Housing Prices in British Columbia: Quantifying the Zoning Effect

by

Nathan Zemp

B.A. (Geography), Simon Fraser University, 2022

Project Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Resource Management (Planning)

in the
School of Resource and Environmental Management
Faculty of Environment

SIMON FRASER UNIVERSITY
Spring 2024

Declaration of Committee

Name:	**Nathan Zemp**
Degree:	**Master of Resource Management (Planning)**
Title:	**Housing Prices in British Columbia: Quantifying the Zoning Effect**
Committee:	**Mark Jaccard** Supervisor Professor, Resource and Environmental Management
	Brett van Poorten Committee Member Assistant Professor, Resource and Environmental Management

Abstract

British Columbia (B.C.)'s housing prices have increased dramatically in recent times, and one potential explanation is municipal zoning bylaws limiting housing supply. However, the effect of zoning on housing prices in aggregate has not yet been studied in B.C. In this study, I use a regression analysis, adapted from an Australian study, to estimate the "zoning effect": the extent to which zoning controls increase the sale prices of dwellings. I calculate this effect for detached homes in 30 of B.C.'s largest cities and towns, and for apartments in the Metro Vancouver region. I look at how home prices changed between 2016 and 2022, and the extent to which the zoning effect influenced this trend. Finally, I evaluate the potential of government initiatives aimed at decreasing the cost of housing through the lens of the zoning effect, and suggest possible future courses of action.

Keywords: Zoning; Housing prices; Land prices; Housing affordability; British Columbia

Acknowledgments

To Mark, thank you for accepting and encouraging my unusual line of research, enriching my thought processes with insights from the world of energy economics, and keeping me grounded with honest critiques. Your decidedly non-ideological guidance has made me a stronger researcher and critical thinker.

To Brett, when nobody else was willing to spare the time, your support made me feel valued. Thank you for working with me to tackle the statistical analysis that made this study possible.

To Andréanne and Brad, thank you for providing a listening ear and fostering my career goals. You have both inspired me throughout my time in the REM program.

To my friends and family, thank you for providing the support in life to allow me to focus on this research endeavour, and for giving me a welcome distraction at times that I needed it. Your willingness to hear me out on zoning insights allowed me to distill my thoughts, and your questions helped me express myself more effectively.

Thank you to Ross Kendall and Peter Tulip, without whose example I would not have been able to complete this study.

All those who helped to acquaint me with the datasets for this project, thank you for contributing to this growing literature. In particular, thank you to Giovanna Aida from BC Assessment and Carla Graebner from the SFU Library for helping me access the Data Advice and Residential Inventory datasets that formed the core of this project. Thank you also to Lesley Patten for directing me to the Altus Cost Guides, and to every municipality that maintains an Open Data Catalogue; these online tools are invaluable for researchers and have advanced immensely even during my very short academic career. For those municipalities that have not yet made this leap, I am grateful to the data technicians who helped provide me with their zoning data directly.

Thank you to the Social Sciences and Humanities Research Council of Canada for providing the funding to jump-start this study. Thank you also to Mitacs and Navius Research for affording me the opportunity to work alongside gifted mentors during my most intensive period of research. Additional funding came from SFU Alumni, the Local Government Management Association of BC, and the Canadian Association of Geographers, for which I am grateful. To the Planning Institute of British Columbia and the

Canadian Institute of Planners, I am thankful to be given the opportunity to share my insights in forums where they may truly make a difference.

Table of Contents

List of Tables

List of Figures

Glossary

Agricultural Land Reserve (ALR)	A B.C. provincial regulation, introduced in 1973, that prohibits urban development in land set aside for agricultural use. Administered by the Agricultural Land Commission (ALC). To remove land from the ALR, local governments must appeal to the ALC.
Altus Group	A Canadian consulting firm that specializes in real estate market analytics. Produces the annual Altus Construction Cost Guide, which reports on average construction costs in Canadian urban centres.
as-of-right	Developable with just a building permit, as opposed to requiring additional permission from the City.
Baunutzungsverordnung (BauNVO)	The German system of zoning, which uses a single system of zoning classifications for the entire country instead of having each municipality develop their own classification schemes.
B.C.	British Columbia.
BC Assessment	A Crown corporation tasked with providing fair and up-to-date assessments of the value of every property in B.C.
bubble	In housing discourse, a runaway increase in home prices due to speculation, that is not backed up by inherent worth or scarcity. In this paper, I argue that B.C.'s rising housing prices are not primarily due to a bubble.
community amenity contribution (CAC)	A fee levied by municipalities to pay for amenities that are not directly related to the costs of servicing a development, such as a community centre or plaza. Can be in the form of amenities directly provided by the developer or cash-in-lieu. Compare with density bonusing, contrast with development cost charge.
Comprehensive Development (CD)	A type of site-specific, individually calibrated zone used by municipalities to facilitate unique developments. In CD zones, municipal planners take direct control over

	many aspects of the development in order to shape it according to the perceived needs of the community.
density bonusing	A process through which municipalities increase the allowable density of a development in return for the developer providing community amenities or cash-in-lieu. Compare with community amenity contribution.
development cost charge (DCC)	A fee levied by municipalities on developers to pay for the costs of servicing a development. These include the cost of building sewer connections, electrical wiring, or access lanes. Contrast with community amenity contribution.
dummy variable	A binary variable used to represent a qualitative factor in a regression model. Every possible value that qualitative factor could take is represented by a separate dummy variable.
exclusionary zoning	The use of zoning to keep a neighbourhood exclusive, particularly in terms of race and class. Implicit and explicit racial zoning has a long history in North America, but is difficult to prove for individual cases.
externality	A nuisance or negative effect of someone's behaviour which is not entirely borne by that person, but affects other people or the environment too. Zoning is employed to limit the perceived externalities of development.
exurb	A distant suburb at the outer limits of a metropolitan area. Examples include Langley and Maple Ridge for Metro Vancouver and Sooke for Greater Victoria.
floor area ratio (FAR)	A regulatory limit on the amount of floor space that can be built on a property. A FAR of 1.0 on a 1000 sq ft lot means that no more than 1000 sq ft of floor space can be built on that property (e.g. 500 sq ft on the first floor and 500 sq ft on the second floor).

Greater Victoria	The metropolitan area surrounding B.C.'s provincial capital of Victoria. The second-largest metro area in the province.
greenfield development	A development that is built on natural or rural land. Contrast with infill development.
infill development	A development that adds additional density to urban or suburban land. Contrast with greenfield development.
land lift	An increase in property value that accrues to a lot when it is up-zoned, allowing higher-density developments on it. Occurs particularly when there is a shortage of developable sites in a city.
land value tax	A tax on the value of land alone, excluding the value of improvements.
log-log regression	A regression model in which both the independent and dependent variables are log-transformed. Useful for variables that scale nonlinearly, such as the marginal value of land.
marginal value of land	The amount that consumers are willing to pay for an additional unit of land at the margin. Scales nonlinearly with lot size. See also physical value of land.
Metro Vancouver	A regional-level government in B.C. that includes the City of Vancouver and 20 surrounding municipalities, as well as one Treaty First Nation (Tsawwassen First Nation) and some unincorporated land. Contains approximately half of B.C.'s population.
minimum lot size	A regulatory limit on how much land can be subdivided in a particular area. A smaller minimum lot size means that more subdivision is possible.
minimum parking requirement	A municipal bylaw that requires developers to build a certain amount of parking spaces in conjunction with each development.
missing middle housing	Incrementally dense forms of housing, including townhouses, rowhouses, duplexes,

	and cottage courts, which single-family zoning outlaws.
multiplex	A form of multi-family attached housing including duplexes, triplexes, four- and six-plexes.
Official Community Plan (OCP)	A document that all B.C. municipalities are required to produce and update every few years, that lays out the overall trajectory for the growth and development of their community. The aspirations written in the OCP are made concrete using bylaws, particular the zoning bylaw.
parking mandate	See minimum parking requirement.
peppercorn	An unusually small payment that is used to provide a record of a transaction for legal purposes but does not accurately reflect the value of the good being exchanged.
physical value of land	The value of land given by its physical utility, without the additional value added by the zoning effect. Equal to the marginal value of land multiplied by the lot size.
public engagement	A forum held as part of the process of developing a new municipal plan or approving a new construction project. Intended to gather feedback from residents on the proposed change.
quota	A regulatory limit on the number of suppliers that are allowed to supply goods or services in a market. This controls supply, increasing prices and profit margins for the suppliers allowed to participate. Zoning, I argue, places a de facto quota on housing supply.
real estate investment trust (REIT)	A type of private equity fund that invests in real estate.
regulation burden	A term coined by Dachis and Thivierge (2018) to describe the aggregate effect of land use policies on housing prices. Conceptually similar to the zoning effect, but calculated slightly differently.

