HOUSING RESEARCH REPORT

Rent Control and Rental Prices in Toronto

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Rent Control and Rental Prices: A Dynamic Hedonic Analysis of Toronto†

Lin Zhang*,[a] and Tingting Guo[a]

[a] *Canada Mortgage and Housing Corporation, 700 Montreal Road, Ontario K1A0P7, Canada*

Abstract

Between 1992 and 2016, rent control in Toronto exempts rental units built after November 1991. In this paper, we first document controlled and uncontrolled rental prices using record-level rental survey data. Uncontrolled rents are 37.7% higher and 5.5 times more volatile than controlled rents with the same average growth rate. We then evaluate the effects of rent control on rental prices, using hedonic models combined with quantile regressions. We validate the causality with regression discontinuity design (RDD). From 1992 to 2016, rent control accounts for 36.3% of the difference between uncontrolled and controlled rents. However, rent control explains only 16.3% of the rent difference during the adjustment period from 1992 to 1997 and does not make low-end units more affordable. Rent control accounts for 37.9% of the rent difference during the booming period from 2010 to 2016 and its effects are higher at the upper quartiles. Our results are robust with various specifications.

Keywords: Rent control; Rental prices; Hedonic models

JEL Classifications: R38, R31, C22

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* Corresponding author at: Canada Mortgage and Housing Corporation, 700 Montreal Road, Ontario K1A0P7, Canada. E-mail address: lzhang@cmhc.gc.ca (L. Zhang).

Executive summary

Why do we do?

Rent control laws, adopted to limit rent increases, often exempt newly-built rental units. With exemptions, controlled and uncontrolled rental prices coexist in a city. Understanding the basic facts of these prices and the impact of rent controls on rental prices provides a basis to address rental housing affordability issues.

Yet, little is known about controlled and uncontrolled rental prices.

- What are basic statistic properties such as mean, volatility, and autocorrelation of these rental prices?
- What are the effects of rent controls rental prices from a dynamic and distributional perspective?
    - Do the effects of rent controls vary over time?
    - Do the effects of rent controls vary across price ranges of rental units?

What do we do?

In this paper, we address these issues.

We document some stylised facts on rent control in Toronto using a unique dataset.[1]

- We use unit-level Rental Market Survey (RMS) data of more than twenty-five years. RMS is collected by CMHC every year in October and covers privately-owned rental buildings with more than three units.
- We construct controlled and uncontrolled rental prices, and compare some basic statistics of these prices. According to the Rent Control Act 1992 of Ontario, units built before November 1991 are subject to rent control, while units built after are not.

We formally evaluate the effects of rent control on rental prices.

- We study the effects of rent control during the adjustment period (*i.e.* 1992-1997) and the booming period (*i.e.* 2010-2016), respectively.
- We evaluate the effects of rent control across quartiles of rental units using quantile regressions.

What are the main results?

From 1992 to 2016, we observe several basic facts:

[1] The study can be extended to other cities with similar rent control exemptions such as Vancouver and Montreal.

- With more than 5.4 millions of units of observations in Toronto, only 1% of units are not subject to rent controls. The average uncontrolled rent is Can$357.5 or 37.7% higher than the average controlled rent.
- Interestingly, despite the gap in level, the average growth rate of controlled and uncontrolled rents is 2.4%, close to the average increase guidelines (*i.e.* maximum rent increase predefined by the government) of 2.5%. Uncontrolled rents are 5.5 times more volatile than controlled rents that are two times more volatile rent increase guidelines.
- The rent gap between controlled and uncontrolled rents varies with market conditions. During the period of house-price/rent adjustments or 1992-1997, market rents trend down and converge to controlled rents, while during the booming 2010-2016 period, the rent gap persists.

Regarding the effects of rent controls, our main results show:

- From 1992 to 2016, rent control reduced rents by 13.7% compared to market rents, accounting for 36.3% of the gap between uncontrolled and controlled rents.
- The effects of rent control vary across adjustment and booming periods. During the adjustment period from 1992 to 1997, rent control in average reduced rents by 5%, explaining only 16.3% of the rent gap. Across quartiles, during the adjustment period, rent control did not make low-end rental units under rent control more affordable, compared to the low-end units that were not subject to rent control.
- During the booming period from 2010 to 2016, rent control reduced rent by 16.8%, compared to market rents, accounting for 37.9% of the rent difference. Across quartiles, the effect of rent control is larger at the higher quartile.

Résumé

Pourquoi faisons-nous cela?

Les lois sur le contrôle des loyers, adoptées pour limiter les hausses de loyer, exemptent souvent les logements locatifs neufs. Avec ces exemptions, les prix de logements locatifs réglementés et non réglementés coexistent dans une ville. La compréhension des faits fondamentaux de ces prix et de l'incidence du contrôle des loyers sur les prix des logements locatifs fournit une base pour résoudre les problèmes d'abordabilité des logements locatifs.

Pourtant, on en sait peu sur les prix des logements locatifs réglementés et non réglementés.

- Quelles sont les caractéristiques statistiques de base, comme la moyenne, la volatilité et l'autocorrélation des prix des logements locatifs?
- Quels sont les effets du contrôle des loyers sur les prix des logements locatifs du point de vue de la dynamique et de la distribution?

- Les effets du contrôle des loyers varient-ils en fonction des périodes d'expansion et de rajustement?
- Les effets du contrôle des loyers varient-ils selon les fourchettes de prix des logements locatifs?

Que faisons-nous?

Dans le présent document, nous abordons ces questions.

Nous documentons certains faits stylisés sur le contrôle des loyers à Toronto à l'aide d'un ensemble de données unique[2].

- Nous utilisons les données de l'Enquête sur les logements locatifs (ELL) portant sur plus de 25 ans. Les données de l'ELL sont recueillies chaque année en octobre par la SCHL. Elles couvrent les immeubles locatifs privés comptant plus de trois logements.
- Nous établissons des prix de location réglementés et non réglementés et comparons certaines statistiques de base sur ces prix. Selon la *Loi de 1992 sur le contrôle des loyers* de l'Ontario, les logements construits avant novembre 1991 sont assujettis au contrôle des loyers, alors que les logements bâtis après cette date ne le sont pas.

Nous évaluons officiellement les effets du contrôle des loyers sur les prix des logements locatifs.

- Nous étudions les effets du contrôle des loyers pendant la période de rajustement (*p. ex.*, de 1992 à 1997) et la période d'expansion (*p. ex.*, de 2010 à 2016), respectivement.
- Nous évaluons les effets du contrôle des loyers sur les quartiles des logements locatifs au moyen de régressions quantiles.

Quelles sont nos résultats principaux?

De 1992 à 2016, nous observons plusieurs faits fondamentaux :

- Sur plus de 5,4 millions de logements visés par l'enquête à Toronto, seulement 1 % des logements ne sont pas assujettis au contrôle des loyers. Le loyer moyen non réglementé est de 357,5 $ CAN, soit 37,7 % de plus que le loyer moyen réglementé.
- Il est intéressant de noter que, malgré l'écart de niveau, le taux de croissance moyen des loyers réglementés et non réglementés est de 2,4 %, ce qui est proche du taux légal d'augmentation des loyers de 2,5 % (*c.-à-d.* l'augmentation maximale des loyers prédéfinie par le gouvernement). Les loyers non réglementés sont 5,5 fois plus volatils que les loyers réglementés, qui sont deux fois plus volatils que le taux légal d'augmentation des loyers.

[2] L'étude peut être étendue à d'autres villes bénéficiant d'exemptions semblables relatives au contrôle des loyers, comme Vancouver et Montréal.

- L’écart entre les loyers réglementés et ceux non réglementés varie selon la conjoncture du marché. Pendant la période de rajustement des prix et des loyers de 1992 à 1997, les loyers du marché affichent une tendance à la baisse et se rapprochent des loyers réglementés, tandis que durant la période d’expansion de 2010 à 2016, l’écart entre les loyers persiste.

