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## Stimulating housing policy and housing tenure choice: Evidence from the G7 Countries

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# Stimulating Housing Policy and Housing Tenure Choice

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Eugeniya Malinskaya, Konstantin A. Kholodilin

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#### IMPRESSUM

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# Stimulating housing policy and housing tenure choice: Evidence from the G7 countries

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## Abstract

Housing affordability is a hotly debated issue on global scale. A lack of affordable housing of decent quality is a chronic problem in urban areas. Governments try to alleviate it by stimulating homeownership among middle-income households and providing social housing for the low-income households. Such policies are very costly. Thus, this study aims to assess at least tentatively the effectiveness of the policies supporting construction of affordable housing. We do this using a novel index of the governmental support of affordable housing construction. It covers G7 countries between 1919 and 2020. We conclude from our empirical analysis that governmental policy indeed positively affects homeownership rates and social housing rates. Thus, the government can contribute to the provision of the affordable housing, although the cost of this policy cannot be quantified yet.

**Keywords:** housing policy; affordable housing; homeownership rate; social housing; G7 countries; regulation indices.

**JEL classification:** K25; R38; C23; C43.

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## 1. Introduction

The housing shortage, especially of low-price dwellings, is a perennial attribute of urban areas. Urbanization contributes to the spread of this issue across the entire world. Although the market fluctuations sometimes alleviate the housing issue, it does not disappear completely. It can reappear each time a positive demand or a negative supply shock shakes the cities. Therefore, governments often intervene in the housing market, trying to improve the supply of affordable housing.

Governments apply different housing policy instruments to ensure that households, especially the low-income ones, have access to affordable housing. The toolkit of housing policy includes restrictive measures (rent control, eviction protections, and housing rationing), stimulating measures (provision of social housing, stimulation of housing construction, and provision of housing allowances), and other types of regulations, like tax and banking policy (Kholodilin, 2020). Stimulating housing policy is very costly, requiring the allocation of considerable state funds compared to, for example, rent control that costs virtually nothing to the treasury. Moreover, stimulating policies affect both owner-occupied and social rental housing. Therefore, it is important to assess the impact of stimulating policy on housing provision. The purpose of this study is to evaluate the effectiveness of the policy fostering affordable housing by analyzing its impact on the formation of the homeownership stimulation and promotion of social rental housing. The results provide insights into the strength of policy measures on property purchases and renting, while simultaneously assessing the feasibility of high government expenses.

In most countries, homeownership rates (HOR) have increased dramatically since World War II, such that homeowners now comprise a majority worldwide (Kholodilin and Kohl, 2021). The Great Recession of 2008–2009 led to a certain setback of the homeownership in some countries; see Figure 1. Interestingly, in many such countries, the rental housing sector is dominated by social housing. This is the case in European countries like Austria, Denmark, and the Netherlands (Scanlon et al., 2015). Even in the UK, with its relatively small social housing sector, it is still larger than the private rental sector. In France, the social housing sector (16% in 2011) is just marginally smaller than the private rental sector (21% in 2011). This implies that governmental support of housing construction can result in the spread of both owner-occupied and social rental housing. Germany has the smallest gap between homeownership rate



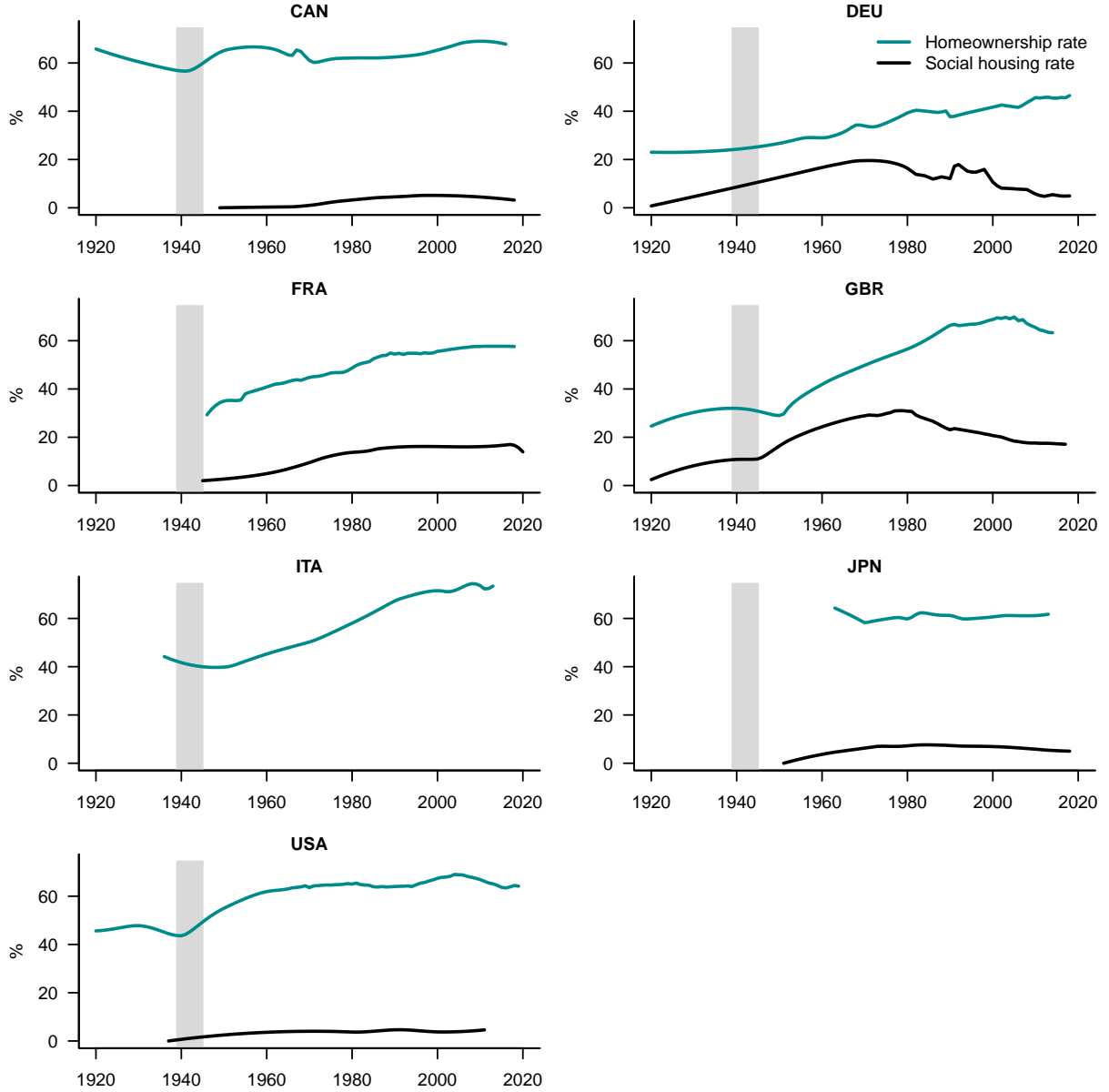
and share of social housing. Counted as one of Northern Europe’s welfare states, its approach to social housing provision differs greatly and consists of subsidizing private landlords who provide low-cost dwellings to specific population groups.

Governments tend to promote property purchases because of its positive effects on the economy and society. Homeowners tend to be the most involved in social and political processes, ensuring long-term prosperity and sustainable development of the nation ([Andrews and Sánchez, 2011](#)). Low criminal activity and relatively high rates of child education are widespread among homeowners ([Gwin and Ong, 2008](#)). However, high homeownership rates are generally associated with low labor mobility, which leads to higher unemployment, since homeowners are less likely to change their place of residence and, consequently, to change jobs ([Oswald, 1999](#)). In the 21st century, ongoing demographic aging put forward the motive of the old-age security. The homeownership formation is seen as an important complement to the already strained state pension system, since homeowners tend to have lower housing costs and can release additional means through downsizing or the letting out of their dwellings ([Doling and Ronald, 2010](#)). However, not all households are capable of becoming homeowners. Some must rely either on housing allowances or on social rental housing. Moreover, the reliance on the promotion of homeownership as an income complement for the elderly is mainly applicable in liberal welfare states ([Delfani et al., 2014](#)). Therefore, many countries also engage in promoting the affordability of the rental market, especially for the low-income population.

In order to assess the impact of the housing construction support policies, we need to quantify them. This is done here using a leximetric approach that consists of approximating individual policies by binary indices and averaging them to obtain a composite index of stimulating affordable housing construction policy. We construct such indices for G7 countries between 1920 and 2020. We also consider both options: equal weights of particular housing affordability regulation instruments and principal component analysis-based indices, which were included in regression models to assess their impact on the housing market.

The study is organized as follows. Section 2 contains a literature review highlighting the determinants of homeownership, including the role of governmental regulations. Section 3 provides a detailed account of the individual housing construction support measures and describes the algorithm for constructing a numerical index. The evolution of country-specific regula-

Figure 1: Homeownership and social housing rates in G7 countries, 1920–2020



Note: The greenish line depicts the interpolated homeownership rate, while the black line shows the interpolated social housing rate as a percentage of the total housing stock. The shaded gray areas correspond to World War II.

Sources: HORs are from [Kholodilin and Kohl \(2021\)](#) and social housing rates are from [Kholodilin et al. \(2022\)](#).

tions are outlined in section 4. Section 5 presents the econometric methods used and discusses the results of our analysis. Finally, section 6 provides a discussion emphasizing the future development of the study.

## 2. Literature review: Housing tenure determinants

Many studies investigate the choice between alternative housing tenure forms. Most concentrate on the homeownership tenure. [Kholodilin and Kohl \(2021\)](#) study the determinants of the private rental sector. We could find no study investigating the factors behind the size of the social rental housing sector. In their extensive survey of the related literature, [Zavisca and Gerber \(2016\)](#) mention only studies looking at the effects of the homeownership and social rental housing. Therefore, here, we provide an overview of the existing literature that focuses exclusively on the determinants of the homeownership in general and governmental housing policies that can affect it in particular.

### 2.1. Socioeconomic determinants

Many studies focus mainly on socioeconomic and demographic characteristics like income, age structure, and household size. The predominance of these factors lies in their paramount role in choosing the housing tenure. As the housing tenure choice topic has evolved, research has expanded the range of variables assessed. For example, [Andrews and Sánchez \(2011\)](#); [Gabriel and Rosenthal \(2005\)](#) include race, ethnicity, and immigration status, using these variables as indicators of social deprivation.

*Age structure.* First, age is positively related to ownership. Its prevalence in housing formation models draws on the life cycle concept. The theory assumes that transition from one life stage to another contributes to housing conditions changes ([Goodman et al., 2015](#)). For example, decisions to buy real estate are typical for middle-aged people possessing sufficient savings and income to pay the mortgage and cover the down payment. Meanwhile, young people have better access to private rental housing ([Andrews and Sánchez, 2011](#); [Carter, 2011](#)). In addition, the young population is characterized by increased mobility in social and labor life. As for the older generation, there are two types of research. Some studies point to a non-linear relationship between age and HOR, suggesting a shift in older people's preferences

toward alternative forms of tenure (Goodman et al., 2015). Others argue that the ability to maintain own property increases with age due to wealth accumulation (Bourassa, 1995; Fisher and Jaffe, 2003). Bourassa et al. (2015) confirm the importance of age consideration in the international context: aggregate HOR in the United States increased by 3.3 percentage points between 1960 and 1980, while the value would have increased by 7.7 percentage points had the age composition of the population remained unchanged.

*Income.* Income is also widely used to evaluate the decision to own property (Priemus and Dieleman, 2002; Gwin and Ong, 2008). Age and education level variables are usually implemented to approximate a household’s financial situation. Nevertheless, some researchers have succeeded in collecting such data over a long period. Gwin and Ong (2008) confirm the positive relationship between household income and HOR. Thus, the trend toward the dominance of the owner-occupied housing market in high-income countries is emphasized. Another finding concerning income contradicts the theoretical concepts of the property choice model (Fisher and Jaffe, 2003). The negative insignificant coefficient between income and HOR reveals no explanatory power. International macroeconomic studies consider GDP per capita and its growth as a general measure of wealth and well-being. Most commonly, GDP per capita is positively associated with homeownership rates because a better financial situation in society leads to increased property purchase intentions (Fisher and Jaffe, 2003; Gwin and Ong, 2008). Meanwhile, GDP growth is found to correlate negatively with the percentage of homeowners in the country, providing an increase in housing prices as a result of growing purchasing power and reducing the affordability of homeownership in the long run (Kholodilin and Kohl, 2021).

Moreover, Li (1997); Andrews and Sánchez (2011) use the interaction terms of income with each age group to examine the unobserved effects of lifetime wealth on households. Based on data from the US Metropolitan Statistical Areas, Li (1997) adds numerous interactions among variables for determining the probability of becoming a homeowner. For example, he considers the cross-product between real income and household size, approximating budget constraints. In turn, the interaction of income and race reflects discriminatory aspects in housing prices for the African American population.

*Affordability.* The housing price-to-rent ratio is considered to be an important determinant of tenure choice. The indicator is calculated as the ratio of the property purchasing cost to

the money obtained from renting out this dwelling (Quercia et al., 2003; Carter, 2011). The results support the idea of an inverse relationship between the homeownership rate in a country and the ratio: owning property is more expensive and less affordable than renting. Gwin and Ong (2008) obtain contradictory results that are consistent with the hypothesis of a positive relationship between the price-to-rent ratio and the homeownership rate. Rising rents, which lead to higher prices in the private sector, encourage households to choose the stability of their owned housing. The choice to purchase real estate serves as a kind of insurance against future rent volatility, predetermining costs and providing the possibility of obtaining a fixed-rate mortgage.

*Other county-level indicators.* Fisher and Jaffe (2003), applying cross-country analysis, include in the housing choice model the percentage of urban population and of government consumption as the measure of state tendency to promote financial support for housing. Moreover, the authors assess the impact of the legal system aspects based on its historical origins. An interesting example is the attempt to incorporate the categorical variables of law origin (e.g., common English law and civil law) based on the existing classification. In addition, inflation and interest rates account for intertemporal market trends affecting property prices (Andrews and Sánchez, 2011).

## 2.2. Housing policy and homeownership

Governments gain the benefits of a large variety of tools to provide effective housing market regulations. As socioeconomic factors cannot fully explain country differences and temporal variations in housing choice models, the existing literature covers credit and tax policies, financing programs for rental and affordable housing, as well as rationing instruments, looking at the characteristics and consequences of state intervention in the real estate market.

*Banking policy.* Credit constraints are widely used by governments dealing with real estate market volatility that arise as the result of housing price shocks. This policy is approximated mainly in terms of loan-to-value or down payment ratios, known as mortgage market restriction indicators. Loan-to-value (LTV) ratio is the relationship between the amount of money that borrowers can take as a mortgage and the market value of the real estate. In turn, the minimum down payment is the opposite term, which means the accumulated amount borrowers need to pay at one time to make a purchase. Wong et al. (2011), analyzing panel data from 13

countries between 1991 and 2010 years, prove that the LTV policy is effective in stabilizing the property market. Meanwhile, [Bian et al. \(2018\)](#) consider the theoretically unambiguous hypothesis of credit policies' moderation effect on house price growth. The authors argue that a higher LTV increases the probability of buying an overpriced property. Finally, [Linneman et al. \(1997\)](#) analyze the impact of borrowing constraints in conjunction with the interest rate on purchase decisions among Americans. The results show that the most significant impact on homeownership is the variation at the highest level of LTV (from 80% to 90%). The authors also find a negative relationship between interest rates and homeownership. Moreover, several studies of the young population argue that restrictions force young people to postpone the purchase of real estate to save enough money for a down payment, thereby preventing an even distribution of LTV rate across age cohorts ([Chiuri and Jappelli, 2003](#); [Goodman et al., 2015](#)).

