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Working Paper

Forward to the past: Short-term effects of the rent freeze in Berlin

DIW Discussion Papers, No. 1999

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Hahn, Anja M.; Kholodilin, Konstantin A.; Walzl, Sofie; Fongoni, Marco (2022) : Forward to the past: Short-term effects of the rent freeze in Berlin, DIW Discussion Papers, No. 1999, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

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1999

Discussion
Papers

Deutsches Institut für Wirtschaftsforschung

2022

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IMPRESSUM

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<https://www.diw.de>

ISSN electronic edition 1619-4535

Papers can be downloaded free of charge from the DIW Berlin website:
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Forward to the Past: Short-Term Effects of the Rent Freeze in Berlin

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Abstract

In 2020, Berlin introduced a rigorous rent-control policy responding to soaring rents by setting a cap on rental prices: the *Mietendeckel* (rent freeze). The policy was revoked one year later by the German Constitutional Court. Although successful in reducing rents during its duration, the consequences for Berlin's rental market and adjacent municipalities are not clear. In this paper we evaluate the short-term causal effect of the rent freeze on the supply-side of the market, both in terms of prices and quantities. We develop a theoretical framework capturing the key features of the rent freeze, and test its predictions using a rich pool of detailed rent adverts. In addition, we estimate hedonic-style Difference-in-Differences and Spatial Regression Discontinuity models comparing price trajectories of dwellings inside and outside the policy's scope. Advertised rents drop significantly upon the policy's enactment. A substantial rent gap across the administrative border emerges, with rapidly growing rents for Berlin's (unregulated) adjacent municipalities. Moreover, we document a significant drop in the number of advertised properties for rent, a share of which appears to be permanently lost for the rental sector.

Keywords: First-Generation Rent Control; Rent Freeze; Urban Policy; Local Political Economy; Supply Disruptions; Legal Uncertainty; Berlin.

JEL classification: C14; C43; O18; D04.

Acknowledgments and Disclaimer: We thank Sumit Agarwal, Wilfried Altzinger, Claus Michelsen, Margit Schratzenstaller as well as participants at seminars and conferences for their helpful comments and suggestions: at *idealista España*, *LISER*, the *Vienna University of Economics and Business*, the *3rd International Workshop "Market Studies and Spatial Economics"* in Moscow, the *27th Annual Conference of the European Real Estate Society*, the *20th International Conference in Public Economics*, *Journées Louis-Andre Gerard-Varet*, the *2021 Annual Meeting of the Austrian Economic Association (NOeG)*, the *2021 Social Policy Association Annual Conference*, the *2021 European Network for Social Policy Analysis (ESPAnet) Conference*, the *DIW Berlin Virtual Rent Control Workshop*, the *AK Young Economists Conference*, the *2021 Real Estate Markets and Capital Markets (ReCapNet) Conference*, and the workshop *The Socioeconomics of Housing and Finance* at *Free University Berlin* in 2022. A policy-brief appeared as *DIW Weekly Report* (Hahn et al., 2021). This article uses data kindly provided by *VALUE Marktdaten* (formerly *Empirica Systeme*). The results presented may not reflect the opinion of the data providers. Any remaining errors are ours.

1. Introduction

In 2020, Germany’s capital Berlin introduced, and soon after revoked, a rigorous and old-fashionably designed rent control policy. For decades Germany had in place relatively moderate rent control policies. Yet, as in the 2010s rents started to rise rapidly, Germany began to expand rent control again until, in February 2020, a more radical additional policy came into force: the rent freeze (in German: *Mietendeckel*), a policy responding to soaring rents by basically switching off fundamental market economy mechanisms. The rent freeze was successful in temporarily lowering the overall price level for newly advertised rents. However, it is not clear what the nuanced additional consequences for Berlin’s rental housing market and adjacent municipalities are.

This article is thus first in jointly exploring the immediate causal effects of the rent freeze on rent prices and the volume of flats-to-rent on the market. We focus on supply-side effects by assessing changes in landlords’ decisions to advertise properties for rent upon vacancy. We analyse participation decisions in a simple theoretical model of the rental property market that captures the key features of the rent freeze in Berlin, and subsequently test its predictions by relying on micro-data on rent adverts. In addition, we employ causal inference techniques to measure the size of immediate price effects within and around Berlin. We find a substantial decline in rental properties in Berlin, combined with an immediate drop in advertised rent prices.

During its existence, Berlin’s rent freeze determined a maximum rent price per square meter. To a certain extent, it was allowed to account for usual price-driving attributes such as location and extraordinary provisions. In such cases, strictly pre-defined mark-ups to the basic rent were permitted. Yet, the result was still an unambiguous maximum price. Undercutting this price was allowed, but exceeding it could have been sanctioned. Due to these features, Berlin’s rent freeze can be considered as a first-generation rent control policy as opposed to today’s standard stabilizing second-generation policies tailored around limiting rent increases for sitting tenants (see [Arnott, 2003](#)).

In general, economic theory does not support the use of first-generation rent control.¹ While

¹See [Kholodilin \(2022\)](#) for a thorough review of the published empirical studies on all possible effects of rent

it may be beneficial for existing tenants, the consensus is that a ceiling on rents reduces both the quantity and quality of housing available in the market (Arnott, 1995). For instance, owners seeing the value of renting to fall would retard maintenance, or convert their rental unit into owner-occupied housing. The shortage in supply may also force new residents to live in sub-optimal locations, and pay relatively higher uncontrolled rents (Early, 2000). Glaeser and Luttmer (2003) have shown that the welfare costs of misallocation may be even greater than the efficiency loss stemming from supply shortages. More recently, Borck and Gohl (2021) show that a rental cap such as the rent freeze in Berlin would reduce welfare across all income groups, with poorer households being the worst affected.

The theoretical framework used in this article adds to this list by analysing a number of other channels through which the rent freeze affects the supply of rental units in the short run. First, we show that forward-looking owners might exit the rental market even upon announcement of a rent control policy. Moreover, this response is reinforced by the incentive to keep a unit vacant for refurbishment and modernisation, which gives an opportunity to be exempt from rent control. Finally, we analyse the implications of the occurrence of double-pricing rents, a practice adopted by owners in Berlin to hedge the expected foregone rents, as the constitutional basis for the rent freeze was shaky. We show that the adoption of double-pricing mitigates the negative impact of the rent freeze on the supply of rental units, but it does not offset it.

We make use of a comprehensive pool of rent advertisements to empirically test for model predictions and further price effects. Using a hedonic Difference-in-Differences approach we document a remarkable immediate aggregate drop of 7–11% in advertised rent prices. While co-movements between sales and rent prices had been rather the norm, the two indices follow opposing trends ever since the rent freeze’s enactment, hinting towards a *substitution effect between sectors*, which is also supported by the large number of units converted from rental to owner-occupied dwellings. We document a *leakage* and likely *second substitution effect* for Berlin’s neighboring city Potsdam as well as for further small surrounding municipalities, where asking rents were surging at accelerated pace ever since the rent freeze came into force. We further estimate Spatial Regression Discontinuity models to assess price effects directly at the

control.

administrative border with Berlin’s enclosing federal state Brandenburg, which was not covered by the policy. Indeed, we detect a large discontinuity of advertised prices along the administrative border.

Next to price effects, we document a substantial, and likely lasting, sharp decline in available rental units in Berlin. The incentives set by the rent freeze encourage a modernization of the housing stock, at the expense of more affordable older units, and it also increases the conversion of rental units into owner-occupied properties. We find strong empirical evidence supporting all three channels: increased conversions of rental to owner-occupied units; a reduction in newly built dwellings; and a drop in property advertised for rent.

Due to reduced supply the housing search within the rent segment became particularly challenging for both, established households in Berlin aiming for life-cycle adaptations as well as would-be renters. These include new-comers and young people facing a double burden: a low (initial) income and lower availability of suitable housing options. The latter is quite problematic as people aged between 18 and 35 years are the largest group moving into German cities (Kholodilin, 2017b).

Our study thus shows that plain rent freezes bring more harm than good. Alternative policy attempts may thus be preferred. These include established second-generation rent control policies but also completely different regulatory attempts theoretically and empirically found to be effective in tackling issues concerning housing supply shortage or affordability: For instance, Segú (2020) finds a substantial long-term causal increase in available housing units due to vacancy taxes in France, Agarwal et al. (2019) document how increases in minimum wages translate into over-proportional drops in rental defaults in the US, and Curry and Gensch (1975) demonstrate how incentives for renovation in older residential neighborhoods can increase the quality and quantity of the local rental housing stock for low-income families.

The rest of the article is organized as follows: [section 2](#) discusses the international, historic and regulatory context surrounding the rent freeze, and describes the key distinctive features of the policy. In [section 3](#), we develop the theoretical framework and in [section 4](#) we describe the data used for the empirical assessment. Next, we examine price and quantity effects in [section 5](#) and [section 6](#) respectively. Finally, [section 7](#) conducts a variety of robustness checks and [section 8](#) concludes. A supplemental appendix provides further details.

2. Historic, International, and Regulatory Context

This section discusses the historical and regulatory context surrounding the rent freeze in Berlin. After an overview of rent regulation in Germany in comparison with other countries, the current nation-wide regulations in place in Germany are discussed. The section concludes by describing the additional specific rules of the rent freeze.

2.1. A Visual History of Rent Control in Germany

Rent control in Germany has a long tradition dating back to 1919 (see [Kholodilin, 2017a](#)). Regulatory measures are usually put in place in extraordinary times, e.g., world wars (see [Kholodilin et al., 2021](#)) and, most recently, in response to the global economic crisis triggered by the COVID-19 pandemic (see [Francke and Korevaar, 2021](#); [Kholodilin, 2020a](#)). Besides such extreme events, the intensity of rental housing market regulations has been generally increasing following a decades-long deregulation trend. [Figure 1](#) depicts the intensity of rent control measures in Germany between 1910 and 2021, and compares it to Europe and the rest of the world.

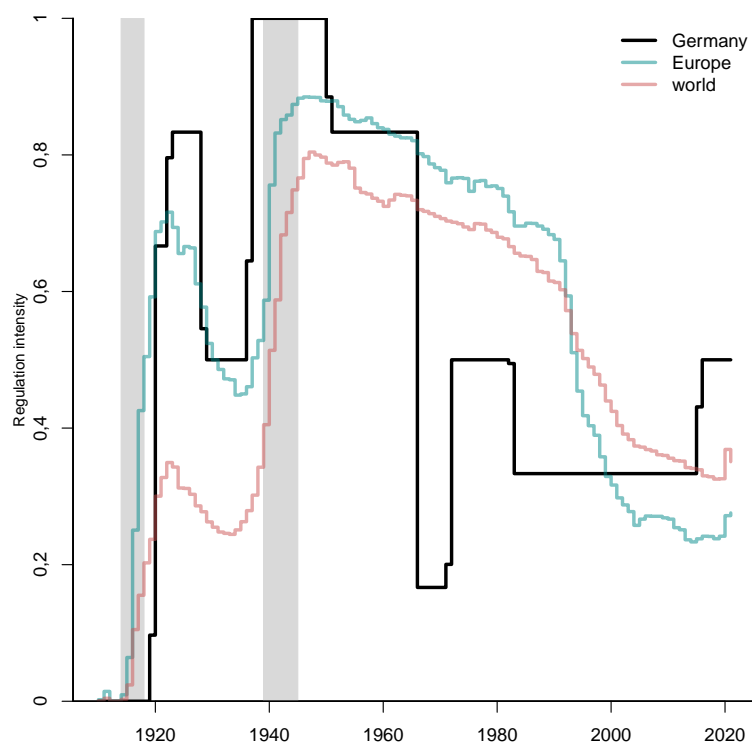
2.2. National and International Resonance

Within Germany, the rent freeze attained lots of public attention: [Figure 2](#) plots the number of occurrences of the word *Mietendeckel* (rent freeze) in German media between January 2018 and December 2021.² The rent freeze was mentioned on a couple of occasions first in 2018. However, it is only in early 2019 that the number of occurrences became non-negligible. The topic was most prominently discussed between the policy’s announcement and enactment, and again upon its revocation and during the federal election campaign in September 2021, when the issue of introducing a nation-wide rent freeze was raised.

The announcement of the rent freeze in Berlin triggered also broad international reactions, with leading newspapers, such as *Financial Times* (UK), *Le Monde* (France), and *The New York Times* (USA) writing about it. The example of Berlin also inspired other actors in different parts of Germany and abroad to request similar regulations. For instance, in October 2019,

²The data are taken from the database GENIOS including about 2,200 high-quality German-speaking media with the total number of documents exceeding 500 million. See <https://www.genios.de>, last accessed in January 2022.

Figure 1: Rent Control Regulation Intensity, 1910–2021



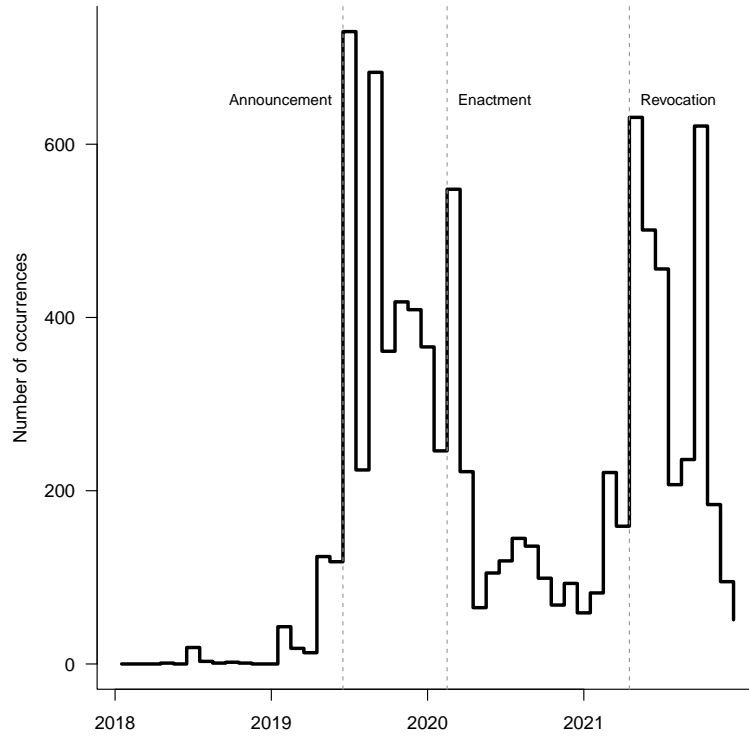
Notes: The figure depicts the intensity of rent control policies in Germany, and compares it to the situation in Europe (40 countries) and the rest of the world (125 countries and sub-national regions). The grey shaded bars indicate World War I and II, respectively. The regulation intensity is computed as a simple average of six binary indices, each reflecting an aspect of rent control (e.g., real and nominal freeze, setting of the initial level of rent, and various exceptions).

Source: Updated calculations based on [Kholodilin \(2020b\)](#).

Munich’s tenants association launched an initiative to organize a referendum concerning the introduction of a similar rent freeze in the German federal state Bavaria. In September 2020, the mayor of London Sadiq Khan suggested to freeze private housing rents in the British capital for two years, alluding to the case of Berlin.³

³“If Berlin can freeze rents for five years, there’s no reason London shouldn’t be able to freeze rents for two years in these extraordinary times.” See <https://www.london.gov.uk/press-releases/mayoral/mayor-calls-for-two-year-rent-freeze>, last accessed in December 2020.

Figure 2: Coverage of the Rent Freeze in German Media



Notes: The figure shows the monthly number of occurrences of the word *Mietendeckel* (rent freeze) in the database of German print media GENIOS. The data are obtained through an automatic search for this keyword in the GENIOS database across all media items published between January 2018 and December 2021.

Source: Author’s visualisation based on data provided by GENIOS.

2.3. Regulatory Context in Berlin

2.3.1. The Rent Brake

The new rent freeze regulation was preceded by the so-called rent brake, which was introduced in June 2015.⁴ According to this policy, the rent for a dwelling located in an area classified as a *tight housing market* (*angespannter Wohnungsmarkt*) may be at most 10% higher than the typical local rent.⁵ Thus, the rent brake is a stricter form of second-generation rent

⁴The title of the original law is “Gesetz zur Dämpfung des Mietanstiegs auf angespannten Wohnungsmärkten und zur Stärkung des Bestellerprinzips bei der Wohnungsvermittlung (MietNovG)” as of 21 April 2015. See the “Bundesgesetzblatt Jahrgang 2015 Teil I Nr. 16, ausgegeben zu Bonn am 27. April 2015” for juridical details.

⁵To identify a tight market, at least one of the following four conditions must be met: (1) local rents grow faster than at the national level; (2) the local average rent-to-income ratio is significantly higher than the national average; (3) population grows, whereas new housing construction does not create enough dwellings; or (4) the vacancy rate is low, while demand is high. Nonetheless, even in areas witnessing tight housing market conditions, not *all* dwellings are subject to the rent brake. There are two explicit exceptions: (1) dwellings

control, since, in contrast to a standard version, it imposes limitations not only to price increases but also on the initial rent. By 2020, 12 out of 16 German federal states have adopted the rent brake.⁶ Though initially set for five years, the law was prolonged for another five years in March 2020.⁷

2.3.2. The Rent Freeze

The idea of a rent freeze was publicly announced on 4 June 2019 by Berlin’s then-minister of construction Katrin Lompscher (a member of the leftist political party *Die Linke*).⁸ As an immediate reaction, on 9 June 2019, the landlords’ and homeowners’ association *Haus und Grund* called upon landlords to raise rents before 18 June 2019, hoping that the rent determining the basis for rent setting would rise.⁹ Initially, it was unclear whether the controversial law would indeed be enacted, since the constitutional basis for law-making in the domain of housing markets at the federal state level was shaky. Nevertheless, in late 2019 it became clear that the law would pass. In February 2020, Berlin enacted the pre-announced rent freeze,¹⁰ only to be abolished 13 months later, on 25 March 2021, by the German constitutional court.