En ce qui concerne les effets du contrôle des loyers, nos principaux résultats montrent ce qui suit :

- De 1992 à 2016, le contrôle des loyers a réduit les loyers de 13,7 % par rapport aux loyers du marché, ce qui représente 36,3 % de l’écart entre les loyers non réglementés et ceux réglementés.
- Les effets du contrôle des loyers varient en fonction des périodes de rajustement et d’expansion. Pendant la période de rajustement de 1992 à 1997, le contrôle des loyers a réduit les loyers de 5 % en moyenne, ce qui explique seulement 16,3 % de l’écart des loyers. Dans tous les quartiles, pendant la période de rajustement, le contrôle des loyers n’a pas rendu les logements locatifs d’entrée de gamme assujettis au contrôle des loyers plus abordables que les logements d’entrée de gamme qui n’étaient pas assujettis au contrôle des loyers.
- Durant la période d’expansion (2010 à 2016), le contrôle des loyers a réduit les loyers de 16,8 % par rapport aux loyers du marché, ce qui représente 37,9 % de l’écart des loyers. Dans tous les quartiles, l’effet du contrôle des loyers est plus important dans le quartile supérieur.

1. Introduction

Rent control laws, adopted to limit rent increases, often exempt newly-built rental units (Arnott, 1995).[3] Between 1992 and 2016, rent control laws in Toronto exempt rental units built after November 1991. With exemptions, controlled and uncontrolled rental prices coexist in a city. Understanding the basic facts of these prices and the impact of rent controls on rental prices provides a basis to address rental housing affordability issues.

As an affordability policy, the role of rent controls has been empirically assessed in several studies, *e.g.* Fallis and Smith (1984; 1985), Glaeser and Luttmer (2003), Bulow and Klemperer (2012), Autor, et al. (2014), Sims (2007), and Diamond et al. (2019), among others. These studies evaluate the impacts of rent control on rent levels, housing allocation, spillover effects, housing maintenance, and housing supply, respectively. Favilukis *et al.* (2019) shows rent controls are social-welfare improving in a general-equilibrium model with heterogeneous households.

Yet, little is known about controlled and uncontrolled rental prices. What are basic statistic properties such as mean, volatility, and autocorrelation of these rental prices? What are the effects of rent controls rental prices from a dynamic and distributional perspective? In particular, do the effects of rent controls vary in adjustment and booming periods of rental/house prices? Do the effects of rent controls vary across price ranges of rental units? We leave other questions to future research, such as the impact of rent control on the construction of rental housing.

In this paper, we first document some stylised facts on rent control in Toronto and evaluate the impacts of rent control on rental prices using a unique dataset. We use unit-level Rental Market Survey (RMS) data of more than twenty-five years. RMS is collected by CMHC every year in October and covers privately-owned rental buildings with more than three units. According to the Rent Control Act 1992 of Ontario, units built before November 1991 are subject to rent control, while units built after are not.[4] We use this dual system of rent control in Toronto to construct controlled and uncontrolled rents.[5]

Then, we formally evaluate the effects of rent control on rental prices. Rent control with exemptions creates a control group for units under rent control. However, the standard program

[3] First-generation rent controls, initially adopted as a war measure, were retained in some European countries and North America after the end of the Second World War. Retaining these rigid controls after the end of war was opposed by many economists. As famously put by Lindbeck (1971), "next to bombing, rent control seems in many cases to be the most efficient technique so far known for destroying cities". This view more or less was shared by many prominent economists, *e.g.* Hayek (1929), Friedman and Stigler (1946), Olsen (1972), among many others.

[4] Note in April 2017, Ontario adopted the Rental Fairness Act and extended rent control to rental building built or occupied after November 1, 1991. The 2017 Act does not exempt rent controls over rentals units built after April 2017. See Section 2 for more details.

[5] Exemption rule in Toronto aims to reduce the impact of rent control on the supply of rental units. In our sample, rental units built after 1992 were exempted from rent control from 1992 to 2016. For instance, rental units built in 1992 had been exempted from rent control for 24 years. Here, we do not evaluate the possible effect of rent control on the supply of rental units as in Diamond et al. (2019) tracing conversion of rental units to owner-occupied condos.

evaluation method difference-in-differences is not suitable in our case because we do not observe rental rates prior to 1992 of units built after 1992. Instead, we incorporate a group dummy indicating whether units are built before or after 1992 into hedonic models. We validate the causality between rent control and rental prices using RDD. We construct treated and untreated units using rental units completed two years before and after the cut-off year of 1992, respectively. As location matters in accounting for price levels, we control for community effect at Census Tract level with 886 Census Tracts in Toronto.

Last, we study the effects of rent control during the adjustment period (*i.e.* 1992-1997) and the booming period (*i.e.* 2010-2016), respectively. Because rent control is considered as a measure to address affordability issues, the distributional effects are of importance. Thus, we also evaluate the effects of rent control across quartiles using quantile regressions. As changes of rent control laws often were adopted with specific goals, we evaluate the effects of policy announcement regarding to the Rent Control Act in 1992.

From 1992 to 2016, we observe several basic facts. With more than 5.4 millions of units of observations, only 1% of units are not subject to rent controls. The average market rent (*i.e.* uncontrolled rent) is Can$357.5 or 37.7% higher than the average rent of units subject to rent control (*i.e.* controlled rent). Interestingly, despite the gap in level, the average growth rate of controlled and uncontrolled rents is 2.4%, close to the average increase guidelines (*i.e.* maximum rent increase predefined by the government) of 2.5%. However, uncontrolled rents are 5.5 times more volatile than controlled rents that are two times more volatile rent increase guidelines. Moreover, the rent gap between controlled and uncontrolled rents varies with market conditions. During the period of house-price/rent adjustments or 1992-1997, market rents trend down and converge to controlled rents, while during the booming 2010-2016 period, the rent gap persists.

Regarding the effects of rent controls, our main results show that from 1992 to 2016 the average rent of units under rent control is 12.5% lower than the average rent of units not subject to rent control, all other variables being equal. In average, rent control reduced rents by 13.7% compared to market rents, accounting for 36.3% of the gap between uncontrolled and controlled rents. The effects of rent control vary across adjustment and booming periods. During the adjustment period from 1992 to 1997, rent control in average reduced rents by 5%, explaining only 16.3% of the rent gap. Across quartiles, the effect of rent control on the 25th percentile is positive, while it is negative and increasing from the median and the 75th percentile. Therefore, during the adjustment period, rent control did not make low-end rental units under rent control more affordable, compared to the low-end units that were not subject to rent control. During the booming period from 2010 to 2016, rent control reduced rent by 16.8%, compared to market rents, accounting for 37.9% of the rent difference. Across quartiles, the effect of rent control is larger at the higher quartile. Finally, enacting the Rent Control Act in 1992 reduced rent by 1% between 1992 and 1995, compared to the average rent from 1989 to 1991. Our results are robust with different specifications.

Despite the fact that many Canadian cities have adopted rent controls, there are few studies on documenting basic facts of rent controls and evaluating the impacts of rent controls due to the lack of micro data. Denton *et al.* (1993) pulls different time series at metropolitan level together to study the impacts of rental controls on rents, housing starts, property values, vacancy rates, and tenure preferences. Due to the lack of appropriate controls, many results are inconclusive. Fallis and Smith (1985) surveyed around 600 rental units subject to rent control and 500 units not subject to controls in 1982 to study the effects of rent control in Toronto. They find that rent control explains around one-half of the rent difference between market and controlled rents. Compared to our study, the sample used in their study is not representative and covers only one year's data, missing the dynamic aspects of rent controls.

The rest of the paper is organized as follows. Section 2 introduces the institutional background of rent control in Toronto. Section 3 provides a brief introduction to data and documents some stylized facts on controlled and uncontrolled rents. Section 4 presents empirical methodologies and results with the 1992-2016 sample. Section 5 includes quantile regression results with subsamples. Section 6 contains some concluding remarks.