*Tax policy.* There are several approaches to measuring tax policy in the literature. For example, [Carter \(2011\)](#) calculates the marginal tax rate of each household, taking into account its size and structure. Upward shifts in marginal tax rates increase the likelihood of homeownership as the share of additional income and the tax base become higher. [Andrews and Sánchez \(2011\)](#), based on panel data from OECD countries, add an interaction variable between tax and the maximum LTV because of the tax benefit temporal consistency. The results show a negative coefficient, highlighting the diminishing impact of borrowing constraints on mortgage market regulation in countries with generous tax incentives. Thus, tax-related measures can prevail over mortgage regulation policies and make access to homeownership for low-income families even more restricted. This finding is consistent with the concept of limited savings among the low-income population, which prevents them from making purchasing decisions. [Atterhöög \(2005\)](#), using his own indices of government ownership support policies between 1970 and 2000 for 13 countries, finds that such policies are likely to increase the HOR. His support index is based on six individual indices: direct grants for buying, other subsidies, mortgage deduction, grant tax deduction, low property tax, and homeownership allowances. Likewise, [Kholodilin et al. \(2021\)](#) construct homeownership taxation indices covering the following instruments: imputed rent tax, capital gain tax, value-added tax on new housing, and mortgage interest deductibility. The data set encompasses 37 countries and covers the period from 1910 through 2020.

*Restrictive rental housing policies.* These policies include rent control, protection of tenants from eviction, and housing rationing (Kholodilin, 2020). Most respective studies deal only with the effects of rent control. In his comprehensive review of the studies on rent control effects published in referred journals, Kholodilin (2022) shows that the absolute majority of studies (nine out of 13) conclude that rent control results in higher homeownership rates. Kholodilin and Kohl (2021), who use the numeric indices of rental housing market regulations for 15 years covering the 1910–2020 period, arrive at similar conclusions. The typical explanation is that by limiting rental yields, rent control diminishes the incentives for landlords to let dwellings. Therefore, conversions to condominium property are carried out that reduce the private rental sector. Moreover, newly built housing is also mainly aimed at the homeowners. By contrast, Gyourko and Linneman (1989) find that rent control, by offering the sitting tenants cheap housing, reduces their incentives to become homeowners.

*Stimulation of housing construction.* The impact of governmental policy fostering affordable housing construction on the formation of the homeownership is not a well-developed concept in the literature. Moreover, it can be assessed differently depending on the study focus. For example, Whitehead (1999) identifies the following types of state assistance for low-income tenants in the United Kingdom: income subsidies, rent and tax exemptions by local authorities, central government grants and corporate loans provided by housing associations, and homeowner assistance in the form of cheaper and insured mortgage loans. Meanwhile, in Germany, the concept of such housing legislation has been described as exclusively demand and affordability-driven public construction projects and programs (Scanlon et al., 2014). Fisher and Jaffe (2003) use a binary variable to estimate state financial assistance existence. They conclude that public inputs and grant schemes lead to higher HOR.

*Social housing provision.* The other type of research considers social housing provision. In this case, mainly rental housing owned by the government is addressed. Kholodilin (2017) contributes to the literature by developing a numeric index of fostering housing policy for Germany over the century 1913–2015, where social policy is defined as a set of instruments supporting the construction and maintenance of social housing as well as the federal government’s expenses for these purposes. In addition, many descriptive articles elaborate on theoretical aspect of the social housing policy, including Priemus and Dieleman (2002); Scanlon et al. (2015). The

results of the conducted literature aggregation are presented in Table 1, revealing the conceptual differences of housing markets within countries. [Kemeny \(1995\)](#) developed a classification distinguishing between unitary and dualistic systems, predetermining the future direction of social policy. Blurred boundaries between the private and public rental housing markets are common to unitary markets. In contrast, the dualistic system ensures a clear distinction between the private rental market and the tightly controlled non-profit sector. As a result of the institutional aspects of each country, the importance of social housing policy varies a lot.

Table 1: Typology of social housing in G7 countries

Country	SH providers	Subjects	Housing profile	Stigma-tization	Right to buy	Studies
Canada	1. Dualist system 2. Run by the state, non-profit housing, and cooperative organizations	The bottom two income quantiles are chosen with Core Housing Need Model	1. Compliance with standards' requirements	No	Yes (private sector)	<a href="#">Van Dyk (1995)</a>
France	1. Unitary housing system 2. Provided by central and local governments, non-profit companies (ESH)	Assistance can be directed at different income quantiles depending on program type Means tests to assess income ceiling.	1. Higher quality than in private rental sector 2. Big living spaces 3. Rental price is 40% lower than in private	No	No	<a href="#">Scanlon et al. (2014)</a>
Germany	1. Unitary housing system 2. Subsidy-related aid independent of the landlord's type 3. The major portion of funds is provided by state	Two target groups: higher income, qualified working class and increasingly elderly and fully covered assistance for low-income tenants under welfare code	1. High quality 2. Higher rental prices than the market average 3. Time restriction to SH commitments	No	No	<a href="#">Kirchner (2007)</a> ; <a href="#">Voigtländer (2009)</a>
Italy	1. Dualist system 2. Governmental, public-private financing, the non-profit sector	Low-income households. Integrated System of Funds for middle class	1. Unfavorable conditions 2. Remoted areas	Yes	Yes	<a href="#">Poggio and Boreiko (2017)</a>
Japan	1. Dualist system 2. Big share of corporate housing 3. Government supports homeownership mostly	Low-income households. Special population groups	1. Weak government support 2. Unfavorable quality and location	Yes	No	<a href="#">Hirayama and Ronald (2007)</a>
UK	1. Dualist system 2. Around 50% of social housing is provided by local governments	Median household income is less than 60% of the national average	1. High quality 2. Rental price is 60% -80% of the market level	No	Yes	<a href="#">Scanlon et al. (2014)</a>
USA	1. Dualist system 2. Provided by local (mostly) and state Public housing Authorities PHAs	Means tests for low-income families, area median income (AMI) test	1. Unfavorable conditions 2. High crime areas 3. 30% of the household income adjusted for family composition	Yes	No	<a href="#">Peppercorn and Taffin (2009)</a>

### 3. Construction of fostering affordable housing index

#### 3.1. Leximetric approach to quantifying the legislation

Leximetrics is an approach to quantifying laws used in a variety of fields, including labor market ([Adams and Deakin, 2017](#)) and shareholder protection ([Lele and Siems, 2007](#); [Siems,](#)



2008).<sup>1</sup> In most works, the concept is based on coding binary variables, which are converted subsequently into an aggregated continuous index ranging from 0 to 1. The leximetric approach is also applied to housing market regulations. The first attempt to quantify restrictive housing policies is undertaken by [Malpezzi and Ball \(1993\)](#), who developed a composite index based on the nine binary variables, including enforcement, coverage, rent setting, annual inflation rate, and tenure security. It covers 51 countries in 1991. Several later works also use cross-section of countries, omitting the time dimension ([Djankov et al., 2003](#); [Andrews and Caldera Sánchez, 2011](#)). In 2010s, the longitudinal indices, covering both countries and time, appeared. For instance, [Weber \(2017\)](#) constructs two indices (rent laws and tenure security) for 18 developed economies between 1973 and 2005, while [Kholodilin \(2020\)](#) does it for 101 countries and states between 1910 and 2020.

### 3.2. *Individual policy indices*

Here, we focus entirely on the policies that support housing construction. We do not consider governmental subsidies as housing allowances, also known as housing benefits, that are provided to landlords or to tenants in order to reduce their rental burden. The housing benefits also pursue the purpose of improving the welfare of low-income households, but they focus specifically on the demand side and not supply side as the policies supporting the housing construction. They can potentially affect the tenure structure, for they are often considered as an alternative to the social housing and can reduce incentives to become homeowners. However, measuring the housing allowance policies is a tremendous task, given a sheer variety of institutional forms and often difficult access to the statistical data.<sup>2</sup> To the best of our knowledge, there is only one study trying to measure the housing allowances that covers 31 developed countries between 2001 and 2018 using the OECD benefits and wages database ([Nelson et al., 2021](#)).

We also confine ourselves here to the analysis of the number of stimulating tools provided for

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<sup>1</sup>For more details on the application of leximetric to socio-economic analysis see a comprehensive overview by [Kholodilin and Pfeiffer \(2021\)](#).

<sup>2</sup>For example, in Germany after a reform of unemployment benefits carried out in 2005, the total amount of housing allowances and the number of households receiving them dramatically declined. However, this was not due to cuts in these benefits or reduced demand for them. The reason was that unemployment benefits started to include housing benefits.

in the legal acts. A more detailed analysis of the amount of support and the number of supported persons or households is precluded by the lack of relevant data. [Kholodilin \(2017\)](#) attempts to do it for Germany alone by estimating the real federal-planned expenditure and guarantees. The additional support provided by the federal states could not be assessed. However, for the remaining countries, we have not been able to collect enough data on the specific state spending on fostering affordable housing policy. The main reason for this is that most of such data are not in open access. When available, the information covers general spending for some period regardless of a particular program, making it impossible to assess the strength of the law's contribution. Due to varying availability of the data we managed to collect more or less complete data for Germany and the USA, but for other countries we could not gather any information at all.

To measure the intensity of governmental support on the housing market, we start by decomposing it into a set of more or less homogeneous individual policies. This approach is widely used in leximetrics. In the context of fostering affordable housing policy, such an algorithm is applied by [Kholodilin \(2017\)](#). In particular, we distinguish between the following 13 individual political measures:

1. *Provision of cheaper loans.* This policy implies that the government provides loans under favorable conditions to people or institutions willing to build houses. For example, the interest rate charged for such loans can be lower than that of the market.
2. *Provision of loan guarantees.* Under this policy, instead of providing loans, the state provides credit guarantees, meaning that if the borrower will experience difficulties paying out interests, the government takes over this responsibility and covers the borrower's obligations for the credit institution that lent the money.
3. *Provision of subsidies.* This policy measure consists of providing direct financial support to purchase own property. People under prescribed requirements are eligible to receive money from the government to spend for house buying and mortgage down payment.
4. *Exemption from fees and taxes.* For people with income under an established level, it is possible to deduct a fixed sum from the income before calculating the due tax payments. For example, all or some percent can be excluded from taxation, alleviating the burden.

5. *Sale of dwellings to tenants.* In some countries, particularly in Germany, social rental dwellings preserve their rental status forever. However, in other countries, the tenants are allowed to buy the rental housing they occupy at a lower price. It is a means of fostering homeownership formation.
6. *Restricted duration of the social status of dwellings.* This measure is also prevalent only in some countries. Germany’s social dwellings retain such status for a particular period, after which they are privatized or not classified as social housing under certain terms.
7. *Means test during the social rental contract.* In some countries, housing assistance is provided only to eligible persons. The eligibility is typically determined based on personal or household income. As a rule, a means test is conducted before the person moves into the dwelling supported by the government. However, the means test is often not carried out. Sometimes laws are enacted that require conducting such means tests. Formally, when the tenant’s income exceeds the required threshold, he must leave the dwelling. Nevertheless, expelling the tenants from social dwellings appears to be antisocial. Therefore, such tenants remain in the social dwellings. Examples include “scheefwoner” (“skewed” tenants) in Amsterdam ([Frederiks, 2016](#)), a high-income trade union boss occupying a council house in London ([Martin, 2013](#)), and a prosperous management consultant living in 75 square meter dwelling in Hamburg and paying just 440 euros per month ([Fabricius et al., 2015](#)). In France, in 2018, 3% of social tenants belonged to the 20% of the highest-income households ([Delance, 2018](#), p. 2). Similar cases are found in Italy ([Brera and Liguori, 2007](#)). Therefore, another — probably more feasible — opportunity to deal with this issue is to raise rents for tenants whose incomes are above the eligibility threshold. For instance, in the UK, this policy is known as “pay to stay” ([Scanlon et al., 2016](#)). Although such tenants can be charged a higher rent, they are still occupying social housing, thus, preventing other tenants, who need it more, from gaining access to it.
8. *Reduced down payment.* The government is allowed to set a percentage to which the down payment for housing loan is supposed to be reduced. Most frequently, mortgage down payment is decreased by approximately 20% facilitating the process of getting a loan.
9. *Deferred payments.* Under this policy measure, it is possible to postpone mortgage pay-

ments for a defined period. For instance, a borrower can purchase the property immediately and start paying a debt for it in the future. After the deferral period ends, an owner is required to start or continue paying his mortgage.

10. *Prolonged amortization periods.* By setting a prolonged amortization period for mortgage repayment, it is possible to make regular payments lower. This practice allows more people to afford property purchasing on credit.
11. *Targeting of specific population groups.* This aspect is tracked to assess a particular law prevalence among different population groups. Many laws are aimed at the low- or moderate-income population. However, some of the legislative measures considered the elderly, people with disabilities, and the homeless population.
12. *Targeting of specific regions.* This measure considers the spread of particular legal acts within the country. Most of the laws are designed to act nationwide. Nevertheless, some regulations are coming into force in specific parts of the country. For example, many US laws establish rules for particular states. Housing Preservation and Development program along with State Low-income Housing Tax credit act in New York City only.
13. *Support of the homeowners.* Governmental support of affordable housing is not just confined to the tenants. Low-income households often also obtain aid that should enable them to become homeowners.

Table [A1](#) presents the coding rules of the above mentioned variables. Each of these individual regulations is coded into a binary variable that takes the value 1 if the regulation is active in the corresponding period and 0 otherwise:

$$SH_{rt} = \begin{cases} 1, & \text{if the regulation of type } r \text{ is active in year } t \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

In such a way, 13 binary indices are constructed, each reflecting a specific dimension of governmental construction support. These indices are displayed in Appendix in Figures [A1](#) through [A13](#). The black color denotes the ones, and the white denotes the zeros. In the USA, since the

1930s, most described instruments were implemented simultaneously, while the French government gave priority to certain support measures. Since the 2000s, France has been expanding the range of fostering affordable housing construction instruments.

The information on governmental regulations is collected from various sources including official gazettes and overview articles. Table 2 reports these sources of information. It displays the number of analyzed legal acts for each country, the period under inspection, and the sources.<sup>3</sup>

Table 2: Governmental regulation information sources

Country	Number of legal acts	Period	Source
Canada	42	1919–2018	Justice Laws Website ( <a href="http://laws.justice.gc.ca/eng">laws.justice.gc.ca/eng</a> )
France	27	1928–2018	Journal Officiel ( <a href="http://journal-officiel.gouv.fr">journal-officiel.gouv.fr</a> )
Germany	38	1920–2009	Reichsgesetzblatt ( <a href="http://alex.onb.ac.at/tab_dra.htm">alex.onb.ac.at/tab_dra.htm</a> ) and Bundesgesetzblatt ( <a href="http://www.bgbl.de/">www.bgbl.de/</a> )
Italy	31	1919–2014	Gazzetta Ufficiale ( <a href="http://gazzettaufficiale.it">gazzettaufficiale.it</a> )
Japan	24	1929–2015	Hirayama and Ronald (2007)
UK	57	1921–2020	Legislation ( <a href="http://legislation.gov.uk">legislation.gov.uk</a> )
USA	75	1934–2018	Government Information ( <a href="http://govinfo.gov">govinfo.gov</a> )

### 3.3. Composite index based on simple averaging

A composite index is built to obtain a general picture of the governmental support intensity on the housing market. The easiest and the most intuitive way to obtain it is to compute it as a simple average of the individual binary variables. However, imposing equal weights on each policy may seem inappropriate. However, using different weights can be even more arbitrary unless it is based on an extensive data analysis. Therefore, we apply principal component analysis (described in section 3.4) to obtain more objective data-based estimates.