setbacks	Requirements that buildings be built a certain distance away from the property line facing a public right-of-way. Results in large front yards. Used to enforce suburban neighbourhood character.
short-term rentals	The use of apartments and condominiums as tourist accommodations with the aid of websites like Vrbo and AirBnB.
transit-induced gentrification	A term used by social geographers to describe a process through which low-income residents are evicted from older apartments in order that those apartments can be redeveloped into high-rise condos. The pertinent cause is transit-oriented development, not transit itself.
transit-oriented development (TOD)	An urban growth management strategy used by the Metro Vancouver Regional District to concentrate the majority of population growth near rapid transit stations in order to encourage sustainable mobility.
up-zoning	Changing the zoning designation of one or more lots to allow higher density than was allowed before.
urban consolidation boundary	The Australian term for urban containment boundary.
urban containment boundary	A regulation used by some cities and regional districts in Canada and the United States to restrict urban development outside of a given area. Urban containment boundaries are used to spare natural and rural land, and promote more intensive development closer to a city centre.
zoning:	A policy tool used by municipalities to sort their land into categories, which in turn dictate what kinds of developments can be built and what design specifications they must adhere to. In this paper, the term “zoning” encompasses all the requirements that contribute to the zoning effect. These include prescribed land-use types, building height limits, setbacks (large front yards), minimum lot sizes, maximum floor area ratios, building design guidelines, minimum

	parking requirements, and development approval processes.
zoning bylaw	A municipal bylaw that defines, maps out, and gives legal force to zoning classifications.
zoning effect	The dollar amount that zoning increases home prices by. Calculated as the difference between sale prices and physical factors contributing to that price, including physical land values and structure values. Defined in detail in Section 3.

“Or would you know,” pursued the Ghost, “the weight and length of the strong coil you bear yourself? It was full as heavy and as long as this, seven Christmas Eves ago. You have laboured on it, since. It is a ponderous chain!”

—Jacob Marley, *A Christmas Carol*

1. Introduction

In the Canadian province of British Columbia (B.C.), housing prices are rising dramatically with no obvious singular explanation. This rise in prices has enriched long-time homeowners, but has made it difficult for young people and non-wealthy new arrivals to purchase their first home (Cyca, 2023). Rental prices have risen along with house prices, and in response some people have resorted to living out of their vans or sleeping on the couches of friends to survive this situation, which has been called a “housing crisis” (Hasegawa, 2022). B.C.’s housing affordability woes are part of a nationwide and even global trend of increasing prices (Rajagopal, 2023; Stokes, 2021).

With a great diversity of landscapes, some of which boast the mildest climates in Canada, B.C. has long been promoted as a desirable place to live. Its largest city, Vancouver, rose to global prominence through hosting Expo ’86 and the 2010 Olympic Winter Games, and has been praised for its high quality of life (Galloway, 2023). However, Vancouver is also one of the world’s most unaffordable cities. Its median home price, relative to local incomes, is the third-highest in the world, sitting behind only Hong Kong and Sydney (Lee-Young, 2022). The provincial capital of Victoria is also expensive, ranking among the top 20 least affordable cities in the world in recent years (Spalteholz, 2019). Outside of these two cities’ metro areas, which together comprise roughly two-thirds of B.C.’s population, housing has historically been more affordable. However, Vancouverites and Victorians priced out of their home cities are now bidding up home prices in smaller towns. Kelowna and Nelson are examples of mid-sized B.C. cities that are now overwhelmed by housing demand, driven largely by migration out of B.C.’s largest metros (Femia, 2023; Metcalfe, 2023).

While housing prices have been rising for decades, incomes have grown at a slower rate, resulting in a widening gap. Under the standard metric of housing price-to-income ratio (PIR), a ratio of 3.0 or lower is typically considered affordable in North America. B.C. cities generally do not meet this benchmark. The average PIR in B.C. in 2018 was 5.4, a level considered “severely unaffordable”. The PIR for Metro Vancouver was 7.4, and it reached 17.2 in the District of West Vancouver (Gougeon & Moussouni, 2021). While the PIR obscures the fact that many people rely more on wealth than income to purchase their homes, it clearly conveys that the average income is insufficient to purchase a house in most of B.C.

Rent in B.C. cities has also outstripped income as a general trend. When shelter costs (rent or mortgage payments) exceed 30% of monthly income, a household is considered to be in housing hardship (National Household Survey, 2021). However, some financial advisors now consider the 30% benchmark “aspirational” rather than realistic for British Columbians (Zeidler, 2023). The proportion of British Columbians spending more than half their income on rent and utilities is 16%, the highest in Canada. With rent consuming more of their monthly budgets, renters in B.C. have less money left over for food, transportation, and things they enjoy.

With voters seeking urgent action, federal, provincial, and municipal governments have all prioritized quelling price increases (Aiello, 2023; Chan, 2023; Little, 2023a). However, there is not yet consensus on the causes of, and potential solutions to, the crisis. Some recent literature reviews aim to offer some clarity, but there is still disagreement among experts to a degree not seen for other serious problems like climate change (Bawuah, 2024; Farhan, 2024).

Some claim that foreign investment, particularly from China, is inflating prices, and believe preventing foreigners from buying homes in B.C. is the most promising solution (Gordon, 2016; Ley, 2017). Others point out that the federal government has scaled back investment in social housing, and argue for more public housing supply, stronger rent controls, and more property wealth taxation (Ivanova & Hemingway, 2023). Some point to regulations and taxes as being the primary cause, dampening supply by restricting what developers can build and how quickly (Dachis & Thivierge, 2018; Sullivan, 2018). In contrast, others say that new supply built by developers is likely to be too expensive, so there should be more controls to ensure new housing is affordable (Olsen, 2024). Some believe that the best way to do this is by encouraging more privately-built below-market and small housing (Todd & Hein, 2023). Others are fed up with half-steps that seem designed to placate neighbours instead of deliver significant amounts of new construction; they advocate for sweeping changes like allowing apartments everywhere (Bozikovic, 2023; Zivo et al., 2023). The lack of consensus among experts contributes to a kind of “housing despair” for young residents not fortunate enough to count on intergenerational wealth for a home purchase. However, most British Columbians are hopeful that solutions to the housing crisis are out there (Lloyd, 2023).

In this study, I explore the potential for zoning to be a contributor to B.C.’s high cost of housing. Under zoning, each category of land use, or “zone”, allows only certain types

of development; for example, in a Single-Family Residential zone, detached houses are allowed, but townhouses, apartment buildings, shops, and factories are not. Zoning also regulates how tall buildings can be, how far back they must be from the street, how large each lot needs to be, and how much floor space can be built on that lot. Zoning can also include additional requirements to control the look of building façades, ensure that they don't block too much sunlight, and make sure they have a minimum number of parking spaces. In this paper I use "zoning" to refer to all these policies collectively, since they are all used together to control neighbourhood form and shape settlement patterns.

Because zoning determines where and how housing developments can be built in B.C., they have the potential to limit the supply of housing, making dwellings more expensive because there are fewer available. In this research paper, I estimate whether zoning increases housing prices, and if so by how much. I refer to this dollar value as the *zoning effect.* I use the zoning effect to illustrate the impact of zoning on British Columbia's housing market, and discuss how policy changes can increase or decrease the zoning effect. Based on this, I then evaluate the potential impact of the B.C. government's response to the housing crisis, and what other interventions might help reduce housing prices.

2. Literature Review

2.1. History of Zoning

The concept of spatially segregating land uses predates the oldest modern zoning plans by centuries. In early Chinese cities, commerce and development were tightly regulated to limit congestion and pollution (Elvin, 1998). The Industrial Revolution in Europe led to the separation of living and working spaces for public health reasons (Lens, 2022). In New York, zoning rules were applied to preserve access to sunlight, limit land speculation, and attempt to improve housing conditions for the poor (Talen, 2012). The use of zoning to protect residents from actual and perceived externalities continues to be a paramount motivation today. However, this was not the primary impetus for zoning in the British Columbia context, particularly in Vancouver.