2. Institutional background

Rent controls were introduced[6] in Canada during the Second World War in 1944 as part of National Housing Act. This first generation of rent controls took a form of freezing nominal rents. Its initial inspiration can be traced back to the First World War when rent controls were adopted in European countries as a war-time measure to protect veterans from evictions and rent increases. The rent freeze, as a war-time measure, seems justified during the war time, while retaining it even after the end of the war started to generate strong negative effects on the supply of rental units, labor mobility, and property maintenance (Arnott, 1995). These first-generation rent controls, largely analysed in the text book as rigid and hard with large dead-weight losses, are in general opposed by both economists and business sectors. As a result, rent controls were removed in Ontario in 1949.[7]

In the wake of the oil crisis, rent controls were reintroduced in Ontario in 1975 as part of the Residential Premises Rent Review Act and in conjunction with the federal wage and price control program. These controls, classified as the second-generation rent controls, differed significantly from the first-generation rent controls with more flexible provisions. These controls exempted private rental units built after January 1976, luxury accommodation, government owned buildings, and social housing. Under these controls, only one rent increase is allowed over a period of twelve months in amount not to exceed a predetermined percentage set by the government. Increases

[6] Note that the origins of rent control can be traced back to 1881 in Ireland where the Land of Court of Ireland set faire rents of land based on assessment values provides by evaluators by taking into account contributions and affordability of tenants (Guldi, 2020). Rent setting was such a central issue that some prominent intellectuals such as John Stuart Mill, Goldwin Smith, and David Ricardo, among others, all carefully studied rent setting.

[7] Though this discontinuity happened to the first-generation rent controls, it is in contrast with the common observation that rent controls belong to the set of policies: once adopted, it would be difficult to remove them for political concerns.

beyond the statutory percentage may be awarded if justified by cost increases; if there is a financial loss with the property; or if justified by capital expenditures. These rent increase provisions and exemptions lay down the basis from which the Ontario rent control system has been evolving.

Since 1975, the Ontario rent control system has been evolving with two major changes. The first major change consists of intermittent exemptions. The Residential Rent Regulation Act in 1985 brought previously exempted units and newly built units under rent controls. Both new buildings and buildings constructed after 1976 were subject to rent controls. Rent control with exemptions was restored by the Rent Control Act in 1992, according to which all rental buildings built after November 1, 1991 were exempted for rent controls. With rising affordability issues in Ontario, Ontario government extended rent controls to rental buildings built after November 1, 1991 in April 2017. In 2018, the newly elected government enacted legislation so that rent control does not apply to buildings built or first occupied after November 15, 2018. Rent control with exemptions has been once again restored in Ontario.

The second major change of the Ontario rent control system is marked by the tenancy deregulation in June 1998 as part of the Ontario Tenant Protection Act. According the 1998 Act, landlords in Ontario can increase more than allowed by rent increase guidelines for the beginning of a tenancy, but they have to follow guidelines during a tenancy. The 1998 Act is considered as a relaxation of the previous rent control as landlords are allowed to reset rental prices with changes of tenants. Unlike exemptions, this tenancy deregulation has been retained since then. This type of rent control is descriptively termed tenancy rent control or partial rent control (Arnott, 2003). Thus, the current Ontario rent control system is a partial one with exemptions.

Fallis and Smith (1984) provides a model of rent control with exemptions. The model predicts that rental prices of uncontrolled units are higher than controlled ones. In particular, the higher the expectations of developers that rent controls will be extended to new construction the higher will be uncontrolled rents. The model provides a comparative static analysis of controlled and uncontrolled prices, but does not analyse the impacts of rent increase guidelines. As the model is static, introducing rent increase guidelines does not qualitatively change the results. However, rent increase guidelines play an important role in a dynamic environment because rental prices of each period will be affected by the fact that landlords of units under rent controls have to follow guidelines.

3. Data

We use the Rental Market Survey (RMS) data. RMS is conducted by CMHC every year in October on a sample basis in all urban areas with populations of 10,000 and more. It targets only privately initiated structures with at least three rental units that have been on the market for at least three months. RMS covers primary rental markets that comprise one half of total rental markets, while the other half consists of secondary rental markets. Information such as unit characteristics, rents, and availability for all sampled structures is collected during the survey.

Table 1: Summary statistics for rental properties from 1992 to 2016

Toronto	Units under rent control				Units not under rent control			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
All Bedrooms								
Rent	937.10	291.58	100	14460	1305.68	636.59	300	15000
Bedrooms	1.52	0.76	0	3	1.50	0.69	0	3
Building age	49.49	11.57	26	170	12.73	5.78	0	24
Obs.	5349462				52947			
Bachelor								
Rent	710.52	188.83	140	7258	1168.51	288.91	450	3100
Obs.	410155				3478			
1-Bedroom								
Rent	855.98	217.64	100	12500	1394.36	400.66	300	4000
Obs.	2229943				22072			
2-Bedroom								
Rent	1006.72	276.56	101	11222	1600.41	726.35	600	11000
Obs.	2234589				24883			
3plus-Bedroom								
Rent	1186.14	429.62	102	14460	1783.94	1165.71	764	15000
Obs.	474775				2514			

Note: Rents are in current Canadian dollars. The number of observations refers to the total rental in the 1992-2016 sample.

As shown in Table 1, the majority of units are rent-controlled, while only 1% of units are not under rent control. From 1992 to 2016, our data sample includes 5.35 million controlled units and 52947 uncontrolled units.[8] The average rent of uncontrolled units is Can$357.54 or 37.71% higher than that of controlled units. Uncontrolled units have in average 1.5 bedrooms, similar to 1.52 bedrooms of controlled units. Breaking down by number of bedrooms, most units are of one and two bedrooms for both controlled and uncontrolled units, with the share of 84% and 89%, respectively. Units with two and three plus bedrooms exhibit rent gaps of Can$594 and Can$598 between controlled and uncontrolled one, respectively. Though not reported in the table, both controlled and non-controlled units exhibit very low vacancy rates of under 1.5%. As of 2016, controlled units are in average 50 years old, while uncontrolled units are 13 years old. Note that the samples of controlled and uncontrolled units are quite different in terms of the size. One may suggest to draw a smaller subsample from controlled units so that two samples have the same size, but this approach can bias the results because of the importance of locations in determining rental prices. Instead, we use regression discontinuity design to show that using the whole sample for controlled units provides robust results.

[8] RMS is sampled every year. It is possible to trace same buildings overtime as far as the same buildings are sampled in every year. However, the number of uncontrolled units in the panel data is too small to conduct credible analysis. We use regression discontinuity design (RDD) to make control and treatment groups more balanced when formally evaluating the impact of rent control. More specifically, we construct treated and untreated units using rental units completed two years before and after the cut-off year of 1992, respectively. In this way, we have more balanced treated and control samples.

Table 2. Proportions of units with rents including electricity, parking, and cable from 1992 to 2016

Amenities and services	Units under rent control	Units not under rent control
Electricity	76.79%	35.64%
Parking	26.85%	13.99%
Cable	6.72%	4.81%

As RMS covers primary rental markets, its rents may include amenities and services such as hydro, heat, parking, hot water, and cable. Indeed, 99% of rents include heat and hot water. Here we document proportions of units with rents including electricity, parking, and cable service. As shown in Table 2, in general there are higher proportions of units under rent control including electricity, parking, and cable in their rents than non-controlled units. For units under rent control, 76.79% of units include electricity in the rents, 26.85% include parking, and 6.72% include cable, while only 35.64% of uncontrolled units include electricity, 13.99% include parking, and 4.81% include cable.

Figure 1. Average controlled and uncontrolled rents of Toronto from 1992 to 2016

Note: Rents are in current Canadian dollars.

As our sample covers data of 25 years, we also document its dynamic characteristics. We compute average rents of controlled and non-controlled units from 1992 and 2016. As show in Figure 1, the dashed line represents uncontrolled rents or market rents, while the solid line represents controlled rents. We have two interesting observations. First, both types of rents exhibit

an upward trend. Except in 1999, average uncontrolled rents are higher than controlled rents.[9] Second, market rents trend down before and during the 2007-2008 global financial crisis, while controlled rents fluctuate to a less extent with business cycles. Market rents are more volatile than controlled rents. These observations are supported with basic statistics of growth rates of average market and controlled rents shown in Table 3. Both market and controlled rents are not stationary and are I(1). We compute their growth rates to make the series stationary.