<sup>3</sup>A complete list of legislation, with descriptions and implemented tools, can be found at [https://rpubs.com/Evgenia\\_Malin/SHRI](https://rpubs.com/Evgenia_Malin/SHRI).

The composite index based on a simple average is computed as follows:

$$SHRI_t = \frac{1}{R} \sum_{r=1}^R SH_{rt} \quad (2)$$

where  $R$  is the number of binary variables and  $SH_{rt}$  is a binary index reflecting a specific individual regulation  $r$  in year  $t$ . The result is a continuous numeric index with values ranging from 0 to 1. The higher the index value, the more generous governmental support is provided to the housing market.

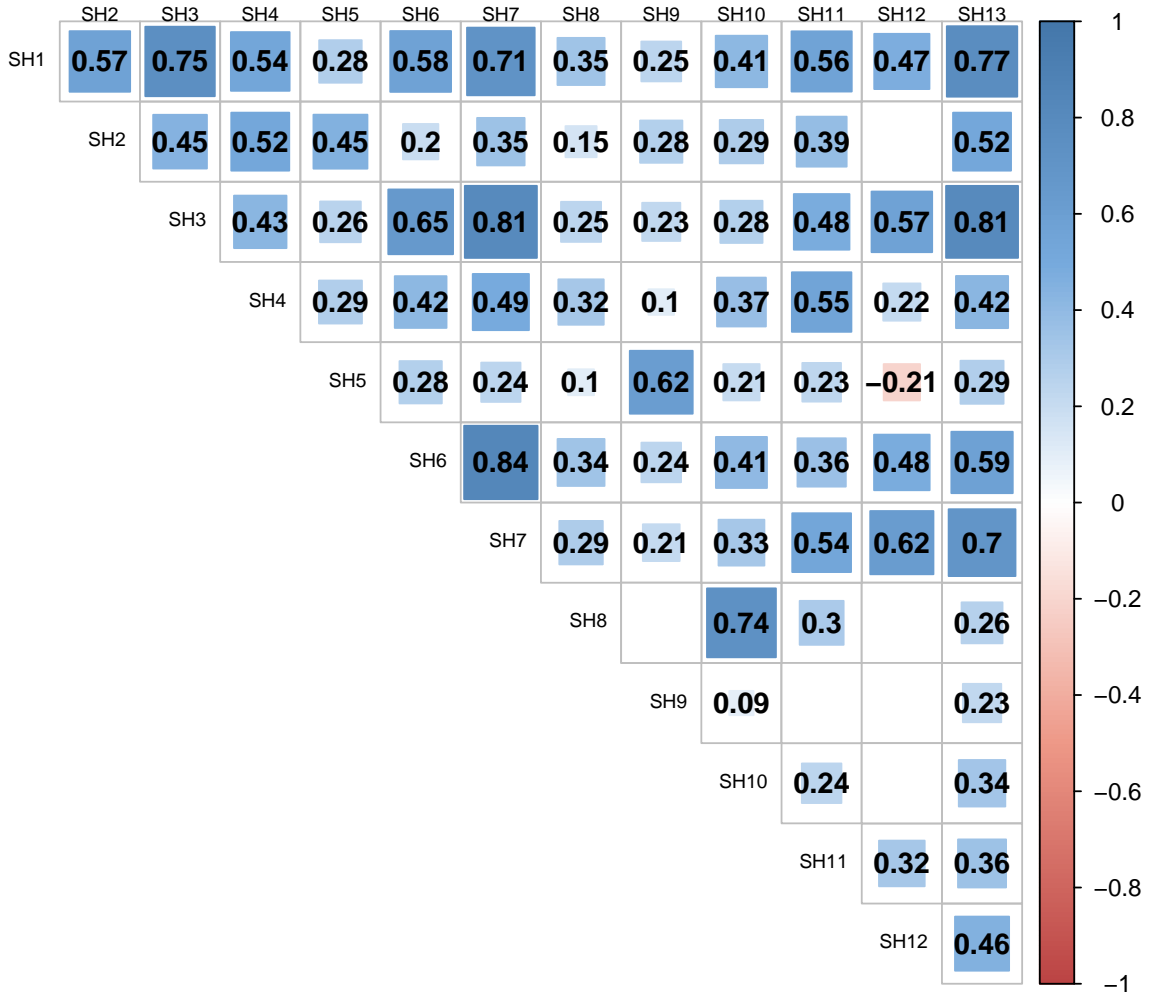
The specific binary indices characterize various aspects of governmental housing construction support policy and are not always strongly correlated with each other (see Figure 2). The highest correlations are observed between SH3 (provision of subsidies) and SH7 (means test); as well as between SH6 (restricted duration) and SH7 (means test) and SH3 and SH13 (support of the homeowners). The index SH12 (targeting specific regions) has the lowest correlations with other binary indices. It is correlated negatively with SH5 (sale to tenants). SH8 (reduced down payment) and SH9 (deferred payments) are relatively unrelated to the other indices.

### 3.4. Composite index based on principal component analysis

An alternative to simple averaging is to combine individual components using a weighted approach using the principal components analysis (PCA). This technique is already applied to the construction of other regulation indices. For example, [Nicoletti et al. \(1999\)](#) are among the first to use PCA weights based on the contribution of each variable to the total variance of the data to form a weighted average composite index. The authors assign weights to the variables that, consequently, are used to build the final indicator of employment protection legislation regulation. Thereby, they preserve the amount of data collected.

The algorithm for calculating the weighted average index of public policy on affordable housing consists of the following steps. First, the variables — instruments of affordable housing regulation policy from which the aggregate index is constructed — are normalized by subtracting country averages. It is done to eliminate the influence of national characteristics and identify principal components in the entire data set. Second, the Bartlett sphericity criterion is calculated, assessing the feasibility of identifying principal components from the data set. Testing the hypothesis that the correlation matrix of individual political instruments used to

Figure 2: Correlations between binary regulation indices



Note: The size of each square is proportional to the absolute value of the corresponding correlation coefficient. The blue color stands for a positive correlation, while the red color stands for a negative correlation. The darker the color, the higher the correlation coefficient. The correlation coefficients that are not statistically significant are not shown.

construct composite index is an identity matrix, we find that the relation between them exists, revealing the appropriateness of applying principal component analysis (Dziuban, 1974). Third, the number of components required for the most accurate data representation is determined based on the following most common rules:

- (1) The Kaiser criterion, under which all variables with eigenvalue less than 1 are dropped. The logic behind this rule is that a principal component with such a variance is less informative than the original variable.
- (2) The individual contribution of each variable to the explanation of the total variance of the data exceeds 10%, with an accumulated explained variation of at least 60% (Nicoletti et al., 1999).
- (3) Scree plot showing the eigenvalues for each individual principal component on the y-axis and the number of factors on the x-axis is a graphical tool to indicate the number of factors that should be generated. All components before the line flattens out should be selected as the principal components.

Fourth, the weights are calculated. Three relevant factors are identified under the analysis of collected stimulating affordable housing policy variables based on the combination of the rules stated above. Thereafter, these factors are used to calculate the weights of variables to construct the resulted weighted index of fostering affordable housing. According to the methodology adopted by Nicoletti et al. (1999), the weights of each variable in a component can be calculated based on the proportion of the variation explained by the principal component (i.e., the square of the factor loading). The sum of the squared factor loadings is the eigenvalue of the component, showing the proportion of variation in the entire data set:

$$w_i^{SH} = \frac{L_i^2}{\sum_{j=1}^{12} L_j^2} \quad (3)$$

where  $w_i^{SH}$  is the weight of the variable in the component and  $L_i$  is the factor loading of the variable in the component  $i$ . The constructed PCA-based index appears to be similar to the equal-weights index values with an average cross-country correlation of 0.995. However,



changing the sample may lead to biased estimates, which indicates the advantage of using a weighted index.

The approach used here to construct the indices of fostering housing policy has certain limitations. In this study, we base our indices on the formal provisions stated in the legal acts that concern the stimulating of residential construction. However, we ignore how much the government spends on supporting both owner-occupied and social rental housing. It would be more reasonable to collect data on the government spending on the implementation of a specific measure. It would allow to better estimate the efficiency of a particular policy tool and the overall policy fostering residential construction. Unfortunately, the corresponding data are lacking and often quite fragmented, given a wide variety of different support programs. Another limitation of this study is its small sample since it covers only the G7 states. Broadening the sample with the inclusion of developing countries might lead to more accurate results. Furthermore, the measures aimed at social tenants and would-be homeowners are not distinguished because they are often provided simultaneously. Thus, the same index can be “responsible” for the support of both homeowners and tenants.

#### **4. Country-specific regulations**

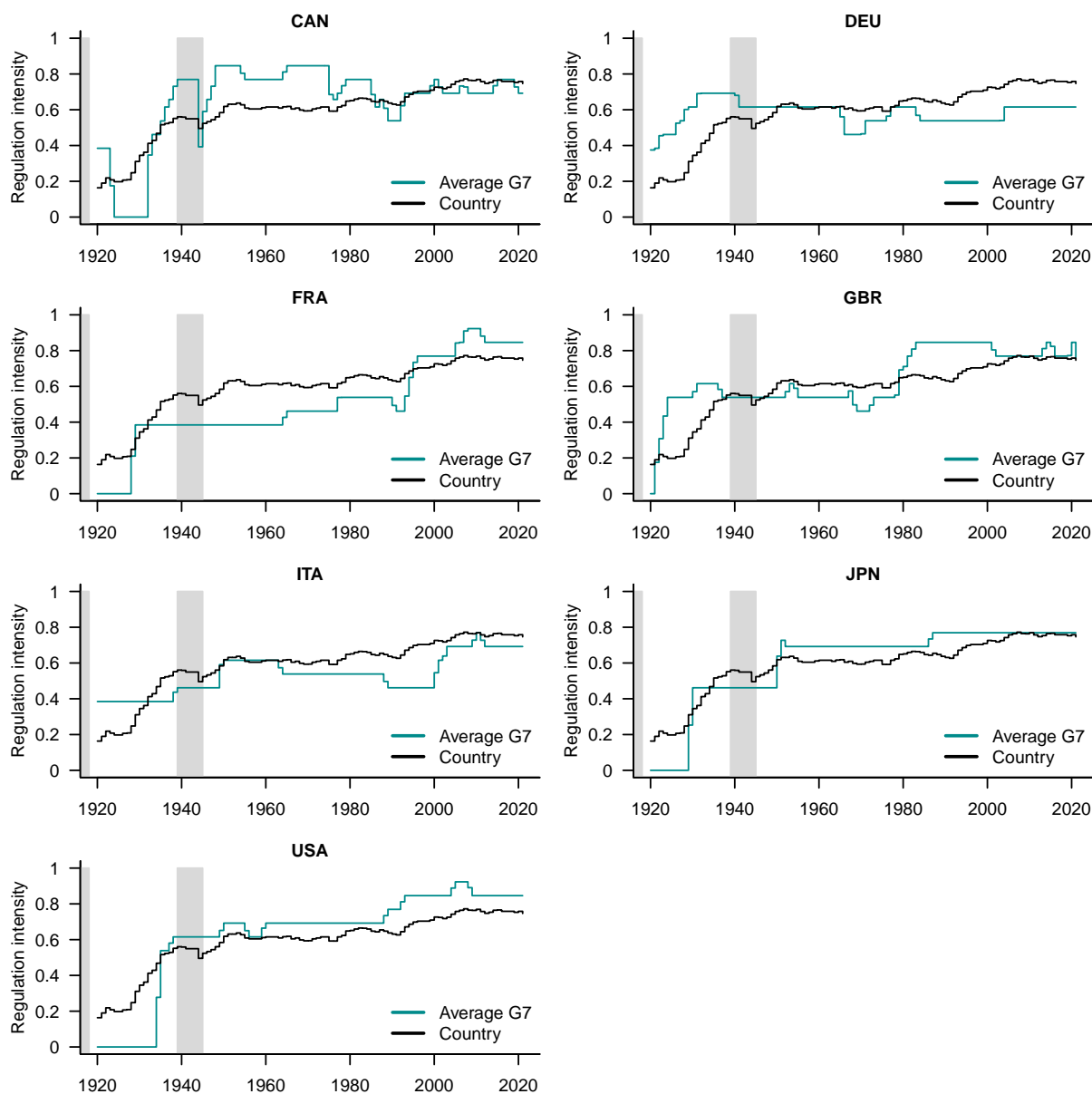
Figure 3 depicts the dynamics of the composite construction simulation index for individual countries. For example, in Canada and Japan, the regulation has remained roughly at the level of the 1920s with slight variation over the study period, while most countries have seen an increase in homeownership, peaking in the late 2000s. For its part, Germany also shows an upward trend in owner-occupancy rates. However, the overall numbers are much lower than those of the G7. In contrast, the US homeownership rate exceeded the cumulative average throughout the period.

##### *4.1. Canada*

Canada’s policy regarding housing affordability has varied widely over the period studied (see Figure 3). The diversity index ranged from 0.1 during the recovery period after the First World War to 0.83 in the mid-1970s.

The first law aimed at stimulating the housing market among the poor through subsidies was enacted in 1919. The introduction of major housing law named the Dominion Housing

Figure 3: Country-specific composite indices of housing construction incentives



Note: The black line displays the intensity of state housing construction incentives in the respective country, while the greenish line shows the same index averaged across G7 countries. The shaded gray areas correspond to both World Wars.

Act 1935 resulted in rapid index growth. Its purpose was to overcome the effects of the Great Depression through loans, subsidies, and tax breaks. By 1940, the act was reinforced through the National Housing Act of 1938 enactment.

After World War II, government policy aimed at combating shortages in the real estate market. The National Housing Act (NHA) focused on direct subsidies for construction went into force in 1944 as the most cost-effective measure to support the population. This measure remained the core regulation underlying the Canadian housing market with the subsequent amendments in 1954. However, in the early 1970s, in the face of growing state budget deficits, priority was given to concessional lending instruments. The arrival of a new Conservative government in 1985 marked the beginning of the target groups covered by legislative initiatives expansion. The decline in index values between 1978 and 1985 corresponds to the limited housing affordability among low-income population due to the government's focus on helping middle-income households. Since 1992 the government has introduced several amendments to NHA maintaining the index values at 0.75–0.8 level.

#### *4.2. France*

The dynamics of the housing affordability regulation index in France are similar to those of the United States (see Figure 3). It is especially true at the beginning of the 21st century when the index values exceeded the average for the G7 countries for the first time; a trend that remains unchanged. State participation in financing housing construction began actively in the postwar period. The government focused on overcoming the breakdown that emerged after military actions and strict rent control political track. However, the variety of support initiatives remained minimal for a long time. Since the mid-1960s, laws to provide housing allowances and long-term loans at reduced interest rates began to appear, while supply-side financing has gradually declined.

The further index growth in 1977 can be seen on the chart as several acts went into force that year. For example, Barre reform and personalized housing assistance introduced subsidizing rent loans, providing personal financial aid. In response to the growing need for housing among the poor and middle class, measures stimulating investment activity in the rental housing market began in the 1990s, resulting in significant growth of our index. The preferential mortgages law of 1993 enacted state guarantees covering the default risk of the borrower. Housing al-

lowances reached their peak by 2006 and accounted for about half of all public expenditures on housing policy, along with a maximum variety of policies implemented during this period. Since the beginning of the 21st century, 12 housing acts have been introduced that account for approximately 80% of laws collected within the investigated period.

#### *4.3. Germany*

Figure 3 also shows Germany's index of affordable housing policy. In the early 1920s, the intensity of fostering affordable housing policy increased dramatically. As a result of hyperinflation, there was an urgent need to rebuild the real estate market. Most programs provided government subsidies for construction and loan guarantees to construction companies. As an additional tool, tax deductions for mortgage interest are allowed since the 1930s.