What are the main features of the short-lived law? Rents (excluding running costs) within the administrative borders of Berlin were ex-post frozen at the 18 June 2019 level for five years. The law covers all residential premises, with a number of exceptions including, most importantly, housing units that became ready for occupation for the first time on 1 January 2014 or later, residential premises that were uninhabitable (and indeed vacant) for an extended period of time, or were remodelled with efforts comparable to new construction (hence new to

used and let for the first time since 1 October 2014; or (2) dwellings let for the first time after an extensive modernization.

⁶These states are Baden-Wuerttemberg, Bavaria, Berlin, Brandenburg, Bremen, Hamburg, Hessen, Mecklenburg-West Pomerania, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, and Thuringia. Note, each of the 16 German federal states is empowered to establish the areas with tight housing markets.

⁷The title of the proposed law is “Gesetz zur Verlängerung und Verbesserung der Regelungen über die zulässige Miethöhe bei Mietbeginn” as of 19 March 2020.

⁸Information der Koalition zu einem Berliner Mietengesetz Eckpunkte für ein Berliner Mietengesetz; https://haus-und-grund-berlin.de/wp-content/uploads/2019/06/Eckpunkte_Berliner_Mietengesetz.pdf, last accessed in December 2020.

⁹“Erhöhen Sie bis zum 17. Juni 2019 die Miete!” <https://haus-und-grund-berlin.de/wichtig-erhoehen-sie-vor-dem-18-juni-2019-die-miete/>, last accessed in December 2020.

¹⁰The title of the original law is “Gesetz zur Mietenbegrenzung im Wohnungswesen in Berlin (MietenWoG Bln)” as of 11 February 2020. The law was enacted on the 23 February 2020, and abolished on 25 March 2021.

the rental market).¹¹

In addition to these features, the law defines the so-called *valid rent* (*zulässige Miete*) to range between 3.92 and 9.80 EUR/m² per month. The exact amount depends on the building’s construction year and equipment (heating and bath, see [Table 1](#)). A somewhat higher rent is allowed for dwellings in two-family houses (+10%) or dwellings with modern equipment (+1 EUR/m²).¹² In addition, the location is factored in when assessing excessive rent: −0.28 EUR/m² for *simple locations* (“*einfache Wohnlage*”), −0.09 EUR/m² for *average locations* (“*mittlere Wohnlage*”), and +0.74 EUR/m² for *good locations* (“*gute Wohnlage*”).¹³ Hence, the valid rent could be at most 11.54 EUR/m² corresponding to a house built between 2003 and 2013, having central heating and a bathroom as well as general modern equipment, and located in a good neighborhood.

If in June 2019 the rent paid in existing contracts was in excess of the *valid rent* by more than 20%, it would then be classified as *excessive rent* (“*überhöhte Miete*”). Starting from 23 November 2020, excessive rents must have been reduced to reach the maximal allowed level. Non-compliance is classified as an administrative offense and may lead to substantial fines up to EUR 500,000.¹⁴

Starting from 1 January 2022, rents could only be increased in line with the growth rate of the Germany-wide consumer price index subject to a general cap of 1.3%, but only if they would still be below the valid rent. Thus, rents equal to or exceeding the valid rent are effectively frozen. Finally, monthly rents may be increased by no more than 1 EUR/m² in properties that underwent modernization, and must nevertheless follow the general guidelines.

¹¹Further premises excluded from the regulation’s scope are units fulfilling at least one of the following criteria: 1) housing units built under state support schemes; 2) residential premises modernized and refurbished using public aid and which are already subject to rent restrictions; and 3) dormitories and similar accommodation facilities.

¹²Modern equipment (*moderne Ausstattung*) means that at least three of the following features are available: an elevator (accessible without steps), fitted kitchen, valuable sanitary equipment, valuable flooring in most rooms, or energy consumption below 120 kWh/m².

¹³See therefore the official classification of locations in Berlin (“Mietspiegel”) described in [subsection 4.3](#).

¹⁴The Berlin city council offered support to tenants to check their rental agreement and give a complaint in case of landlords refusing to provide sufficient information needed to compute the valid rent.

Table 1: Valid Rent under the Rent Freeze

		Equipment			Valid Rent [EUR/m ²]
		$CH \wedge B$	$CH \vee B$	$\neg CH \wedge \neg B$	
1.	before 1918	✓			6.45
2.			✓		5.00
3.				✓	3.92
4.	1919 – 1949	✓			6.27
5.			✓		5.22
6.				✓	4.59
7.	1950 – 1964	✓			6.08
8.			✓		5.62
9.	1965 – 1972	✓			5.95
10.	1973 – 1990	✓			6.04
11.	1991 – 2002	✓			8.13
12.	2003 – 2013	✓			9.80

Notes: The table reports the (unadjusted) valid rent per square meter depending on the year of first-time availability for rent and the provision of basic equipment ($CH \wedge B$ central heating and bathroom, $CH \vee B$ central heating or bathroom, $\neg CH \wedge \neg B$ neither central heating nor bathroom).

Source: “Gesetz zur Mietenbegrenzung im Wohnungswesen in Berlin (MietenWoG Bln)”, §6, as of 11 February 2020.

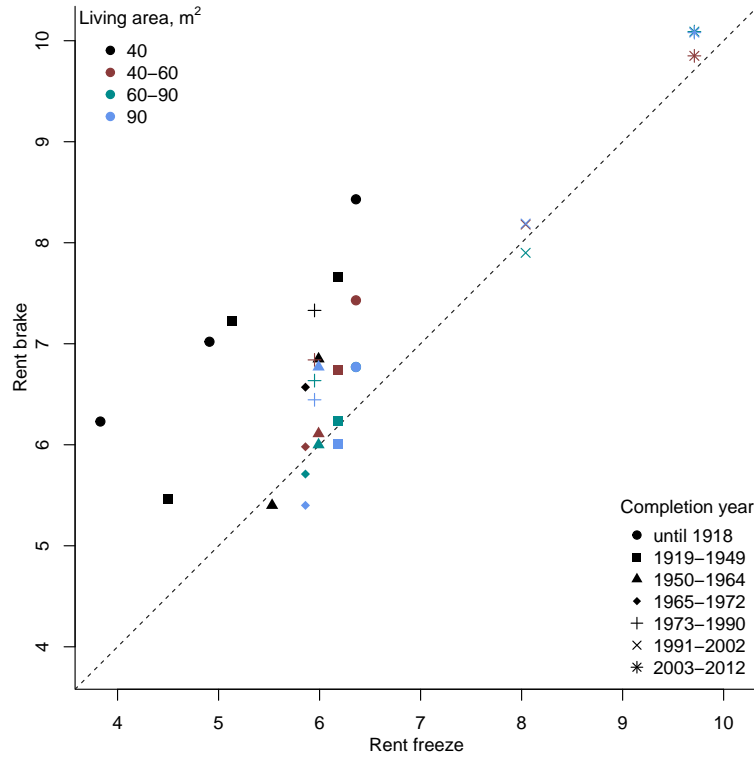
2.3.3. Rent Brake versus Rent Freeze

Under the rent freeze regime, valid rents are generally lower than those following the rent brake guidelines. This is shown in [Figure 3](#), where the horizontal axis corresponds to the valid rent prices set by the rent freeze, while the vertical axis depicts the valid rental prices according to the rent brake, in 2019. The colors denote different floor areas of dwellings, whereas the shape of the dots corresponds to the year of completion of the buildings. Rents refer to dwellings located in average zones.¹⁵

Most dots in [Figure 3](#) lie above the 45°-line, indicating that prices following the rent brake

¹⁵Therefore, we subtract 0.09 EUR to obtain rents following the rent freeze rules. The *Mietspiegel* is an official repository of local market-based rent prices serving as the basis for setting initial rents according to the rent brake. The *Mietspiegel* further differentiates between rents in East and West Berlin as well as by completion years (between 1973 and 1990). As the rent freeze does not comprise such distinctions, we computed a simple average of the East and West Berlin’s rental prices. In addition, the rent freeze does not distinguish between different dwelling sizes.

Figure 3: Valid Rent: Rent Freeze vs. Rent Brake



Notes: The figure shows the valid rental prices per m² per month, according to the rent freeze law (horizontal axis) and rent brake law as contained in the *Mietspiegel* of 2019 (vertical axis). The diagonal dotted line has a slope of 45° and, thus, shows the points where the values of both rent freeze and rent brake coincide.

Sources: (1) *Mietendeckel* – “Gesetz zur Mietenbegrenzung im Wohnungswesen in Berlin (MietenWoG Bln)” as of 11 February 2020; (2) *Mietspiegel* of 2019 – Senatsverwaltung für Stadtentwicklung und Wohnen, <https://www.stadtentwicklung.berlin.de/wohnen/mietspiegel/de/downloads.shtml>; and (3) own representation.

regime are generally higher than those stipulated by the rent freeze. We observe particularly large deviations between rent brake and rent freeze prices for small dwellings (living surface of 40 m² or less). The lowest rents per square meter are set for dwellings in buildings completed between 1965 and 1972. Moreover, for older dwellings, the rent per square meter is higher for smaller dwellings, while we do not detect such a monotonicity for dwellings completed after 1990.

In general, we conclude that prices set under the rent freeze regime lag behind the already low rental prices set under the rent brake regulation. However, this difference will disappear if we take the excessive rent threshold into consideration: 10% above the valid rental price for the rent brake and 20% for the rent freeze.

2.3.4. Further Fostering Policies

Policies directly targeting people in need are often considered being a substitute to supply-side affordability interventions such as the rent brake and the rent freeze (see [Olsen, 2003](#); [Eriksen and Ross, 2015](#)). During the period covered here, there were two such targeted fostering policies in place that could, at least in part, support residents facing housing affordability constraints:¹⁶ social housing construction (*sozialer Wohnungsbau*) and housing allowances (*Wohngeld*). The former covers subsidized private or public construction of affordable housing units. In such dwellings, rents are substantially lower than regular market rents, yet tenants need to fulfill certain criteria (mainly related to income) to be eligible. Housing allowances are directly paid to tenants whenever their household income falls short of a certain minimum, depending on the number and age of household members. Germany-wide social housing makes up just about 4% of the total housing stock ([Pittini et al., 2019](#)). Some measures to increase the financing of social housing were adopted since 2015.¹⁷ Moreover, the new coalition government plans to build up to 100,000 social housing units a year ([Koalition, 2021](#)). Housing allowances have also been reformed recently: amounts were increased and, more importantly, an automatic indexation mechanism was added. The latter links the amount granted to the nation-wide official rent price index.¹⁸

3. Theoretical framework

In this section, we characterize the economic incentives governing owners' decision on how to *use* a unit upon vacancy, that is, whether to re-advertise it for rent or not, and subsequently analyse the impact of the rent freeze on these decisions. Thus, we focus on owners' participation decisions.¹⁹ To do so, we develop a partial equilibrium model of the rental market and focus on the supply of rental units, taking the demand side as given.

¹⁶See [Table C9](#) for related demographic statistics per district.

¹⁷For example in 2015, the federal support towards the annual social housing construction budget was increased from 518.2 to 1,018.2 million EUR. (“Asylverfahrensbeschleunigungsgesetz” as of 20 October 2015, BGBl. I S. 1722; enacted on 24 October 2015).

¹⁸“Gesetz zur Stärkung des Wohngeldes” as of 30 November 2019, BGBl. I S. 1877 (Nr. 44); enacted on 1 January 2020.

¹⁹We abstract from the role of owners as sellers in the housing market. The decision of owners to sell their property could nevertheless fall under the category of using a property for personal use—in this case selling it—the features of which are explained below.

We proceed by setting up the environment and owners’ incentives, and subsequently derive the market participation conditions, in the absence of rent control. Next, we extend this environment by considering the rent freeze and analyse its impact on market participation, including the occurrence of “double-pricing adverts”. A more exhaustive exposition of the model is contained in Appendix [A](#).

3.1. A Partial Equilibrium Model of the Supply of Rental Units

3.1.1. Environment

We consider a mass of measure one of property units uniformly distributed in a city and owned by the same mass of infinitely-lived owners. We define an owner i as an economic agent owning a unit which is suitable to live inside. Time is discrete and each period $t \in \mathbb{N}$ represents a month. We denote owners’ discount factor with δ . We assume the ongoing rental price $R > 0$ at which units can be advertised and rented to be exogenous and constant over time. We also abstract from maintenance costs: as these will be paid regardless of how units are used, they do not matter for participation decisions, and can therefore be ignored. Since we focus on a steady state in which all variables are constant over time, we refrain from using time subscripts to ease the notational burden.

3.1.2. Use of a Property Unit

In each period a unit can be in one of four states: occupied and rented; vacant and employed for personal use; vacant and under refurbishment; or vacant and advertised in the rental market.

Rented. Owners of rented units enjoy the monetary benefits of a monthly rent R . Further, for simplicity, we abstract from the possibility of end-of-tenancy separations: once a property is occupied and rented, it will remain in this state forever.

Personal use. Units in this state are kept out of the rental market. This is to capture both owner-occupation and the use of it for different purposes (e.g., as vacation house, for storage, or for sale in the housing market). We denote owner i ’s per-period benefit of keeping a unit for personal use by $b_i \geq 0$, where b is distributed according to the cumulative distribution function F . Hence, owners are heterogeneous along this dimension: the value of keeping a unit for personal use could depend on personal needs and owners’ preferences.

Under refurbishment. Owners may decide to keep their property *temporarily* out of the rental market to invest in refurbishment and modernization. We assume that these owners will be able to advertise and rent out their unit at a higher price $\hat{R} > R$, once refurbishment is completed. Hence, there are some expected future gains in investing in refurbishment, during which owners give up the benefits from personal use, as well as the possibility of earning a monthly rent. Denote by $T_i^r \in \mathcal{T}^r \subset \mathbb{N}$ the number of periods covering owner i 's refurbishment duration. To preserve tractability we define a function $\rho : \mathcal{T}^r \rightarrow [0, 1]$, strictly decreasing on \mathcal{T}^r , with $\rho(0) = 1$ and $\lim_{T^r \rightarrow \infty} \rho(T^r) = 0$. One way to interpret ρ is to think about it as the per-period, constant probability that a refurbishment lasting T^r periods will be successful; another interpretation is to think about it as an owner's discount factor for a payoff that comes T^r periods ahead in the future. Henceforth, we treat ρ as a parameter and assume it is distributed according to the cumulative distribution function G . Further, we assume that all owners have access to credit and that they will use this channel to fund their investment in refurbishing.²⁰

Advertised. Owners deciding to participate in the rental market will advertise their unit at the ongoing rental price R in search of a suitable tenant. By doing so, owners give up the benefits of using the property for their personal use, and pay an additional search cost, denoted by $k > 0$. The per-period probability that an advertised unit is matched with a resident searching for a unit is exogenous and denoted by $q > 0$. We assume the present value of advertising a unit to be strictly positive, and that matches are mutually advantageous: once a match is formed, the property becomes occupied and the owner starts receiving the monetary benefit of the monthly rent R .

3.1.3. Participation Conditions

We now derive the steady-state conditions under which it would be optimal for owners to participate in the rental market, that is, we seek to find under which configuration of b_i and ρ_i , owners are better off by advertising their unit for rent at the current rental price R , rather than keeping it for personal use, or invest in refurbishment.

²⁰This assumption purposely abstracts from wealth considerations and borrowing constraints of owners, which would imply an interesting, but unnecessary, complication to the model. In fact, following this assumption, and given the infinite-horizon environment, we can then abstract from the extent of the investment in refurbishing and we can focus on its expected duration as the key factor influencing its profitability.

To begin with, denote the expected present discounted value of advertising a unit by V^a , and the analog value of investing in refurbishment by V^r . An owner i would find it optimal to advertise their unit at the current rental price if $V_i^a > V_i^r$, that is, if

$$\frac{\delta}{1-\delta}R > \rho_i \frac{\delta}{1-\delta} \hat{R} + [1-\rho_i] \frac{k}{q}, \quad (1)$$

which implies that the present value of renting at price R must be larger than its opportunity cost in terms of the present value of renting after T_i^r periods at a higher price \hat{R} , net of the expected cost of search. Clearly, whether this condition is satisfied for owner i crucially depends on the duration of refurbishment: the longer the refurbishment period, the smaller the opportunity cost of advertising the unit at the current rental price (the right-hand side of (1) is decreasing in T_i^r).

Lemma 3.1. *There exists a threshold value $\tilde{\rho} = \tilde{\rho}(R, \hat{R})$, such that for all $\rho_i < \tilde{\rho}$, $V_i^a > V_i^r$: advertising is always preferred to refurbishing. Moreover, $\tilde{\rho}$ is strictly increasing in R and strictly decreasing in \hat{R} .*

Next, consider an owner i 's choice between advertising their unit, or keeping it for personal use, the expected present discounted value of which is denoted by V_i^u . Advertising would be optimal if $V_i^a > V_i^u$, that is, if

$$\frac{\delta}{1-\delta}R > \frac{1-\delta[1-q]}{q[1-\delta]}b_i + \frac{k}{q}. \quad (2)$$

An owner would find it optimal to advertise their unit, if the present value of renting at the price R is larger than its opportunity cost in terms of the expected present value of using the unit for personal use, plus the expected cost of search. Hence, the larger the benefit b_i an owner perceives by using the unit for personal use, the larger is the opportunity cost of advertising.

Lemma 3.2. *There exists a threshold value $\tilde{b} = \tilde{b}(R)$, such that for $b_i < \tilde{b}$, $V_i^a > V_i^u$: advertising is always preferred to using the unit for personal use. Moreover, \tilde{b} is strictly increasing in R .*

Thus, owners participating in the rental market would be those for which investing in refurbishing is not profitable, as they would be better off in advertising their property for rent immediately, *and* for which the current rental price is high enough so that the present

value of the income flow from renting outweighs the present value of the benefits that they would perceive from keeping the unit vacant for themselves. These considerations enable us to establish the following result.