As shown in Table 3, despite the gap in level, uncontrolled and controlled rents in average grow by 2.4% from 1992 and 2016. For units under rent control, rent increases are guided by the predefined guidelines calculated from CPI. During the 1992-2016 period, rent increase guidelines in average grow by 2.5%, which is close to the average growth rates of uncontrolled and controlled rents.[10] However, growth rates of uncontrolled rents are 5.5 times more volatile than growth rates of controlled rents that are two times more volatile than rent increase guidelines. Thus, as shown in Figure 2, controlled rents are a lot smoother than uncontrolled rents.[11] These two stylised facts have important welfare implications. According to Lucas (2003), though changes in real GDP growth rates imply larger changes in welfare than changes in volatility, reducing volatility is welfare improving. This implies that controlled rents with lower volatility than market rents induces welfare gains for tenants of controlled units. These basic facts support the argument that rent controls help avoid abrupt rent increases.

Table 3. Basic statistics of growth rates of average market and controlled rents from 1992 to 2016

	Units not under rent control	Units under rent control	Rent increase guidelines
Average growth rate	2.37%	2.43%	2.5%
Standard deviation	0.11	0.02	0.01
Autocorrelation	-0.08	0.47	0.33
Co-movement with nominal GDP	0.20	0.09	0.09

When regressing on the first lag, growth rates of controlled rents are more persistent than growth rates of market rents with a coefficient of first order autocorrelation of 0.47 versus -0.08. The persistence of rent increase guidelines is 0.33, lower than growth rates of controlled rents. Growth rates of uncontrolled rents are more procyclical with respect to nominal GDP than growth

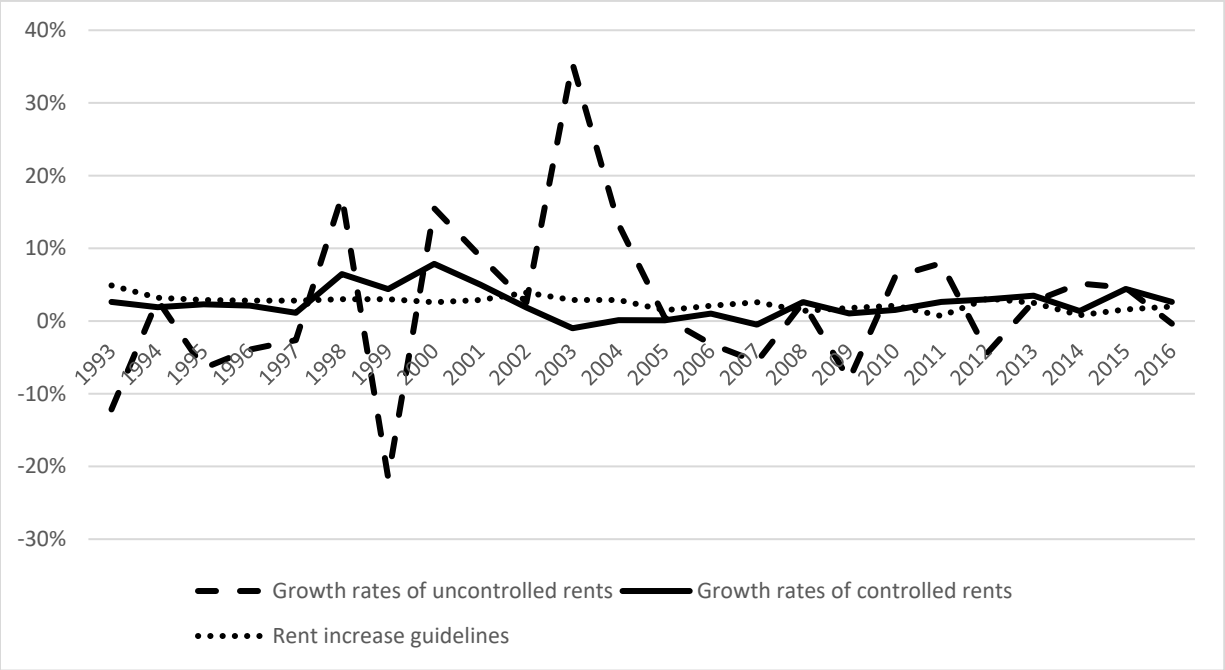
[9] Note that the year of 1999 is marked by the beginning of tenancy deregulation and by the Asian financial crisis.

[10] Having similar average growth rates does not imply that rent control does not affect rent growth as rent growth determinants may include many other demand and supply factors. Neither can we draw causality between rent control and the fact that market rents are more volatile than controlled rents. Testing these two later causality is beyond the scope of our paper and requires time series analysis considering other demand and supply factors.

[11] Note that average uncontrolled rent in 2003 increased by 35.42% from the previous year. This dramatic increase can be explained by market fluctuations and possibly by sampling. RMS is sampled every year and gives more weight to newly built units. If there is a relatively important proportion of newly built units with higher rents in the uncontrolled sample, this would raise the average rate, especially when the uncontrolled sample is quite small compared to the controlled one.

rates of controlled rents and rent increase guidelines. One interesting observation is that unlike market rents, growth rates of controlled rents are mostly positive (negative growth only in 2003 and 2007), while rent increase guidelines are always positive.

Figure 2. Rent increase guidelines and growth rates of market and controlled rents from 1992 to 2016



To sum up, market rents in Toronto are higher than controlled rents from 1992 to 2016, but both rental rates exhibit the same average growth rate; growth rates of market rents are 5.5 times more volatile than growth rates of controlled rents and controlled rents rarely have negative growth rates. Regarding the rent gap, we cannot conclude from summary statistics that it is caused by rent control because uncontrolled units are more newly built and may have better locations or amenities than controlled ones. We therefore need to control for building age, location, and unit characteristics to isolate the impact of rent control.

4. Estimation results with the whole sample

In this section, we present econometric models and estimation results with the whole sample. We start with a discussion on identification strategies.

4.1 Identification strategies

In the absence of randomized assignments, program evaluations rely on the conditional independence between potential outcomes and treatment using methods such as difference in differences (DID) and synthetic controls (Abadie and Cattaneo, 2018). In our study, if we consider units built after 1992 as our control group, then DID is not suitable because we do not observe

their rents before the implementation of rent control in 1992. The before-and-after estimator is not applicable neither because rent control had been implemented to units built before 1992 according to the Residential Premises Rent Review Act of 1975.

Other cities without rent controls could serve as controls. The conditional independence is warranted if the treated units share parallel trends or common factors with untreated units. Other global cities such as Vancouver and Montreal may share common factors with Toronto, but they are under rent controls as well. If we use some other Canadian cities without rent controls as our control group, the assumption of conditional independence is difficult to be satisfied because rental markets in Toronto are less likely to share common factors with these markets. We have tried to use cities without rent controls such as Calgary and Edmonton as controls, but the assumption of parallel trends is not satisfied. Foreign global cities such as New York City and San Francisco are more likely to share common factors with Toronto, but these cities are subject to rent controls as well. Even if we can find global cities without rent controls, we do not have access to their record-level data.

Instead, we opt for a dummy-variable identification strategy with OLS and regression discontinuity design (RDD). The dummy-variable approach groups rental units into uncontrolled and controlled ones according to structure completion years. After controlling for unit characteristics, locations, and year effects, the dummy variable captures the effect of rent control. As a robustness check, we also apply RDD to verify the causality between rent control and rental prices. We construct treated and control groups using rental units completed two years before and after the cut-off year of 1992, respectively. After controlling for unit characteristics, locations, and year effects, any observed rent gap captures the effect of rent control.

4.2 OLS estimation results

The dummy-variable approach compares rental rates between rent-controlled and uncontrolled units from 1992 to 2016. Rental units completed after November 1, 1991 were exempted for rent controls. In our data, we only observe year of completion instead of the exact date. Thus, we cannot know whether those units completed in 1991 are under rent control or not. We drop rental units completed in 1991 so that our uncontrolled and controlled units are not contaminated. In a hedonic specification, this leads to an estimator as follows.

$$\log R_{it} = \alpha + \beta X_{it} + \theta RC_i + \gamma_j + \mu_t + \varepsilon_{it}$$

where the dependent variable, R_{it} is the rental rate of unit i at time t; X_{it} is a vector of rental unit characteristics, including number of bedrooms, building age, and whether rents contain utility costs or not; RC_i is a dummy variable equal to 1 if a rental unit i is under rent control and 0 otherwise; γ_j captures community effect at level j; μ_t is year dummy capturing time-varying factors; and ε_{it} error term. This identification strategy can be considered as a special case of DID by using the subsample after the implementation of rental control or by assuming that the difference of rental

rates between rent-controlled and uncontrolled units before the implementation of rent control averages out to zero across rental units before rent control.