A prolonged period of housing initiatives resumption after the Second World War is inherent to Germany. In 1950, the first housing law (WoBauG) entered into force, pioneering subsidized housing. The measure included direct financial support, combined with credit guarantees and real estate tax reductions for the general population. Until the mid-1960s, direct construction financing with the focus shifting to subsidizing the population played an important role in overcoming the housing crisis. A slight decline in the affordable housing support index in the mid-1980s might arise from the law's enforcement of compensation payments to people whose income increased during the tenancy period. At the beginning of the twenty-first century, the government significantly reduced affordable housing subsidization. Since 2006, the state stopped allocating funds, but federal and regional authorities have the option of using limited financial resources from the federal budget to provide support. The government's choice to implement support measures through alternate measures is reflected by the stable enough index since the early 1940s. Slight volatility describes the periods of augmented direct construction, income eligibility, and personal subsidization.

#### *4.4. Italy*

Figure 3 depicts the constructed index of assistance to Italy's low-income population. In the 1920s, public policies for fostering affordable housing construction in response to the movement for low-income working people began. That period's initiatives principally targeted improved housing conditions and the encouragement of ownership. The growth of the index values on the

graph in 1938 was due to the addition of implemented policy measures by the loans' provision for housing construction. The following increase in the index in 1949 corresponds to the launching of the "Ina-Casa" national plan, whose objective was to overcome the deficit in the real estate market after the Second World War. The act was supported by additional state grants for construction under the Vanoni Plan introduced in 1955. Until the 21st century, the Italian policy might be characterized as stable following the rules of already implemented laws.

At the end of the 1990s, continuous financing mechanisms termination began. However, the regions actively used residual funds from previously abolished programs. In response to the depletion of the public housing fund, the government increased alternative support initiatives, including soft loans and tax exemptions. The 2008 National Housing Plan, having drastic differences from previous policies, introduces regulation mechanisms between the public and private sectors, expanding the target groups to middle-income households. Moreover, it proposed a comprehensive funds system providing affordable housing for financially vulnerable borrowers and young families. The increase in the affordability housing regulation index reflects the launch of these initiatives.

#### *4.5. Japan*

The Japanese fostering housing affordability policy began in 1929 with the enactment of the Public Assistance and Protection Act. Thereafter, the state did not offer initiatives until the early 1950s resulting in consistent index values (see Figure 3).

In the postwar period, the country underwent a radical transformation. First, Westernization was a crucial factor in Japan's economic success internationally. Therefore, the formation and state regulation of the housing system was linked closely to construction financing and mortgage lending, similar to Western countries. The difference between Japanese policies was their focus on encouraging ownership as the core form of property in the country, even within a low-income population. The main direction was to finance mass construction, leading to economic growth, which in turn would expand the market for homeownership (Hirayama and Ronald, 2007). Second, after the end of the war, the demographic changes of society began. The influx of population into cities and the significant increase in households contributed to the growth of demand for housing, prompting the implementation of housing policy measures. Mortgage lending remained the main focus of the initiatives. However, the Government Housing

Credit Corporation (GHLC) was created in 1950, expanding the range of measures by adding direct government subsidies and tax incentives (reflected in an increase in the index value). The affordable housing policy index has remained stable up to the present due to the hollow coverage of the diversity of support measures by the GHLC.

#### 4.6. *UK*

Figure 3 also shows the evolution of the values of the stimulating affordable housing regulation index in the United Kingdom. Active regulation of the housing market began in Great Britain in the early 1920s with government subsidies for construction provision. In 1923, the Chamberlain Act was passed, which introduced several initiatives: concessional lending, mortgage guarantees, and state subsidies. In 1930 tax benefits were replaced by credit guarantees making the measures stable at a high enough level for a significant period.

In 1979, there was a significant increase in the index values. The policy of financing new construction to overcome the housing shortage was replaced by an initiative that gave tenants the right to buy social housing at a reduced price. Moreover, emphasis was centered on affordable housing, both rental and owner-occupied.

The changes in 1988 consisted of a shift in government attention from subsidizing the population to lending to housing associations. However, this policy led to minimal changes due to the parallel increase in rents and high competition between associations in the housing market. State subsidies to stimulate supply on the market increased in the late 2000s, with the start of the state program “Decent Housing” to improve the condition of the affordable housing stock. As of 2022, most subsidies focus on rental assistance and homeownership upgrades. The decline of index values in 2021 might be caused by the shared ownership and affordable housing program (SOAHP 16-21) termination.

#### 4.7. *USA*

The highest diversity of support measures for low-income people in the United States was in the mid-2000s, well above the G7 average (see Figure 3).

Nevertheless, fostering affordable housing construction policies began in the mid-1930s in response to the outbreak of the Great Depression, the most acute period of which occurred in 1929–1933. The first federal housing law, drafted in 1934, provided mortgage insurance and

financing for the housing stock modernization. The initiative was superseded by the National Housing Act of 1937, which expanded the previous supportive measures by providing tax credits. Moreover, Section 8 of that legislation included a voucher program for low-income households to cover rent or property purchases. The National Housing Act of 1949 became the benchmark for mortgage legislation, expanding the federal government’s role in insuring and lending. The increase in the regulatory index by 1950 reflects this change.

A key tool in the affordable rental housing development was the Low-Income Housing Tax Credit (LIHTC) program, created as part of a 1986 change in the federal tax code. The program involves income tax reductions for investors in rental housing for low-income families. Since the late 1990s, local housing regulators have been free to act without direct federal oversight. Many initiatives went into effect in 2007, the most important of which is a program providing grant funding for capital investments in the projects of the successful LIHTC program.

## 5. Estimation technique and results

### 5.1. Regression models

Given the longitudinal nature of the data, we use panel data models to assess the potential impact of housing policy on the homeownership rate and social rental housing. First, we estimate fixed-effects models with PCA-based stimulating index accounting for country-specific characteristics. Subsequently, in order to verify the consistency of the results we estimate models with time-fixed effects that reflect global economic shocks. For example, the formation of a favorable macroeconomic environment within analyzed countries potentially contributes to the increasing appeal of real estate acquisition in the first half of the 2000s ([Andrews and Sánchez, 2011](#)). It is especially relevant for the G7 countries because of the frequent joint decisions affecting the political course and budget allocation. The first lags of explanatory variables are included in all models to alleviate the problem of the potential endogeneity. Although the panel data analysis has the advantage of accounting for country characteristics, meeting the missing significant variables issue, there is a reason for endogeneity in our sample. A simultaneity, being the mutual influence of the dependent variable and the explanatory variable, can cause this issue. For example, in this study, government housing policy affects the share of owner-occupied and rental housing. In turn, the HOR might impact state decisions to stimulate

affordable housing construction and enhance the availability of property purchases. Indeed, strong homeowner or tenant communities can effectively lobby the policies that favor them.

The general model for  $N$  observations and  $T$  periods is defined as follows:

$$y_{it} = X'_{it-1}\beta + u_i + \varepsilon_{it} \quad (4)$$

where  $y_{it}$  is the dependent variable (interpolated HOR or interpolated social housing rate);  $X_{it}$  is the  $k \times 1$  vector of the explanatory variables in year  $t$ ;  $\beta$  is the  $k \times 1$  vector of parameters estimated;  $u_i$  is the country fixed effect; and  $\varepsilon_{it}$  is the error term.

A battery of specification tests was conducted. The null hypothesis of the Breusch-Pagan test that there is no heteroskedasticity in the residuals of the regression models is rejected. For example, changes in homeownership rates due to external economic shocks may be least perceptible for countries with enough high housing support index. The Breusch-Godfrey autocorrelation test is applied because the macro-panels over a long time are analyzed. The rejection of the null hypothesis at the 1% significance level ( $p\text{-value} < 0.01$ ) reveals the presence of serial correlation. Therefore, the significance of the coefficients and errors is accounted for using the Arellano correction. These corrections lead to a decrease in the significance of the results. However, it helps obtaining consistent estimates that are simultaneously robust to heteroscedasticity and autocorrelation of residuals.

## 5.2. Regression variables

This section describes the dependent and explanatory variables used in the models. Table 3 reports descriptive statistics of all the variables included in our regression analysis. The first column includes a code for each variable in the data set, while the second column contains a detailed definition of the variable. The third column indicates the data sources. The remaining columns report various descriptive statistics.

Table 3: Descriptive statistics of dependent and explanatory variables for G7 states

Code	Variable	Source	N	Min	Mean	Max
HOR	Homeownership rate, %	<a href="#">Kohl (2017)</a> , Compendium of Housing Statistics of the UN, national statistical offices	232	23	55.7	74.3
Soc_housing	Share of social housing, %	<a href="#">Kholodilin et al. (2022)</a>	121	0	14.6	31
TI_imprint	Imputed rent tax index	<a href="#">Kholodilin et al. (2021)</a>	744	0	0.7	1



...continuation

Code	Variable	Source	N	Min	Mean	Max
TI_deduct	Interest deduction index	<a href="#">Kholodilin et al. (2021)</a>	744	0	0.5	1
TI_capgain	Capital gain tax index	<a href="#">Kholodilin et al. (2021)</a>	755	0	0.6	1
TI_VAT	Index of value added tax on new housing	<a href="#">Kholodilin et al. (2021)</a>	763	0	0.7	1
Tax_index	Tax attractiveness index	<a href="#">Kholodilin et al. (2021)</a>	744	0	0.6	1
Rent_laws	Rent control index	<a href="#">Kholodilin (2020)</a>	854	0	0.4	1
SHRI	Housing construction support index	own construction	854	0	0.5	0.9
DLGDP_PC	Growth rate of GDP per capita, %	Maddison	833	-71.1	1.9	40.4
pop	Population, million persons	Maddison	840	5.4	74.1	327.8
Pop_0014	Share of young population, %	World Bank	399	12.9	20.6	33.9
Pop_1564	Share of working-age population, %	World Bank	399	58.4	65.6	69.8
Urb_growth	Urban population growth rate, %	World Bank	522	-1.6	1.5	10.4
LTIR	Long-term interest rate	Macrohistory and OECD	834	-0.1	5.6	20.2
Debt2GDP	Government debt-to-GDP rate, %	Macrohistory	792	5.0	64.5	253.5
HP_combined	Housing price index, 2010=100, %	BIS; FRBD; Macrohistory; OECD	787	0	33.8	183.0
P2R_combined	Price-to-rent ratio index, 2010=100, %	BIS; FRBD; Macrohistory; OECD	768	0	77.4	478.4

Notes: *N* stands for the number of observations, while Min and Max stand for the minimum and maximum, respectively. BIS denotes [Bank of International Settlements](#); FRBD stands for the [International House Price Database of the Federal Reserve Bank Dallas](#); Macrohistory is the database of the [MacroFinance and MacroHistory Lab](#); Maddison denotes the [Maddison Project Database](#); OECD stands for [Organization for Economic Cooperation and Development](#); and World Bank denotes [World Bank Open Data](#).

The dependent variables are the homeownership rate and the social housing rate. The HOR is interpolated due to numerous missing observations for the period under study, especially in 1920–1940s. Interpolation was done using the function *stinterp* included in the *stinepack* library of the **R** programming language using the Stineman algorithm ([Stineman, 1980](#)).<sup>4</sup> As a result, we were able to extend the sample from 232 to 613 observations, with approximate preservation of the initial variable average values. Similarly, the social housing rate has been interpolated using the same approach.

The housing regulation indices cover three groups of tools: 1) housing construction support (SHRI); 2) rent control (Rent\_laws); and 3) tax treatment of homeowners (composite index Tax\_index and individual binary indices TI\_imprint, TI\_deduct, TI\_capgain, and TI\_VAT). The first index is the indicator of the degree of governmental support to the residential construction developed in this study. Rent control variable is a composite index constructed by

<sup>4</sup>For more details on this procedure see [Kholodilin and Kohl \(2021\)](#).

Kholodilin (2020) and varying between 0 (no rent control) and 1 (rent freeze in the whole country). The tax treatment index is a composite index suggested in Kholodilin et al. (2021) and ranging between 0 (tax treatment not beneficial to homeowners: only taxes and no deductions) and 1 (tax treatment beneficial for homeowners). This index is computed as a simple average of the four binary indices.

### 5.3. Estimation results

The estimation results of our preferred models are reported in Table 4. The difference between the models lies in the set of control variables: while the first two models include composite taxation index, remaining models reported in the table use the individual tax indices instead of the composite homeownership tax treatment index.

The coefficients of the main explanatory variable — the affordable housing state regulation index (SHRI\_w) — generally point in the expected direction. It positively affects homeownership rate. Hence, an increase in governmental support in promoting housing affordability leads to an increase in housing acquisition by private households. The coefficient of 15.5 at the affordable housing regulation index variable implies that with a 0.01 increase in the initial index value, the share of homeowners would increase by an average of 0.155% in a year, other things being equal. There is a similar pattern in social housing models. The constructed index positively affects the social housing share but to a lesser extent than the homeownership rate.

We also considered other housing policy tools, such as rent control (Rent\_laws) and the tax treatment of the homeowners (Tax\_index). Rent control index has expected signs — negative for the HOR and positive for the social housing — but turns out to not be statistically significant in models presented in Table 4.

The composite tax treatment index is statistically significant only in the homeownership model. It exerts a negative impact, which can be interpreted as follows: by providing more tax incentives the government can simultaneously reduce its assistance due to the limitedness of its fiscal resources. The individual tax treatment tools appear to have mixed effects. The absence of the capital gain tax and the availability of mortgage deductions also decreases the HOR; while the absence of the imputed rent tax exerts a statistically significant positive effect on homeownership. The former two effects are rather counterintuitive since the provision of

Table 4: Estimation results of country fixed-effects panel data models: weighted stimulative housing policy index

Control variables	Dependent variable:			
	HOR_interp	Soc_hous_interp	HOR_interp	Soc_hous_interp
SHRI_pca_lag1	15.483* (6.281)	8.444** (2.974)	15.495*** (3.951)	8.996* (3.304)
Rent_laws_lag1	−5.144 (4.680)	0.206 (1.309)	−3.497 (3.228)	1.024 (1.169)
Tax_index_lag1	−4.568* (2.033)	1.312 (2.622)		
TI_capgain_lag1			−4.952* (2.289)	0.513 (0.615)
TI_deduct_lag1			−2.206** (0.782)	1.386 (1.472)
TI_imprent_lag1			4.101• (2.142)	−0.423 (1.762)
TI_VAT_lag1			2.013 (1.832)	−1.821 (1.621)
DLGDP_PC_lag1	−9.067 (6.079)	6.894• (3.592)	−8.254 (5.273)	7.448** (2.642)
LTIR_lag1	0.081 (0.215)	0.131 (0.155)	−0.081 (0.159)	0.197 (0.169)
Debt2GDP_lag1	−0.085* (0.038)	0.082*** (0.011)	−0.068• (0.035)	0.077*** (0.011)
HP_combined_lag1	0.043 (0.034)	−0.116*** (0.015)	0.019 (0.035)	−0.091*** (0.025)
P2R_combined_lag1	−0.041 (0.032)	0.143*** (0.016)	−0.009 (0.034)	0.118*** (0.025)
Urb_growth_lag1	−0.638 (0.667)	−1.048** (0.386)	−0.733 (0.705)	−0.789• (0.455)
Pop_1564_lag1	−0.872** (0.333)	0.714** (0.248)	−0.831* (0.364)	0.732*** (0.198)
Pop_0014_lag1	−1.013*** (0.276)	0.347* (0.149)	−1.066** (0.345)	0.454** (0.140)
Country fixed effects	✓	✓	✓	✓
Adjusted $R^2$	0.628	0.719	0.701	0.635
Num. obs	392	322	392	322

Robust standard errors in parentheses; •p<0.1; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001.

additional tax incentives to those households considering the purchase of their homes or already owning homes is expected to increase the homeownership rate.