In the United States and Canada in the 20th century, zoning was used as a tool of racial and class segregation. At this time, Canadian cities followed the example of U.S. cities in their zoning plans, with similar underlying values on both sides of the border. Two

landmark U.S. Supreme Court cases shaped zoning law in the United States and, by extension, Canada. The first, *Buchanan v. Warley* (1917), ruled that zoning ordinances based explicitly on racial classifications were unconstitutional. Such ordinances had been adopted by cities throughout the U.S. South, many of which ignored the *Buchanan* ruling and upheld these discriminatory edicts for decades (Silver, 1991). Cities in the northern and western U.S., as well as Canada, also used zoning and land-use regulation for racist aims, a famous example being Modesto, California's 1885 ban on laundries in certain neighbourhoods, which was intended to keep out Chinese residents (Whitnall, 1931). However, these cities masked their intent using the language of neighbourhood form and nuisance control, and thus their bylaws were allowed to stand under the second ruling, *Village of Euclid v. Ambler Realty Co.* (1926). After *Euclid* cemented zoning's legitimacy, it became common practice in all North American cities concerned about the effect a visible minority presence had on property values (Fischler, 1998).

Nowhere in B.C. is the history of zoning more well-documented than in Vancouver. In 1929, when zoning was first introduced in Vancouver, the prevailing view among politicians was that apartments were nuisances that threatened the property values of detached homes (Wood, 2017). The stated primary motivation of the Bartholomew Plan, Vancouver's first zoning plan, was "to prevent the intrusion of apartment houses in single or two-family residential areas" (A Plan for the City of Vancouver, p. 211). Other types of incrementally dense housing, like multiplexes, rowhouses, and cottage courts, now collectively referred to as *missing middle housing,* were also outlawed in most areas by the plan.

The Bartholomew Plan also sought to restrict the proliferation of retail stores, which it identified as the "worst offenders" in neighbourhood blight (A Preliminary Report upon Zoning, p. 1). Corner stores and cafés which already existed were grandfathered in with the zoning plan. Any further commercial intrusions into residential neighbourhoods were outlawed, although Vancouver has since made one exception for neighbourhood grocery stores, recognizing the sentimental value of these establishments (Mackie, 2023). The plan also prescribed large minimum lot sizes and large front yards in certain neighbourhoods, making them inaccessible for poorer residents who could not afford that much extra space (A Plan for the City of Vancouver, p. 276). This cemented in policy the existing wealth inequality between older neighbourhoods with small lots like the Downtown

Eastside/Strathcona, and new neighbourhoods, particularly in the western part of the city, that had to conform with the new minimum lot size.

The zoning regime present in Vancouver was created to reflect the priorities of men who lived one hundred years ago. It was developed in an era where land was not seen as scarce. Apartment living was perceived as disreputable and unsanitary, and thus needed to be confined to a small part of the city. Bartholomew's anti-urban bias is evident in the content and phrasing of the plan, but it was not an unusual viewpoint at the time (Gold, 2020). To other planners involved in the commission, Bartholomew's views were common sense. It was inconceivable to them that apartments could be healthy, comfortable, highly desired living spaces for rich and poor alike.

Bartholomew and his associates plotted out the Vancouver region's population growth to one million people, but did not appear to consider what would happen beyond this point, which was reached in 1969 (Harland Bartholomew and Associates, 1928). They might have imagined that at some point further population growth may warrant changes to the zoning plan, but they did not provide for this flexibility in their policy design. They also did not envision the possibility that British Columbians would put in place policies to preserve rural land, eliminating suburban expansion as an alternative path for accommodating population growth. As a result, zoning in Vancouver has been unresponsive to decades of changes in values, demographics, and economic realities. Figure 1 below is a map of the City of Vancouver's zoning designations digitized by the UBC Sociology Zoning Project (Lauster & von Bergmann, 2020). As Figure 1 demonstrates, Vancouver's vast expanse of single-family zoned land (shown in yellow) remains largely unaltered today. Although some commercial (red) and industrial (blue) land has been changed to mixed-use (pink), the orange rectangle around the city centre where apartments are allowed has barely expanded in 90 years.

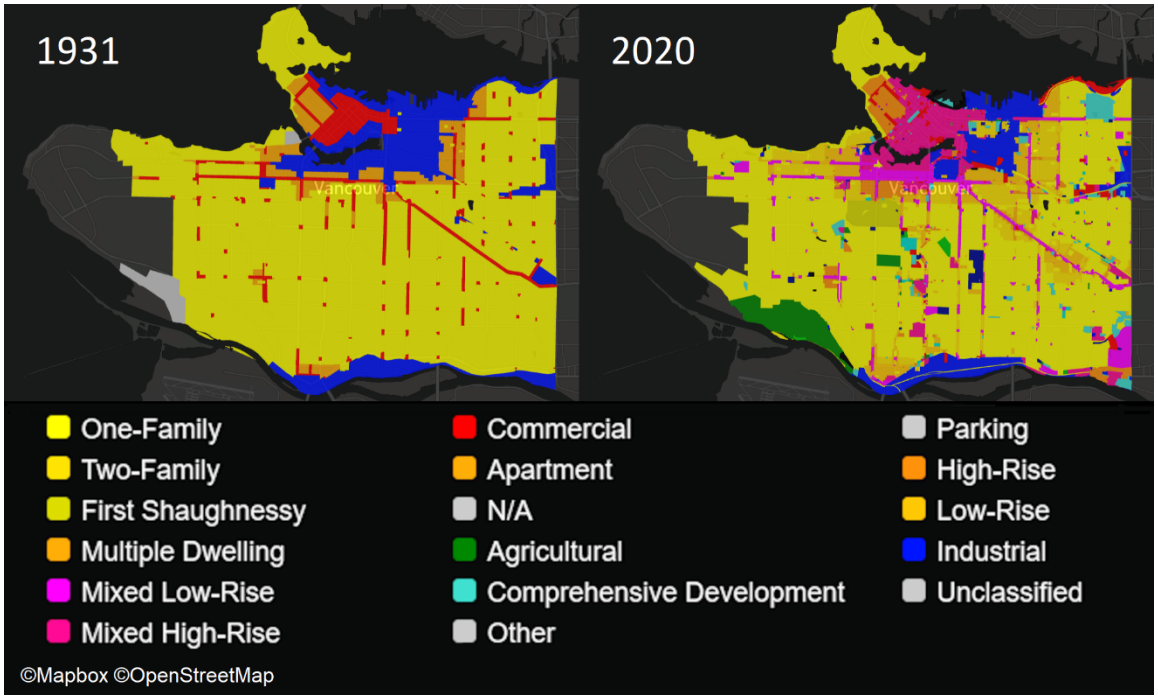

Figure 1. Map of zoning designations in the City of Vancouver (Lauster & von Bergmann, 2020).

Throughout the Lower Mainland and elsewhere in British Columbia, other cities have done the same as Vancouver. Vancouver reserves 79% of its residential land for detached houses, but other cities are even more restrictive. In most B.C. municipalities, the percentage of residential land in which multi-family residences are banned exceeds 80%, as shown below in Figure 2. There are some exceptions; Vernon, at the left side of the graph, has a relatively high amount of multi-family zoned land due to widespread use of “four-plex” zoning (maximum four units per building). Other municipalities, such as North Cowichan and Mission at the right side of the graph, don’t allow substantially less multi-family housing than other cities in absolute terms, but their large land areas make the percentage extremely small.