Proposition 3.1. *The steady-state share of units advertised in the rental market is given by*

$$\alpha(R, \hat{R}) = F(\tilde{b})G(\tilde{\rho}), \quad (3)$$

where α is strictly increasing in R and strictly decreasing in \hat{R} .

The higher the current rental price R the larger the proportion of owners that would prefer to advertise their unit in the market. Note, this effect works on both participation margins. On the other hand a higher expected gain from refurbishing a property, all else equal, would decrease the share of owners participating in the rental property market, which would rather invest in refurbishment and enjoy a higher stream of income in the future.

3.2. Rent Freeze, Double-pricing, and Participation

Next, we use the theoretical framework to analyze the impact of the rent freeze on owners' participation decision. Our assumptions and definitions capture the specific environment of the rent freeze in Berlin. Hence, we explicitly consider the announcement, enactment, and subsequent abolishing of the rent freeze. Further, we also model and analyze the implications of owners adopting "double-pricing adverts", that is, the observed occurrence of adverts with two alternative prices listed: one for the duration of the rent freeze, and one (higher) contingent on the policy being abolished.

3.2.1. The Rent Freeze Environment

We define the rent freeze as a rent control policy under which the absolute monthly rental price is exogenously set below the current market price: $\bar{R} < R$. This feature is common to all first-generation rent control policies. Further, we assume that once a rent freeze policy is announced, in each subsequent period there is a constant probability p that the policy will be enacted, and a probability $1 - p$ that the policy will not be enacted. Further, denote by $\bar{T} \in \bar{\mathcal{T}} \subset \mathbb{N}$ the expected number of periods covering the life-time of the rent freeze, and define the function $\gamma : \bar{\mathcal{T}} \rightarrow [0, 1]$, which is assumed to be strictly decreasing on $\bar{\mathcal{T}}$, with $\gamma(0) = 1$ and $\lim_{\bar{T} \rightarrow \infty} \gamma(\bar{T}) = 0$. The interpretation of γ is analogous to the interpretation of ρ , and can be

thought as the probability that the rent freeze policy will be abolished after \bar{T} periods, or as the owners' discount factor for a payoff that comes \bar{T} periods ahead. For simplicity, p and γ are common to all owners.

Double-price advertising. Owners adopting double-price adverts will advertise their unit with a clause: if the rent freeze policy was abolished, their matched tenant will have to retrospectively pay a monthly rent of $R + D$ for a number of months equal to the number of months corresponding to the duration of the rent freeze, where $D \equiv R - \bar{R}$ is the monthly rent that was foregone under the rent freeze. If double-pricing is not adopted, $D = 0$. Hence, conditional on the rent freeze policy being enacted, owners adopting a double-price advert will expect to receive a monthly rent of \bar{R} for \bar{T} periods, the expected duration of the rent freeze, an augmented monthly rent of $R + D$ for the subsequent \bar{T} periods, after the rent freeze is abolished, and the market rental price R forever afterwards.

3.2.2. The Impact of the Rent Freeze on Participation

Analyzing the effect of the rent freeze on the supply of advertised units in the rental market requires analyzing the impact of a lower expected rental price on owners' participation decision — captured by the steady-state share of advertised units α derived in Proposition 3.1.

Our framework is also suitable to derive predictions on the impact of the announcement of the policy, of the use of double-price adverts, and of owners' expectations about the duration of the rent freeze.

To begin with, consider owners' choice of adopting double-price advertising in the environment of the rent freeze, and denote by \bar{V}^a and \bar{V}^d the expected present discounted values of single- and double-price advertising since the policy is announced.

Lemma 3.3. *For all $p > 0$ and $0 < \gamma < 1$, $\bar{V}_i^d > \bar{V}_i^a$: double-price advertising is always preferred to single-price advertising.*

Lemma 3.3 implies that, as long as there is a positive probability that the rent freeze will be enacted, and subsequently, but not immediately, abolished, it would be optimal for all owners to switch to double-pricing adverts after the policy has been announced. Indeed, the intuition is straightforward: double-pricing increases the expected rental price at which units can be advertised and rented once, and if, the rent freeze is abolished.

Next, denote the share of advertised units in the environment of the rent freeze by $\bar{\alpha}$, and consider the following proposition.

Proposition 3.2. *For all $p > 0$, $\gamma < 1$, and $D = \{0, R - \bar{R}\}$, the steady-state share of advertised units in the rental market after the rent freeze is announced decreases, that is:*

$$\bar{\alpha}(R, \hat{R}, \bar{R}, D, p, \gamma) < \alpha(R, \hat{R}),$$

where $\bar{\alpha}$ is strictly decreasing in p and strictly increasing in γ .

Proposition 3.2 establishes that the rent freeze negatively affects the supply of advertised units in the rental market. Importantly, this effect takes place as soon as the policy is announced, and works on both participation margins: the introduction of the rent freeze also increases the expected gain from refurbishing a property unit. Perhaps surprisingly, the incentive to refurbish – which ideally aims to counteract the long-term negative effects of under-maintenance – exacerbates the negative impact of the rent freeze in the short run. Moreover, the higher the probability that the rent freeze will be enacted (i.e., a higher p), the smaller the share of advertised units in the market, which implies that once the policy is enacted (i.e., if $p = 1$) the share of advertised units in the market would be even smaller than when the policy was announced. Proposition 3.2 also establishes that, as owners expect the rent freeze to remain in place for longer (i.e., a lower γ), the drop in the share of advertised units in the market would be greater. The intuition behind these results resides in the effect of the rent freeze on owners' expectation of the rental price at which units can be advertised and rented in the future. In fact, the expectation of renting a unit at a lower rental price for the duration of the rent freeze lowers the present value of advertising and increases the opportunity cost of doing so: the expected gains from investing in refurbishment, or from keeping the unit for personal use, are now higher.

Finally, note that Proposition 3.2 holds even in the case of occurrence of double-price adverts in the market. Even though under double-pricing owners expect to be paid the foregone rent differential D , since these foregone rents are collected at a later date in the future, once and if the policy is abolished, their value is discounted: the present value of advertising with double prices in the environment of the rent freeze is smaller than if the rent freeze was never announced. Hence, while double-price advertising dampens the negative effect of the rent freeze – as Lemma 3.3 would imply – its adoption is not enough to offset it.

4. Data

To assess the immediate impact of the rent freeze on advertised rents we primarily use online sale and rent adverts collected and processed by *VALUE Marktdaten* (formerly *Empirica Systeme*).²¹ This database constitutes the most comprehensive data source for rent adverts in Germany as data from several platforms are pooled.

For a more detailed analysis regarding the occurrence of double-pricing adverts, we also need information that is not contained in *VALUE Marktdaten*. Thus, for some analyses we rely on the subsample of adverts posted on the single largest platform *ImmobilienScout24*, for which we provide summary statistics.

Both sources are further complemented by the “Mietspiegel”,²² an official repository reporting the typical current rent paid in different parts of Berlin.

4.1. *VALUE Marktdaten*

We assess the immediate impact of the policies on advertised asking rents. For this purpose, we primarily use online sale and rent advertisements collected and processed by *VALUE Marktdaten* (formerly *Empirica Systeme*).²³ This platform gathers ample information on all types of apartments and houses on the market by pooling a rich set of real estate information providers, including asking prices as well as various dwelling characteristics.²⁴ Importantly, it allows us to obtain precise information on location by geo-coding exact addresses mentioned in the adverts.²⁵

For our estimation sample we exclude statistical outliers (properties older than 300 years) and units that, even if advertised, were not built yet. In total, we exclude only eight observations

²¹See <https://www.value-marktdaten.de/> (last accessed in April 2021) and a description of sources as well as quality checks applied.

²²See <https://www.stadtentwicklung.berlin.de/wohnen/mietspiegel/de/wohnlagenkarte.shtml>, last accessed in December 2020

²³See <https://www.value-marktdaten.de/> (last accessed in April 2021) and a description of sources as well as quality checks applied.

²⁴Thus, privately concluded contracts – common, e.g., among students living in shared apartments – are not covered. However, these cases do not typically involve a new rental agreement with landlords. Therefore, they fall outside the scope of our analysis.

²⁵In the case of missing exact address information (e.g., street name but no street number), geographic coordinates are estimated as well as a “confidence circle”. We use this circle as a measure of trustworthiness into the constructed pseudo-address and check the impact on results. However, these technicalities do not affect the overall results (see Appendix B).

leaving 74,657 in the full estimation sample, covering the period between January 2018 and June 2020. Summary statistics compiled for all advertisements included in our sample are shown in [Table C1](#) in [Appendix C](#). More detailed statistics, compiled to assess the comparability of types of units advertised before and after the announcement and enactment of the rent freeze, are reported as a part of comprehensive robustness and plausibility checks in [Appendix B](#).

4.2. *ImmobilienScout24*

In order to obtain additional information on advertised rents we contacted *ImmobilienScout24*, the single largest real estate advertisement platform. Doing so enabled us to obtain information from adverts’ “free-text fields”, which are frequently used to provide clarification on the demanded rent, in case the rent freeze was abolished. However, due to data protection concerns, we were not provided with the full content of the free-text entries (which sometimes also contain names and contact information). Thus, we asked *ImmobilienScout24* to provide us with results from a keywords search within the free-text fields, next to the standard housing characteristics and asking prices. We summarize keywords used for this query in [Table 2](#). We use keywords for identifying adverts covered by the rent freeze policy that are mentioned in at least in 3% of the adverts.²⁶

Overall, we obtained over 323,000 adverts covering the period from January 2018 through June 2021. [Table C2](#) in [Appendix C](#) reports summary statistics for the *ImmobilienScout24* data. We do not detect any substantial difference as compared to the *Value Marketdaten* sample. We also compile spatially stratified summary analyses (reported in [Table C3](#)) and do not find significant deviations between the two data sources.²⁷

²⁶For this reason, further tested keywords have been discarded, namely “Abschlag” (reduction), “alternativ” (alternative), “aufheben” (revoke), “Nutzungsgeld (usage fee), “Senat” (senate) and “Wohnrecht” (housing legislation).

²⁷[Table C3](#) compares the number and proportion of advertisements of rental dwellings by 12 Berlin’s districts, according to *ImmobilienScout24* and *VALUE Marktdaten*. There is a very strong positive relationship: the larger the share of observations in one district, according to the *ImmobilienScout24*, the larger the share, according the *VALUE Marktdaten*. The differences in the shares vary between -1.6 percentage points for Charlottenburg-Wilmersdorf (the share is larger according to *VALUE Marktdaten* than according to *ImmobilienScout24*) to $+2.9$ percentage points for Marzahn-Hellersdorf. This is relatively small, given that the average share is about 8.3%.

Table 2: Keywords for Double Rent Identification

German	English	Keyword	Frequency of Appearance
MietenWoG		abbreviation of the rent freeze law [technical term]	4.4%
Mietendeckel		rent ceiling	2.6%
nichtig		void, invalid [technical term]	2.2%
verfassungswidrig		unconstitutional	2.2%

Notes: The table summarizes the queries used to identify double rent prices in the context of the rent freeze. In addition to these keywords, we searched for numerical values and currency symbols that were retrieved whenever our search for keywords was successful.

Source: Author’s calculations based on data provided by *ImmobilienScout24*.

4.3. The “Mietspiegel”

The so-called *Mietspiegel* is an official source of information on local rents for comparable dwellings that are used for determining the allowed rents. It is based on rent price data that are collected in the course of a representative survey among renters. The survey covers rental contracts concluded within the last six years and should be updated every two years.

Importantly, the quality of each address in Berlin is classified into one of three categories: simple locations (“*einfache Wohnlage*”), average locations (“*mittlere Wohnlage*”), and good locations (“*gute Wohnlage*”). These classifications are used in determining rent caps in accordance with the rent freeze (see [subsection 2.3](#) for the detailed rules).

5. Immediate Price Effects

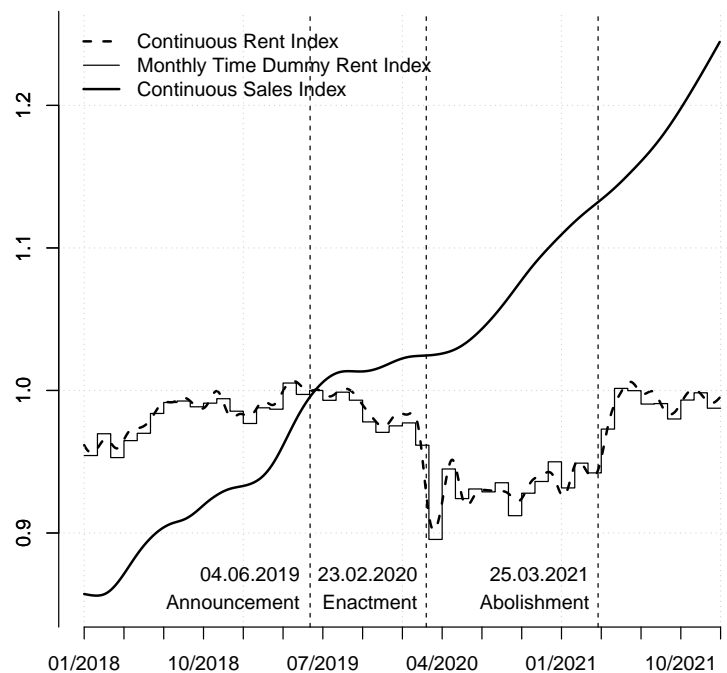
In this section we empirically evaluate the short-run effect of the rent freeze on advertised rental prices. After descriptive analyses including comparisons to sales prices and rent prices in other German cities, we measure causal price effects. To do so, we use a hedonic Difference-in-Differences approach for changes within Berlin and a Spatial Regression Discontinuity model to measure effects along the border with the federal state of Brandenburg.

5.1. Descriptive Analysis

To illustrate the general trends in Berlin’s housing market, [Figure 4](#) shows hedonic rent price indices (see [Rosen, 1974](#)). To put movements into perspective, we also show a residential

house sales price index based again on adverts (separate indices for units that would be, given their characteristics, regulated or not are shown in [Figure 7](#) in the Appendix). Since roughly mid-2018, sales prices were increasing at a much more rapid pace than rents. Sales prices, though being more volatile, also left an ever-increasing price trajectory, yet we do not observe declining prices. While co-movements between sales and rent prices were rather the norm before 2019, ever since the enactment of the rent freeze the two indices follow opposing trends.

Figure 4: Nominal Sales and Rent Price Indices: Berlin



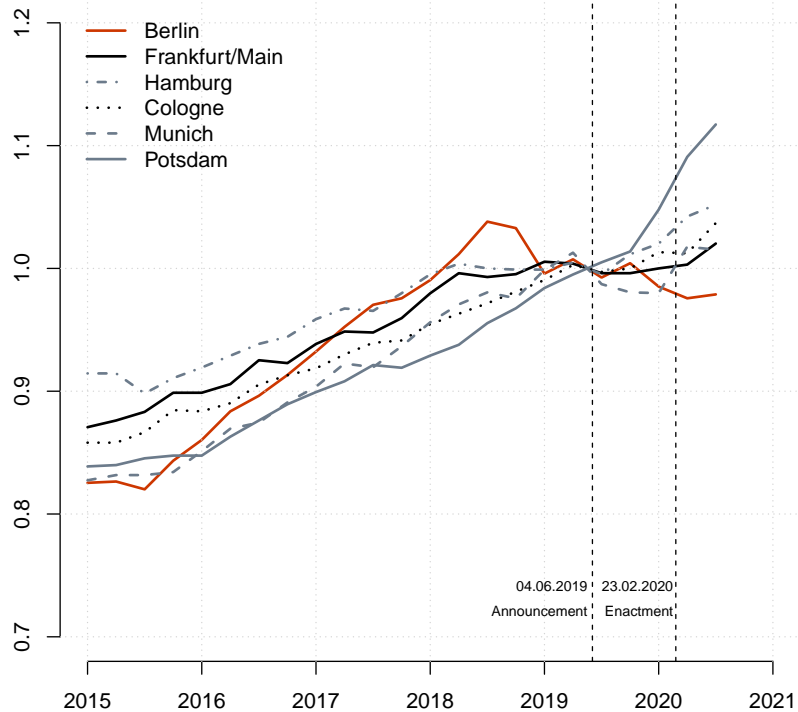
Notes: The indices unveil the general trend in the sales and rental market between 2018 and 2021. Indices are normalized to their respective average index number in June 2019, when the announcement took place. The time-continuous indices follow the methodology developed in [Waltl \(2016\)](#) based on *adaptive smoothing* techniques. The continuous trend in the rental market is compared to a standard monthly time-dummy index (see [de Haan and Diewert, 2013](#)).

Source: Author's visualisation based on data provided by *VALUE Marktdaten*.

We identify increases in rent prices up until June 2019 after which advertised rents stagnate, and then subsequently start falling. The continuing decline in rents ever since February 2020 already hints towards substantial price effects related to the rent freeze.

The exceptional disruptions in Berlin’s rental market are even more visible when comparing changes in asking rents in Berlin to those in other major German cities as well as in Berlin’s satellite city Potsdam and adjacent municipalities (see [Figure 5](#) and [Table 3](#)). While in 2020

Figure 5: Rent Price Indices for Selected German Cities and Communes



Notes: The figure shows quarterly asking rent price indices for existing property units (“Bestandswohnungen”) for several large German cities (Cologne, Frankfurt/Main, Hamburg, and Munich) as well as for Berlin’s satellite city Potsdam. Indices are normalized to the average index number in the second and third quarters 2019.