The OLS estimation results of the whole sample from 1992 to 2016 are reported in Table 4. The first column includes the dummy variable of rent control, the number of bedrooms, dummy variables indicating whether rents include electricity, parking, and cable, building age[12], trend, trend squared, and the fixed effect variable at census tract level. To test the robustness of our specification, we gradually add variables into the regressions. Columns 2 to 5 report estimation results of different models.

As for the rent control variable, we notice the magnitude of its coefficient[13] is decreasing in absolute value as more variables are controlled for. When controlling only for the number of bedrooms and dummy variables indicating whether rents include electricity, parking, and cable service, rental rates of controlled units are 37.71% lower than the uncontrolled rents, holding other variables constant. The coefficient in absolute value decreased by more than half when controlling for building age and year dummies. R-squared increases from 0.23 to 0.60. As locations matter for rents, the rent control coefficient is reduced to 0.13 once fixed effect at Census Tract[14] (CT) level is added. In total, we control for 886 Census Tracts. All estimated coefficients are significant at 1% level. We use more than five millions of observations.

With the full specification, the controlled rent is 13.71% lower than the uncontrolled rent, all else being equal. Explanatory power increases to 79%, indicating that our model fits well data. As the average uncontrolled rent is 37.71% higher than the average controlled rent, rent control accounts for 36.33% of the difference between uncontrolled and controlled rental prices. Thus, rent control reduced rental rates by 13.71% and accounts for 36.33% of the difference between uncontrolled and controlled rents using the sample from 1992 to 2016.

[12] As the treatment group is defined as rental units built after 1992, one may think that building age could be a bad control. However, building age is not a bad control. As demonstrated by Angrist and Pischke (2009), a bad control is an outcome variable of the treatment. Building age is not the outcome of rent control and is determined before rent control.

[13] As the dependent variable is in natural logarithm, the coefficient approximates the difference in percentage when the number is relatively small. Otherwise, taking exponential is necessary to compute the exact percentage by $e^{\beta} - 1$, where β is an estimated coefficient.

14 A Census Tract is a relatively stable geographic area with a population between 2500 and 8000 persons, with a preferred average of 4000.

Table 4: Estimation results with the 1992-2016 sample

Ln(Rent)	Model (1)	Model (2)	Model (3)	Model (4)
RC	-0.453***	-0.314***	-0.191***	-0.128***
	(0.002)	(0.002)	(0.002)	(0.035)
Bedroom1	0.198***	0.185***	0.180***	0.230***
	(0.000)	(0.000)	(0.000)	(0.005)
Bedroom2	0.360***	0.338***	0.332***	0.407***
	(0.000)	(0.000)	(0.000)	(0.007)
Bredroom3	0.514***	0.487***	0.478***	0.559***
	(0.001)	(0.001)	(0.001)	(0.011)
Electricity	0.016***	-0.016***	0.014***	0.046***
	(0.000)	(0.000)	(0.000)	(0.007)
Parking	-0.071***	-0.070***	-0.043***	-0.002
	(0.000)	(0.000)	(0.000)	(0.005)
Cable	0.050***	0.043***	0.090***	0.046***
	(0.001)	(0.001)	(0.000)	(0.016)
Building age		-0.003***	-0.004***	-0.004***
		(0.000)	(0.0000)	(0.000)
Year			Yes	Yes
Census tract effect				Yes
Intercept	6.980***	7.051***	6.608***	6.217***
	(0.002)	(0.002	(0.002)	(0.015)
N	5380179	5380179	5380179	5368304
R^2	0.229	0.245	0.598	0.789

Note: For model (4), robust standard errors, clustered by census tract, are in parenthesis, while for other models, only robust standard errors are reported. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

Continuing with other variables, rental rates of one-bedroom apartments are 25.86% higher than bachelors, 50.23% higher for two-bedroom apartments, and 74.89% higher for three-bedroom apartments. Rents including electricity are 4.71% higher that without. Interestingly, rents including parking are not significantly different. Rents including cable service are 4.71% higher than without. One-year older building reduces rents by 0.4%.

These estimated coefficients also represent implicit rents of unit attributes and can be used to construct rent indices. We fit these implicit rents to rental units and compute average rents of controlled and uncontrolled units. There is a gap between the market and controlled rents. The average growth rate of the predicted market rent is 3.1%, which is higher than the average growth rate of 2.3% of controlled units. Moreover, the predicted growth rates of market rents are seven times more volatile than the predicted growth rates of controlled rents. These constructed rents suggest that rent control not only reduces rental rates in level, but also the growth rates and volatility.

We also conduct quantile regressions to verify whether the effect of rent control varies across quantiles. We report quantile regression results of the 1992-2016 sample in Table 5. We control for Census Subdivision (CSD) effect to reduce computational burden. In the second column, we report the OLS results, while in the third to fifth column, we report quantile regression results. Controlling for CSD effect, the average rent of controlled units is 19.36% lower than the uncontrolled ones, which is higher than 13.71% obtained when controlling for CT effect. The explaining power controlling for CSD effect is only 60.7%, which is much lower than 78.9% controlling for CT effect.

Rent control negatively affects rental prices across quartiles. One striking result is that the effect of rent control on rent is not significant in the 25th percentile, while it is significant in the median and 75th percentile. The effect is increasing in quartile. To a certain extent, rent control does not have effects on low-end units and thereby does not make these units more affordable. However, it significantly reduces rental prices of middle- and high-end units.

Table 5: Quantile regression estimation results with the 1992-2016 sample, controlling for CSD effect

	OLS	Q (0.25)	Q(0.5)	Q (0.75)
RC	-0.177**	-0.073	-0.169**	-0.192*
	(0.079)	(0.112)	(0.087)	(0.120)
Bedroom1	0.188***	0.178***	0.163***	0.173***
	(0.013)	(0.007)	(0.020)	(0.015)
Bedroom2	0.346***	0.318***	0.307***	0.327***
	(0.020)	(0.010)	(0.026)	(0.021)
Bredroom3	0.492***	0.445***	0.446***	0.466***
	(0.023)	(0.010)	(0.026)	(0.022)
Electricity	0.016	0.024***	0.016*	-0.004
	(0.010)	(0.008)	(0.009)	(0.017)
Parking	-0.034***	-0.029***	-0.031***	-0.032***
	(0.007)	(0.004)	(0.008)	(0.011)
Cable	0.084***	0.029***	0.061**	0.085
	(0.020)	(0.012)	(0.021)	(0.026)
Building age	-0.004***	-0.005***	-0.005***	-0.004***
	(0.001)	(0.001)	(0.002)	(0.001)
Year	Yes	Yes	Yes	Yes
CSD effect	Yes	Yes	Yes	Yes
Intercept	6.555***	6.427***	6.555***	6.641***
	(0.069)	(0.071)	(0.069)	(0.108)
N	5368304	5368304	5368304	5368304
R^2	0.607	0.594	0.603	0.604

Note: Robust standard errors clustered by CSD are reported in parenthesis. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

4.3 Regression discontinuity design

We find significant rent differences between uncontrolled and controlled units after controlling for unit characteristics, year effects, and community effects. To establish causality between rent control and rental prices, we use RDD. We explore the cut-off year of exemptions to construct treated and control units.

As rental buildings are sampled every year with more weights on recently built units, sample size for units constructed since 1991 has increasingly become smaller. To have a reliable sample of uncontrolled units, we consider rental units completed in 1992 and 1993 as our untreated units, while rental units completed in 1989 and 1990 as our treated units.15 We vary sample periods to verify how the effects of rent control, if there are any, vary over time.