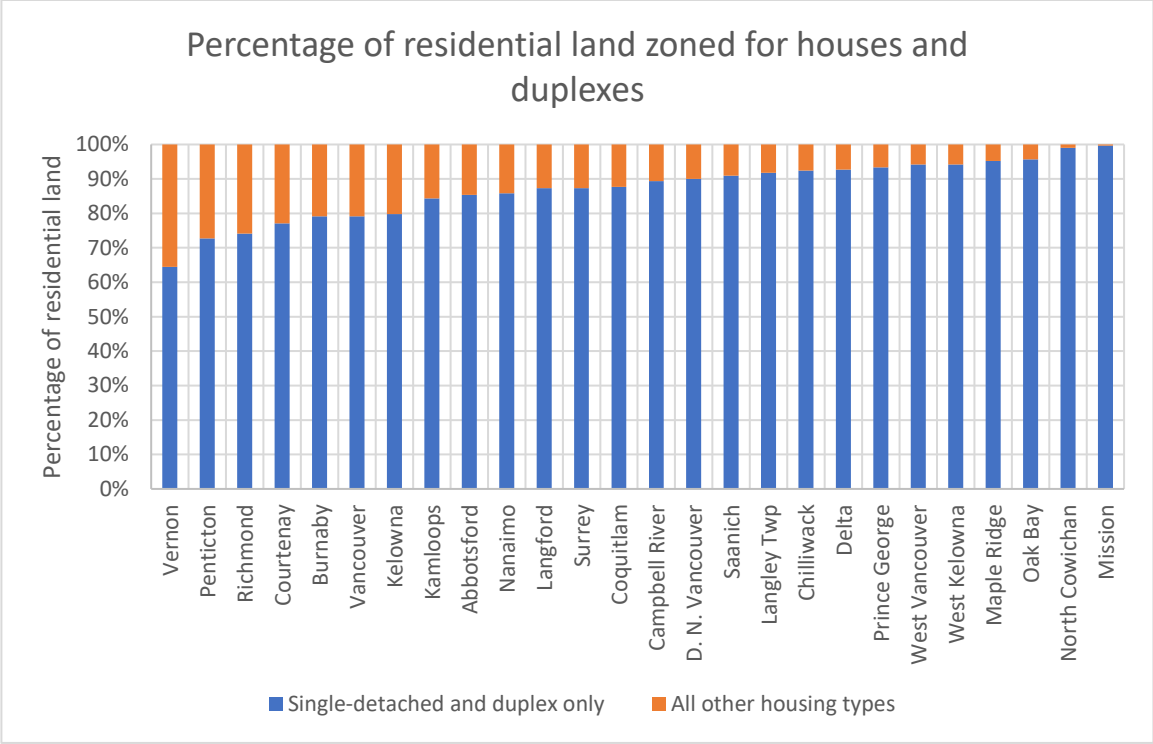

Figure 2. Estimated percentage of residential land each major B.C. city reserves for detached and duplex housing (2024, most recent data. See Appendix 10.1).

2.2. Consequences of Zoning

The most immediate effect of zoning is that it prevents densification in certain neighbourhoods. Once a strictly zoned neighbourhood is fully built out, any further construction and population growth that would have occurred in that neighbourhood is displaced to the next-most suitable development site, based on the convenience and desirability of the location. This may be a nearby neighbourhood that is zoned for more dwellings than are currently built, or it may be a new greenfield development at the edge of the city, so long as transportation costs and urban containment boundaries allow it. As the population of a region grows, home prices in strictly zoned neighbourhoods rise as more people compete for a limited number of dwellings. The displacement of demand to outlying neighbourhoods increases prices in those neighbourhoods as well, with the effect diminishing further from the core.

The price effect of zoning is proportional to the number of potential dwellings prevented by it. In a low-demand neighbourhood where only single-family dwellings could

feasibly be built and sold, single-family zoning will have little effect. In a high-demand neighbourhood where there are enough people wanting to live there to finance high-rise apartment buildings, single-family zoning's effects will be large, as individuals with a high willingness to pay will bid up the prices of these limited dwellings. Zoning will also increase home prices if it shifts development to more costly sites. For example, if zoning prohibits apartment construction everywhere in a neighbourhood except on one steeply sloped area, the only allowable apartments will be more expensive to construct, increasing the price effect of zoning.

Minimum lot sizes and setbacks function in a similar way, by limiting the number of dwellings that can exist on a particular amount of land and requiring residents to consume more land. When a city like Vancouver decides an area can only contain large lots, the consequence is that fewer houses can be built on the same amount of land. When large front-yard setbacks are enforced, residents must own more land than they might otherwise need. Each resident who wants to live there thus has to outbid more residents to secure a dwelling.

Other policies like building design guidelines, minimum parking requirements, and permitting processes don't limit the number of dwellings explicitly, but they make new dwellings more expensive and difficult to build. Any building elements, including parking spaces, that wouldn't otherwise be included by the developer in the absence of mandates increase costs. This results in all final sale units being more expensive, and a few projects becoming nonviable, further reducing housing supply and increasing prices. Some developers would still include these features without being required to do so, just as some residents would continue to consume large amounts of land and upscale housing in the absence of regulations mandating such behaviour. However, zoning obscures the true opportunity cost of doing so by disallowing cheaper options like small houses on small lots and apartment buildings without parking garages.

2.3. Incentives for Municipal Governments to Resist Growth

Zoning is a nearly universal aspect of modern city planning, and Figure 2 shows that municipalities everywhere in B.C. consistently prohibit multi-family housing across the majority of their urban area. This may be an honest reflection of consumer preferences; after all, municipal governments are democratically elected, and even unelected staff tend to be ideologically aligned with their municipal voter base (Lucas, 2022). However, there

are several aspects of municipal democratic processes that favour those who benefit from single-family zoning at the expense of others.

In modern planning practice, new developments are almost always preceded by public engagement events, allowing those affected by the development to share their thoughts. The construction of a new apartment building makes some residents much better off (the owner and future tenants), some slightly worse off (neighbours who are subjected to the unsightly construction), and some marginally better off (every other renter and homebuyer in the city, who faces marginally lower prices as a result of the increased supply). Of these three groups, the neighbours will dominate the public engagement, since they are the most likely to know about the project and be motivated to challenge any threat to their property values (Clingermayer, 2004; Einstein et al., 2019). In addition, existing homeowners are more likely to be wealthy and/or retired, and thus have the time and capacity to show up to public engagements (Yoder, 2020). Therefore, public engagement events give disproportionate voice to those who are against the development.

A similar dynamic plays out in municipal elections; the interests of existing homeowners are given priority over those of renters and future residents. Aside from higher voter turnout among homeowners in general, they also have the advantage of continuity in municipal election processes, resulting in municipal governments catering heavily to homeowners' interests above those of other groups (Einstein et al., 2022; Fischel, 2001). Future homebuyers lack a voice in municipal elections if they have not yet moved to the municipality or are too young to vote at the time a zoning plan is drawn up. It is certainly impractical to incorporate the opinions of non-residents and children into city council elections; nonetheless, ignoring them creates a distorted view of a city's housing needs. Some municipalities have tried to resolve this problem by soliciting non-voters' feedback at public engagements; however, public engagements themselves are representationally flawed, although there are efforts to make them more egalitarian (Carcasson, 2020).

Reforming zoning in Metro Vancouver is even harder than in other metropolitan areas because of its jurisdictional fragmentation. Rather than a single central city which grows and annexes adjacent areas, Metro Vancouver is composed of 21 municipalities, one electoral area, and one Treaty First Nation (Tsawwassen), none of which contains more than a quarter of the region's residents. This makes ending single-family zoning a collective action problem. If, for example, the City of Burnaby decided unilaterally to end

single-family zoning on its own, it would absorb nearly all the region's new development, along with the social costs presumed to accompany that development, while the benefits of improved affordability would be diffused throughout the region (Lewyn, 2016; E. K. Wilson, 2016). Given the influence of homeowners in municipal elections, it is unlikely any city council would make such a politically risky move.

2.4. Modern Efforts to Reform Zoning

Abolishing single-family zoning has become a popular cause among progressive urbanists as well as free-market advocates. Recent articles in the Journal of the American Planning Association have called for ending single-family zoning in no uncertain terms – a complete reversal from the state of the profession half a century ago (Manville et al., 2020; Wegmann, 2020). Organizations such as Strong Towns have built up networks of advocates around this issue, often in tandem with related causes like making streets safer for pedestrians and cyclists (Abramson, 2023).

In the past five years, single-family zoning has been largely abolished in the U.S. states of Washington, Oregon, California, and Maine, and the country of New Zealand. These reforms apply to all large cities in these jurisdictions, and generally allow multiplexes of 2, 3, or 4 units on all lots, as well as secondary suites. While all of these reforms were too recent to have spawned an academic literature on their results, grey literature suggests that generally they were followed by a boom in housing construction and a slowing down or reversal of housing price increases (Bipartisan Policy Center, 2023; Blumgart, 2022; Clark, 2023; Millsap, 2023). However, in some places, this building boom may have resulted from other reforms, such as removing minimum parking requirements or allowing more high-rises along transit corridors. In addition, allowing multiplexes reduces, but does not eliminate, the zoning effect in neighbourhoods where latent demand is high enough to call for apartments. Over the next decade, we should expect to see more literature emerge on the longer-term effectiveness of these governments' decisions.

One might think that increasing the allowable density of a lot (also known as *up-zoning*) increases its price and thus fails to quell price increases. To resolve this concern, one must distinguish between zoning's effect on individual properties and its effect in aggregate. While an up-zoned lot will become more valuable than neighbouring single-family zoned lots (what I describe later on as "land lift"), it is the zoning restriction on the neighbouring lots that creates this premium. Were the whole city up-zoned together, this

effect would dissipate with the rollout of new housing supply. One Australian paper found that relaxing zoning regulations in spot areas of Brisbane did not result in lower prices (Murray & Limb, 2020). However, the price increases this study reported were the result of land lift. Increasing the allowable density of an entire city had not been tried anywhere until recently, and as a result it has not yet been thoroughly analyzed. Nevertheless, several studies have attempted to describe the relationship between zoning controls and housing prices.