Source: VALUE Marktdaten.

asking rents kept increasing at a similar pace in all other cities, asking rents in Berlin fell instead. Importantly, the adjacent areas as well as the satellite city Potsdam are – though part of the urban conglomerate – not covered by the rent freeze as they are located outside of the administrative boundaries of the German capital.

Particularly remarkable is the sharp rise in rents in Potsdam as reported in [Table 3](#). The

Table 3: Berlin vs. Other German Locations

	Aggregation Level	Change since Announcement – Δ		
		Q1:2020	Q2:2020	Q3:2020
Germany	Whole Country	0.019	0.028	0.035
Berlin	Major City	-0.015	-0.024	-0.021
Hamburg	Major City	0.020	0.042	0.052
Cologne	Major City	0.013	0.012	0.037
Frankfurt/Main	Major City	0.000	0.003	0.020
Munich	Major City	-0.020	0.018	0.015
Potsdam	Satellite City	0.048	0.091	0.117
Barnim	Adjacent Municipality	0.023	0.053	0.084
Dahme-Spreewald	Adjacent Municipality	0.028	0.060	0.081
Havelland	Adjacent Municipality	0.015	0.017	0.055
Märkisch-Oderland	Adjacent Municipality	0.075	0.067	0.090
Oberhavel	Adjacent Municipality	0.040	0.039	0.075
Oder-Spree	Adjacent Municipality	0.027	0.011	0.034
Potsdam-Mittelmark	Adjacent Municipality	0.012	0.005	0.013

Notes: The table reports changes in various hedonic rent price indices. Nearby municipalities are adjacent municipalities bordering Berlin. $I(Q_t)$, the change in index numbers between quarter Q_t and the reference period, is computed via $\Delta(Q_t) = I(Q_t)/\text{Mean}(I(Q2:2019), I(Q3:2019)) - 1$.

Source: Author’s calculations based on indices provided by *VALUE Marktdaten*.

cumulative change ever since the announcement of the rent freeze amounts to roughly 5%, 9%, and 12% in the first three quarters of 2020 respectively. Comparing these increases to Germany-wide changes or other major cities, Berlin truly stands out. Smaller adjacent municipalities also experienced substantial increases comparable to that in Potsdam. These findings indicate a *substitution effect* likely triggered by the rent freeze, which exclusively applies to dwellings strictly located within Berlin’s administrative boundaries.

Why are owners substantially increasing asking rents outside of Berlin? A possible explanation could rely on the one-time opportunity for owners of vacant apartments located just across Berlin’s border, which are exempted from the rent freeze regulation: as we show that the supply of rental units dropped significantly within Berlin upon enactment of the policy (see [Figure 10](#)), the excessive demand from home-seekers needing to rent immediately might have leaked across the border, resulting in those owners taking advantage of this by asking for

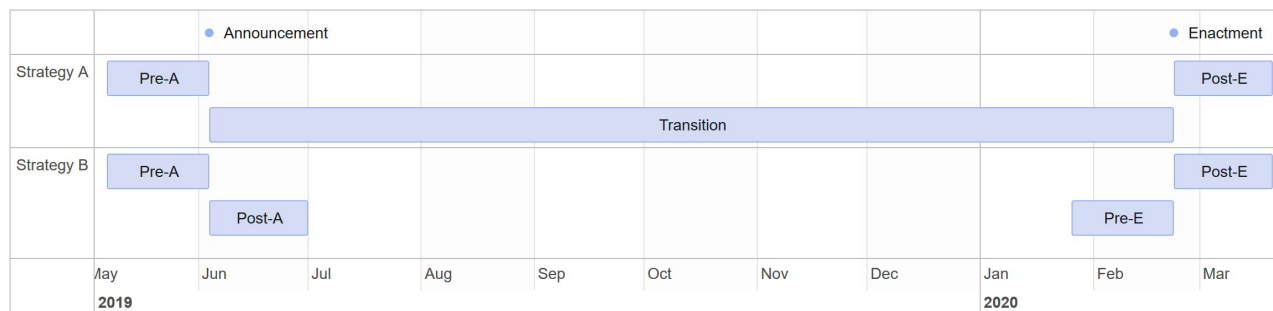
relatively higher rental prices.

5.2. Measuring Causal Price Effects

5.2.1. Identification Strategy

We use the rent freeze announcement and enactment dates, together with data from exempt units, to causally identify corresponding supply-side reactions. Specifically, we select *advertised rents* for this purpose, in order to avoid timing ambiguity due to the common lengthy time gap between first advertisement and the subsequent signing of rent contracts. The rent freeze was first communicated on 4 June 2019 and, finally, became effective on 23 February 2020. These two dates delineate the three clearly distinguishable time periods as depicted in [Figure 6](#).

Figure 6: Time-line



Notes: The timelines visualizes the sequence of relevant events as well as the definition of periods.

To put a clear focus on the immediate price effects, we look at the shorter periods of 28 days before and after each event. The length of 28 days has been chosen in an attempt to exclude potential confounding effects of the COVID-19 pandemic: on 22 March 2020, i.e., 28 days after the enactment, the second regulation on pandemic containment measures became effective in Berlin.²⁸ The strict health measures aimed at combating the pandemic led to a (shortly lived) deep economic downturn affecting also rent price dynamics.²⁹

²⁸See “Zweite Verordnung zur Änderung der SARS-CoV-2-Eindämmungsmaßnahmenverordnung, vom 21. März 2020”, available online in German <https://www.berlin.de/sen/justiz/service/gesetze-und-verordnungen/2020/ausgabe-nr-12-vom-27-3-2020-s-217-224.pdf>, last accessed in December 2020

²⁹In Germany, the government reacted to the strained financial situation of tenants caused by the pandemic by imposing stronger protection from eviction. In late March 2020, a law was enacted that prohibited eviction of tenants who did not pay their rent between 1 April and 30 June 2020 (Gesetz zur Abmilderung der Folgen

The resulting sub-periods are: (1) *pre-announcement, Pre-A* — between 7 May 2019 and 3 June 2019; (2) *post-announcement, Post-A* — between 4 June 2019 and 1 July 2019, i.e., after the announcement of the new law; (3) *pre-enactment, Pre-E* — between 26 January 2020 and 22 February 2020; and (4) *post-enactment, Post-E* — between 23 February 2020 and 21 March 2020, i.e., after the rent freeze became legally binding.

We estimate hedonic Difference-in-Differences (DiD) models to identify the immediate price effects upon announcement and enactment of the rent freeze. Therefore, we use dwellings *explicitly excluded* from the policy as control group. As a robustness check, [subsection B.1](#) in [Appendix B](#) relaxes the strict selection criteria to advertised units that are not *for sure*, yet *likely*, exempt.

The explicit control group comprises newly constructed buildings ready for occupancy for the first time starting from 1 January 2014 or, in particular cases, apartments that have been modernized to a substantial degree after a prolonged period of non-occupancy (*Neubauaufwand*). To identify those objects, we use the variable “first time occupancy” collected by *VALUE Marktdaten*. This yields a subset comprising all apartments that were ready for first time occupancy starting from 1 January 2014, covering both units in newly built properties and substantially refurbished ones. Moreover, apartments that were built from 1 January 2014 onward are generally included into the control group as they are not covered by the rent freeze. To increase precision – similarly as [Mense et al. \(2019\)](#) – we exclude relatively old units (built before 2013), which are offered under the label “first-time occupancy” even if they have not undergone any modernization.³⁰ Accordingly, we also exclude all units that were renovated before 2013.

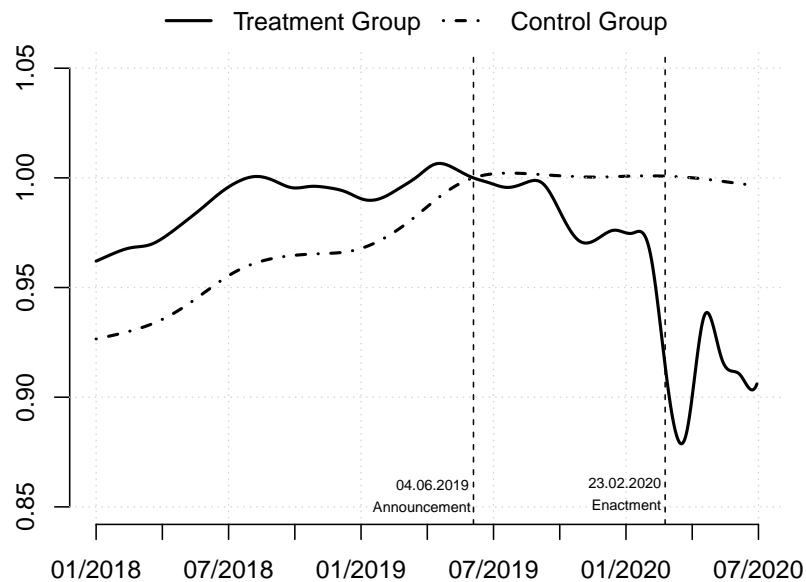
One could be concerned that dwellings in the control and treatment group may be different with regard to their features and may thus attract a distinct audience. We tackle this issue by including a rich set of hedonic control variables including, most importantly, the exact

der COVID-19-Pandemie im Zivil-, Insolvenz- und Strafverfahrensrecht of 27 March 2020). Unlike some other countries, no rent freezes were introduced. The purchasing power of households was supported by different subsidies that allowed them, among other things, to pay rent on time. For example, the ratio of rent debts to the total rent revenue computed for housing companies belonging to the Federal Association of German Housing and Real Estate Companies (GdW Bundesverband deutscher Wohnungs- und Immobilienunternehmen e.V.) remained in 2020 at 2.1% even lower than the average over the 2011–2019 period.

³⁰In their investigation regarding the rent brake, [Mense et al. \(2019\)](#) exclude dwellings with building ages ranging between two and ten years, although they were reported as *first time use*, in order to mitigate measurement error.

location of a dwelling. In this spirit, we further check the *common trend assumption* crucial when employing a DiD estimator. Therefore, [Figure 7](#) shows pre-trends for both the treatment and control group by comparing identically compiled hedonic indices, separately evaluated for dwellings in the control and treatment group. Indeed, both types of apartments appear to follow a common trend up until the announcement of the new law. Thereafter, trends diverge.

Figure 7: Common Trend Assumption



Notes: The indices show the general trend of prices in the treatment vs. control group between 2018 and the end of the second quarter 2020. Indices are normalized to the announcement date (4 June 2019). The time-continuous indices follow the methodology developed in [Waltl \(2016\)](#) based on *adaptive smoothing* techniques.

Source: Author’s visualisation based on data provided by *VALUE Marktdaten*.

We rely on two complementary strategies to measure sudden shifts in rent prices as depicted in [Figure 6](#). *Strategy A* relies on a single model covering the entire time span (see model [A](#)), whereas *strategy B* estimates separate models for the events “announcement” (model [B.1](#)) and

“enactment” (model B.2):

$$\log(R_{it}) = \beta_0 + \beta_1 C_i + \beta_3 \text{Transition}_t + \beta_4 \text{Post-E}_t \quad (\text{A})$$

$$+ \beta_6 C_i \times \text{Transition}_t + \beta_7 C_i \times \text{Post-E}_t + \xi' X_i + \varepsilon_{it},$$

$$\log(R_{it}) = \beta_0 + \beta_1 C_i + \beta_2 \text{Post-A}_t + \beta_5 C_i \times \text{Post-A}_t + \xi' X_i + \varepsilon_{it}, \quad (\text{B.1})$$

$$\log(R_{it}) = \beta_0 + \beta_1 C_i + \beta_4 \text{Post-E}_t + \beta_7 C_i \times \text{Post-E}_t + \xi' X_i + \varepsilon_{it}, \quad (\text{B.2})$$

where R_{it} denotes the monthly rent of unit i as advertised at time t . The dummy variable C_i equals one, if the apartment is covered by the rent freeze, and zero otherwise. The dummies Transition_t , Post-A_t , and Post-E_t indicate in which time period the advert was observed. Further, β_j for $j \in \{0, \dots, 7\}$ are associated parameters. X_i denotes a matrix containing various hedonic characteristics including a smooth locational spline with associated parameter vector ξ . Finally, ε_{it} is a normally and independently distributed error term. As the set of covariates includes smooth regressors, the models are consequently estimated via *penalized least squares*.

5.2.2. Results from Hedonic Difference-in-Differences Estimation

Table 4 reports key estimation results focusing on the 28-days periods before and after the rent freeze’s announcement and its legally-binding enactment, as well as the in-between transition period as shown in Figure 6. Table C4 in Appendix reports the full set of results.

The mere announcement has no significant immediate impact on advertised rent prices when contrasting the regulated sector against the unregulated one. Apparently, owners did not follow the call by the landlords’ and homeowners’ association *Haus und Grund* to raise rents before the rent freeze would come into force.³¹ In contrast, the legal enactment of the rent freeze led to a sharp and statistically highly significant decrease in asking rents among the treatment group (-0.075^{***}) as compared to the non-regulated control group.

We find that units covered by the rent freeze (treatment group) are generally less expensive than those exempt (control group). Given the fact that the control group comprises *new and renovated* property units, this result is in line with what we would expect. Reassuringly, the

³¹It is still possible that the rents were raised for the already concluded contracts, which cannot be observed from asking prices. However, given rather strict regulations concerning rent adjustment within existing contracts, this is quite improbable.

Table 4: Main Results

	Response: <i>Monthly Rent (log)</i>		
	Strategy A	Strategy B	
Treatment (units covered by rent freeze)	−0.063*** (0.012)	−0.075*** (0.017)	−0.073** (0.024)
Post-A		−0.009 (0.013)	
Transition	−0.007 (0.010)		
Post-E	−0.018 (0.017)		−0.018 (0.020)
Treatment × Post-A		0.007 (0.014)	
Treatment × Transition	−0.008 (0.011)		
Treatment × Post-E	−0.113*** (0.019)		−0.075*** (0.022)
Housing characteristics	✓	✓	✓
Number of observations	26,842	5,311	3,314
Adjusted R ²	0.832	0.843	0.830

Notes: Standard errors shown in parentheses. The GAMs estimated include the variables *location* (smooth term), *age* (smooth term), *first time occupation*, *living area*, *number of rooms*, *garden*, *balcony/terrace*, *fitted kitchen*, *parking*, *elevator*, *separate toilet*. The full set of results are reported in [Table C4](#). Significance is indicated using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01; ***p-value<0.001.

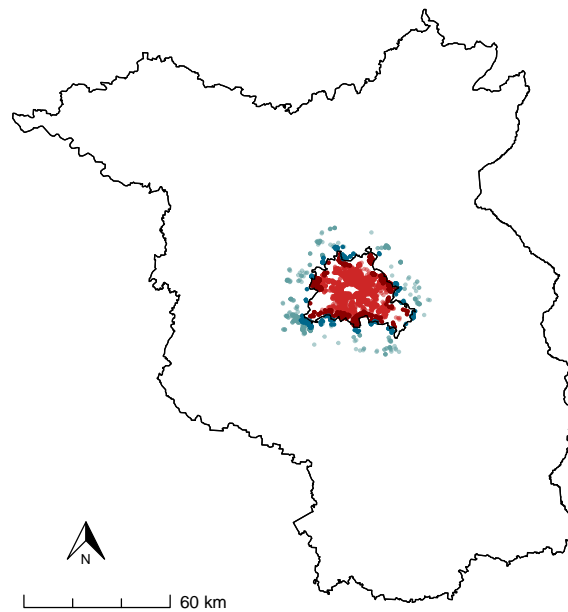
size of the estimated coefficient associated with the classification into covered and exempt units remains practically identical for both specifications as reported in the first line in [Table 4](#).

A potential concern, however, is that the effect sizes we estimate can depend on — possibly adverse — changes in asking rents for unregulated units. The trends shown in [Figure 7](#) do not indicate such a reciprocal effect. Additionally, the study design itself limits such an impact: First, we look at the very short run. Systematic effects can — if ever — only be observed later on. Second, occupied dwellings cannot be freed up immediately, due to contractually agreed contract lengths and notice periods. Hence, we deduce that the time elapsed between the first detailed announcement and the final enactment is likely to be too short to trigger substantial changes in this direction.

5.3. The Role of Administrative Borders

As shown in [Figure 8](#), Berlin is entirely enclosed in the federal state Brandenburg. Together they form the *German capital region* considered as a single metropolitan agglomerate. Being part of a single urban zone is particularly true for large parts of the directly neighbouring area. The rent freeze, however, is exclusively applicable to the administrative territory of Berlin. Units just across the border are not covered by the regulations.

Figure 8: Apartments close to the border with Brandenburg



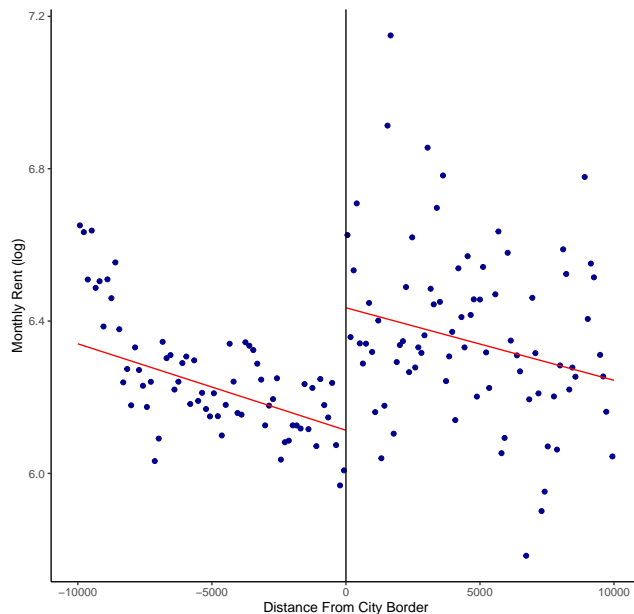
Notes: The figure shows the shapes of Berlin (red) and Brandenburg (blue). Each dot represents the location of a property unit advertised in the extended *post-enactment* (*POST*) period (23 February 2020 – 30 June 2020) in Berlin or Brandenburg. The dots in darker shades lie within 2km of the border, whereas those in lighter shades are located within a 10km band. Advertised units are scattered around the entire city except local recreation areas (e.g., in the South/South-East the “Müggelspree-Löcknitzer Wald- und Seengebiet”, see also [Table 5](#)).