The choice of macroeconomic control variables included in our models is based on the literature. The growth rate of GDP per capita (DLGDP\_PC) characterizes the overall dynamics of well-being. It is expected that faster growth of the economy should increase demand for housing and allow both private households to purchase homes and the government to support housing construction. However, the coefficient is insignificant — differences in income (GDP) across countries have little power in explaining homeownership rates (in line with [Fisher and Jaffe 2003](#)). In turn, social housing share is unexpectedly positively affected by the GDP per capita growth.

The long-term interest rate (LTIR) reflects the cost of the borrowed capital. It appears to be statistically insignificant when used to explain the homeownership, which is in line with the findings of [Painter and Redfearn \(2002\)](#). It also does not have significant results in the social housing models.

The government debt-to-GDP ratio (Debt2GDP) is directly related to fiscal policy. When fiscal policy is expansionary, the government borrows money from the credit market to finance its increased expenditure. In part, this money is used to encourage social housing construction. At the same time, by borrowing money, the government crowds out the private investors (for example, households) since it exhausts the limited pool of credit resources. Therefore, the demand for own homes decreases.

The impact of two price variables is also considered: housing price growth (HP\_combined) and housing price-to-rent ratio (P2R\_combined). The first variable indicates how expensive dwellings are. It seems to have a statistically significant impact on the social housing rate. Rising housing prices make it more difficult for the government to purchase or finance the construction of social housing. The price-to-rent ratio measures the speculative component of the housing prices. It also approximates the inverse of the yields of rental dwellings. Lower rental yields make it less attractive for private landlords to let out dwellings. Therefore, the government must step in to provide the missing housing to low-income households.

The urbanization rate (Urb\_growth) reflects the relative growth of the urban population. It appears to have no impact on the HOR, but a negative statistically significant effect on the

social housing rate.

The shares of population aged 15–64 and under 14 years old (Pop\_1564 and Pop\_0014, respectively) reflect the impact of demographic factors on the aggregate demand for housing. The coefficients have negative statistically significant impact in homeownership models, but positive impact in social housing models. However, these effects almost disappear when year fixed effects are included into the models (see Table 5).

The above findings are robust under the specifications presented in Table A2, where the PCA-based index is replaced with the simple average index of fostering affordable housing. The result with considered time fixed effects (see Table 5) are also consistent in the social housing models. However, the impact of fostering the affordable housing index on the homeownership rate becomes statistically insignificant. Although the signs of coefficients remained unchanged; in the social housing models, the size of the coefficients of government fostering affordable housing policies became larger than that of the corresponding coefficients in the homeownership models. The findings also do not change qualitatively, when only country-fixed effects are used, as seen in Table A2.

Table A3 reports the estimation results for models using binary individual indices of construction stimulation policies instead of the composite index, *SHRI*. For example, the provision of loan guarantees (SH2) stimulates homeownership considering both year and country fixed effects. Moreover, the provision of subsidies (SH3) has an unexpected effect in the homeownership model, while it negatively affects the social housing rate. The possible explanation for these results is that households save money received from the government to make mortgage down payments in the future. Targeting the specific population (SH11) has a positive statistically significant impact in all considered models. It allows a wider range of the population to receive government support, thereby stimulating homeownership and the rental housing market.

## 6. Conclusion

In this study, based on the legal acts, we develop a numeric index of the policy fostering residential construction for the G7 states between 1919 and 2020. The purpose of the index is to approximate the degree of governmental support of those middle-income households desiring to become homeowners and the low-income households that need affordable rental housing. The

Table 5: Estimation results of panel data models with country and time fixed effects: weighted stimulative housing policy index

Control variables	Dependent variable:			
	HOR_interp	Soc_hous_interp	HOR_interp	Soc_hous_interp
SHRI_pca_lag1	0.635 (3.338)	10.658*** (2.467)	1.439 (2.656)	9.767*** (2.276)
Rent_laws_lag1	−6.963* (3.256)	1.992* (0.856)	−4.361** (1.452)	2.251** (0.781)
Tax_index_lag1	−0.357 (1.774)	1.862 (6.222)		
TI_capgain_lag1			−5.264** (1.871)	−0.393 (0.470)
TI_deduct_lag1			0.677 (1.445)	1.643 (1.426)
TI_imprent_lag1			4.253* (1.731)	−0.407 (1.926)
TI_VAT_lag1			3.884** (1.436)	−0.291 (1.535)
DLGDP_PC_lag1	−9.718• (5.397)	0.936 (4.416)	−7.866 (5.618)	0.952 (3.354)
LTIR_lag1	−0.246 (0.299)	0.636** (0.227)	−0.046 (0.321)	0.625** (0.197)
Debt2GDP_lag1	−0.068* (0.030)	0.078*** (0.014)	−0.071** (0.021)	0.078*** (0.016)
HP_combined_lag1	−0.101** (0.038)	−0.095*** (0.023)	−0.071* (0.028)	−0.078** (0.029)
P2R_combined_lag1	0.045 (0.032)	0.151*** (0.017)	0.043 (0.027)	0.124*** (0.025)
Urb_growth_lag1	−0.884• (0.529)	−1.253*** (0.618)	−1.117• (0.606)	−1.116** (0.593)
Pop_1564_lag1	−0.439 (0.507)	0.245 (0.540)	−0.733• (0.392)	0.496* (0.209)
Pop_0014_lag1	0.561 (0.471)	−0.268 (0.516)	0.099 (0.384)	0.249 (0.232)
Country fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Adjusted $R^2$	0.203	0.661	0.365	0.535
Num. obs	392	322	392	322

Robust standard errors in parentheses; •p<0.1; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001

index covers the main instruments used as support measures, including loans, subsidies, and tax incentives, then estimates the extent of prevalence among respective demographic groups.

The analysis of the housing legislation shows the emergence of the relevant initiatives in the 1920s, followed by a postwar years intensification to combat the acute housing shortage. The process of active privatization at the end of the 20th century reduced the variety of support measures. The situation changed in the late 2000s when the financial crisis and rising real estate prices renewed the need for assistance to the poor and the implementation of numerous programs to combat homelessness.

The overall fostering policy index is used in the panel-data models to assess the impact of such policies on the homeownership formation and the social housing rates. The estimation results show that fostering policies positively affect both these rates, although not in all specifications. This means that the government achieves its goals. However, the relation between the incurred costs and obtained results is still unknown, given that our indices measure only potential support and not the actual expenses. Moreover, the role of construction simulation policy has wider implications than simply fostering the homeownership or providing affordable housing to the poor. This policy is also used as a countercyclical measure, since the construction sector can serve as a motor for the overall economic recovery. In such cases, the governmental support to builders of both owner-occupied and social housing can complement the weak private spending and help the economy to overcome the recession. In addition, both policies supporting the homeownership and those promoting the social housing have indirect impacts on the income and wealth inequality (Foster and Kleit, 2015; Heylen and Haffner, 2012). Therefore, given the complexity of measuring the policy costs and the variety of its social outcomes, the evaluation of the effectiveness of policies fostering housing construction should be left for the future research.

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## Appendix

Table A1: Rules of coding binary variables

Code	Short name	Coding rule
SH1	Provision of cheaper loans	1, if loans with lower fixed interest rate are provided
SH2	Provision of loan guarantees	1, if the state provides guarantees to take over the obligations of debtor in case he cannot fulfill them
SH3	Provision of subsidies	1, if the state provides grants and subsidies
SH4	Exemption from fees and taxes	1, if the tax burden is reduced by exempting from fees and taxes
SH5	Sale to tenants	1, if tenants can purchase the rental social dwelling at a lower price
SH6	Restricted duration	1, if the social dwelling keeps its status without time limitations
SH7	Means test during the contract	1, if during the social rental contract duration the means of tenants are not tested
SH8	Reduced down payment	1, if by the provision of loans the own capital proportion is reduced or LTV is increased
SH9	Deferred payments	1, if the possibility is provided to start amortizing the mortgage loan after a certain period
SH10	Prolonged amortization periods	1, if a longer amortization period for the mortgage loan is provided
SH11	Targeting of specific population groups	1, if the support extends to wider segments of the population than only low-income households
SH12	Targeting of specific regions	1, if the support is provided in all the regions of the country
SH13	Support of the homeowners	1, if the support is provided not only to rental but also to the owner-occupied housing

Table A2: Estimation results of panel data models country fixed-effects: equal weights stimulative housing policy index

Control variables	Dependent variable:			
	HOR_interp	Soc_hous_interp	HOR_interp	Soc_hous_interp
SHRI_lag1	16.608*	8.127**	15.059**	9.396**
	(6.615)	(2.962)	(4.706)	(3.075)
Rent_laws_lag1	−4.827	0.136	−3.536	1.033
	(4.791)	(1.206)	(3.410)	(1.192)
Tax_index_lag1	−4.414*	1.867		
	(2.136)	(2.861)		
TI_capgain_lag1			−4.596•	0.932
			(2.570)	(0.658)
TI_deduct_lag1			−2.056**	1.435
			(0.701)	(1.565)
TI_imprent_lag1			3.776•	−0.516
			(2.138)	(1.824)
TI_VAT_lag1			1.819	−2.038
			(2.032)	(1.446)
P2R_combined_lag1	−0.041	0.144***	−0.014	0.118***
	(0.029)	(0.016)	(0.034)	(0.025)
DLGDP_PC_lag1	−8.082	7.245•	−7.319	7.847**
	(6.104)	(3.775)	(5.391)	(3.018)
LTIR_lag1	0.122	0.138	−0.035	0.226
	(0.201)	(0.155)	(0.140)	(0.169)
Debt2GDP_lag1	−0.078*	0.084***	−0.064•	0.079***
	(0.036)	(0.012)	(0.035)	(0.011)
HP_combined_lag1	0.045	−0.115***	0.025	−0.091***
	(0.033)	(0.015)	(0.035)	(0.026)
Urb_growth_lag1	−0.594	−1.002*	−0.693	−0.729
	(0.652)	(0.411)	(0.682)	(0.470)
Pop_1564_lag1	−0.776*	0.745**	−0.753•	0.779***
	(0.347)	(0.273)	(0.388)	(0.215)
Pop_0014_lag1	−0.949***	0.367*	−0.998**	0.496***
	(0.272)	(0.157)	(0.383)	(0.134)
Country fixed effects	✓	✓	✓	✓
Adjusted $R^2$	0.632	0.709	0.693	0.745
Num. obs	392	322	392	322

Robust standard errors in parentheses; •p<0.1; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001

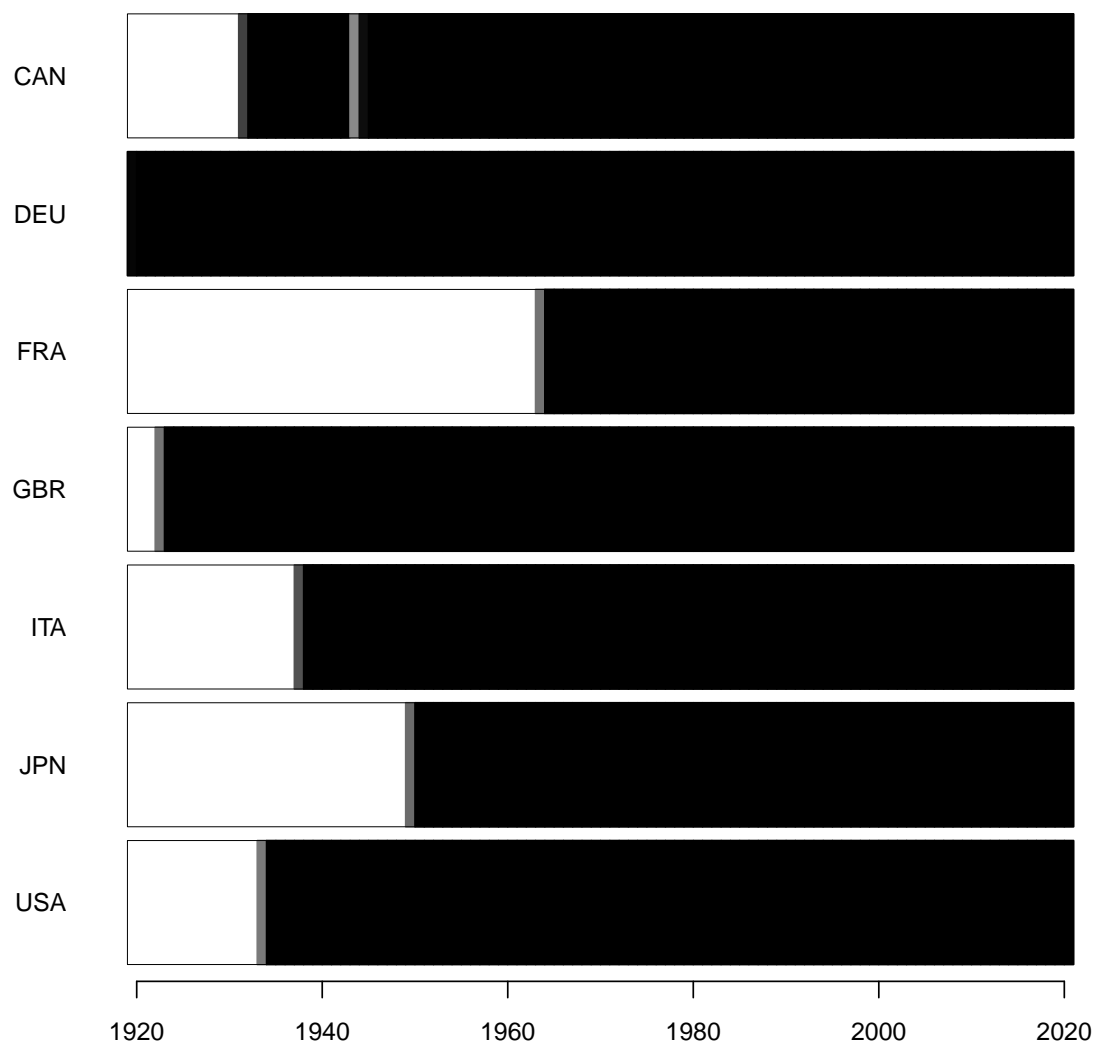
Table A3: Estimation results of panel data models with individual stimulation policy indices and with country and time fixed-effects: weighted stimulative housing policy index

Control variables	Dependent variable:			
	HOR_interp	Soc_hous_interp	HOR_interp	Soc_hous_interp
SH1_lag1	−1.239 (2.039)		−3.418 (2.614)	
SH2_lag1	5.296** (2.421)	0.497 (0.622)	4.033* (2.081)	1.473* (0.848)
SH3_lag1	−3.972*** (1.378)	−1.521*** (0.380)	−3.404* (1.734)	−1.598*** (0.536)
SH4_lag1	−2.591 (2.121)	−0.979 (0.617)	−2.178 (2.257)	−1.047** (0.493)
SH5_lag1	−1.261 (2.060)	1.268 (0.946)	−3.529*** (1.143)	1.678** (0.787)
SH6_lag1	0.350 (1.449)	−2.559** (1.013)	−0.329 (1.481)	−2.826*** (0.758)
SH7_lag1	0.294 (1.395)	1.194* (0.708)	1.975 (1.234)	1.409* (0.721)
SH8_lag1	−0.365 (0.479)	0.641 (0.576)	−3.266*** (0.986)	1.494*** (0.561)
SH9_lag1	2.417** (1.172)	−0.239 (0.669)	−0.043 (1.173)	0.414 (0.754)
SH10_lag1	3.432*** (0.573)	1.677 (1.040)	2.093** (1.034)	2.464*** (0.948)
SH11_lag1	4.356*** (1.069)	2.323** (0.924)	5.004*** (0.840)	2.152** (0.899)
SH12_lag1	−3.088 (1.889)	2.000 (1.234)	−0.754 (1.444)	−0.349 (0.796)
SH13_lag1	−2.528 (2.352)	−2.198*** (0.589)	−0.905 (1.881)	−3.014*** (0.833)
Rent_laws_lag1	−4.060 (3.476)	−0.411 (1.019)	−5.655** (2.455)	1.363* (0.818)
Tax_index_lag1	−5.078 (3.970)	2.475 (1.832)	−4.328*** (1.470)	3.749*** (1.056)
Macroeconomic control variables	✓	✓	✓	✓
Country fixed effects	✓	✓	✓	✓
Time fixed effects	—	—	✓	✓
Adjusted $R^2$	754	740	465	699
Num. obs	392	378	392	378