2.5. Past Studies Quantifying Zoning

Most studies quantifying zoning have focused on the effect of zoning designations on particular properties or neighbourhoods, rather than the aggregate effect of zoning across an entire city or metropolitan area. A 1991 literature review of North American studies quantifying zoning found few consistent patterns; the price effects of zoning diverged significantly from city to city (Pogodzinski & Sass, 1991). This inconsistency may stem from the fact that zoning bylaws were binding in fewer cities in the 1980s than today; most downtowns were not experiencing a resurgence in popularity, and housing demand was still primarily in the not-yet-constrained suburbs. There were two partially consistent trends: multi-family housing always had either zero effect or a negative effect on the price of nearby detached houses, and detached houses sold for more money when located on single-family zoned land. These are micro-scale findings though; no papers in this study looked at the total effect of zoning regimes on housing prices. This survey also predates much of the affordability discourse in urban studies; the papers reviewed in it viewed increasing property values as an unqualified benefit of zoning.

Other studies have focused on the motivations behind zoning, and particularly its use as a tool of exclusion. Exclusionary zoning is the use of zoning to keep certain people out of a neighbourhood, and it can be influenced by individual voters as well as politicians and planners. Individual motivations for exclusionary zoning include maintaining the aesthetic of a neighbourhood, preventing congestion of free parking and street space, and securing high property values by reducing supply. Political motivations can include collecting more property tax revenue per resident (fiscal zoning), screening out residents who consume more public services or negatively impact existing residents (public good zoning and consumption zoning), or maintaining the political leaning of the area (political economic zoning). However, identifying the motivations behind zoning based on its effects is impossible, as variously motivated zoning decisions lead toward the same result

(Bogart, 1993). Additionally, decision-makers tend to hide insidious motivations for zoning with euphemistic language to avoid public outcry and potential civil rights litigation (Clingermayer, 2004). While identifying the motivations behind zoning would be useful for deciding whether to retain it in B.C. cities, in this study I focus specifically on estimating zoning's likely effects.

Papers focusing on the aggregate effect of zoning agree that zoning significantly increases housing prices wherever it is binding on land-use choices. Studies from the United States (Glaeser & Gyourko, 2002; Gyourko & Molloy, 2014), England (Hilber & Vermeulen, 2016), Australia (Kendall & Tulip, 2018), and New Zealand (Lees, 2017) show housing prices vastly outstripping incomes and construction costs since the late 20th century. The authors are unanimous in their identification of land-use regulations as the main cause, as opposed to physical constraints or bubble effects. Of these regulations, density limitations created by zoning are the primary reason mentioned, with minimum lot sizes and development approval processes also playing a major role.

Previous studies of the Vancouver area are mixed in their evaluation of zoning's effect on housing prices. Two early studies found negligible or inconsistent effects of upzoning on property values, and no effects on neighbouring properties (Mark & Goldberg, 1981, 1986). However, these studies focused on localized effects of zoning rather than aggregate effects. They also notably predate the post-Expo '86 investment boom, often seen as a turning point in Vancouver's housing market. More recently, a C. D. Howe Institute study of Canadian housing prices found that the "regulation burden", a sum total of government policies affecting housing construction, added $600,000 to dwelling costs in Vancouver (Dachis & Thivierge, 2018). An Urban Land Institute study that looked specifically at Vancouver apartments found that taxes and fees alone accounted for $220,256 of the total $840,000 cost of a typical new apartment (Sullivan, 2018). While both the above studies provide important findings, my study brings an updated perspective to the Vancouver market, and new insights on housing markets elsewhere in British Columbia.

3. What Is the Zoning Effect?

Because this term constitutes the core of my paper, I will elaborate on it to ensure it will not be misunderstood or misinterpreted. The zoning effect, as previously defined by Kendall & Tulip (2018), is the amount that the average sale price of a detached home or

apartment in a given area is increased due to zoning and related policies prohibiting, slowing down, or increasing the cost of subdivision, densification, and development. I describe below other phenomena which the zoning effect could be confused with.

3.1. Zoning Effect Is Not Land Lift

Zoning effect is not the increase in the land value that happens when a low-density lot is rezoned to high-density. This is called *land lift,* and it results in a windfall gain for the owner of that particular lot. However, my research focuses not on these small releases of pent-up housing demand, but rather the build-up of demand that is created by zoning restrictions in the first place. If zoning is a dam impounding a river of housing supply, then land lift is represented by the pressure jet of water that sprays out if one pokes a small hole in the dam. Conversely, the zoning effect is the weight of the entire reservoir.

3.2. Zoning Effect Is Not Localized “Benefits of Zoning”

The zoning effect is also not the benefit that is presumed to accrue to homeowners from living in a strictly zoned neighbourhood where higher-density development is not allowed. The reasoning here is that development can cause negative externalities, and zoning can increase the welfare of existing homeowners by blocking these externalities. Crudely put, this is the “benefit of zoning” while the zoning effect, which I am quantifying, is the “cost of zoning”. However, it would be more accurate to call this the localized or demand-side impact of zoning, while what I am calculating is the aggregate or supply-side impact. This was the phenomenon studied in the 1991 Pogodzinski & Sass literature review paper, as well as the two Mark & Goldberg studies focusing on the Vancouver area (1981, 1986).

While it would fall to a separate study to calculate the demand-side impact of zoning today, the two previous studies of the Vancouver area found it to be so small as to be statistically insignificant. This led the authors to question whether there were in fact any real development externalities worth regulating through zoning. While construction certainly causes some inconvenience for neighbours, the authors found no evidence that this inconvenience is reflected in material terms. In other words, there is no significant difference in housing sale prices between homogenous single-family neighbourhoods and mixed-density neighbourhoods, all else being equal. Several decades have passed since these studies were conducted, and it is possible that there is a positive demand-side

impact of zoning in B.C. today. However, given how much attention is paid to building massing, roof lines, and other “neighbourliness” features in modern municipal building design guidelines, it is unlikely that any development externality effects are present today that were not in the 1980s.

3.3. Policies that Directly Contribute to the Zoning Effect

Zoning per se is not the only policy that contributes to the zoning effect. Because the housing market is constantly subject to ever-changing trends and policy interventions at several spatial scales, the market indicators I analyze (marginal land values and home sale prices) do not indicate a specific causal policy. The zoning effect is a mathematical relationship that represents the friction that stems from nonphysical (i.e. regulatory) factors inhibiting housing stock adjustment. Zoning and zoning-like policies account for the lion’s share of this friction, but other policies are also at play. To identify the magnitude of each individual policy’s contribution to the zoning effect would require a separate analysis.

The primary factors that increase the zoning effect by limiting supply-side responsiveness to housing demand are the interventions traditionally thought of as zoning: height restrictions, minimum lot sizes, setbacks, and maximum floor area ratios (FARs). Building design guidelines, such as specifications of building materials, façade designs, and rules governing the “bulk” and “massing” of buildings, also fall under the zoning umbrella and also contribute to the zoning effect. Minimum parking requirements, used in conjunction with zoning, also contribute to the zoning effect since they add an additional mandatory cost to the construction of denser buildings. Finally, all of the approval delays that result from these policies increase the cost of projects and thus contribute to the zoning effect.

I would like to emphasize that all these policies only contribute to the zoning effect in places where they are binding. They have no effect when they don’t force developers to change what they would otherwise build. Any minimum standards that fall below what the market already demands do not increase the zoning effect. Correspondingly, when these policies are binding, they have a larger impact when they are more out of touch with market equilibrium conditions. A 5-acre minimum lot size will have a larger impact on the zoning effect in a downtown-adjacent neighbourhood than it will in a rural exurb.

3.4. Policies that Do Not Directly Contribute to the Zoning Effect

Some policies which surprisingly have no direct impact on the zoning effect are two substantial fees levied by municipalities: development cost charges (DCCs) and community amenity contributions (CACs). DCCs are fees that developers pay in order to be connected to municipal utility and road networks, while CACs are fees paid not because of any cost directly related to the new development, but because the municipality would like the developer to pay for a new amenity for the community as a whole to enjoy, such as a park or plaza. Because DCCs are unavoidable in the process of producing a functioning building, they are included in the cost of construction and thus have no bearing on the zoning effect.