Source: Author’s visualisation based on data provided by *VALUE Marktdaten*.

Hence, we compare how advertised prices changed in the *post-enactment* (*POST*) period (extended until 30 June 2020), for apartments that, given their characteristics, would have been covered by the rent freeze if they were located in Berlin. Yet, apartments with such features located just across the administrative border are *not* covered. We exploit this spatial discontinuity to assess how advertised rents are affected by the rent freeze on both sides of the city border.

First, notice that a general comparison of asking rents on both sides of the border — without controlling for hedonic dwelling features — already indicates a substantial price differential (see [Figure 9](#)). Nevertheless, to achieve better comparability across advertised units, we estimate

Figure 9: RDD – Graphical Analysis



Notes: The figure compares the logged prices of apartments in Berlin vs. Brandenburg, lying within a 10 km band around the border. A negative distance refers to dwellings within Berlin and a positive distance for those in Brandenburg. A triangular kernel function has been used to construct the linear estimator. The binning of the data has been optimised (see [Calonico et al., 2015](#)).

Source: Author’s visualisation based on data provided by *VALUE Marktdaten*.

suitably designed hedonic-style *Spatial Regression Discontinuity Models* (see [Thistlethwaite and Campbell, 1960](#); [Imbens and Lemieux, 2008](#)). Similar to the hedonic DiDs adopted earlier, we regress the logged monthly advertised rent on a set of physical dwelling characteristics, posting time t , and steering variables. These steering variables are: a dummy indicating on which side of the border the property unit is located, and a continuous variable measuring the distance to the border (expressed in 100 meters entities defined as the minimum Cartesian distance between an apartment’s geo-location and the border polygon).³²

However, as we explicitly measure a spatial discontinuity, we substitute the locational spline

³²We apply the Universal Transverse Mercator (UTM) projection, zone 33, where Brandenburg and Berlin are located.

used previously by a dummy indicating whether the unit is located within or across the administrative border of Berlin. By doing so, we project two-dimensional co-ordinates into a one-dimensional unit, missing the modelling of price variations across different border areas. Thus, we re-introduce a second dimension via an additional dummy variable CD , which indicates compass directions. We distinguish eight directions: North (N), North-East (NE), East (E), South-East (SE), South (S), South-West (SW), West (W) and North-West (NW). We allocate each apartment to its closest compass direction, which we compute using the exact geo-location of the property unit.

These three geographic elements uniquely define the exact geo-location of advertised units, just as longitudes and latitudes, but now in the spirit of a polar coordinate system rather than the Cartesian system we have used before: compass directions CD , the distance to the city-border polygon d (topologically equivalent to a circle) and the indicator discriminating between locations inside and outside of the city-border polygon,

$$\log(R_{it}) = \beta_0 + g(t) + f(d_i) + \beta_1 \text{Brandenburg}_i + \beta_2' CD_i + \xi' X_i + \varepsilon_{it}. \quad (\text{RD})$$

Time enters the model as a linear function or a higher degree polynomial. Given there are hardly any differences, we opt for the simple linear case: $g(t) = \gamma t$. We define a negative distance $d_i < 0$ for units within Berlin, and a positive one $d_i > 0$ for observations outside. We estimate $f(d)$ again as either a continuous linear variable or a smoothly estimated function relying on polynomials of order up to four, but finally select $f(d_i) = \delta d_i$.

We use a local linear modelling approach and set the bandwidths to two, five, and ten kilometres, respectively.³³ A weighting scheme based on a triangular kernel ensures that observations close to the border ($d_i \approx 0$) receive more weight. Our findings are robust to other specifications including interaction terms between the Brandenburg dummy and distance d_i ,³⁴ or excluding kernel weights.

Table 6 reports our main estimation results. We find a stark spatial price effect along the

³³The largest distance between any advertised advert in Berlin and the city boundaries in the *POST* period was 11.8 km. Thus, a distance of more than 10 km would introduce ambiguity regarding the allocation to unique border segments.

³⁴When adding interaction terms, the effect size is slightly larger for the 2 km bandwidth and slightly smaller for the 5 km and 10 km bandwidths.

Table 5: Apartments at the Border: Compass Directions

	N	NE	E	SE	S	SW	W	NW	Total
Brandenburg	35	40	65	59	22	237	109	63	630
Berlin	561	622	547	484	194	339	620	508	3,875
Total	596	662	612	543	216	576	729	571	4,505

Notes: The table reports the number of advertised property units for rent within 10km of the administrative border between the federal states Berlin and Brandenburg by compass direction. Compass directions are abbreviated as follows: North (N), North-East (NE), East (E), South-East (SE), South (S), South-West (SW), West (W) and North-West (NW).

Source: Author’s calculations based on data provided by *VALUE Marktdaten*.

border with Brandenburg measured by the Brandenburg dummy. Comparable advertised units located just across the border demand significantly higher rents than their counterparts within Berlin. The effect is most pronounced (and most precisely measured) when assessing a very narrow bandwidth of 2 km covering the direct border area only. The effects remains significant even when including hedonic controls or moving further away from the border.

Thus, the rent freeze has indeed introduced an artificial price border within Germany, which is instead usually observed along national borders, when substantially different housing markets and regulation regimes meet (see, for instance, [Micheli et al., 2019](#)).

6. Quantity Effects

In this section, we empirically evaluate the short-run effect of the rent freeze on the supplied quantity of property units in Berlin. We first test the predictions of our theoretical framework in terms of the quantity of advertised property units, and then assess the impact of the occurrence double-pricing rents.

6.1. The Fluctuating Number of Adverts

Our theoretical framework predicts that both the announcement and enactment of the rent freeze would adversely affect owners’ participation in the rental market. This prediction is in line with empirical findings by [Diamond et al. \(2019\)](#) analysing the impact of a rent control policy in San Francisco. They document that “[l]andlords treated by rent control reduce rental housing supplies by 15 percent by selling to owner-occupants and redeveloping buildings.” From

Table 6: Spatial Regression Results

Max. Distance	Response: <i>Monthly Rent (log)</i>					
	2 km		5 km		10 km	
Brandenburg	0.211*** (0.029)	0.188*** (0.030)	0.130*** (0.020)	0.150*** (0.019)	0.137*** (0.014)	0.166*** (0.014)
Distance d	-0.007*** (0.002)	-0.006*** (0.002)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Housing characteristics	✓	✓	✓	✓	✓	✓
Compass directions	✓	✗	✓	✗	✓	✗
No. of observations	882	882	2,301	2,301	4,505	4,505
Adjusted R ²	0.813	0.793	0.782	0.771	0.747	0.74

Notes: The table reports estimation results of model RD. Models differ in the set of rent advertisements included (maximum distance of 2, 5, or 10 km away from the administrative city boundaries) and the inclusion of compass directions. Kernel weights (triangular) are respected. Housing characteristics comprise the same variables as in the DiD specification plus a linear time trend. Full results to be found Table C7, Table C6 and Table C5 in the appendix.

Source: Author’s calculations based on data provided by *VALUE Marktdaten.*

a macroeconomic perspective, Leamer (2007) even argues in favor of generally assessing more the *housing volume cycle* to detect fluctuations rather than focusing on price movements only.

We empirically evaluate predicted quantity effects on the supply side in three dimensions: changes in the use of dwellings, changes in new construction, and changes in the number of posted advertisements (“volume”).

First, regarding the use of dwellings, it is insightful assessing units in Berlin that were converted from rental to owner-occupied apartments. Their number sharply increased from 12,700 in 2019 to 19,200 in 2020 indicating that these dwellings can be permanently lost for renters.³⁵

Second, the number of completed new dwellings predicts the medium- to long-term effects, which – according to or theoretical framework – should also be affected due to the lower expected stream of income from renting, reducing the number of participating actors in this market. Indeed, in 2020 this number declined sharply by 14% as compared to 2019, while in Germany as a whole this indicator increased by almost 5% (see Destatis, 2021).

Finally, we assess the immediate effects on flats directly targeted by the rent freeze. There-

³⁵See https://www.stadtentwicklung.berlin.de/aktuell/pressebox/archiv_volltext.shtml?arch_2112/nachricht7242.html, p. 72, sec. 3.3 Berlin. Last accessed in January 2022.

Table 7: Volume Effects

		Number of new adverts per week		
		Mean	Median	Interquartile Range
Rent Adverts				
PRE	1 Jan 2018 – 3 June 2019	628.55	639.50	152.75
	...thereof in treatment group	510.04	517.00	98.25
	...thereof in control group	118.51	115.50	29.50
TRANS	4 June 2019 – 22 Feb 2020	614.97	619.00	105.00
	...thereof in treatment group	509.14	522.00	79.00
	...thereof in control group	105.84	106.00	36.00
POST	23 Feb 2020 – 30 June 2020	276.28	262.50	79.75
	...thereof in treatment group	224.00	223.50	50.50
	...thereof in control group	52.28	54.00	19.50
POST-2018	23 Feb 2018 – 30 June 2018	598.18	587.00	89.00
POST-2019	23 Feb 2019 – 30 June 2019	651.41	644.00	92.00
Sales Adverts				
PRE	1 Jan 2018 – 3 June 2019	143.85	140.50	41.00
TRANS	4 June 2019 – 22 Feb 2020	126.41	126.00	31.00
POST	23 Feb 2020 – 30 June 2020	105.83	107.50	19.25
POST-2018	23 Feb 2018 – 30 June 2018	144.53	141.00	23.00
POST-2019	23 Feb 2019 – 30 June 2019	140.24	133.00	19.00

Notes: The number of new adverts for apartments to rent or sale per week measures the *volume changes* on the supply side. Numbers are reported for all types of property units as well as for rental advertisements separately for those falling into the treatment and control group, respectively. For comparability across seasons, the trade volume for usual activity between 23 February and 30 June are included for the two preceding years 2018 and 2019. For the calculations, all adverts fulfilling our selection procedure described in [section 4](#) are considered. The data are visualized in [Figure 10](#).

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

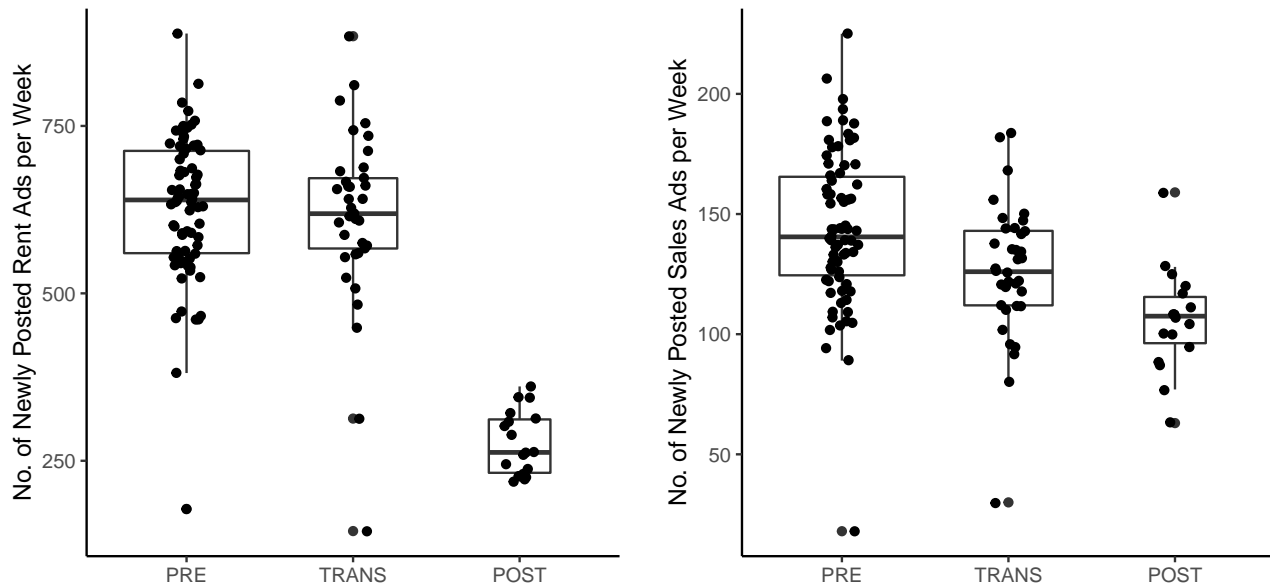
fore, we measure the number of newly posted adverts per week. [Table 7](#) and [Figure 10](#) report the results: While there are hardly any noticeable differences between the *pre-announcement* (*PRE-A*) and *transition* (*TRANS*) period, the ultimate enactment of the policy led to remarkable disruptions. The number of weekly advertised units to rent halved from more than 600 per week before announcement to less than 300 only once the policy was implemented.³⁶ The

³⁶Incomplete weeks are excluded from the analysis.

changes are statistically significant as indicated by the non-overlapping whiskers (95% coverage intervals) in Figure 10 and as formally confirmed by *Tukey Post-Hoc tests* (Tukey, 1949). Full results are reported in Table C8 in the appendix.

We also repeat the same exercise for sales adverts and observe a small drop in the number of adverts in the *post-enactment POST-E* period, even though changes are less pronounced and not significant.

Figure 10: Number of Newly Posted Rent and Sales Adverts Per Week



Notes: The boxplots depict the number of *newly* posted rent (left) and sales (right) advertisements per week separately for the PRE, TRANS and POST period as defined in Table 7. Each dot represents a unique full week. Corresponding numeric results are presented in Table 7.

Source: Author’s visualisation based on data provided by *VALUE Marktdaten*.

The volume usually also varies across seasons. To rule out that measured effects are in fact seasonal ones, we additionally compare the volume in the 2020 POST-treatment period to the exactly same time span in 2018 and 2019. The transaction volume in the two preceding years is indistinguishable from that in the 2020 PRE and TRANS periods. For measuring quantity effects we – unlike to price effects – look at a period overlapping the first COVID restrictions in Berlin. This seems valid as supply has not decreased in other parts of Germany.³⁷ Hence, the

³⁷See figures reported by *ImmobilienScout24*: <https://www.immobilienscout24.de/lp/covid19/>

volume effect we document here is a unique feature unambiguously linked to the rent freeze.

It is important to note that the volume of property units in both the treatment and control group falls roughly by the same rate (see split ups in [Table 7](#)): those being directly captured by the rent freeze as well as those exempt. This finding hints – together with those for new construction and transformation of tenure status – towards a substantial, and likely lasting, sharp decline in available rental units in Berlin.

6.2. *A double-pricing strategy*

After enactment, there was a high degree of uncertainty about the constitutionality of the rent freeze law. As a response, a double-pricing strategy evolved allowing landlords to hedge the risk of renting out a vacant unit at an irrevocable lower price under the rent freeze. This would have meant losses in the expected future income flows over an extended period of time, as laid out in [section 3](#).

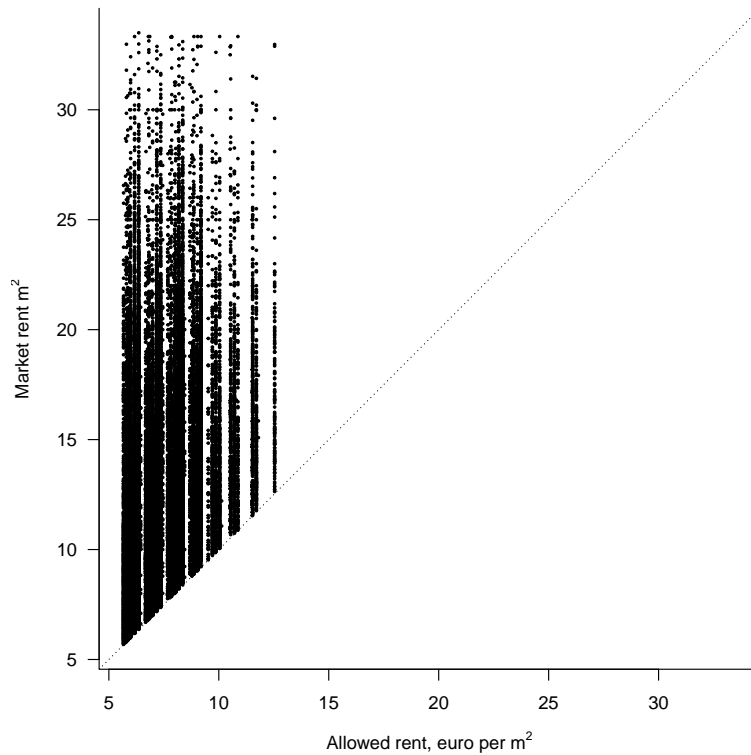
Landlords could hedge this risk by advertising double rent prices: the market and the allowed one. Typically, the authors of adverts mentioned in the section “Miscellaneous” that, in case the law would be revoked, the tenants would have to pay the market price from then onward and additionally refund the foregone difference accumulated during the validity of the rent freeze. This strategy is free of charge for landlords, and potentially provides them with extra future income in case the rent freeze is abolished.

Landlords’ potential economic benefit is confirmed in [Figure 11](#), which shows that the stated alternative rents in adverts are considerably higher than rents following the rent freeze regulations. All dots are above the 45°-line implying that landlords expect substantially higher rents than the allowed ones. In fact, the median difference between the two types of prices amounts to 51%. This difference is even higher for dwellings in good locations (63%), but even for dwellings in simple and average locations, the difference is about 47–48%. Indeed, [Lemma 3.3](#) in our theoretical framework would predict that all landlords should adopt this strategy.

