spatial econometrics*. Chapman and Hall.

Lo, K.-T. (2012). The crowding-out effect of homeownership on fertility. *Journal of family and economic issues 33*(1), 108–117.

Lösch, A. (1944). *Die räumliche Ordnung der Wirtschaft*. Verlag von Gustav Fischer.

Malpezzi, S. (2003). Hedonic pricing models: A selective and applied review. In T. O. Sullivan and K. Gibbs (Eds.), *Housing Economics: Essays in Honour of Duncan Maclennan*. Blackwell.

Mayor of London (2015). Housing in London 2015. Greater London Authority.

McDonald, J. F. and D. P. McMillen (2011). *Urban economics and real estate: theory and policy.* John Wiley & Sons.

McKenzie, D. J., R. M. Betts, and C. A. Jensen (2011). *Essentials of real estate economics.* Cengage Learning.

Megbolugbe, I. F. and P. D. Linneman (1993). Home ownership. *Urban Studies 30*(4-5), 659–682.

Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. *The Journal of finance 32*(4), 1151–1168.

Mills, E. S. (1972). *Studies in the structure of the urban economy.* ERIC.

Mooya, M. M. (2016). *Real Estate Valuation Theory: A Critical Appraisal.* Springer Verlag.

Mumford, L. (1961). *The city in history. Its origins, its transformations, and its prospects.* New York: Harcourt Brace Jovanovich, inc.

Muth, R. F. (1975). *Urban economic problems.* HarperCollins Publishers.

Гусев, А. Б. (2008). Доступность жилья в России и за рубежом: сравнительный анализ. http://kapital-rus.ru/articles/article/dostupnost_zhilya_v_rossii_i_za_rubezhom.

Nzonzo, M. T. (2005). A critical discussion and analysis of the relevance and efficacy of the rent act vis-à-vis the impact of other housing laws governing land tenure in Zambia. University of Zambia.

OECD (2013). Definition of functional urban areas (FUA) for the OECD metropolitan database. Organisation for Economic Co-operation and Development.

О'Салливан, А. (2002). *Экономика города.* Москва: «ИНФРА-М».

O'Sullivan, A. (2008). The first cities. In *A companion to urban economics*, pp. 40–54. Blackwell Publishing.

O'Sullivan, A. (2012). *Urban economics.* McGraw-Hill International Edition.

Oswald, A. (1996). *A conjecture on the explanation for high unemployment in the industrialised nations: Part 1.* Department of Economics, University of Warwick Warwick, UK.

Phillips, P. C., S. Shi, and J. Yu (2015). Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500. *International Economic Review 56*(4), 1043–1078.

Piketty, T. and G. Zucman (2014). Capital is back: Wealth-income ratios in rich countries 1700–2010. *The Quarterly Journal of Economics 129*(3), 1255–1310.

Reinhart, C. M. and G. L. Kaminsky (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review 89*(3), 473–500.

Rink, D. and M. Wolff (2015). Wohnungsleerstand in Deutschland. Zur Konzeptualisierung der Leerstandsquote als Schlüsselindikator der Wohnungsmarktbeobachtung anhand der GWZ 2011. *Raumforschung und Raumordnung (Spatial Research and Planning) 73*(5), 311–325.

Rohe, W. M. and L. S. Stewart (1996). Homeownership and neighborhood stability. *Housing Policy Debate 7*(1), 37–81.

Rosen, K. T. and L. B. Smith (1983). The price-adjustment process for rental housing and the natural vacancy rate. *The American Economic Review 73*(4), 779–786.

Rünstler, G. (2016). How distinct are financial cycles from business cycles? *Research Bulletin 26*, 1.

Ruonavaara, H. (1993). Types and forms of housing tenure: Towards solving the comparison/translation problem. *Scandinavian Housing and Planning Research 10*(1), 3–20.

Sánchez, A. C. and D. Andrews (2011). Residential mobility and public policy in OECD countries. *OECD Journal: Economic Studies 2011*(1), 185–206.

Schwabe, H. (1868). *Das Verhältnis von Miete und Einkommen in Berlin und seine Entwicklung*. Berlin.