CACs, on the other hand, appear at first glance to be a likely contributor to the zoning effect. After all, they are used to make a developer pay for amenities they would not have otherwise provided; this must therefore increase the cost of the development. However, municipalities have to provide something in return to ensure the project will still be viable, and this usually comes in the form of a relaxation of height restrictions or an additional FAR allowance. While this shows that the original height limit or FAR standard was arbitrary, it also means that the value of the CAC was already a part of the zoning effect due to existing zoning regulations. By making dwellings scarcer, zoning regulations create a producer surplus, or excess profit for housing suppliers, and the CAC just transfers that existing producer surplus from the landowner and developer to the municipal government. While CACs don't directly increase the zoning effect, they are not benign either. They incentivize municipal governments to tighten zoning restrictions to a lower development standard than is otherwise desirable in order to gain a bargaining chip in CAC negotiations (Bertaud, 2018). Municipalities may also unintentionally kill projects if they accidentally set the CAC rate higher than the producer surplus (Davidoff & Somerville, 2021).

Increasing construction costs do not increase the zoning effect. I separate out structure values when calculating the zoning effect, and construction costs are reflected in structure values. The Agricultural Land Reserve (ALR), a major provincial land-use intervention in B.C. that reserves land for agricultural use, also does not increase the zoning effect. I exclude the ALR from my analysis, despite the fact that it does increase house prices on developable land, for several reasons. For one, it is a provincial rather

than municipal initiative, thus urban planners, who only have control over zoning, cannot take action regarding the ALR. In addition, public support for the ALR is much higher than single-family zoning, making it more politically difficult to reform or abolish (Canseco, 2019; Real Estate Foundation of BC & Vancouver Foundation, 2014). Therefore, my analysis excludes properties on ALR land, and reports the zoning effect relative to a scenario with no density zoning, but still with an ALR.

Finally, the zoning effect is a supply-side effect. Therefore, all demand-side occurrences are taken as exogenous in its calculation. Phenomena like increased immigration, interprovincial migration to B.C., and short-term rentals increase housing demand; insofar as the housing market is unable to accommodate this demand due to zoning, the zoning effect will thus increase (but so too will the physical value of land). Increased foreign direct investment in B.C. property, another demand-side effect, plays out the same way as immigration at first. However, because zoning restricts supply responses, it accelerates appreciation of property values, making property a more attractive investment. Therefore, zoning can create a feedback loop through the mechanism of foreign direct investment, and the zoning effect captures this. Nonetheless, this is not a runaway feedback loop (a “bubble”). If it were, housing sale prices would rapidly outstrip rental rates. Rental rates have also been rising precipitously, showing that there is real unmet demand for housing units in B.C. (Hudes, 2023).

While the zoning effect is a supply-side effect, this is not to say that demand-side responses won’t reduce the size of the zoning effect in monetary terms. Housing demand shocks like investment booms and conversions to short-term rental suites are amplified by the zoning effect, but targeting the demand shocks themselves is still a strategy for reducing prices. However, only supply-side reforms can directly target the zoning effect. Demand-side reforms can reduce its magnitude by reducing the size of the unmet demand, but they do not address the underlying causes. For this reason, I leave aside discussion of demand-side interventions in this paper. While they are worth considering for policymakers, they are not directly relevant for my purposes.

3.5. Simplifying Assumptions

Like any study, my project includes several simplifying assumptions. The first is that I do not incorporate subdivision or infrastructure costs in my analysis. The reason is that liberalization of zoning does not increase the land footprint of a city. Substantial

infrastructure upgrades are typically associated with greenfield development, while incremental densification necessitates only incremental upgrades. Increased development in an area does increase demand for infrastructure and amenities in that area, but also correspondingly reduces demand for those services elsewhere at a given population level. It is possible that liberalization of zoning would have a rebound effect as the lowering of house prices would encourage more migration to a city. However, because infill development can take advantage of existing built infrastructure, average infrastructure costs would decrease if zoning liberalization were pursued as an alternative to sprawl (Kendall & Tulip, 2018). Finally, since infrastructure is increasingly funded through CACs, which are obtained by cities through the use of zoning, these costs are largely included in the zoning effect already.

I declined to address several other potentially complicating factors, all of which would serve to further inflate the zoning premium if quantified. Kendall and Tulip (2018) also omitted these factors, and thus like theirs, my estimates of the zoning effect are likely on the conservative side. One of these factors is the scarcity effect of industrial and agricultural zoning, which make land unavailable for residential use. The physical value of land is taken as exogenous by the model, but in fact is influenced by the additional administrative scarcity caused by industrial and agricultural zoning, which I don't consider as part of the zoning effect. Another factor is the time delay between increasing housing demand and new housing supply coming online. Insofar as such delays are the result of inherent market processes, this concern is mitigated by considering the zoning effect over a multi-year time span, as I do. However, delays resulting from regulatory obstacles should be considered part of the zoning effect, and calculating the cost of these delays would increase my estimates of it.

A final factor I did not consider is the possibility that development firms are able to exhibit market power and thus earn supernormal profits. However, existing studies have shown development markets to be highly competitive (Glaeser et al., 2005; Lees, 2017; Minifie et al., 2017). Firms do earn profits, as evidenced by the effectiveness of community amenity contributions; however, this is because zoning effectively places a limit or "quota" on housing supply. Similar to agricultural quotas, this limit enables substantial profits for the developers who are allowed to produce, since supply opportunities are limited. However, there is no basis to assume any development firms earn additional profits through monopolistic influence.

3.6. Why is it called the “zoning effect”?

If some non-zoning policies contribute to the zoning effect, why do I use that term? Firstly, I use it to be consistent with the Kendall & Tulip (2018) paper that uses the same terminology. Secondly, the terminology “zoning effect” is evocative and useful to planners since it places this abstract economic phenomenon in meaningful policy terms. Thirdly, it is more politically neutral than other terms available that make direct reference to bureaucratic regulations and burdensome delays. Finally, the zoning effect is primarily influenced by zoning and zoning-derived policies, and the minor contributions of other regulations do not diminish zoning’s central role.

4. Model Structure and Data Preparation

4.1. Core Procedure

In this study, I relied primarily on methods adapted from the Australian study, “The Effect of Zoning on Housing Prices” (Kendall & Tulip, 2018). This study sought to quantify in four Australian cities (Sydney, Melbourne, Brisbane, and Perth) the same phenomenon I describe in this paper. Kendall and Tulip examined the effect of zoning on detached home prices and apartments and analyzed this effect across multiple neighbourhoods and years. I reproduce these applications in this paper, but with slight changes in methodology to accommodate the different data sources available to me.

The model I employed in this research paper was a statistical analysis to separate out home prices into three components: the physical value of land, the value of improvements, and the zoning effect. The physical value of land is the value that land holds as a useful commodity; it is calculated by measuring how much people are willing to pay for additional land at the margin. I inferred this by seeing how much more people are willing to pay for larger lots, while controlling for all other variables that may influence sale prices. Improvement value is the value of the building that exists on the lot, which is determined by property assessors. Any additional value from the sale price that is not explained by these two values is the zoning effect. Therefore, the zoning effect is equal to the difference between sale price and the sum of physical land value and structure value. It is the mean value for this difference across all detached homes within the area in question. I explain all of these components in more detail in section 5.1.

When I performed this analysis for apartments, their sale prices had only two components instead of three, since constructing an additional apartment unit does not require any additional land. In this case, the zoning effect is the difference between the marginal cost of building a new apartment unit and the average sale price of an apartment. Of course, apartment sale prices never perfectly equal the costs of construction; developers make profits. However, these profits are largely the result of the zoning effect, as explained in the final paragraph of section 3.5. In a previous study of U.S. cities, sale prices were found to be close to production costs in cities without tight zoning restrictions (Glaeser & Gyourko, 2018).

4.2. Data Sources

The principal datasets I used in this study were the “Data Advice” and “Residential Inventory” datasets, compiled and made available for research use by the British Columbia Assessment Authority (BC Assessment). BC Assessment is a Crown corporation whose mandate is to provide accurate yearly assessments of property values for the entire province. To this end, they track several characteristics of residential properties, such as the year of construction, the number of bedrooms and bathrooms, and the total floor area. All of these characteristics and more were used in the regression portion of my analysis. The Data Advice dataset also includes sales data, which were vital for my calculation of the zoning effect. These datasets are normally only made available for the most recent year, but the University of British Columbia Library maintains an archive going back to 2016 on the Abacus Data Network. I used this archive to extend my time series analysis to the 2016-2022 range.