To empirically investigate this issue we use the *ImmobilienScout24* data set. This was necessary as the alternative rents were stated in the unsystematic free-text field, which is not

[immobilienmarkt-in-zeiten-von-corona.html](#), last accessed in February 2022.

Figure 11: Asking vs. allowed rents



Notes: Alternative rents are asking rent prices stated in the advertisements, while allowed rents are those imposed by the rent freeze. The dotted line has 45°.

Source: Author's visualisation based on data provided by *ImmobilienScout24*.

collected by *VALUE Marktdaten*.³⁸

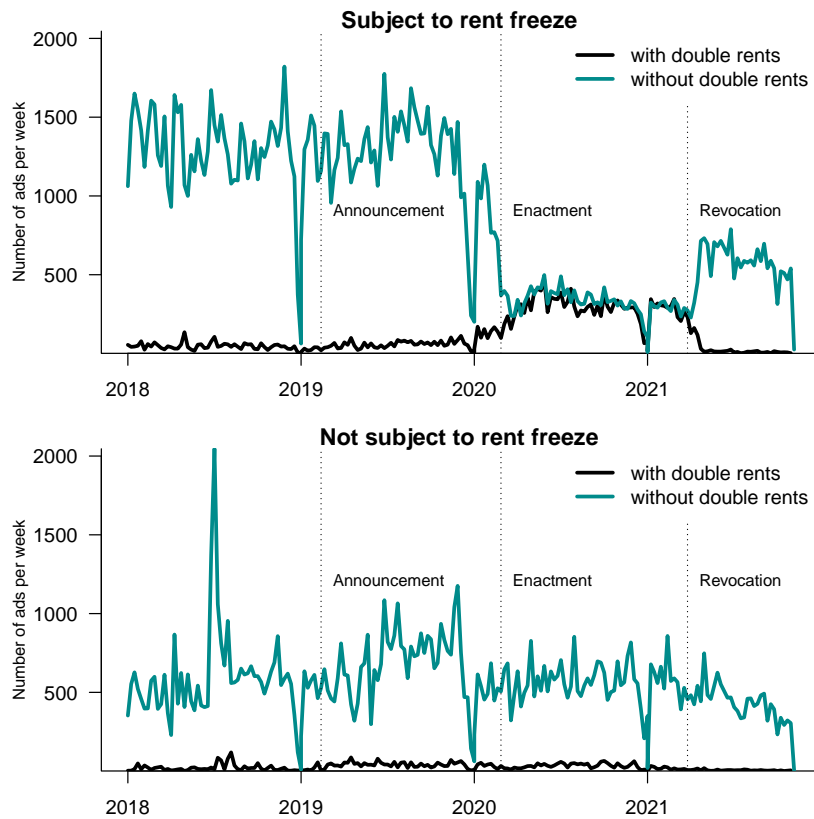
Among the *ImmobilienScout24* advertisements, 51% were subject to the rent freeze following the same classification procedure as for the *VALUE Marktdaten* adverts. Among covered adverts, the share mentioning the rent freeze law varies across time as shown in [Figure 12](#) displaying weekly dynamics of the number of adverts with and without double rents. The upper (lower) panel depicts the dynamics for dwellings (not) subject to the rent freeze.

The share of adverts with double rents started off with 11% in February 2020,³⁹ increased to 34% in March 2020, and further stabilized at 45–50% until March 2021. After the revocation

³⁸Reassuringly however, we show in [section 4](#) that the subsample of units advertised on the *ImmobilienScout24* platform does not systematically deviate from the full set of online advertisements collected by *Value Marktdaten*.

³⁹Apparently, some authors of adverts were informed about the coming law and included the corresponding provisions in their adverts. Another explanation is that such provisions were included later in the advertisements that were published prior to the enactment of the rent freeze law.

Figure 12: Number of adverts with and without double rents



Notes: The black line shows the number of adverts stating double rents, while the greenish one displays the number of adverts without double rents. Two vertical lines indicate the enactment and revocation of the rent freeze, respectively. Spikes depict the usual monthly, quarterly and year-end dynamics.

Source: Author's visualisation based on data provided by *ImmobilienScout24*.

of the law, the share of such adverts plummeted. Before enactment, as well as after revocation, the phenomenon of adverts with double rents is a very rare one.

While the majority of posted adverts subject to the rent freeze did indeed apply the hedge, still a substantial portion did not. As the rent freeze was heavily debated in Berlin (see [section 2](#)), it appears unlikely that this observation is due to lack of information, but perhaps landlords had different beliefs about whether and when the rent freeze would be abolished, which could explain a more heterogeneous response in the adoption of the hedging strategy.

7. Robustness Analyses

We perform a variety of robustness checks and sensitivity analyses to increase confidence in our empirical results. Detailed results are presented in Appendix B.

First, we relax the strict selection criteria to delineate treated and non-treated rent advertisements by relying on a single variable available in the data set. These changes lead to some re-classifications, with more adverts allocated to the control group than when relying on the detailed classification procedure.

Next, we check whether the types of property units offered vary over the three constructed periods under consideration, by assessing their characteristics. If so, our DiD results may be confounded. Yet, we do not find any systematic changes.

Importantly, we check whether the results from our core estimation change when leaving out hedonic controls. Additional controls should add in precision, yet general trends should also be visible without them.

Next, we test whether technical choices have an impact on regression results. The data by *Value Marktdaten* contain geo-locations for adverts by reporting an exact address, i.e., street name and number, and the main results presented in the article exclusively rely on these exact geo-codes. Nevertheless, we re-estimate results on the full data including adverts that contain partial address information. These pieces of information result in *quasi locations*, which indicate an approximate position of the property unit. In addition, we use confidence circles constructed by *Value Marktdaten* which reports the level of insecurity depending on the amount of spatial information provided. For instance, if an advert only reports information on the street name without a number, it implies the unit could be located anywhere along that street: the longer the street, the greater the insecurity about the exact location of the property. The radius of the insecurity circle would then be larger for longer streets. We use this additional indicator to elicit as much additional information as possible. Again, main results are not affected by including adverts with quasi-locations.

Finally, we perform several placebo tests all ruling out statistical artifacts. We use sale adverts instead of rent adverts. Therefore, we allocate sale adverts to the treatment and control group, given their characteristics as if they were rent adverts. In addition, we estimate the spatial regression results also for previous years. It turns out that though there has always

been a certain “border effect”, the rent freeze appears to have strongly widened the gap in rent levels along the administrative border between Berlin and Brandenburg.

8. Conclusions

This article discusses the immediate effects of the rent freeze, a recently introduced rigorous rent control policy in Berlin, which was soon after abolished by the constitutional court.

We develop a simple theoretical framework of the rental market that is suitable to analyse the impact of first-generation rent control regimes on the supply of rental properties, with features specific to the rent freeze in Berlin. As predicted, we find that the number of posted adverts declined upon enactment of the policy, with a positive share of rental units leaving this market segment. In addition, we estimate the magnitudes of price and quantity effects upon the policy’s announcement and enactment. As the rent freeze covered only property units within the administrative boundaries between the city of Berlin and enclosing it federal state Brandenburg, we additionally assess the border region which is still part of the metropolitan agglomeration.

For this purpose, we estimate Difference-in-Differences and Spatial Regression Discontinuity models supplemented by a large battery of well established hedonic characteristics accounting for justified heterogeneity in rent prices. This approach guarantees a precise measurement of the effect size. Results thoroughly survive numerous robustness checks.

The supply side reacted to the rent freeze enactment in February 2020 as intended by policy makers: advertised rent prices indeed dropped substantially. As compared to non-regulated properties, these price drops are highly significant — both in economic and statistical terms. At the same time, asking rents surged in Berlin’s satellite city Potsdam and further neighboring municipalities, indicating a substitution effect. We detect a stark border effect: advertised prices for property units just across the administrative border have been higher even before the rent freeze (yet in part statistically insignificantly), however, this gap increased substantially upon enactment of the rent freeze.

Next to the price effects, we identify a considerable decline in the number of advertised rental units. This sizable — yet potentially non-intended — side effect hampers renter’s flexibility and adaptability. In particular, newcomers, young first-time renters, and households moving within

Berlin will face hurdles finding a suitable place to live. The drop in supply can be transitory, yet it could also display the prelude to even harsher housing searching conditions in the future, as our theoretical framework would suggest. For instance, a fraction of the existing property units may be replaced by newly built, or substantially refurbished ones, while another fraction would simply leave the market. These channels could likely lead to lower supply and higher rents in the future, as more affordable units are replaced by newer and more expensive ones.

The overall conclusions are mixed. In particular, rigorous price restrictions seem to be short-sighted, if they come without supplemental strategies to increase the supply of rental units. An overall welfare increasing effect is doubtful (see [Borck and Gohl \(2021\)](#)).

The rent freeze was short-lived but did create substantial turbulence in Berlin's rental market. This "experiment" provides a glimpse of the likely side-effects of introducing strict, but legally shaky policies in a market in distress.

Appendix

A. Theoretical Appendix

A.1. The Model

The time horizon is infinite, and we focus on a steady state in which all variables are constant over time. This environment implies that if a decision is optimal in a given period, it will also be optimal for all subsequent periods. It is thanks to this feature that we can express owners' value functions corresponding to the use of a property unit as follows.

A.1.1. Uses of a Property Unit: Value Functions

In this section we derive the present discounted values of using a unit in the four different states as described in the main body of the article. These expressions will be useful to prove the results established in [subsection 3.1](#).

Denote the present discounted value of a rented unit by O . This can be expressed as

$$O(R) = \frac{1}{1 - \delta}R, \quad (4)$$

which is common to all owners. While owner i 's present discounted value of keeping a unit for personal use is given by

$$V_i^u = \frac{1}{1 - \delta}b_i. \quad (5)$$

Next, the present discounted value of advertising a unit at the current rental price can be expressed as

$$V^a(R) = -k + \delta q O(R) + \delta[1 - q]V^a(R), \quad (6)$$

which, again, is common to all owners. Using (4) this value can be rearranged to

$$V^a(R) = -\frac{1}{1 - \delta[1 - q]}k + \frac{\delta q}{1 - \delta[1 - q]} \frac{1}{1 - \delta}R. \quad (7)$$

Finally, owner i 's present discounted value of keeping a unit vacant to invest in refurbishment can be expressed as

$$V_i^r(\hat{R}) = \rho_i V_i^a(\hat{R}), \quad (8)$$

which, using equation (7), can be rearranged as

$$V_i^r(\hat{R}) = -\rho_i \frac{1}{1 - \delta[1 - q]} k + \rho_i \frac{\delta q}{1 - \delta[1 - q]} \frac{1}{1 - \delta} \hat{R}. \quad (9)$$

A.1.2. Assumptions

These assumptions are necessary to prove the key results of the model.

Assumption A.1. *The parameters of the model are such that $V^a(R) > 0$.*

Assumption A.2. *F is strictly increasing with support $[b, \bar{b}]$.*

Assumption A.3. *G is strictly increasing with support $[0, 1]$.*

A.1.3. Expected Present Value of Renting under the Rent Freeze

In this section, we formally characterise the expected present value of owners' income flow of renting a unit in the rent freeze setting, and we state a lemma characterizing the related expected, per-period, rental price. This will be particularly useful to prove the results established in [subsection 3.2](#).

Recall that owners renting a unit under the rent freeze regime will expect to receive the monthly rent \bar{R} over its entire duration. Hence, to fix ideas, consider the case in which the rent freeze has been enacted (i.e., $p = 1$). Without the use of double-pricing, the expected present discounted value of renting can be expressed as

$$\bar{O}(R, \bar{R}) = \frac{1 - \gamma}{1 - \delta} \bar{R} + \gamma \frac{1}{1 - \delta} R. \quad (10)$$

Thereby, recall that one interpretation of γ is the probability that the rent freeze will be abolished in each period. In fact, if $\gamma = 0$, the rent freeze is expected to last forever, i.e., $\bar{T} \rightarrow \infty$, and thus the present value of renting becomes $\bar{O}(R, \bar{R}) = \frac{1}{1 - \delta} \bar{R}$, that is, owners can only charge the capped rental price \bar{R} from the period in which the policy is enacted and forever afterwards. While if $\gamma = 1$, the rent freeze is expected to be immediately abolished, i.e., $\bar{T} = 0$, and thus the present value of renting becomes $\bar{O}(R, \bar{R}) = \frac{1}{1 - \delta} R$, which is equivalent to the one in (4), that is, as if the rent freeze never happened.

Next, let us now consider double-price advertising, holding the assumption that the rent freeze has been enacted, i.e., $p = 1$. Recall that with double-pricing, owners will expect to

receive a monthly rent of R for \bar{T} periods, an augmented monthly rent of $R + D$ for the subsequent \bar{T} periods, and the market rental price R forever afterwards. Using our interpretation of γ as owners' discount factor for a payoff that comes \bar{T} periods ahead, we can express the present discounted value of renting a unit with double-pricing as:

$$\bar{O}^d(R, \bar{R}, D) = \frac{1 - \gamma}{1 - \delta} \bar{R} + \gamma \frac{1 - \gamma}{1 - \delta} [R + D] + \gamma^2 \frac{1}{1 - \delta} R, \quad (11)$$

where $\bar{O}^d(R, \bar{R}, D) > \bar{O}(R, \bar{R})$ if $D = R - \bar{R} > 0$, and indeed if $D = 0$, i.e., no double-pricing, then $\bar{O}^d(R, \bar{R}, 0) = \bar{O}(R, \bar{R})$, that is, (11) collapses to (10).

Now consider the general case in which there is a constant positive probability $p > 0$ that the rent freeze will be enacted in each period, and a probability $1 - p$ that it will not. The expected present discounted value of renting from the period in which the rent freeze is announced can now be expressed as:

$$\bar{O}^{RF}(R, \bar{R}, D) = p \bar{O}^d(R, \bar{R}, D) + [1 - p] O(R). \quad (12)$$

With probability p owners will perceive the present value of renting under the rent freeze $\bar{O}^d(R, \bar{R}, D)$ as given by (11), while with probability $1 - p$ owners will perceive the present value of renting absent the rent freeze $O(R)$ as given by (4). Substituting (4) and (11) into (12) and rearranging terms collecting R as common factor yields

$$\bar{O}^{RF}(R^{RF}) = \frac{1}{1 - \delta} R^{RF}, \quad (13)$$

where R^{RF} is defined by the following lemma

Lemma A.1. R^{RF} is the expected per-period rental price following the rent freeze:

$$R^{RF} = R^{RF}(p, \gamma, D) = p[1 - \gamma] \bar{R} + \{1 - p[1 - \gamma]\} R + \gamma p[1 - \gamma] D, \quad (14)$$

which is strictly decreasing in p and strictly increasing in γ .

Lemma 14 establishes that the per-period (monthly) rent owners expect to earn, from the announcement of the rent freeze onward, can be expressed as a weighted average of R and \bar{R} , where the weights depend on the probability p that the rent freeze will be enacted, and on the

probability γ that the rent freeze will be abolished – or, on the expected duration of the policy, subsumed by the parameter γ .

To see this, note that if the policy is not enacted with certainty, i.e., $p = 0$, the expected rental price collapses to the market rental price $R^{RF}(0, \gamma, D) = R$ and indeed $\bar{O}^{RF}(R^{RF}) = O(R)$. This will also be the case, if the policy is abolished immediately with certainty: if $\gamma = 1$, then $R^{RF}(p, 1, D) = R$ and $\bar{O}^{RF}(R^{RF}) = O(R)$. Second, consider the case in which the policy is enacted with certainty, i.e., $p = 1$, and is expected to last forever, i.e., $\bar{T} \rightarrow \infty$ which implies that $\gamma = 0$. Then, indeed, the expected rental price will be given by the price set according to the rent freeze $R^{RF}(1, 0, D) = \bar{R}$ and $\bar{O}^{RF}(R^{RF}) = \bar{O}(R, \bar{R})$. Moreover, the rules of differentiation can be used to show that, as intuition would suggest, R^{RF} is strictly decreasing in p and strictly increasing in γ : the higher the probability the rent freeze is enacted, the lower the expected rental price; while, the higher the probability the rent freeze will be abolished, the higher the expected rental price.

Finally, note that $R^{RF}(p, \gamma, D) > R^{RF}(p, \gamma, 0)$: the expected rental price under double-pricing is strictly higher than the expected rental price without this hedge.