Shleifer, A. and R. W. Vishny (1997). The limits of arbitrage. *The Journal of finance 52*(1), 35–55.

Siliverstovs, B. (2005). The bi-parameter smooth transition autoregressive model. *Economics Bulletin 3*(23), 1–11.

Siskiö, O. (1990). Learning from tenure: an international comparison of the meaning of tenure in nine European countries — East and West. Housing evaluation. Rotterdam: CIB Proceedings, publication 118.

Speck, J. (2012). *Walkable city: How downtown can save America, one step at a time*. Farrar, Straus and Giroux.

Statistisches Amt der Stadt Berlin (1902). *Die Grundstücks-Aufnahme Ende Oktober 1900 sowie die Wohnungs- und die Bevölkerungs-Aufnahme vom 1. Dezember 1900 in Berlin und dreiundzwanzig Nachbargemeinden*. Berlin: Puttkammer und Mühlbrecht.

Statistisches Amt der Stadt Berlin (1910). *Die Grundstücks-Aufnahme vom Ende Oktober 1905 sowie die Wohnungs- und die Bevölkerungs-Aufnahme vom 1. Dezember 1905 in der Stadt Berlin und 29 benachbarten Gemeinden*. Berlin: Puttkammer und Mühlbrecht.

Statistisches Amt der Stadt Berlin (1925). *Die Grundstücks- und Wohnungsaufnahme sowie die Volks-, Berufs- und Betriebszählung in Berlin im Jahre 1925, Heft 3, Nr. 5.* Berlin: Puttkammer und Mühlbrecht.

Statistisches Bundesamt (2000). *50 Jahre Wohnen in Deutschland.* Metzler-Poeschel Stuttgart.

Statistisches Bundesamt (2013). *Erste Ergebnisse des Zensus 2011 für Gebäude und Wohnungen. Ausgewählte Daten für Gemeinden.* Wiesbaden.

Steel, C. (2013). *Hungry city: How food shapes our lives.* Random House.

Stein, J. C. (1995). Prices and trading volume in the housing market: A model with down-payment effects. *The Quarterly Journal of Economics 110*(2), 379–406.

Sveinsson, J. R. (2004). The formation of urban homeownership in Iceland. Paper presented at the ENHR 2004 Conference “Housing: Growth and Regeneration”, Cambridge, 2–6 July 2004.

Teräsvirta, T. and H. M. Anderson (1992, Suppl. De). Characterizing nonlinearities in business cycles using smooth transition autoregressive models. *Journal of Applied Econometrics 7*(S), S119–36.

Tirole, J. (1985). Asset bubbles and overlapping generations. *Econometrica: Journal of the Econometric Society 53*(6), 1499–1528.

Tong, H. (1978). On a threshold model. In C. Chen (Ed.), *Pattern recognition and signal processing.* Sijhoff & Noordhoff.

Tong, H. (1990). *Non-linear time series: A dynamical system approach.* Oxford University Press.

van Dijk, D. and P. H. Franses (1999). Modeling multiple regimes in the business cycle. *Macroeconomic Dynamics 3*(03), 311–340.

van Dijk, D., T. Teräsvirta, and P. H. Franses (2002). Smooth transition autoregressive models — a survey of recent developments. *Econometric Reviews 21*(1), 1–47.

van Heelsum, A. (2007). CLIP case study on housing in Amsterdam, The Netherlands. Report of the Amsterdam Institute for Social Science Research.

von Thünen, J. H. (1826). *Der isolierte Staat. Beziehung auf Landwirtschaft und Nationalökonomie, oder Untersuchungen über den Einfluß, den die Getreidepreise, der Reichthum des Bodens und die Abgaben auf den Ackerbau ausüben.* Hamburg.

von Thünen, J. H. (1966). *Isolated state.* Pergamon Press.

Vuchic, V. (2017). *Transportation for livable cities.* Routledge.

Wilhelmsson, M., R. Andersson, and K. Klingborg (2011). Rent control and vacancies in sweden. *International Journal of Housing Markets and Analysis 4*(2), 105–129.