Each yearly run of the Data Advice dataset contains several tables, which are interrelated using a key field. The names of these tables change from year to year, but the structure of the content is consistent. One table consists of property descriptions, including attributes for use in regression analysis. I supplemented these with additional attributes from the Residential Inventory dataset. The second table contains addresses, which I used to place each property within a municipality and a neighbourhood for the purposes of regression. The third table is made up of assessed values for the last complete year, divided into land and improvement values. The fourth table includes all sales, plus the date and price. It also includes conveyance type: whether the transaction is for single or multiple properties, and whether the properties are improved or vacant. In early years a

fifth table is required to link these tables together, but in later years the key for joining records is self-contained.

In certain situations, I corroborated BC Assessment's estimates of structure values with values obtained from the Altus Construction Cost Guide. This report is produced on a yearly basis by the Altus Group and details construction costs per square foot of various building types in major Canadian cities. It is a widely used industry reference and its numbers helped me to correct for potential inaccuracies in BC Assessment's values from 2015 onwards, as I explain below in section 4.4.

4.3. Data Refining

For my regression analysis, I created a large dataset of all B.C. property sales records by joining all the tables above into one large table: the Residential Inventory attributes and the Data Advice datasets of addresses, assessed values, property descriptions and sales. To make the dataset suitable for analysis, I had to trim it:

- I removed non-residential buildings and multi-unit buildings (multi-unit residential buildings would be used in my later analysis of apartments).
- I removed records for secondary addresses to eliminate most duplicate sales.
- I removed records that said "Reject – Not Suitable for Sales Analysis".
- I combined records that separated land and improvement values into different rows.
- I dropped records with a missing street address, neighbourhood, date of sale, or postal code.
- I removed sales under $1000, which were either errors or peppercorns (nominal payments that are used to provide a legal record of a transaction but do not accurately reflect the value of the good being exchanged).
- I removed records with 0 land area or missing land area data.
- I removed properties in the Agricultural Land Reserve, since their land values are heavily distorted by that classification, and ALR designation is not considered as part of the zoning effect (see section 3.4).
- I removed records with total finished area greater than 10,000 square metres (~100,000 square feet), an unrealistically large amount that was found by Kendall & Tulip to be overwhelmingly erroneous in their data.

- I removed remaining duplicate sales with the same price on the same day, and averaged duplicates with a different price on the same day.
- I tidied up the neighbourhood classifications and jurisdiction classifications to ensure they were consistent from year to year.

I separated the sales data into separate tables for each year of sale from 2016 to 2022, and calculated individual regressions for each year. In doing so, I made sure that each yearly dataset only contained sales from that year and matching assessed values from the year preceding the sale.

4.4. Adding in Altus Estimates

BC Assessment's estimates are generally very accurate, deviating less than 3% from what properties are actually sold for (2022-23 to 2024-25 Service Plan, 2022). However, while exploring the datasets, I noticed BC Assessment's average assessed values for houses built after 2014 dropped off precipitously with each year of construction, despite sale prices climbing over the sale time period. Whether this trend was due to some sort of tax loophole for new construction or, more likely, an error in how the dataset was compiled, it was not an accurate representation of structure values either way. Using BC Assessment's values for houses built after 2014 would yield unrealistically low structure values for those houses, thus an unrealistically high zoning effect. For this reason, I decided to instead infer structure values of houses built after 2014 from the Altus Construction Cost Guides.

To extrapolate structure values from construction costs, I took the midpoints of the ranges provided for standard single-family dwellings and custom-built single-family dwellings. I calculated a weighted mean of these two values, weighting standard at 88% and custom at 12% to reflect that 12% of new detached home purchasers custom-build their homes (BC Residential Building Statistics & Trends Report, 2020). This weighted mean gave me an average per-square-foot construction cost, which I then multiplied by total finished area to give an estimated improvement value for each given property. The economic rationale for this is the tendency for the cost of new goods to equal their cost of construction in a competitive equilibrium (Dachis & Thivierge, 2018), and existing studies suggest development markets are very competitive (Glaeser et al., 2005; Lees, 2017; Minifie et al., 2017). Since improvement value was not a predictor variable in the regression, it did not matter that individual records of this value were not based in reality;

what mattered was the average, which displayed a realistic continuation of the trend in structure values up until 2014, as shown below in Figure 3. While imprecise (note the unrealistic diagonal line the final four years form), the overall trend of the Altus estimates provided a more accurate picture for the final results than BC Assessment's values.

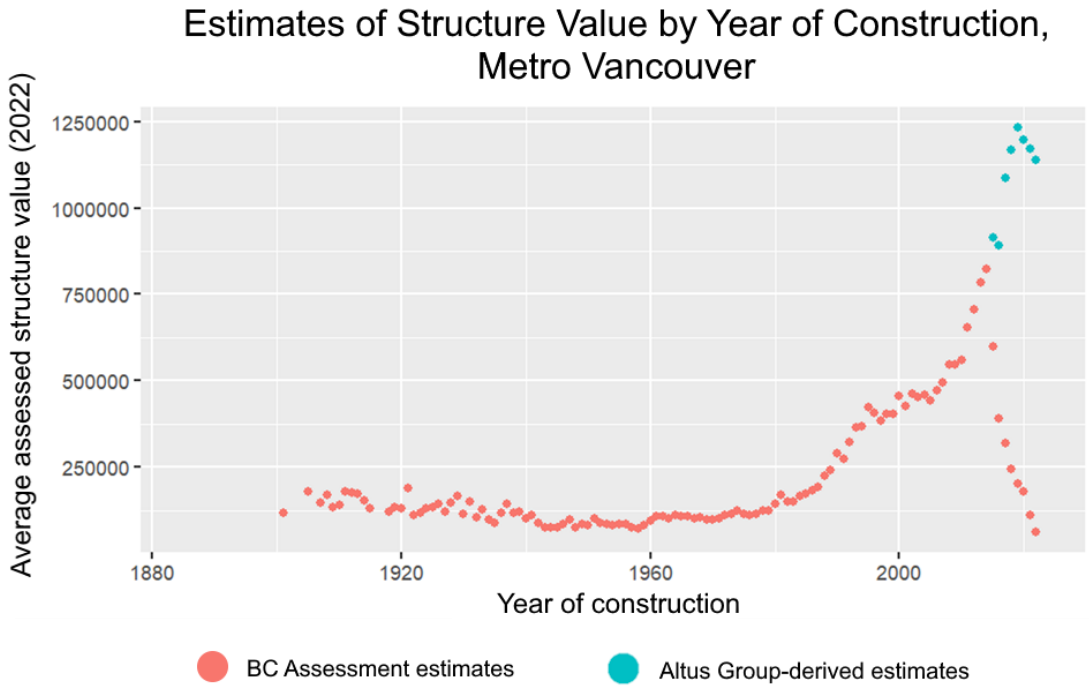

Figure 3. Comparing structure value estimates from two sources.

To eliminate bias from the unrealistic post-2014 BC Assessment improvement values, I overwrote them entirely with the Altus Group values. Any loss of precision from doing so was more than made up for by the increase in accuracy across the years. In addition, houses constructed post-2014 never accounted for more than 20% of the total sales in a given year, so these estimations did not dominate the analysis. The last consideration was that the Altus values were calculated for Metro Vancouver, and other urban areas would presumably have different construction costs. To account for this, I scaled the Altus-derived values in proportion to the ratio between average per-square foot structure values in the locale in question and Metro Vancouver. In doing so I assumed that relative construction costs between different B.C. communities remained roughly constant

over the medium-term, which was likely since the construction sector is not locally autarkic.

5. Calculating the Zoning Effect for Detached Houses

For detached houses, I calculated the zoning effect in Metro Vancouver as a whole, in ten municipalities of Metro Vancouver, in Greater Victoria as a whole, in four municipalities of Greater Victoria, and in sixteen other B.C. municipalities – as many as had at least ten times as many observations as independent variables, including dummy variables. As a result, each municipality required a minimum of 300-400 home sales per regression year. This method satisfied two rules of thumb for multivariate analysis: that one should have a minimum of ten observations per predictor variable, and that the sample size should exceed the number of predictors by at least 50 (Wilson Van Voorhis & Morgan, 2007). In my analysis I defined Metro Vancouver as all properties within the Metro Vancouver Regional District, and Greater Victoria as all properties within the Capital Regional District, regardless of whether they fell within a municipality I was already calculating the zoning effect for separately.