A.2. Proofs

Proof of Lemma 3.1. For start, note that the participation condition (1) is derived by making use of equations (7) and (9) in this appendix, for the case in which $V^a(R) > V_i^r(\hat{R})$. Next, the threshold value $\tilde{\rho}$ can be found by solving for the value of ρ at which the inequality in the participation condition (1) becomes binding. Doing so yields

$$\tilde{\rho} = \tilde{\rho}(R, \hat{R}) = \frac{\delta q R - [1 - \delta]k}{\delta q \hat{R} - [1 - \delta]k}. \quad (15)$$

Hence, it is straightforward to note that if $\rho_i < \tilde{\rho}$, $V^a(R) > V_i^r(\hat{R})$. Moreover, it can be inferred that $\tilde{\rho}$ is strictly increasing in R and decreasing in \hat{R} . ■

Proof of Lemma 3.2. The participation condition (2) is derived by making use of equations (7) and (5) in this appendix, for the case in which $V^a(R) > V_i^u$. Next, the threshold value \tilde{b} can be found by solving for the value of b at which the inequality in the participation

condition (2) becomes an equality. Doing so yields

$$\tilde{b} = \tilde{b}(R) = \frac{\delta q R - k[1 - \delta]}{1 - \delta[1 - q]} \quad (16)$$

Hence, it is straight forward to note that if $b_i < \tilde{b}$, $V^a(R) > V_i^u$. Moreover, it can be inferred that \tilde{b} is strictly increasing in R . ■

Proof of Proposition 3.1. Given the results established in Lemma 3.1 and Lemma 3.2, it follows that $F(\tilde{b})$ captures the proportion of owners for which advertising is always preferred to personal use, for any given ρ_i , while $G(\tilde{\rho})$ captures the proportion of owners for which advertising is always preferred to refurbishing, for any given b_i . Hence, the proportion of owners for whom it is optimal to advertise, denoted by α , would be given by the proportion of owners for which $\rho_i < \tilde{\rho}$ and $b_i < \tilde{b}$. Since b_i and ρ_i are independent from each other, it follows that $\alpha = \alpha(R, \hat{R}) = F(\tilde{b}(R))G(\tilde{\rho}(R, \hat{R}))$. That α is strictly increasing in R and strictly decreasing in \hat{R} follows directly from the fact that F and G are strictly increasing and the results established in Lemma 3.1 and Lemma 3.2 hold. ■

Proof of Lemma 3.3. It is convenient to express the present values of advertising under single- and double-pricing explicitly, i.e., \bar{V}^a and \bar{V}^d . Making use of (7) in which $O(R)$ is substituted by (10) and (11) respectively, these values can be written as

$$\bar{V}^a(R, \bar{R}) = -k + \delta q \bar{O}(R, \bar{R}) + \delta[1 - q] \bar{V}^a(R, \bar{R}),$$

and

$$\bar{V}^d(R, \bar{R}, D) = -k + \delta q \bar{O}^d(R, \bar{R}, D) + \delta[1 - q] \bar{V}^d(R, \bar{R}, D).$$

Now, since $\bar{O}^d(R, \bar{R}, D) > \bar{O}(R, \bar{R})$ if $D = R - \bar{R} > 0$, which is the case under double-pricing, it follows that $\bar{V}^d(R, \bar{R}, D) > \bar{V}^a(R, \bar{R})$ as long as $p > 0$ and $0 < \gamma < 1$. ■

Proof of Proposition 3.2. This proof makes use of the result established by Lemma A.1 in this appendix. First notice that for all $D = \{0, R - \bar{R}\}$, $p > 0$ and $\gamma < 1$, $R^{RF} < R$ as long

as $\bar{R} < R$. Next, from the results established in Lemma 3.1 and Lemma 3.2, we know that α is strictly increasing in R , hence, if the per-period rental price is given by R^{RF} in the rent freeze environment, it follows that $\bar{\alpha}$ is equivalent to α where R is replaced by R^{RF} , which implies that $\bar{\alpha} < \alpha$. That $\bar{\alpha}$ is strictly decreasing in p and strictly increasing in γ follows from the fact that $\bar{\alpha}$ is strictly increasing in R^{RF} , and from Lemma A.1 which states that R^{RF} is strictly decreasing in p and strictly increasing in γ . ■

B. Extended Robustness Analyses

B.1. Alternative Control Group

An alternative specification of the control group includes all apartments that were built or offered for first-time occupancy (either in newly built or substantially refurbished units) after 1 January 2014. This classification is less strict, since it can also cover relatively old property units that are nonetheless offered for first-time occupancy. We re-estimate the main results for this alternative, less strict specification of the control group. This alternative specification still yields the same significant coefficients as before (see Table B1). The values even stay the same for the pre and post announcement (*Pre-Pre* and *Pre-Post*) DiD regression and change only slightly in the *Post-Pre* and *Post-Post* DiD models.

B.2. Choice of Periods

A possible side effect of any restrictive rent policy can affect the *type of dwellings* offered for rent. Plausible reasons of such a change include, for instance, differences in the type of landlords. Some of them can be able to keep a property units empty while awaiting a final decision of the courts and establish a suitable rental agreement only thereafter. This would be much harder for owners depending more strongly on the regular income flows from rental agreements. Other potential reason is the possibility of taking the apartment off the rental market for good. It could be used by owners or their relatives themselves, sold, or simply kept vacant whenever an owner believes that depreciation and associated maintenance costs due to living in an apartment exceed the reduced potential rent income.

The transmitting channels potentially at work here are numerous. Although we observe neither socio-economic nor demographic characteristics of the owners, we tackle this issue in an

Table B1: Alternative Control Group

	Response: <i>Monthly Rent (log)</i>		
	Strategy A	Strategy B	
Treatment (units covered by rent freeze)	−0.078*** (0.013)	−0.075*** (0.020)	−0.109*** (0.026)
Post-A		−0.009 (0.012)	
Transition	−0.008 (0.009)		
Post-E	−0.030 (0.016)		−0.031 (0.019)
Treatment × Post-A		0.006 (0.014)	
Treatment × Transition	−0.007 (0.010)		
Treatment × Post-E	−0.100*** (0.018)		−0.059** (0.022)
Housing characteristics	✓	✓	✓
Number of observations	26,842	5,311	3,314
Adjusted R ²	0.832	0.843	0.830

Notes: Standard errors shown in parentheses. The full set of results are reported in [Table C4](#). Significance is indicated using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Source: Author’s calculations based on data provided by *VALU Marktdaten*.

indirect way by assessing the changes in the types of housing units-to-let over the three periods under investigation. Therefore, [Table B2](#), [Table B3](#) and [Table B4](#) report summary statistics separately compiled for the pre-announcement, transition, and post-enactment periods.

Except for the previously discussed number of observations, we do not find any systematic differences in characteristics across periods and hence conclude that no systematic change in the type of properties on the market occurred.

B.3. Price Effects and Hedonic Controls

We re-estimate the DiD models estimated in [subsection 5.2.2](#) leaving out the large set of hedonic controls. We argued in favor of including them as they capture fundamental rent-determining features. Hence, we refrain from over-interpreting the effect sizes, yet non-significance of our key treatment variables would create serious doubts.

Table B2: Summary Statistics — Pre-Announcement Period

	Mean	St. Dev.	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Monthly Rent [EUR]	738.47	450.91	165.00	446.00	610.50	883.00	4,400.00
Monthly Rent [EUR/m ²]	10.79	3.76	4.57	8.00	10.01	12.72	31.05
Age [years]	61.23	39.35	1.00	31.00	53.00	100.00	156.00
Living Area [m ²]	67.11	26.70	19.00	50.30	62.60	77.00	251.00
		1 room	2 rooms	3 rooms	4 rooms	5+ rooms	
Number of rooms [%]		18.61	44.77	26.79	7.99	1.84	
Shares [%]		Yes	No				
First-Time Occupation		18.99	81.01				
Garden		12.65	87.35				
Balcony/Terrace		76.32	23.68				
Fitted kitchen		41.09	58.91				
Parking		19.62	80.38				
Elevator		48.11	51.89				
Separate Toilet		9.76	90.24				
No. of Observations							2,665

Notes: The table reports summary statistics for property units offered for rent in the period between 7 May 2019 and 3 June 2019 (28 days of PRE announcement period). The start of the placement of the advertisement is decisive for the division into periods. All advertisements also include geo-coded information of the location of the unit (longitudes and latitudes).

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Reassuringly, both the direction and significance of results remain unchanged as reported in [Table B5](#). Nonetheless, as compared to the core results, the effect sizes are much larger. Hence, hedonic control variables are indeed important to be included to ensure a clean measurement thereof. The well established battery of relevant housing characteristics used for hedonic price modelling helps also here to precisely filter policy effects and disentangle them from variation stemming from changes in the (*per construction* always varying) mix of dwelling characteristics as already claimed by [Rosen \(1974\)](#).

In fact, describing changes in advertised rent prices solely by dummies differentiating treated and untreated dwellings explains already a large chunk of variability. The model aimed for measuring the rent freeze's announcement effects achieves an adjusted R^2 value of 12.7%, which is solely driven by the explanatory power of general price differences between the control and treatment group. The same model design (equal in degrees of freedom) yet shifted in time to measure the enactment effect achieves an adjusted R^2 value of 20.7%. The substantial

Table B3: Summary Statistics - Transition Period

	Mean	St. Dev.	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Monthly Rent [EUR]	717.46	448.28	144.00	436.50	587.70	850.00	7,481.00
Monthly Rent [EUR/m ²]	10.67	3.77	3.21	7.84	9.95	12.64	49.33
Age [years]	62.47	39.64	0.00	32.00	55.00	102.00	220.00
Living Area [m ²]	66.00	27.07	11.00	49.00	61.44	76.92	415.60
Number of Rooms [%]		1 room	2 rooms	3 rooms	4 rooms	5+ rooms	
		20.56	44.49	25.86	7.37	1.72	
Shares [%]		Yes	No				
First-time occupation		16.45	83.55				
Garden		11.36	88.64				
Balcony/Terrace		72.21	27.79				
Fitted kitchen		38.42	61.58				
Parking		17.62	82.38				
Elevator		48.03	51.97				
Separate Toilet		9.83	90.17				
No. of Observations							23,057

Notes: The table reports summary statistics for property units offered for rent in the period between 04 June 2019 and 22 February 2020 (264 days of TRANS period). The start of the placement of the advertisement is decisive for the division into periods. All advertisements also include geo-coded information of the location of the unit (longitudes and latitudes).

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Table B4: Summary Statistics - Post-Enactment Period

	Mean	St. Dev.	Minimum	1st Quartile	Median	3rd Quartile	Maximum
Monthly Rent [EUR]	701.26	533.95	153.00	363.40	536.80	877.20	4,982.00
Monthly Rent [EUR/m ²]	10.03	4.53	4.41	6.44	8.90	12.06	46.67
Age [years]	54.40	39.85	0.00	24.00	47.00	89.00	150.00
Living Area [m ²]	67.17	29.22	15.00	48.97	62.00	77.83	280.00
		1 Room	2 Rooms	3 Rooms	4 Rooms	5+ Rooms	
Number of Rooms [%]		21.88	43.75	24.20	8.04	2.14	
		Yes	No				
Shares [%]							
First-Time Occupation		13.93	86.07				
Garden		12.32	87.68				
Balcony/Terrace		74.64	25.36				
Fitted kitchen		38.57	61.43				
Parking		18.21	81.79				
Elevator		54.38	45.62				
Separate Toilet		13.13	86.87				
No. of Observations							1,120

Notes: The table reports summary statistics for property units offered for rent in the period between 23 February 2020 and 21 March 2020 (28 days of POST period). The start of the placement of the advertisement is decisive for the division into periods. All advertisements also include geo-coded information of the location of the unit (longitudes and latitudes).

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

increase in explanatory power constitutes a second convincing argument supporting the policy's effectiveness.

B.4. Geo-coding

A source of insecurity stems from the fact that geographic co-ordinates (longitudes and latitudes) are estimated in case of absence of a precise address mentioned in the ad. We use the randomly assigned *quasi-location* instead of exact locations provided by *VALUE Marktdaten*. Depending on the details provided in the advert (e.g., district only or street name without street number) the radius of the circle overlapping the quasi-location increases. For instance, in the case of a missing street number, the circle associated with the provided quasi-location overlaps the true location with a 95% probability. Hence, the larger the circle's radius the less the provided location should be trusted.

The main models only include properties with known exact geo-location. And the vast majority, in fact, does include this information. Nonetheless, we re-estimate the main model

Table B5: Neglecting Hedonic Controls

	Response: <i>Monthly Rent (log)</i>		
	Strategy A	Strategy B	
Treatment (units covered by rent freeze)	−0.456*** (0.023)	−0.456*** (0.023)	−0.574*** (0.027)
Post-A		−0.014 (0.029)	
Transition	0.013 (0.022)		
Post-E	0.088* (0.037)		0.049 (0.040)
Treatment × Post-A		0.013 (0.032)	
Treatment × Transition	−0.040 (0.025)		
Treatment × Post-E	−0.264*** (0.042)		−0.146** (0.045)
Housing characteristics	X	X	X
Number of observations	26,842	5,311	3,314
Adjusted R ²	0.142	0.127	0.207

Notes: The table extends results reported in [Table 4](#). Standard errors shown in parentheses. Significance is indicated using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Source: Author’s calculations based on data provided by *VALUE Marktdaten*.

results on the full data set including also quasi-locations. Thus, we weigh all observations by the inverse of this quasi-location’s radius resulting in an information-weighted estimation of the main model; see [Table B6](#), columns (1) and (2). Additionally, we include all observations without information-weighting; see columns (3) and (4). Neither significance levels nor the estimated parameters deviate considerably from the originally estimated model. Moreover, overall goodness-of-fit measures remain practically unchanged. Our conservative approach to exclude observations without exact geo-location is hence considered to be very reliable.

B.5. Placebo Test: Hedonic DIDs using Sales Adverts

We repeat our main models but we use sale adverts instead of rent adverts as input data. Thus, our placebo treatment group covers apartments for sale which have the same characteristics as rent adverts forming the original treatment group. This means they would fall under the

Table B6: Estimation Results: Full Data Set

	Response: <i>Monthly Rent (log)</i>			
	(1)	(2)	(3)	(4)
Treatment (apartments covered by rent freeze)	−0.076*** (0.015)	−0.071** (0.022)	−0.076*** (0.015)	−0.076*** (0.021)
Post period	−0.011 (0.012)	−0.021 (0.018)	−0.009 (0.011)	−0.012 (0.016)
Treatment × Post period	0.008 (0.013)	−0.073*** (0.020)	0.009 (0.013)	−0.075*** (0.018)
Housing characteristics	✓	✓	✓	✓
Post period=Policy Announcement	✓	✗	✓	✗
Post period=Policy Enactment	✗	✓	✗	✓
Information weighting	✓	✓	✗	✗
No. of Observations	6,350	4,061	6,350	4,061
Adjusted R^2	0.843	0.832	0.849	0.841

Notes: The full data set used includes observations with and without exact address. Standard errors are shown in parentheses. The full set of results are reported in [Table C4](#). Significance is indicated using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

rent freeze, if they were rented out. Correspondingly, the control group comprises apartments for sale which would not fall under the rent freeze if rented out (i.e., new and renovated units).

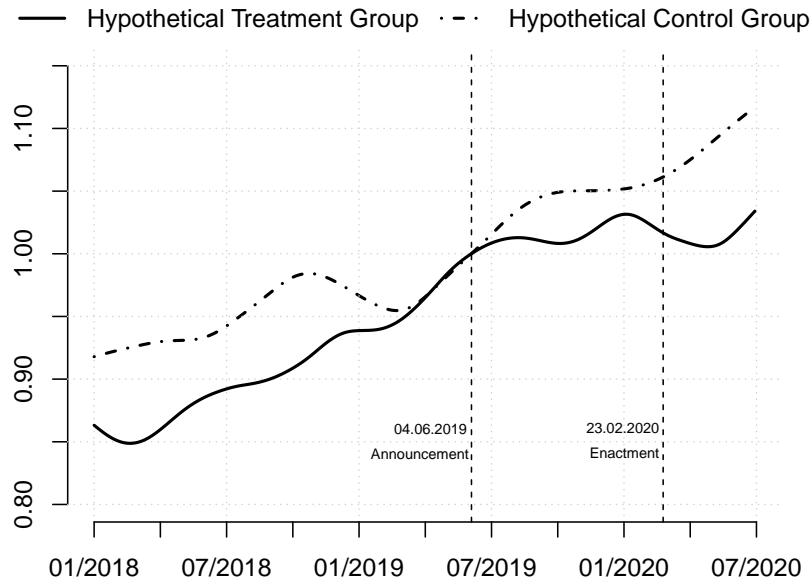
[Figure B1](#) shows hedonic sales indices for the hypothetical treatment and control groups. Unlike the rent counterpart shown in [Figure 7](#), the two groups do not follow completely different price paths upon enactment of the rent freeze.

Next, we look into this in more detail and estimate models (A), (B.1) and (B.2) on sales data. Again we rely on the placebo control and treatment groups. The results are reported in [Table B7](#). Reassuringly, neither the announcement nor the enactment of the rent freeze had significant effects on sales prices.

B.6. Placebo Test: Spatial RDD for previous years

We test the robustness of our spatial regression results reported [Table 6](#) by estimating the same RDD models for the years 2019 and 2018, and compare effect sizes and significance levels

Figure B1: Nominal Sales Indices: Hypothetical Treatment vs. Control Group



Notes: The indices unveil the general price trends for the *hypothetical* treatment and control groups in the sales market between 2018 and the end of the second quarter 2020. *Hypothetical* means apartments that would be covered by the rent freeze if they were rented out. Indices are normalized to the day of the announcement of the rent freeze (4 June 2019). The time-continuous indices follow the methodology developed in [Waltl \(2016\)](#) based on *adaptive smoothing* techniques.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

to the rent freeze year 2020. [Table B8](#) and [Table B9](#) summarize the results.

For the 2 km and 5 km bandwidths, the steering variable is much less convincingly significant than in the rent freeze year 2020 and measured effect sizes are much lower meaning that though there appears to be a general border effect the rent freeze appears having intensified this effect.