Table 6: Summary statistics for RDD analysis surveyed in 1992 and 1993

Toronto	Controlled units constructed in 1989 and 1990				Uncontrolled units constructed in 1992 and 1993			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Rent	1026.61	197.04	490	2081	1043.26	179.25	487	1300
Bedrooms	1.76	0.52	0	3	1.98	0.26	0	3
Obs.	9739				874			

As shown in Table 6 for survey year in 1992 and 1993, the average rent of uncontrolled units is only 1.6% higher than controlled units. The sample of uncontrolled units is one tenth of controlled ones. After controlling for locations and the number of bedrooms, shown in Table 7, rent control significantly reduced rental prices by 10% to 13.7% for different sample periods. The range is quite close to our OLS estimation results, which validates the causality in our OLS specification.

Though RDD is preferable to OLS in terms of establishing causality, the sample size is dramatically reduced, especially for uncontrolled units, which limits our study using quantile regressions. As RDD validates the results of OLS, we continue our analysis using OLS with subsamples.

[15] We obtain similar results using units constructed in 1990 as treated units and units constructed in 1992 as untreated ones. We also obtain similar results using only rental units in the same CT.

Table 7: RDD results for different periods

Ln(Rent)	1992-1993	1992-1997	1992-2010	1992-2016
RC	-0.128***	-0.105***	-0.098***	-0.098***
	(0.005)	(0.004)	(0.008)	(0.009)
Bedroom1	0.189***	0.173***	0.140***	0.147***
	(0.046)	(0.045)	(0.019)	(0.016)
Bedroom2	0.328***	0.326***	0.293***	0.300***
	(0.050)	(0.049)	(0.021)	(0.017)
Bredroom3	0.516***	0.496***	0.451***	0.455***
	(0.059)	(0.050)	(0.021)	(0.017)
Year	Yes	Yes	Yes	Yes
Census tract effect	Yes	Yes	Yes	Yes
Intercept	6.341***	6.362***	6.301***	6.288***
	(0.048)	(0.063)	(0.039)	(0.037)
N	10613	26284	38652	41556
R^2	0.747	0.752	0.785	0.801

Note: Robust standard errors, clustered by census tract, are reported in parenthesis. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

5. Estimation results with subsamples

As shown in Figure 1, the gap between market and controlled rents narrows during recessions and enlarges during expansions. This suggests that the impacts of rent control may vary with economic fluctuations. Moreover, rent control, considered as a policy to address affordability issues, could have different effects over different rent ranges. To further address these issues, we conduct both OLS and quantile analyses with two subsamples: the 1992-1997 sample and the 2010-2016 sample. As quantile regressions require more computing power than OLS, we control fixed effect at only Census Subdivision (CSD) or municipality level for all quantile regressions. We report OLS results controlling for fixed effect at CSD level as well for comparison purpose.

5.2. Estimation results with the 1992-1997 sample

We start with the 1992-1997 sample to capture the effects of rent control during the period when market rent is trending down and the average growth rate of house prices is only 0.25% using average MLS house prices. This is the period characterised by the recovering period aftermath of the 1990-1992 recession and by entering into the period of the 1997-1998 Asian financial crisis. This is the period when rental properties built after 1992 were supposedly exempted for rent control for five years, but the 5-year exemption was extended until 2017. This is also the period before the implementation of the tenancy deregulation in June 1998, according to which landlords are allowed to set rental rates at any rate for the beginning of a tenancy. We report summary statistics in Table 8. We identify only 4358 units without rent control, which represent only 0.3% of the total units under rent control. During the 1992-1997 period, the average market rent is 30.9% higher than the controlled rent.

Table 8: Summary statistics for rental properties with the 1992-1997 sample

Toronto	Units under Rent Control				Units not under Rent Control			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Rent	732.57	198.47	102	5701	958.92	168.34	450	1407
Bedrooms	1.52	0.76	0	3	1.66	0.59	0	3
Obs.	1432577				4358			

We report OLS regression results controlling for CT effect in Table 9. We use the same specification as for the 1992-2016 sample. As shown in the fifth column, the average rent of controlled units is 5.02% lower than the average rent of uncontrolled units during the 1992-1997 period, all other variables being equal. The effect of rent control is reduced to 5.02% for the 1992-1997 period, compared to the 13.7% from the 1992-2016 sample.

Table 9: OLS estimation results with the 1992-1997 sample, controlling for CT effect

	Model (1)	Model (2)	Model (3)	Model (4)
RC	-0.164***	-0.035***	-0.026***	-0.049***
	(0.004)	(0.004)	(0.004)	(0.072)
Bedroom1	0.204***	0.183***	0.184***	0.223***
	(0.001)	(0.001)	(0.001)	(0.006)
Bedroom2	0.385***	0.350***	0.351***	0.402***
	(0.001)	(0.001)	(0.001)	(0.008)
Bredroom3	0.549***	0.507***	0.508***	0.559***
	(0.001)	(0.001)	(0.001)	(0.013)
Electricity		0.026***	0.025***	0.062***
		(0.001)	(0.001)	(0.013)
Parking		-0.024***	-0.023***	0.012***
		(0.000)	(0.000)	(0.009)
Cable		0.061***	0.064***	0.041***
		(0.001)	(0.001)	(0.017)
Building age		-0.006***	-0.006***	-0.005***
		(0.000)	(0.000)	(0.001)
Year			Yes	Yes
Census tract effect				Yes
Intercept	6.374***	6.584***	6.514***	6.358***
	(0.004)	(0.004)	(0.004)	(0.077)
N	1430144	1430144	1430144	1430144
R^2	0.372	0.430	0.457	0.689

Note: For model (4), robust standard errors, clustered by census tract, are in parenthesis, while for other models, only robust standard errors are reported. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

The coefficients of other variables are similar between these two samples. Compared to the reference group of bachelors, the average rent of one-bedroom apartments is 24.98% higher, 49.48% higher for two-bedroom apartments, and 74.89% higher for three-bedroom apartments. Rents including electricity are 6.40% higher than without it; rents including parking are 1.21% higher than without; rents including cable service are 4.19% higher than without. One-year older

building reduces rents by 0.5%. As the average uncontrolled rent is 30.9% higher than the average controlled rent, rent control only accounts for 16.25% of the difference between uncontrolled and controlled rental prices. Thus, rent control reduced rental rates by 5.02% and accounts for 16.25% of the difference between uncontrolled and controlled rents using the sample from 1992 to 1997.

We report quantile regression results of the 1992-1997 sample in Table 10. In the second column, we report the OLS results, while in the third to fifth column, we report quantile regression results. Controlling for CSD effect, the average rent of controlled units is 1.41% lower than the uncontrolled ones, which is lower than 5.02% obtained when controlling for CT effect. The explaining power controlling for CSD effect is only 50%, which is much lower than 69% controlling for CT effect.

One striking result is that the effect of rent control on rent is positive in the 25th percentile during the 1992-1997 period, while it is negative in the median and 75th percentile. Note also the effects of rent control become insignificant in the median and 75th percentile. To a certain extent, rent control does not make low-end units more affordable during rent adjustment periods.

Table 10: Quantile regression estimation results with the 1992-1997 sample, controlling for CSD effect

	OLS	Q (0.25)	Q(0.5)	Q (0.75)
RC	-0.014***	0.161**	-0.049	-0.064
	(0.074)	(0.079)	(0.438)	(0.050)
Bedroom1	0.223***	0.198***	0.212***	0.224***
	(0.013)	(0.007)	(0.013)	(0.018)
Bedroom2	0.411***	0.362***	0.386***	0.405***
	(0.032)	(0.015)	(0.029)	(0.035)
Bredroom3	0.575***	0.497***	0.525***	0.555***
	(0.050)	(0.029)	(0.037)	(0.049)
Electricity	0.042***	0.033*	0.031*	0.032*
	(0.021)	(0.018)	(0.018)	(0.019)
Parking	-0.007	-0.001	-0.004	0.008
	(0.012)	(0.012)	(0.017)	(0.011)
Cable	0.048***	0.016	0.031**	0.033
	(0.025)	(0.022)	(0.017)	(0.032)
Building age	-0.006***	-0.010***	-0.008***	-0.007***
	(0.002)	(0.003)	(0.002)	(0.002)
Year	Yes	Yes	Yes	Yes
CSD effect	Yes	Yes	Yes	Yes
Intercept	6.429***	6.316***	6.487***	6.645***
	(0.098)	(0.086)	(0.461)	(0.044)
N	1430144	1430144	1430144	1430144
R^2	0.500	0.467	0.489	0.494

Note: Robust standard errors clustered by CSD are reported in parenthesis. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

As for the number of bedrooms, all coefficients are increasing in quantiles. For instance, rents of units with two bedrooms in the 25th percentile are 43.62% higher than the reference group of bachelors, 47.11% higher in the median, and 49.93% higher in the 75th percentile. Thus, returns of having one more bedroom are higher for high-end rental units. There is no obvious pattern for variables indicating whether rents include electricity, parking, and cable. Though it is small, the effect of building age is decreasing in quantile. Compared to low-end rental properties, the effect of building age is smaller for high-end ones.