Robust standard errors in parentheses; •p<0.1; \*p<0.05; \*\*p<0.01; \*\*\*p<0.001

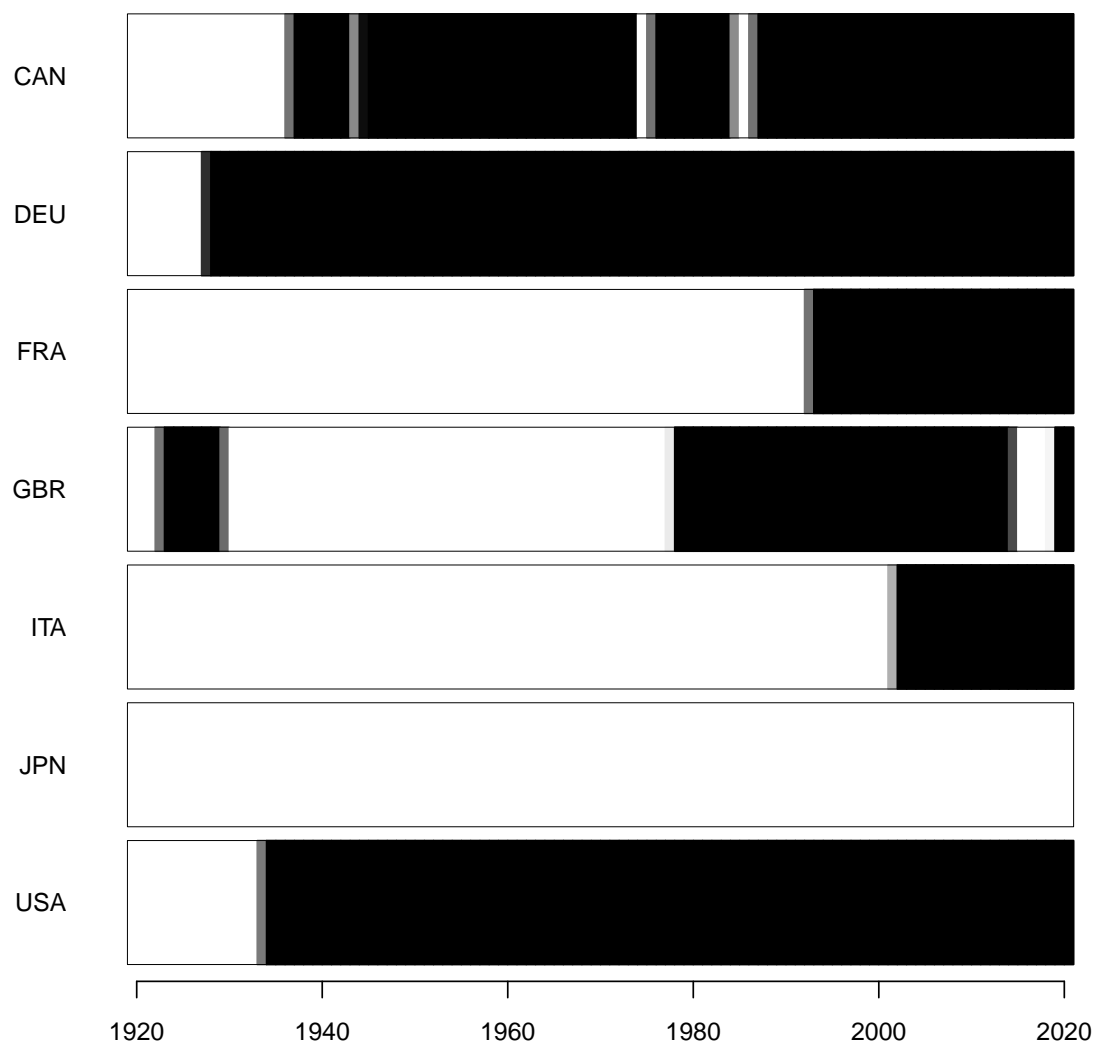


Figure A1: Provision of (cheaper) loans, 1920–2020



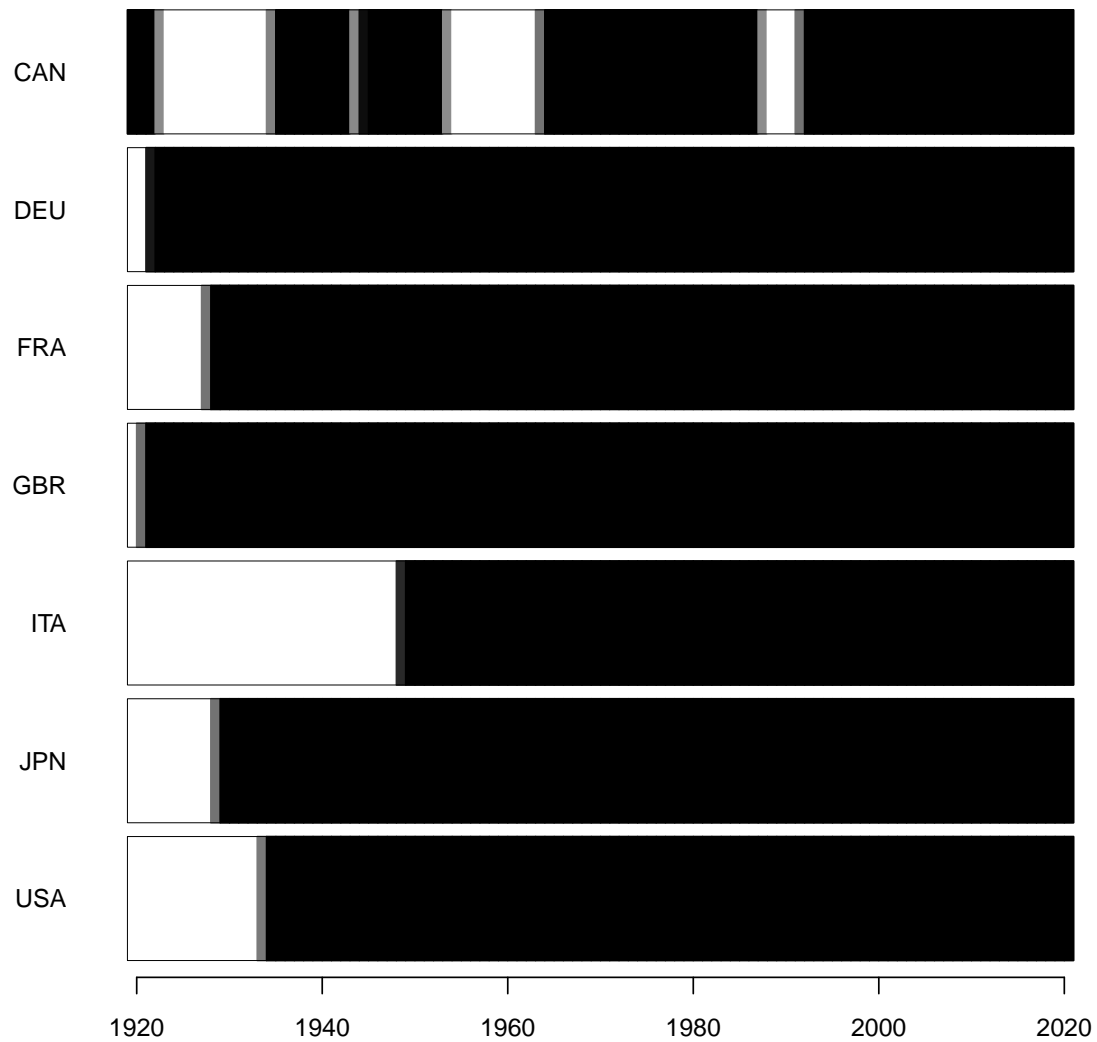
Note: Darker shading stands for a more generous housing construction support.

Figure A2: Provision of loan guarantees, 1920–2020



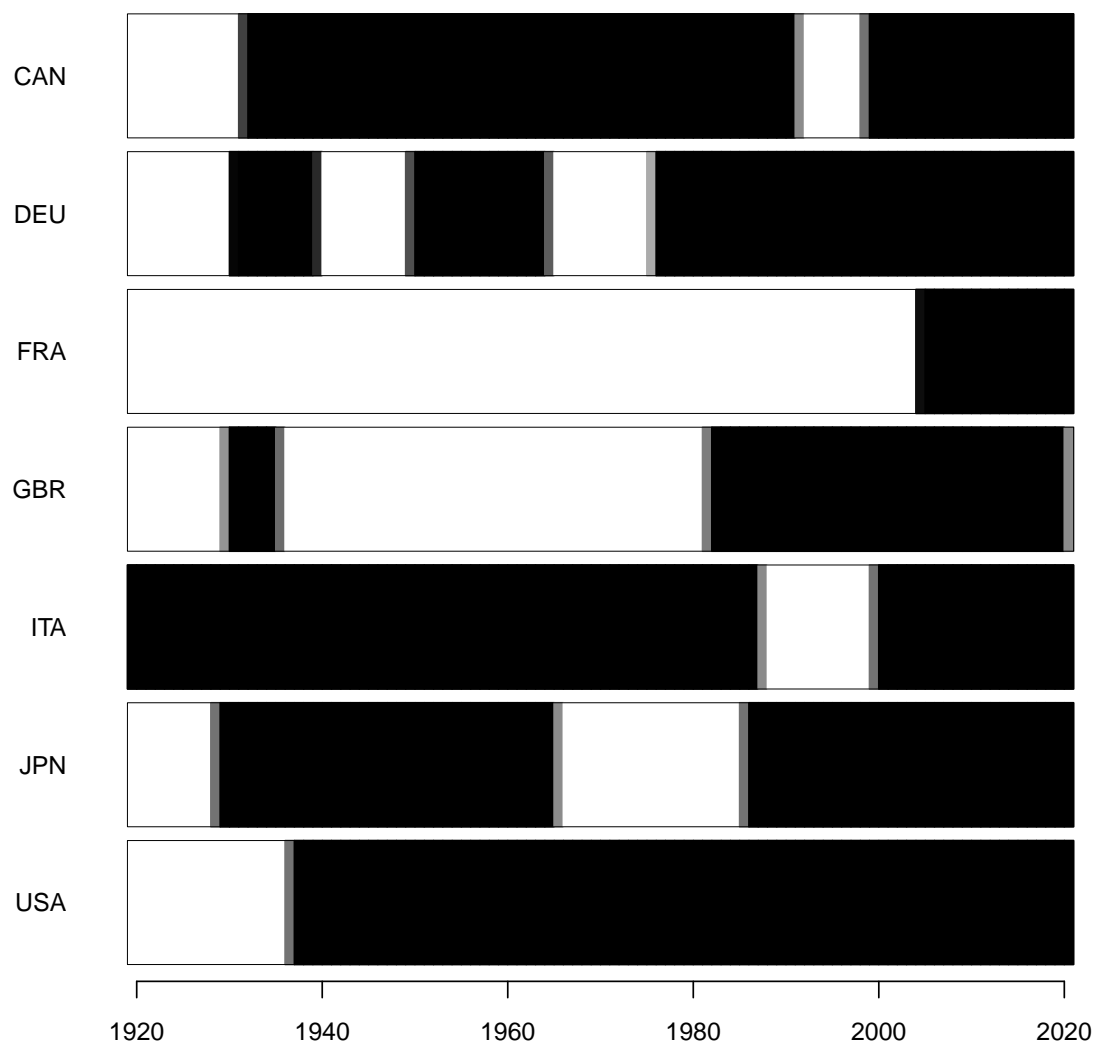
Note: Darker shading stands for a more generous housing construction support.

Figure A3: Provision of subsidies, 1920–2020



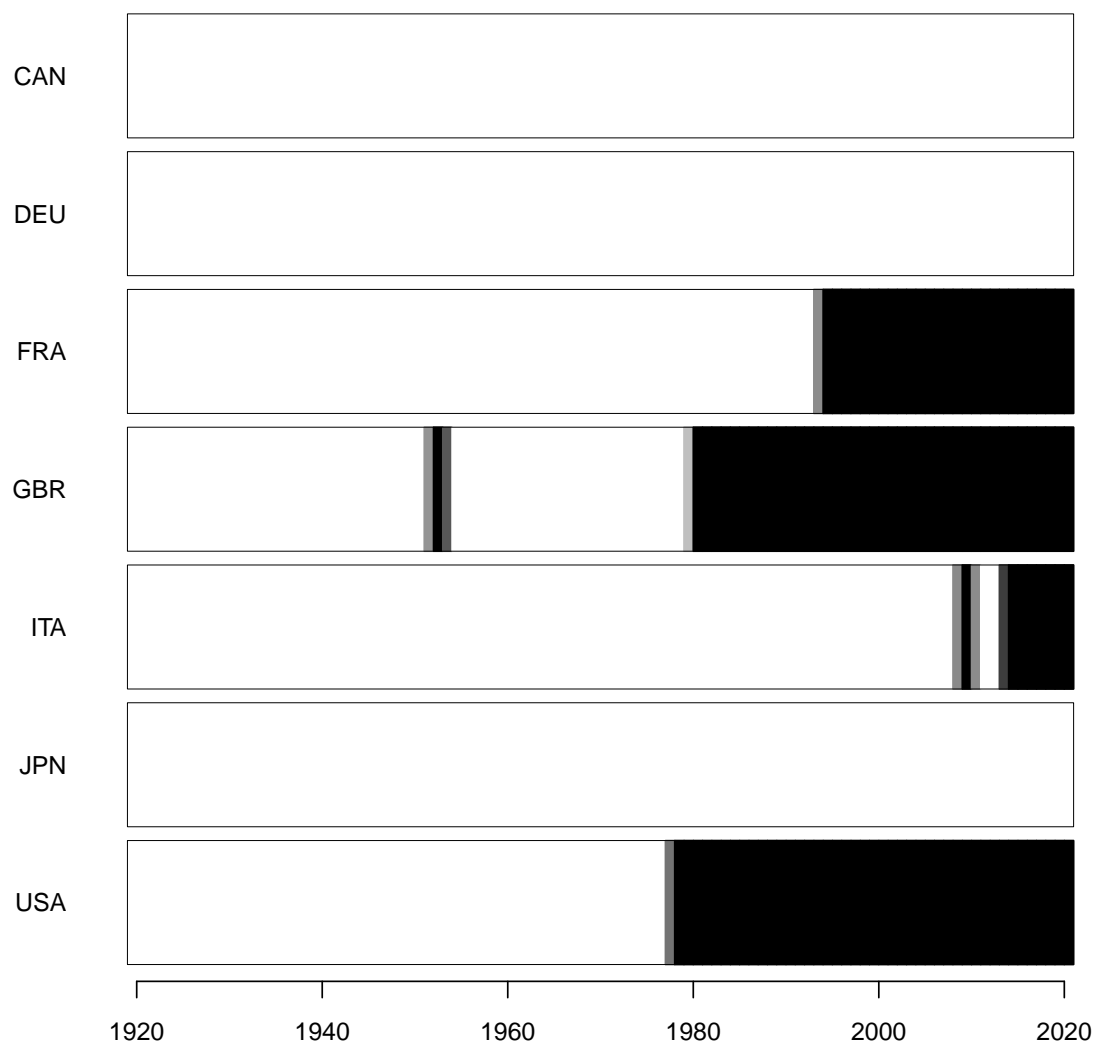
Note: Darker shading stands for a more generous housing construction support.