Table B7: Sales Counterfactual

	Response: <i>Sales Price (log)</i>		
	Strategy A	Strategy B	
Treatment (units covered by rent freeze)	-0.137*** (0.032)	-0.147** (0.052)	-0.327*** (0.063)
Post-A		-0.022 (0.031)	
Transition	0.017 (0.022)		
Post-E	0.021 (0.034)		0.034 (0.046)
Treatment × Post-A		0.043 (0.036)	
Treatment × Transition	-0.000 (0.026)		
Treatment × Post-E	0.005 (0.038)		-0.008 (0.051)
Housing characteristics	✓	✓	✓
Number of observations	5,832	1,040	997
Adjusted R ²	0.852	0.890	0.859

Notes: Standard errors shown in parentheses. Significance is indicated using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Table B8: Spatial Regression Results 2019

Max. Distance	Response: <i>Monthly Rent (log)</i>					
	2km		5km		10km	
Brandenburg	-0.026 (0.018)	-0.017 (0.018)	0.016 (0.012)	0.035** (0.012)	0.066*** (0.009)	0.084*** (0.009)
Distance d	-0.001 (0.001)	0.001 (0.001)	-0.002*** (0.000)	-0.001*** (0.000)	-0.003*** (0.000)	-0.002*** (0.000)
Housing characteristics	✓	✓	✓	✓	✓	✓
Compass directions	✓	✗	✓	✗	✓	✗
No. of observations	2,019	2,019	4,982	4,982	9,716	9,716
Adjusted R ²	0.789	0.776	0.785	0.774	0.763	0.755

Notes: Models differ in the set of rent adverts included (maximum distance of 2, 5, or 10 km away from the administrative city boundaries) and the inclusion of compass directions. Kernel weights (triangular) are respected. Housing characteristics comprise the same variables as in the DiD specification plus a linear time trend.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Table B9: Spatial Regression Results 2018

Max. Distance	Response: <i>Monthly Rent (log)</i>					
	2km		5km		10km	
Brandenburg	-0.023 (0.020)	-0.014 (0.019)	0.034** (0.012)	0.060*** (0.012)	0.087*** (0.009)	0.104*** (0.009)
Distance d	-0.001 (0.001)	0.000 (0.001)	-0.002*** (0.000)	-0.002*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)
Housing characteristics	✓	✓	✓	✓	✓	✓
Compass directions	✓	✗	✓	✗	✓	✗
No. of observations	1,665	1,665	4,302	4,302	9,227	9,227
Adjusted R ²	0.799	0.786	0.776	0.765	0.753	0.745

Notes: Models differ in the set of rent advertisements included (maximum distance of 2, 5, or 10 km away from the administrative city boundaries) and the inclusion of compass directions. Kernel weights (triangular) are respected. Housing characteristics comprise the same variables as in the DiD specification plus a linear time trend.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

C. Supplemental Tables

Table C1: Summary Statistics – VALUE Marktdaten

	Mean	St. dev.	Min.	Q ₁	Median	Q ₃	Max.
Monthly rent [EUR]	733.06	459.20	65.00	448.90	600.00	870.00	11,000.00
Monthly rent [EUR/m ²]	10.71	3.72	2.37	8.01	10.00	12.57	49.38
Age [years]	63.97	40.05	0.00	32.00	57.00	107.00	265.00
Living area [m ²]	67.20	27.85	10.00	50.00	62.20	78.00	416.00
		1 room	2 rooms	3 rooms	4 rooms	5+ rooms	
Number of Rooms [%]		19.61	44.87	25.89	7.76	1.86	
Shares [%]		Yes	No				
First Time Occupation		18.00	82.00				
Garden		13.20	86.80				
Balcony/Terrace		73.32	26.68				
Fitted Kitchen		41.23	58.77				
Parking		18.73	81.27				
Elevator		46.87	53.13				
Separate Toilet		10.40	89.60				
Number of observations							74,657

Notes: The table reports summary statistics of property units offered for rent in the period between 1 January 2018 and 30 June 2020. All advertisements also include geo-coded information of the location of the unit (longitudes and latitudes). Statistical outliers and observations missing exact addresses are removed.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Table C2: Summary statistics – Immobilienscout24

	Mean	St. dev.	Min.	Q ₁	Median	Q ₃	Max.
Monthly rent [EUR]	909.21	693.34	124.71	475.00	699.00	1,125.00	15,000.00
Monthly rent [EUR/m ²]	12.27	5.19	4.00	8.35	11.00	15.00	33.68
Age [years]	52.30	43.68	1	7	43	93	222
Living area [m ²]	72.51	35.47	15.00	51.26	65.39	84.30	482.00
		1 room	2 rooms	3 rooms	4 rooms	5+ rooms	
Number of rooms [%]		16.48	40.54	29.89	9.94	3.15	
Shares [%]		Yes	No				
First time occupation		18.97	81.03				
Garden		10.12	89.88				
Balcony/terrace		71.74	28.26				
Fitted kitchen		45.16	54.84				
Parking		15.70	84.30				
Elevator		48.28	51.72				
Separate toilet		X	X				
Number of observations							321,117

Notes: The table reports summary statistics of units offered for rent in the period between 1 January 2018 and 30 June 2020. All advertisements also include information on location and — whenever applicable — an alternative rent.

Source: Author's calculations based on data provided by *Immobilienscout24*.

Table C3: Spatial Distribution of Adverts: Immobilienscout24 vs. VALUE Marktdaten

	Number of observations		Share of observations, %	
	Immobilienscout24	VALUE Marktdaten	Immobilienscout24	VALUE Marktdaten
Charlottenburg-Wilmersdorf	7,620	8,815	9.0	9.5
Friedrichshain-Kreuzberg	6,700	7,498	7.9	8.1
Lichtenberg	8,267	7,192	9.8	7.7
Marzahn-Hellersdorf	8,082	6,188	9.6	6.7
Mitte	11,644	11,493	13.8	12.4
Neukoelln	4,647	6,420	5.5	6.9
Pankow	9,506	11,424	11.3	12.3
Reinickendorf	3,825	5,675	4.5	6.1
Spandau	5,253	7,115	6.2	7.7
Steglitz-Zehlendorf	4,203	6,161	5.0	6.6
Tempelhof-Schoeneberg	5,445	6,573	6.5	7.1
Treptow-Koepenick	9,117	8,362	10.8	9.0

Notes: The table compares the number and share of rent adverts per district in the *Immobilienscout24* and the *Value Marktdaten* samples.

Source: Author's calculations based on data provided by *Immobilienscout24*.

Table C4: DiDs – Full Results

	Pre-/Post Announcement		Pre-/Post Enactment		Pre-Trans-Post	
Intercept	5.608	***	5.503	***	5.587	***
	(0.019)		(0.027)		(0.012)	
First Time Occupation	0.128	***	0.137	***	0.122	***
	(0.012)		(0.018)		(0.006)	
Living Area	0.009	***	0.011	***	0.010	***
	(0.000)		(0.000)		(0.000)	
2 Rooms	0.136	***	0.133	***	0.123	***
	(0.009)		(0.013)		(0.004)	
3 Rooms	0.199	***	0.185	***	0.179	***
	(0.012)		(0.017)		(0.005)	
4 Rooms	0.199	***	0.167	***	0.186	***
	(0.018)		(0.026)		(0.008)	
5+ Rooms	0.099	***	-0.012		0.029	*
	(0.030)		(0.047)		(0.014)	
Garden	0.050	***	0.042	**	0.034	***
	(0.009)		(0.014)		(0.004)	
Balcony/Terrace	0.0450	***	0.019		0.037	***
	(0.009)		(0.010)		(0.003)	
Fitted Kitchen	0.169	***	0.194	***	0.165	***
	(0.007)		(0.010)		(0.003)	
Parking	0.054	***	0.038	**	0.037	***
	(0.009)		(0.013)		(0.004)	
Elevator	0.028	***	0.037	***	0.036	***
	(0.008)		(0.011)		(0.003)	
Separate Toilet	0.026	*	0.049	**	0.034	***
	(0.012)		(0.017)		(0.005)	
s(longitude,latitude)	214.27	*** (edf)	186.023	*** (edf)	292.08	*** (edf)
s(age)	8.05	*** (edf)	8.358	*** (edf)	8.69	*** (edf)
Adj. R ²	0.84		0.83		0.83	
GCV score	0.04		0.06		0.04	
No. of Observations	5,311		3,314		26,842	

Notes: The table reports the full set of hedonic estimation results extending [Table 4](#). Treatment effects are left out. The *Generalized Cross Validation Score (GCV)* is used to determine smooth components (see [Wood et al., 2016](#)). For smooth terms, we report the *effective degrees of freedom (edf)*.

Source: Author's calculations based on data provided by *VALUE Marktdaten*.

Table C5: RDD Full Results 10km

	(1)	(2)	(3)	(4)
Intercept	-232.670 ** (71.687)	-225.970 ** (72.331)	6.106 *** (0.022)	6.115 *** (0.013)
Time	0.118 *** (0.035)	0.114 ** (0.036)		
Age	-0.001 ** (0.000)	-0.001 * (0.000)		
Age ²	0.000 *** (0.000)	0.000 *** (0.018)		
First Time Occupation	0.230 *** (0.025)	0.234 *** (0.025)		
Living Area	0.013 *** (0.000)	0.014 *** (0.000)		
2 Rooms	0.086 *** (0.011)	0.085 *** (0.011)		
3 Rooms	0.081 *** (0.015)	0.073 *** (0.015)		
4 Rooms	0.045 * (0.023)	0.029 (0.023)		
5+ Rooms	-0.135 *** (0.041)	-0.158 *** (0.041)		
Garden	0.073 *** (0.011)	0.075 *** (0.011)		
Balcony/Terrace	-0.008 (0.009)	0.001 (0.009)		
Fitted Kitchen	0.204 *** (0.008)	0.208 *** (0.008)		
Parking	0.091 *** (0.010)	0.097 *** (0.010)		
Elevator	0.006 (0.008)	0.007 (0.008)		
Separate Toilet	0.034 * (0.016)	0.041 * (0.016)		
North	-0.002 (0.016)		0.131 *** (0.029)	
North-East	-0.111 *** (0.014)		-0.195 *** (0.026)	
North-West	-0.057 *** (0.015)		-0.029 (0.028)	
South	-0.053 ** (0.018)		0.080 * (0.033)	
South-East	-0.030 * (0.014)		0.070 ** (0.026)	
South-West	0.020 (0.014)		0.185 *** (0.026)	
West	-0.033 * (0.014)		0.045 (0.026)	
Distance	-0.002 *** (0.000)	-0.002 *** (0.000)	-0.002 *** (0.000)	-0.002 *** (0.000)
Brandenburg	0.137 *** (0.014)	0.166 *** (0.014)	0.239 *** (0.026)	0.328 *** (0.026)
Adj. R ²	0.747	0.74	0.091	0.036
No. of Observations	4,505	4,505	4,505	4,505

Table C6: RDD Full Results 5km

	(1)	(2)	(3)	(4)
Intercept	-203.048 *	-210.854 *	6.175 ***	6.109 ***
	(91.865)	(93.495)	(0.027)	(0.018)
Time	0.103 *	0.107 *		
	(0.045)	(0.046)		
Age	-0.002 ***	-0.001 **		
	(0.000)	(0.000)		
Age ²	0.000 ***	0.000 ***		
	(0.000)	(0.000)		
First Time Occupation	0.215 ***	0.228 ***		
	(0.032)	(0.032)		
Living Area	0.014 ***	0.014 ***		
	(0.000)	(0.000)		
2 Rooms	0.092 ***	0.095 ***		
	(0.015)	(0.015)		
3 Rooms	0.075 ***	0.068 ***		
	(0.020)	(0.020)		
4 Rooms	0.058 *	0.042		
	(0.029)	(0.029)		
5+ Rooms	-0.102 *	-0.121 *		
	(0.052)	(0.053)		
Garden	0.070 ***	0.076 ***		
	(0.015)	(0.015)		
Balcony/Terrace	-0.008	0.002		
	(0.012)	(0.012)		
Fitted Kitchen	0.175 ***	0.179 ***		
	(0.011)	(0.011)		
Parking	0.077 ***	0.101 ***		
	(0.012)	(0.012)		
Elevator	-0.009	-0.009		
	(0.010)	(0.010)		
Separate Toilet	0.017	0.020		
	(0.019)	(0.020)		
North	-0.069 **		0.115 *	
	(0.023)		(0.045)	
North-East	-0.175 ***		-0.323 ***	
	(0.018)		(0.033)	
North-West	-0.069 ***		0.010	
	(0.021)		(0.041)	
South	-0.099 ***		0.022	
	(0.022)		(0.041)	
South-East	-0.067 ***		0.040	
	(0.019)		(0.036)	
South-West	-0.025		0.118 ***	
	(0.017)		(0.032)	
West	-0.091 ***		-0.096 **	
	(0.017)		(0.032)	
Distance	-0.002 ***	-0.002 ***	-0.002 *	-0.003 **
	(0.000)	(0.000)	(0.001)	(0.001)
Brandenburg	0.130 ***	0.150 ***	0.205 ***	0.337 ***
	(0.020)	(0.019)	(0.038)	(0.037)
Adj. R ²	0.782	0.771	0.136	0.051
No. of Observations	2,301	2,301	2,301	2,301

Table C7: RDD Full Results 2km

	(1)	(2)	(3)	(4)
Intercept	-128.445 (134.346)	-154.451 (139.390)	6.119 *** (0.038)	6.027 *** (0.030)
Time	0.066 (0.066)	0.079 (0.069)		
Age	-0.002 * (0.001)	-0.003 ** (0.001)		
Age ²	0.000 * (0.000)	0.000 ** (0.000)		
First Time Occupation	0.166 *** (0.044)	0.191 *** (0.046)		
Living Area	0.014 *** (0.001)	0.013 *** (0.001)		
2 Rooms	0.109 *** (0.023)	0.126 *** (0.024)		
3 Rooms	0.096 ** (0.030)	0.121 *** (0.031)		
4 Rooms	0.076 . (0.043)	0.106 * (0.045)		
5+ Rooms	-0.049 (0.079)	-0.008 (0.082)		
Garden	0.016 (0.023)	0.025 (0.024)		
Balcony/Terrace	-0.040 * (0.019)	-0.022 (0.020)		
Fitted Kitchen	0.168 *** (0.016)	0.161 *** (0.016)		
Parking	0.080 *** (0.017)	0.129 *** (0.016)		
Elevator	0.002 (0.015)	0.005 (0.015)		
Separate Toilet	0.004 (0.028)	-0.006 (0.029)		
North	-0.177 *** (0.037)		-0.028 (0.073)	
North-East	-0.214 *** (0.025)		-0.416 *** (0.046)	
North-West	-0.108 ** (0.034)		0.157 * (0.066)	
South	-0.111 *** (0.029)		-0.031 (0.053)	
South-East	-0.121 *** (0.026)		-0.023 (0.048)	
South-West	-0.093 *** (0.025)		0.015 (0.045)	
West	-0.186 *** (0.025)		-0.229 *** (0.047)	
Distance	-0.007 *** (0.002)	-0.006 *** (0.002)	-0.017 *** (0.003)	-0.014 *** (0.003)
Brandenburg	0.211 *** (0.029)	0.188 *** (0.030)	0.447 *** (0.056)	0.502 *** (0.057)
Adj. R ²	0.813	0.793	0.212	0.097
No. of Observations	882	882	882	882

Table C8: Differences in Weekly Rent Offers between Periods

<i>Total number of new adverts per week</i>		
PRE – POST	352.28	***
TRANS – POST	338.70	***
PRE – TRANS	13.58	
<i>...thereof in treatment group</i>		
PRE – POST	286.04	***
TRANS – POST	285.14	***
PRE – TRANS	0.91	
<i>...thereof in control group</i>		
PRE – POST	66.24	***
TRANS – POST	53.56	***
PRE – TRANS	12.68	*
<i>POST period 2018, 2019, 2020</i>		
2018 – 2019	–53.24	·
2018 – 2020	321.90	***
2019 – 2020	375.13	***

Notes: The exact dates for each period are stated in [Table 7](#). The Tukey post-hoc test indicates significance of the differences in mean values using standard notation: · p-value<0.1; *p-value<0.05; **p-value<0.01, ***p-value<0.001.

Source: Author’s calculations based on data provided by *VALUE Marktdaten*.

Table C9: Official Statistics for Districts in Berlin

	Avg. Gross Rent [EUR/m ²]	Share of inhabitants aged ... years				Share of Households with Monthly Net Income between ... [EUR/month]						
		0-18	19-30	31-65	66+	<900	[900, 1,300)	[1,300, 1,500)	[1,500; 2 000)	[2,000; 2 600)	[2,600; 3,200)	≥3,200
		[%]										
Charlottenburg-Wilmersdorf	9.53	13.2	14.2	49.0	23.6	8.9	14.2	6.8	15.8	13.1	11.2	29.9
Friedrichshain-Kreuzberg	8.94	15.4	17.0	57.3	10.2	10.8	17.0	5.2	15.4	14.5	11.3	25.7
Lichtenberg	8.08	16.8	14.0	49.7	19.5	10.1	14.7	9.1	18.8	17.5	10.0	19.9
Marzahn-Hellersdorf	7.43	17.7	11.2	50.1	21.0	7.8	14.5	7.2	18.1	16.8	12.6	22.9
Mitte	9.35	15.6	19.7	51.7	13.0	9.7	17.7	7.1	16.9	14.6	11.2	22.7
Neukölln	8.46	16.3	15.4	50.7	17.6	11.4	18.0	9.3	16.5	16.7	9.7	18.2
Pankow	8.97	17.7	12.3	55.0	15.0	5.2	9.9	5.4	17.9	16.8	12.0	32.8
Remickendorf	8.62	17.0	13.6	45.8	23.6	5.8	13.7	7.9	19.3	15.2	10.4	27.4
Spandau	8.41	17.6	14.0	46.4	21.9	9.2	15.4	7.8	18.4	15.0	10.3	23.5
Steglitz-Zehlendorf	8.96	15.7	12.6	45.9	25.8	7.0	11.4	7.0	14.9	15.9	8.5	35.1
Tempelhof-Schöneberg	8.46	15.5	14.2	49.1	21.2	8.5	14.3	7.0	17.5	15.0	11.3	26.2
Treptow-Köpenick	8.46	15.8	12.2	50.1	21.9	6.2	12.2	7.8	17.4	16.8	11.0	28.5
Overall Mean	8.66	16.2	14.2	50.1	19.5	8.4	14.4	7.3	17.3	15.7	10.8	26.1
Overall Median	8.68	16.0	14.0	49.9	21.1	8.7	14.4	7.1	17.5	15.6	11.1	25.9

Notes: The table reports public statistics for Berlin's districts. Overall means and medians are calculated across district-specific values. The values of average gross rent and of the household net income refer to 2018, while the distribution of population by age groups refers to 30 June 2020.

Source: Amt für Statistik Berlin Brandenburg.

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