5.2. Estimation results with the 2010-2016 sample

We continue with the 2010-2016 sample to capture the effects of rent control during the period when the average growth rate of house prices is 9.23%. This is a booming period for housing markets, characterised by recovering from the 2007-2008 global financial crises and by escalating house prices. We report summary statistics in Table 11. We identify 29955 units without rent control, which represent only 2.12% of the total units under rent control. During the 2010-2016 period, the average market rent is 44.31% higher than the controlled rent.

Table 11: Summary statistics for rental properties with the 2010-2016 sample

Toronto	Units under Rent Control				Units not under Rent Control			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
All Bedrooms								
Rent	1124.26	307.07	100	14460	1622.44	594.57	500	12000
Bedrooms	1.46	0.71	0	3	1.46	0.71	0	3
Obs.	1384729				29955			

We report OLS regression results controlling for CT effect in Table 12. As shown in the fifth column, the average rent of controlled units is 16.77% lower than uncontrolled units during the 2010-2016 period, all other variables being equal. The effect of rent control is increased to 16.77% for the 2010-2016 period compared to the 13.7% from the 1992-2016 sample.

Other coefficients are similar between these two samples. Compared to the reference group of bachelors, the average rent of one-bedroom apartments is 25.73% higher, 50.83% higher for two-bedroom apartments, and 76.12% higher for three-bedroom apartments. As the average uncontrolled rent is 44.31% higher than the average controlled rent, rent control accounts for 37.85% of the difference between uncontrolled and controlled rental prices. Thus, rent control reduced rental rates by 16.77% and accounts for 37.85% of the difference between uncontrolled and controlled rents using the sample from 2010 to 2016.

Table 12: OLS estimation results with the 2010-2016 sample, controlling for CT effect

	Model (1)	Model (2)	Model (3)	Model (4)
RC	-0.359***	-0.256***	-0.257***	-0.155***
	(0.002)	(0.002)	(0.002)	(0.036)
Bedroom1	0.177***	0.167***	0.166***	0.229***
	(0.001)	(0.001)	(0.001)	(0.006)
Bedroom2	0.330***	0.313***	0.312***	0.411***
	(0.001)	(0.001)	(0.001)	(0.008)
Bredroom3	0.475***	0.454***	0.453***	0.566***
	(0.001)	(0.001)	(0.001)	(0.012)
Electricity	0.026***	0.006***	0.017***	0.033***
	(0.000)	(0.000)	(0.000)	(0.007)
Parking	-0.064***	-0.062***	-0.056***	-0.010*
	(0.000)	(0.000)	(0.000)	(0.006)
Cable	0.135***	0.131***	0.131***	0.040*
	(0.002)	(0.001)	(0.001)	(0.022)
Building age			-0.002***	-0.003***
			(0.000)	(0.000)
Year			Yes	Yes
Census tract effect				Yes
Intercept	7.091***	7.132***	7.035***	6.812***
	(0.002)	(0.002)	(0.002)	(0.034)
N	1400356	1400356	1400356	1400356
R^2	0.308	0.320	0.375	0.758

Note: For model (4), robust standard errors, clustered by census tract, are in parenthesis, while for other models, only robust standard errors are reported. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

We report quantile regression results of the 2010-2016 sample in Table 13. When controlling for CSD effect, the average rent of controlled units is 27.89% lower than the uncontrolled ones, which is much higher than 16.77% obtained when controlling for CT effect. The explaining power controlling for CSD effect is only 38.3%, which is much lower than 75.8% controlling for CT effect. As controlling for CT effect imposes large computation burden in quantile regressions, we have to opt for controlling for CSD effect. The effect of rent control is increasing in quantiles and the effect is similar in the median and the 75th percentile. During the booming period, the effect of rent control is larger on high-end units than on low-end units. Compared to high-end units, rent control does not make low-end units more affordable during booming periods.

Table 13: Quantile regression estimation results with the 2010-2016 sample, controlling for CSD effect

	OLS	Q (0.25)	Q(0.5)	Q (0.75)
RC	-0.246***	-0.167***	-0.252***	-0.255***
	(0.050)	(0.101)	(0.061)	(0.062)
Bedroom1	0.167***	0.154***	0.131***	0.163***
	(0.003)	(0.003)	(0.003)	(0.001)
Bedroom2	0.315***	0.290***	0.266***	0.299***
	(0.001)	(0.003)	(0.003)	(0.003)
Bredroom3	0.456***	0.426***	0.403***	0.424***
	(0.006)	(0.003)	(0.006)	(0.004)
Electricity	0.017***	0.020***	0.016***	0.008*
	(0.003)	(0.001)	(0.003)	(0.005)
Parking	-0.051***	-0.043***	-0.053***	-0.059***
	(0.004)	(0.002)	(0.005)	(0.005)
Cable	0.127***	0.072***	0.122***	0.134***
	(0.013)	(0.012)	(0.011)	(0.019)
Building age	-0.002***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Year	Yes	Yes	Yes	Yes
CSD effect	Yes	Yes	Yes	Yes
Intercept	6.958***	7.076***	7.212***	7.203***
	(0.025)	(0.077)	(0.022)	(0.035)
N	1400356	1400356	1400356	1400356
R^2	0.383	0.368	0.377	0.379

Note: Standard errors in parenthesis. The standard errors for quantile regression are obtained through 500 bootstrap replications. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

5.3 Policy announcement effect

Several legislative changes on rent control have been made with specific goals. The Rent Control Act 1992 was adopted during the 1991-92 economic recession, while the Fair Housing Plan was launched in 2017 to cool down soaring house prices in Toronto. The announcement of these changes could affect rents by changing public expectations on rental rates.

To test this hypothesis, we study the policy announcement effect of 1992. We compare rental rates before and after the policy announcement. We use RMS data from 1989 to 1995. As we control for the effect of observable housing and location characteristics in a hedonic specification, the comparison leads to a before-after estimator as follows.

$$\log R_{it} = \alpha + \beta X_{it} + \theta PA_t + \gamma_j + \mu_t + \varepsilon_{it}$$

where the dependent variable, R_{it} is the rental rate of unit i at time t; X_{it} is a vector of rental unit characteristics; PA_t is a dummy variable equal to 1 after the policy announcement and 0 before; γ_j is a location or community fixed effect; μ_t is a time trend defined as the difference between

survey year and 1989 ; and ε_{it} error term. Using polynomials of time trend, here the before-after identification[16] is an application of RDD with time as a running variable. It allows to establish the causality from policy announcement and rental prices.