Figure A4: Exemption from fees and taxes, 1920–2020



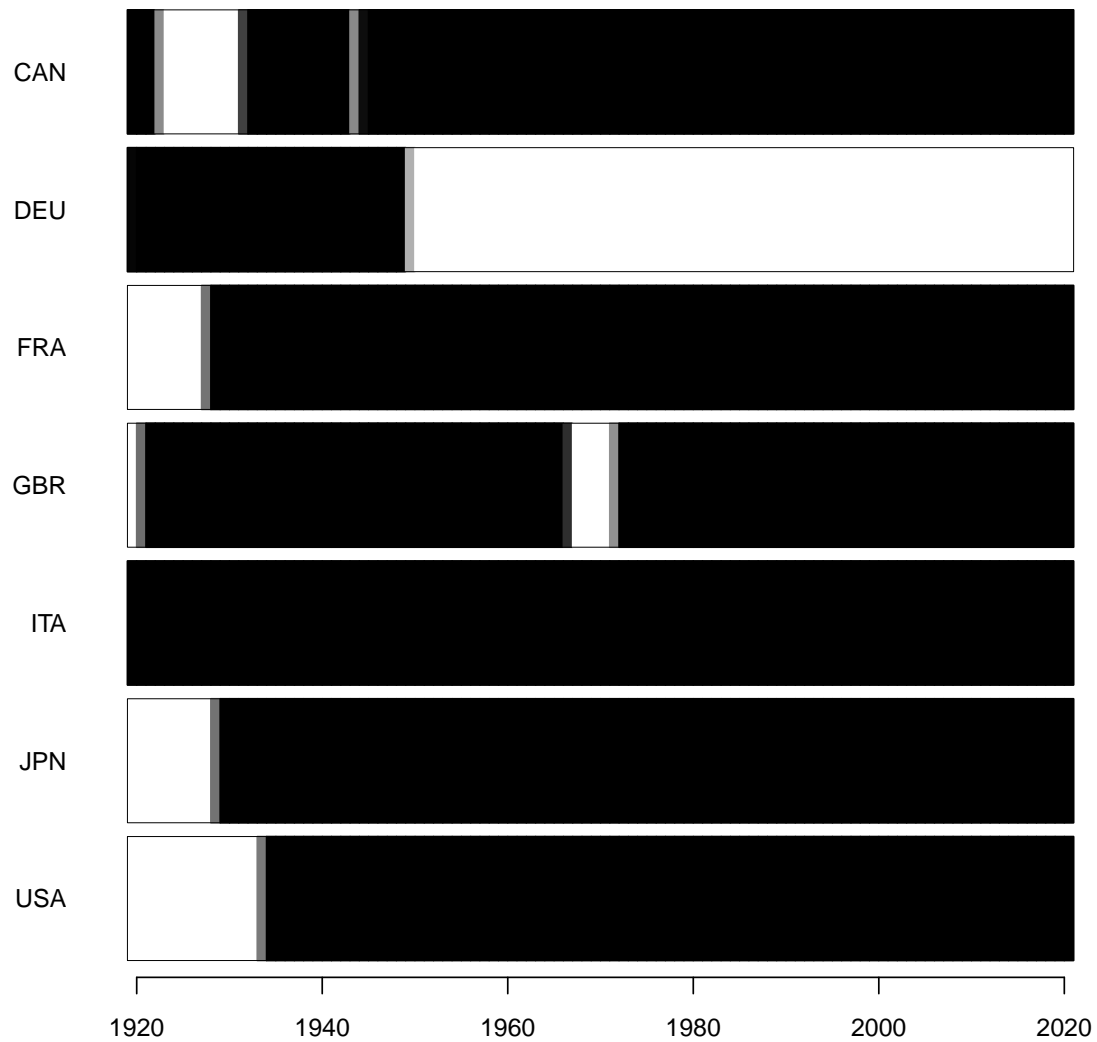
Note: Darker shading stands for a more generous housing construction support.

Figure A5: Sale to tenants, 1920–2020



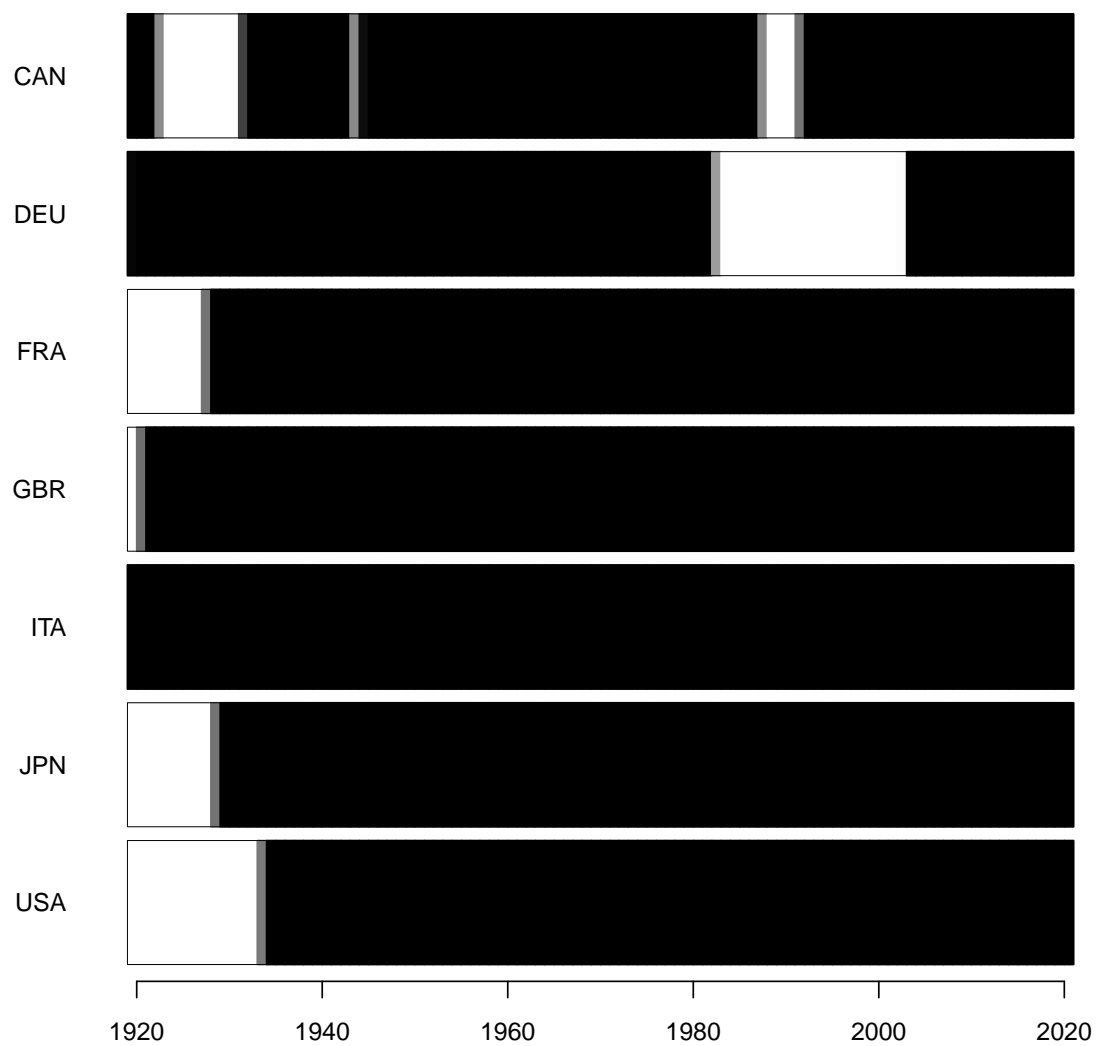
Note: Darker shading stands for a more generous housing construction support.

Figure A6: Restricted duration, 1920–2020



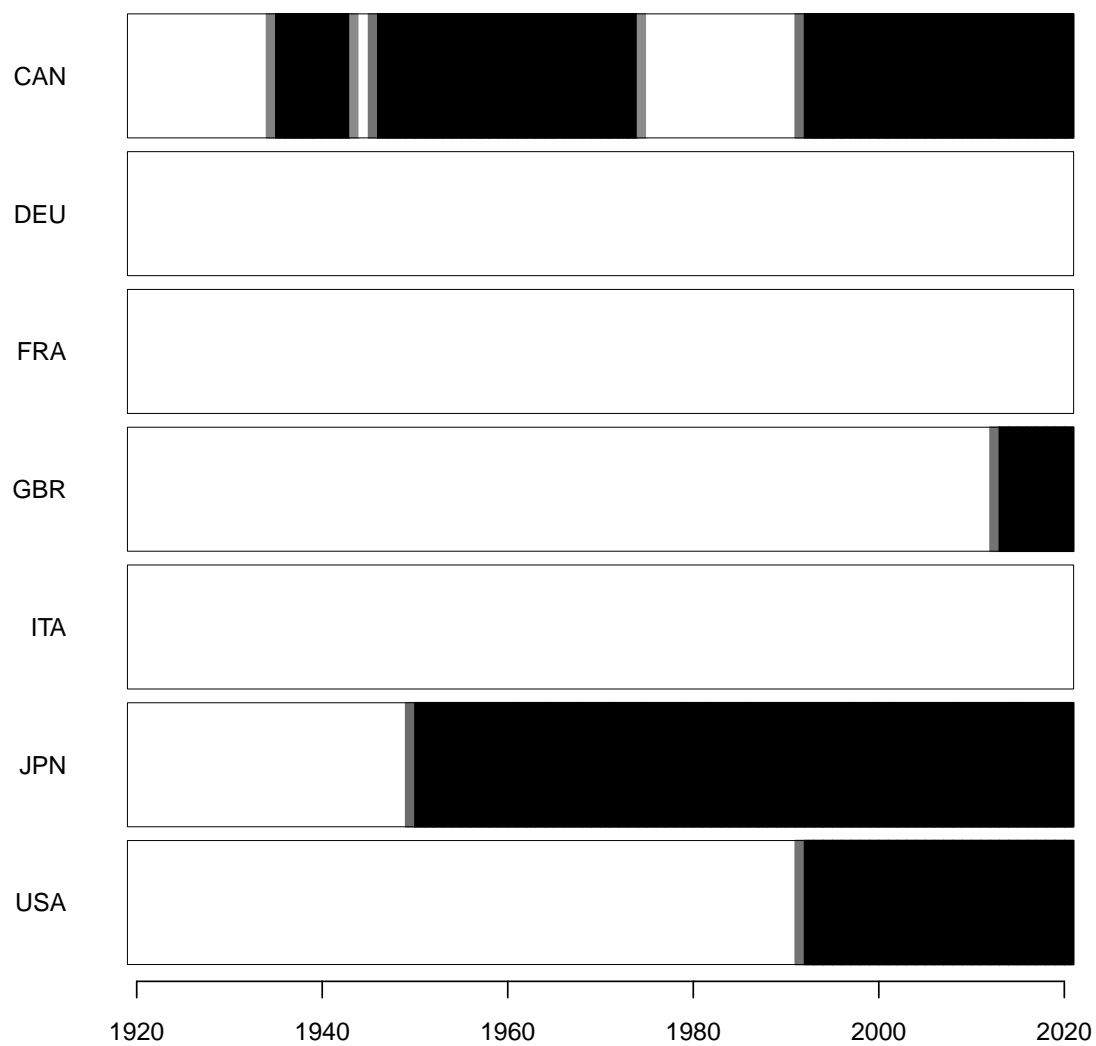
Note: Darker shading stands for a more generous housing construction support.

Figure A7: Means test during the contract, 1920–2020



Note: Darker shading stands for a more generous housing construction support.

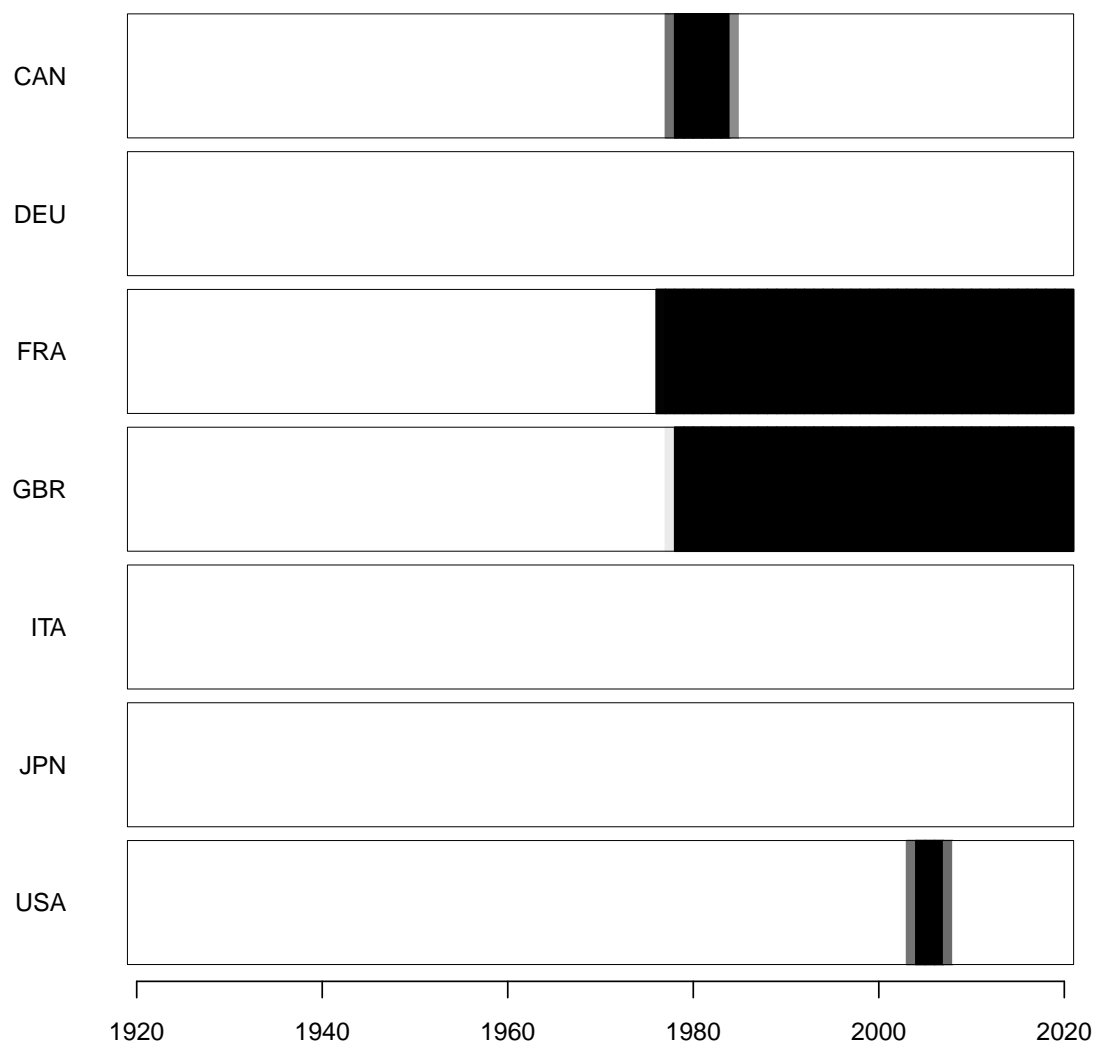
Figure A8: Reduced down payment, 1920–2020



Note: Darker shading stands for a more generous housing construction support.