Table 14: Estimation results with rental properties built before 1992, from 1989 to 1995

	Model (1)	Model (2)	Model (3)	Model (4)
PA	0.143***	0.138***	-0.008***	-0.010**
	(0.000)	(0.000)	(0.001)	(0.0005)
Bedroom1	0.198***	0.170***	0.170***	0.225***
	(0.001)	(0.001)	(0.001)	(0.008)
Bedroom2	0.386***	0.338***	0.339***	0.408***
	(0.001)	(0.001)	(0.001)	(0.010)
Bredroom3	0.561***	0.504***	0.504***	0.574***
	(0.001)	(0.001)	(0.001)	(0.015)
Electricity	0.082***	0.021***	0.020***	0.058***
	(0.000)	(0.001)	(0.001)	(0.013)
Parking	-0.023***	-0.023***	-0.021***	0.014
	(0.000)	(0.000)	(0.001)	(0.010)
Cable	0.060***	0.052***	0.057***	0.033**
	(0.001)	(0.001)	(0.001)	(0.016)
Building age		-0.007***	-0.007***	-0.005***
		(0.000)	(0.000)	(0.001)
Trend			0.069***	0.069***
			(0.000)	(0.003)
Trend^2			-0.005***	-0.005***
			(0.000)	(0.000)
Census tract effect				Yes
Intercept	6.043***	6.460***	6.394***	6.188***
	(0.001)	(0.002)	(0.002)	(0.042)
N	1651717	1651717	1651717	1651717
R^2	0.373	0.442	0.462	0.676

Note: For model (4), robust standard errors, clustered by census tract, are in parenthesis, while for other models, only robust standard errors are reported. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

We report OLS regression results controlling for CT effect in Table 14. We gradually add more control variables into our specification. Model (4) in the fifth column, or the full specification, gives the highest R squared. The average rent after the policy announcement is 1% lower than before the announcement, all other variables being equal. Compared to the reference group of bachelors, the average rent of one-bedroom apartments is 25.23% higher, 50.38% higher for two-

[16] Without polynomials of time trend, the before-after identification can be also considered as a special case of DID by assuming that the before-after difference of rental rates for the control group or untreated units averages out to zero across all untreated units. It basically assumes the existence of two types of unobservables: those specific to a rental unit and fixed over time and those specific to a rental unit but transitory over time. The before-after estimator does not require longitudinal data and can be implemented with repeated cross-section data.

bedroom apartments, and 77.53% higher for three-bedroom apartments. Rents including electricity are 5.97% higher than without it; rents including parking are not significantly different from those without parking; rents including cable service are 3.36% higher than without. One-year older building reduces rents by 0.5%. Year over year, rents increase by 7.14%.

6. Conclusions

A revisionism of the second-generation rent controls with flexible provisions, as suggested by Arnott (1995), requires more empirical evidences on the effects. Evaluating the effects of rent controls is challenging because of the lack of high-quality micro data and the difficult task to isolate their effects from other factors. In this paper, we use more than 25 years of record-level Rental Market Survey data to provide some basic facts about controlled and uncontrolled rents in Toronto and to study the effects of rent control on rental prices. From 1992 to 2016, our sample covers more than 5.4 million privately-owned rental units from primary markets.

We provide several basic facts on rent control with exemptions in Toronto. Using the exemption cut-off year of 1992, the proportion of rental units without rent control is quite small of only 1% from 1992 to 2016. There is an important level difference: the average uncontrolled rent is Can$357.5 or 37.7% higher than the average controlled rent. Despite the important gap in level, both uncontrolled and controlled rents annually grow in average by 2.4%, close to the average increase guidelines set by the government. However, growth rates of uncontrolled rents are five times more volatile than growth rates of controlled rents that are two times more volatile rent increase guidelines. It seems that rent control helps avoid abrupt rent increases. While from 1992 to 2016, rent increase in the guideline was positive, local governments may need to consider how to set the guideline in a deflationary environment.

We then combine policy implementation window with hedonic models to isolate the effects of rent control. The causality is validated with RDD results. We also conduct quantile regressions to study the effects of rent control across quantiles. Our mains results support the hypothesis that rent control reduces rental prices and its effects vary with market conditions. For the whole sample from 1992 to 2016, rent control accounts for 36.3% of the gap between uncontrolled and controlled rents. In particular, during the adjustment period from 1992 to 1997, rent control explains 16.3% of the rent gap and it does not make low-end rental units under rent control more affordable, compared to the low-end units that are not subject to rent control. During the booming period from 2010 to 2016, rent control accounts for 37.9% of the rent gap. Across quartiles, the effect of rent control is larger at the higher quartile. Our results are robust with different specifications. As rent control did not make low-end units more affordable during adjustment periods, housing initiatives should be targeted to aggressively increase affordable housing in adjustment periods.

While our findings from the case of Toronto support a revisionism of the second-generation rent controls regarding their role of price stabilization, more research efforts in three directions are needed for a more complete picture on rent controls.

First, despite the importance of rental expenditures in household spending, the setting of rental prices has been largely overlooked by modern macroeconomic models of which monopolistic competition and price setting à la Calvo have been a key component. With tenancy provisions, rental price setting is very much à la Calvo so that landlords can re-optimize expected rental returns with changes of tenants. Taking into account both nominal and real rigidities in rental markets would provide a new channel for monetary shocks to affect the real economy.

Second, we need more studies on the effects of different variants of rent controls. Rent controls in different jurisdictions vary in provisions and exemptions. For instance, the Ontario rent control differs from the Quebec one in two important ways. The Ontario system exempts new construction for an irregular period of time, while the Quebec system specifies the exemption period of five years. The Ontario system is a partial rental control or tenancy control so that landlords can set rents higher than guidelines at the beginning of a tenancy, while rent control is imposed even with changes of tenants in Quebec. We will continue to evaluate these key differences using our dataset.

Last but not least, we need to evaluate the effects of rent controls on the supply[17], the quality of rental stock, labor mobility, and gentrification as well. As surveyed in Sturtevant (2018), most empirical studies on rent controls are concentrated on the New York City, but the NYC rent control system differs from other rent controls by its implementation of the first-generation rent controls from 1950s to 1970s when rent controls were removed in other jurisdictions. Empirical evidences from other jurisdictions would provide a more general view about the second-generation rent controls.

References

Abadie, A., Cattaneo, M.D., 2018. Econometric methods for program evaluation. Annu. Rev. Econ. 10, 465-503.

Arnott, R., 1995. Time for Revisionism on Rent Control? Journal of Economic Perspectives, 9(1), 99-120

Arnott, R., 2003. Tenancy Rent Control, Swedish Economic Policy Review, 10, 89-121.

Autor, D.H., Palmer, C.J., Pathak, P. A., 2014. Housing Market Spillovers: Evidence from the End of Rent Control in Cambridge, Massachusetts. Journal of Political Economy, 122(3): 661-717.

Bulow, J., Klemperer, P., 2012. Regulated prices, rent seeking, and consumer surplus. Journal of Political Economy, 120(1): 160-186.

[17] In Toronto, we observe a decline of rental construction since 1980s. This decline could be explained by tax reforms and rent controls, but there are no empirical evidences to support the argument. More research efforts are needed to address this issue.

Diamond, R., McQuade, T., Qian, F., 2019. The Effects of Rent Control Expansion on Tenants, Landlords, and Inequality: Evidence from San Francisco, American Economic Review, 109(9), 3365-94.

Fallis G., Smith L.B., 1984. Uncontrolled Prices in a Controlled Market: The Case of Rent Controls. The American Economic Review, 74(1), 193-200.

Fallis G., Smith L.B., 1985. Prices effects of rent control on controlled and uncontrolled rental housing in Toronto: a hedonic index approach. Canadian Journal of Economics, 18(3), 652-659.

Favilukis, J., Mabille, P., Nieuwerburgh, S.V., 2019. Affordable Housing and City Welfare, CEPR Discussion Paper 13758.

Friedman, M., Stigler, G.J., 1946. Roofs or Ceilings? The Current Housing Problem, Popular Essays on Current Problems, 1(2), The Foundation for Economic Education.

Guldi J., 2020. The Birth of Rent Control, e-flux architecture Housing.

Glaeser, E. L., Luttmer, Erzo F. P., 2003. The Misallocation of Housing Under Rent Control," American Economic Review, 93(4), 1027-1046

Hayek F.A., 1929. The Repercussions of Rent Restrictions, in Hayek et al. 1975, the Fraser Institute.

Lindbeck, A., 1971. The Political Economy of the New Left : An Outsider's View, New York University Press.

Lucas, R.E., 2003. Macroeconomic Priorities, The American Economic Review, 93(1), 1-14.

Olsen, E.O., 1972. An Econometric Analysis of Rent Control, Journal of Political Economy, 80(6), 1081-1100.

Sims, D.P., 2007. Out of Control: What Can We Learn from the End of Massachusetts Rent Control? Journal of Urban Economics, 61(1): 129-151.

Sturtevant, L., 2018. The Impacts of Rent Control: A Research Review and Synthesis, Research & Insight, National Multifamily Housing Council, US.

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