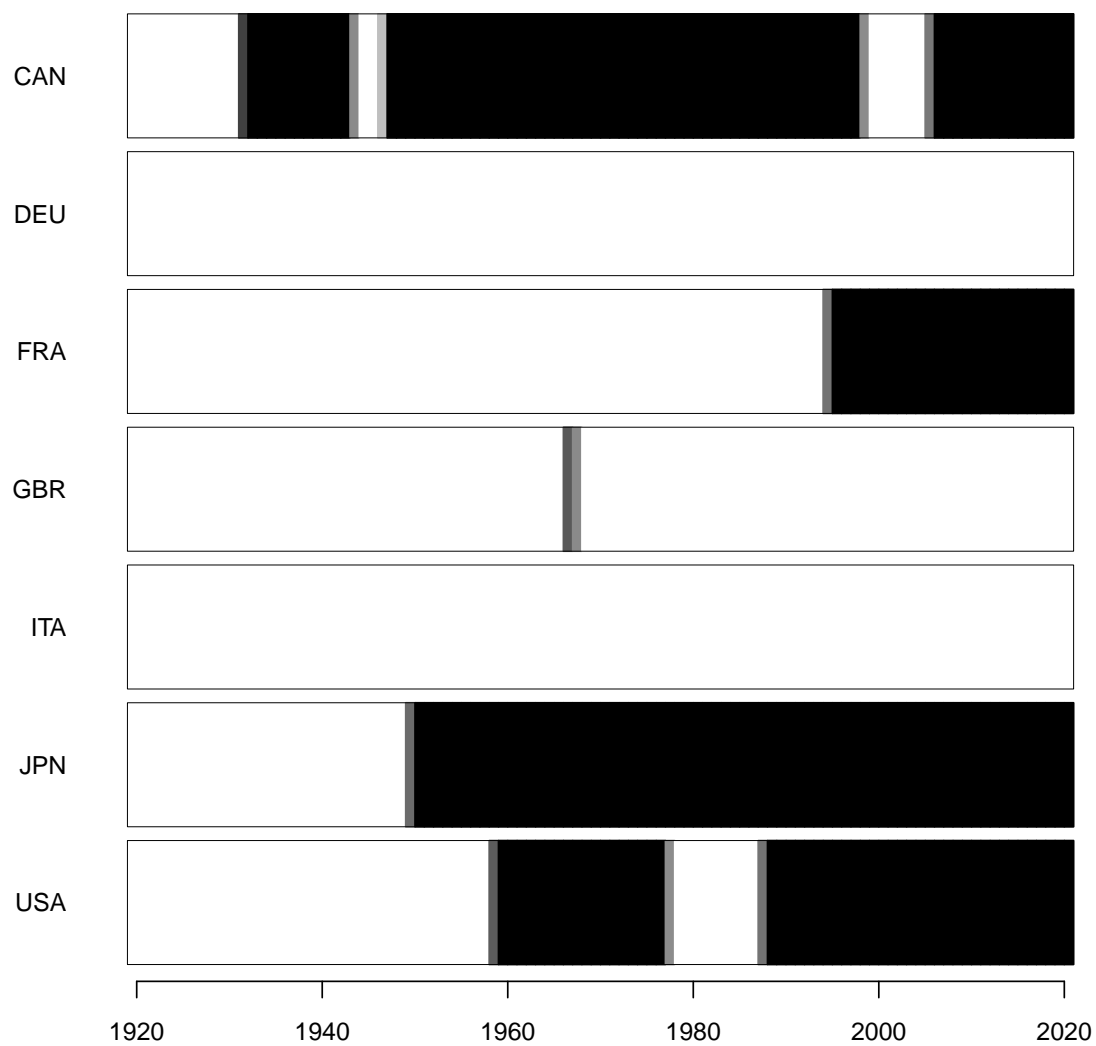


Figure A9: Deferred payments, 1920–2020



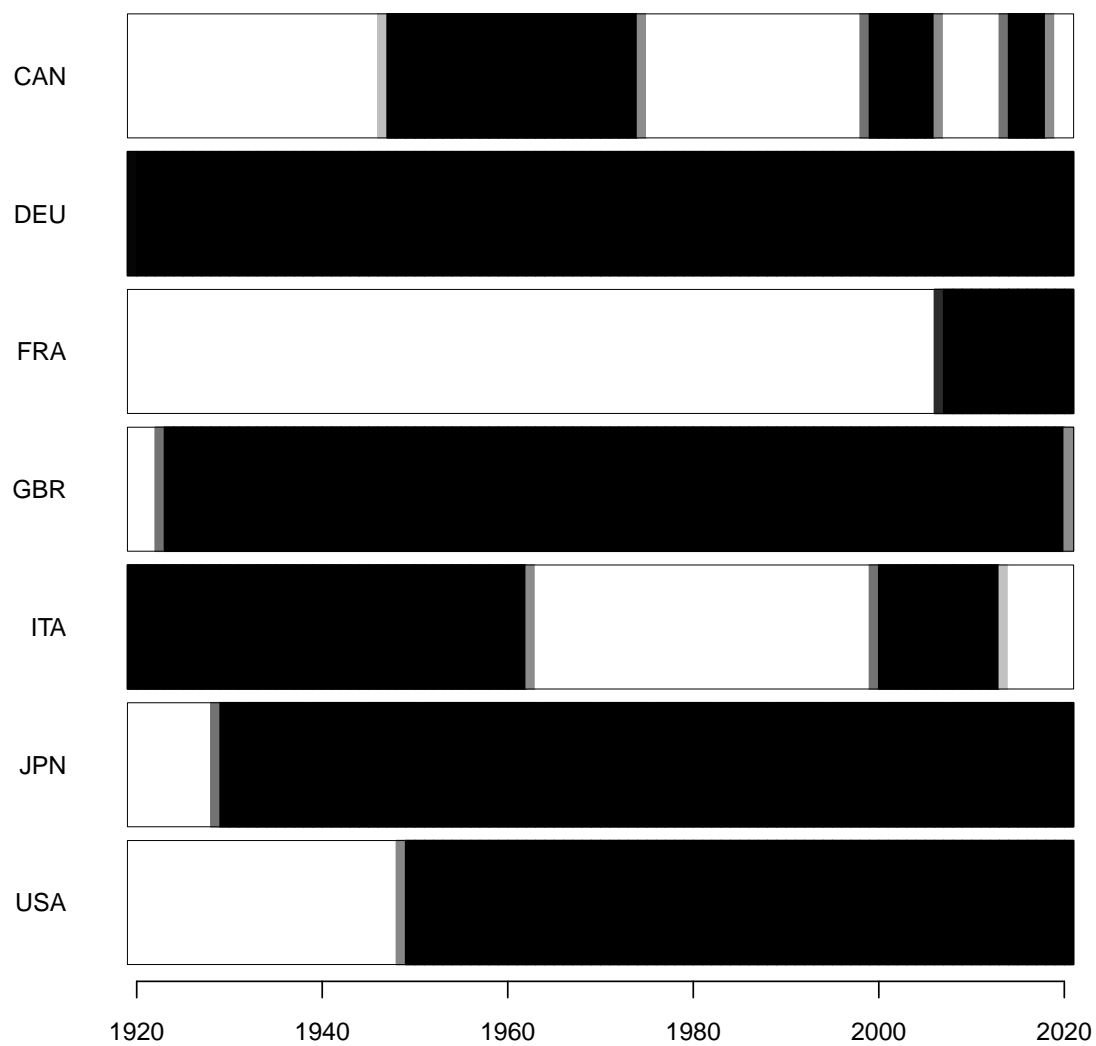
Note: Darker shading stands for a more generous housing construction support.

Figure A10: Prolonged amortization periods, 1920–2020



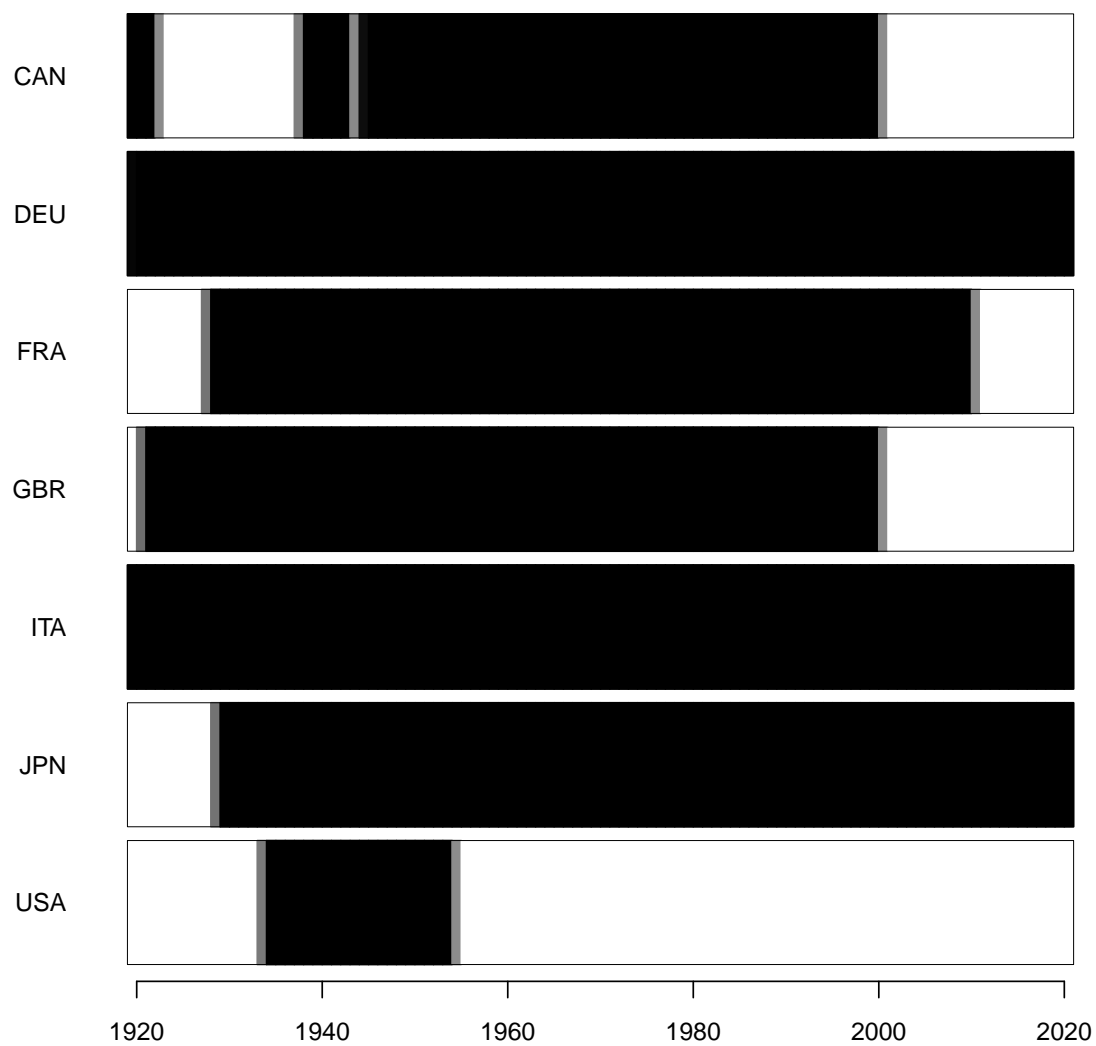
Note: Darker shading stands for a more generous housing construction support.

Figure A11: Targeting of specific population groups, 1920–2020



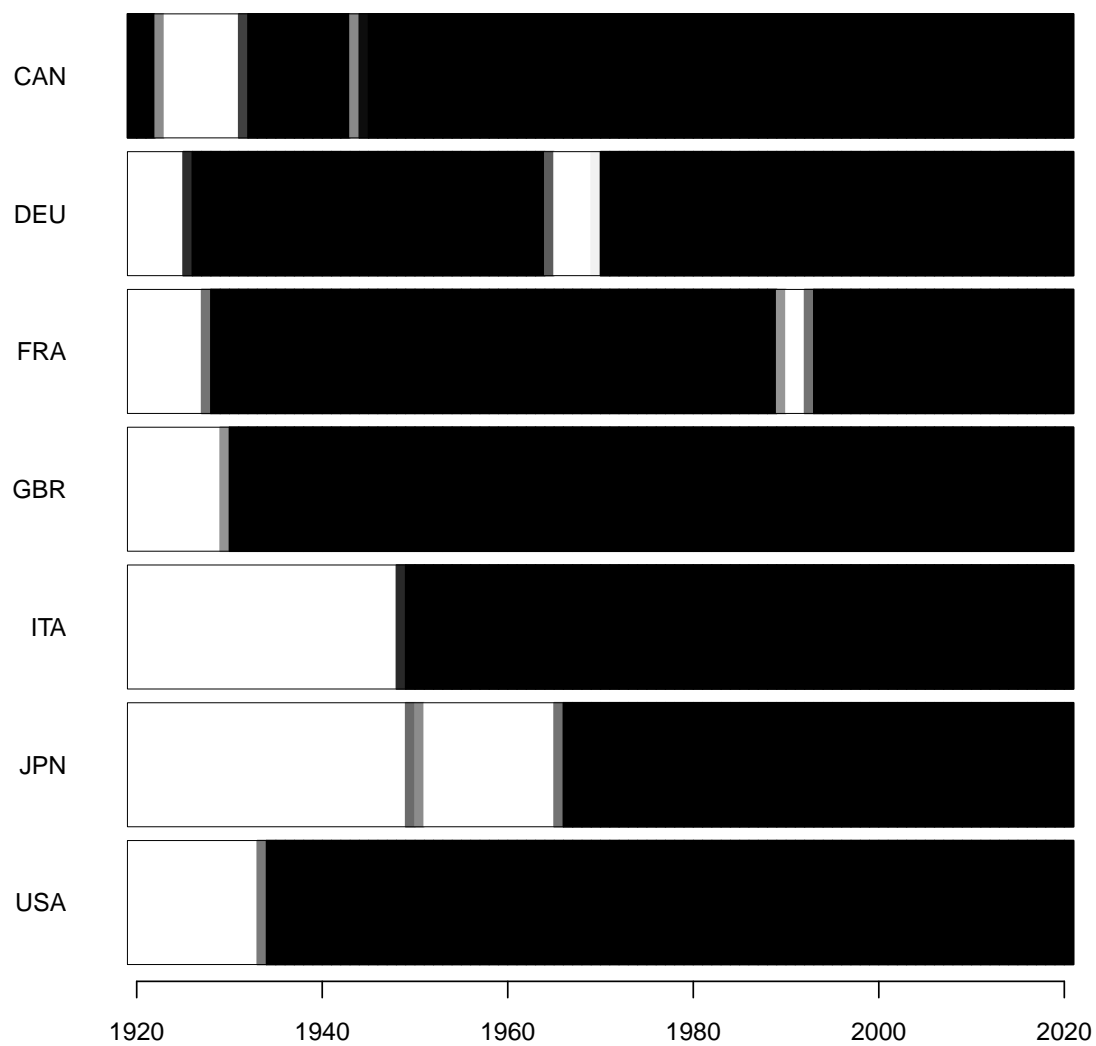
Note: Darker shading stands for a more generous housing construction support.

Figure A12: Targeting of specific regions, 1920–2020



Note: Darker shading stands for a more generous housing construction support.

Figure A13: Support of the homeowners, 1920–2020



Note: Darker shading stands for a more generous housing construction support.