5.1. Calculating the Marginal and Physical Values of Land

For this analysis, I fitted multiple generalized linear models (GLMs) to each portion of my dataset of individual property transactions. I ran a separate analysis for each municipality and for each year of data within that municipality, rather than using year as a covariate. In total, I fit 198 such models, each of which represents a particular municipality or regional district at a particular point in time. All 198 of these models directly and separately inform my results. In each model I assumed a log-normal likelihood and applied a log-link function. I used these fitted estimates to determine the marginal value of land, and ultimately to calculate the zoning effect below.

The marginal value of land is the additional amount that homebuyers are willing to pay for an additional square metre of land, at the margin. This is the value that land has as a physical commodity. In a hypothetical jurisdiction with no zoning or other impediments to subdivision, the physical value of land would constitute its entire value. An 800 m^2 lot would be exactly twice as expensive as a 400 m^2 lot, excluding the value of any structures built on them. However, this is not the case in reality. In B.C. cities as in elsewhere, land values do not scale linearly with lot size; large lots are worth only slightly more than small

lots. This is because zoning and other development restrictions cap the number of property parcels in a city by making them difficult or impossible to subdivide. This places a premium on the right to own a lot in the city, independent of the actual physical utility of the land. If subdivision were made possible, this premium would create an arbitrage opportunity, since two half-size lots produced by subdividing a lot would each sell for more than half the original lot's price. However, zoning prevents such actions, maintaining a premium which is what I refer to as the zoning effect.

To calculate the marginal value of land, I applied a logarithmic transformation to land area within the GLM. This formulation was used because physical land's marginal value is not a constant; it is more expensive at the margin in areas with higher overall prices (Kendall & Tulip, 2018). In addition to this theoretical basis for log-transformation, I found that log-transforming the model improved model fit. This also held true for each spatial variable (land area, floor area, basement finished area, and deck area) when I tested log-transforming each of them individually. Therefore, I log-transformed all spatial variables for the regression. The structure of the equation (after Kendall & Tulip) is as follows:

$$\log(sale\ price) = c + b\log(land\ area) + aX + e$$

Here *c* represents a constant term, *b* is the marginal value of land, *aX* controls for all other home attributes used as variables in the model equation, and *e* is a normally distributed residual. The important value to be taken from this equation is the value of *b,* which is indicates the mean physical land value at the margin for the municipality and year in question. Multiplying this value by the lot size of the property gives the physical value of land. Although *b* is unique to each property, its variation between neighbouring properties is gradual. Overlaying the *b* variable over a map of a neighbourhood would create a smooth, 3D surface, showing how the marginal value of land remains quite similar within a neighbourhood but can vary widely between more distant properties.

Making up the *aX* term was an assortment of other characteristics of properties that influenced their sale prices. I selected these variables by first creating a province-wide regression model that predicted sale price using land area as the sole independent variable. I then incrementally added additional predictor variables that were available in the Data Advice dataset, one at a time, seeing if they improved R-squared. I stopped when additional variables no longer improved R-squared; at this point, the R-squared sat just

above 0.8. I then started incrementally removing variables one at a time, testing if doing so improved AIC, a statistical criterion for evaluating model parsimony. I left out all variables that did not contribute productively to the model's AIC, and continued adjusting the model until removing additional variables did not result in an improvement to AIC. Once the AIC was maximized, and the proportion of variation explained by the data remained high ($R^2 > 0.75$), I determined that this was the set of predictor variables I would use in all subsequent regressions.

I never used the province-wide model to estimate the zoning effect. Rather, I used it to arrive at a concise set of broadly significant predictors across the province, which I could then use in every municipality-specific regression. This provided continuity across jurisdictions and years while minimizing model overfitting. The variables I used are listed below in Table 1.

Table 1. Predictor variables in the log-log regression.

Variable name	Data type	Role in analysis
Sale price	Continuous	Dependent variable
Log land area	Continuous	Key variable of interest
Log floor area	Continuous	Supporting
Log basement finished area	Continuous	Supporting
Log deck area	Continuous	Supporting
Number of bathrooms (not used outside of Metro Vancouver due to missing data)	Discrete	Supporting
Number of bedrooms	Discrete	Supporting
Pool (Y/N)	Binary	Supporting
Scenic view (Y/N)	Binary	Supporting
Dummy (quarter of sale)	Binary (dummy)	Supporting
Dummy (decade built)	Binary (dummy)	Supporting
Dummy (actual use description)	Binary (dummy)	Supporting
Dummy (conveyance type)	Binary (dummy)	Supporting
Dummy (neighbourhood)	Binary (dummy)	Supporting

Additional variables that I did not retain in the final model included the number and type of garages, the number of dens, the existence of a secondary building on the lot, and the area of each floor. I did not include zoning category as a predictor variable, because zoning directly impacts divisibility of land. Assessing the effects of zoning (a categorical variable) directly using regression would be unwieldy and ineffective – it would return a separate coefficient for each zone type, with no comparability between municipalities –

and including zoning in the regression model would interfere with my estimates of the marginal value of land.

I created the five dummy variables to incorporate categorical variables into a mathematical analysis. This process entailed turning every possible qualitative value for quarter of sale, decade built, actual use description, conveyance type, and neighbourhood into a separate binary variable. This allowed the qualitative values contained in these categorical variables to become predictors in the multiple linear regression. The number of dummy variables created from each of the 5 categorical variables depended on the number of qualitative values that categorical variable contained for the year and municipality in question. This means that each dummy variable listed in Table 1 represents several separate binary variables: four in the case of the quarter of sale dummy, and up to twenty in the case of the neighbourhood dummy.

The most important predictor variable was the neighbourhood dummy variable, epitomizing the old saying, “Location, location, location!”. It explained the plurality of the variation in most models. The dominance of the neighbourhood dummy variable meant that the model was not highly sensitive to changes when I adjusted which other variables were included in it. The land area variable accounted for only a minority of the variation in sale price, but it was virtually always significant (see Table 6, Appendix 10.3). Because the same set of variables (except for number of bathrooms) was used for each city and in each year, there were some instances where a variable was included that did not add significant predictive power to the model in that particular year or city. However, these cases of slight model overfitting were necessary in order to analyze each city in the same way from year to year. Because my objective was to obtain a realistic value of *b* rather than a predictive model, I prioritized model consistency over statistical parsimony.

5.2. Calculating the Zoning Effect

Having calculated the marginal value of land, I then incorporated that value into the main equation for calculating the zoning effect. In order to summarize the zoning effect into a single value per year per municipality, I took the mean sale price of each municipality-year, subtracted the mean marginal value of land times the mean lot size, and subtracted the mean structure value from that value. What remained was the zoning effect.

Because the zoning effect is based on the mean home sale price, its value is higher than if it were instead based on the median or benchmark sale price. Generally, mean sale

prices are higher than median or benchmark sale prices because the distribution of home sale prices is not symmetrical. It is skewed towards the upper end because there are more extreme high outliers than low outliers. However, despite the right-tailed skewness of home sale price distributions, the zoning effect is uniform, varying only gradually over large distances. It applies equally to inexpensive and expensive homes that are near each other. Therefore, the mean is the correct measure to base the zoning effect on. Note that because the zoning effect is uniform in absolute terms, it makes up a higher percentage of the value of low-priced homes than of high-priced homes, because high-priced homes have more valuable structures or more physical land.

5.3. Zoning Effect Over Time

For Metro Vancouver as a whole and individually for ten municipalities within it, I calculated the evolution of the zoning effect from 2016 to 2022. For jurisdictions outside of Metro Vancouver, data was not available yet for the most recent year, so I instead calculated it from 2016 to 2021. Unfortunately, this dataset was not available for earlier years to trace further the origins of the zoning effect.

6. Calculating the Zoning Effect for Apartments

The zoning effect increases apartment prices because zoning blocks high-density developments, causing fewer apartment units to be built than the market would otherwise allow. To calculate the zoning effect on apartments, I followed Kendall & Tulip (2018) in using a different method than the procedure used for detached homes, because the key variable involved is not the marginal price of land, but the marginal cost of construction. In market equilibrium, the sale price of an apartment unit tends toward the marginal cost of its construction (Glaeser & Gyourko, 2018). In an idealized market equilibrium these two values are identical, but they tend to differ slightly in real life. However, a large discrepancy between them indicates there are policies that impede or prohibit apartment construction at the quantities desired; the same policies mentioned earlier in section 3.3. Since development markets are highly competitive (Glaeser et al., 2005; Lees, 2017; Minifie et al., 2017), any profits earned by developers are the direct result of the “quota” effect of zoning (see section 3.5); therefore I do not exclude them from the zoning effect.

6.1. Calculating the Marginal Cost of Construction and Zoning Effect

To begin the process of calculating the marginal cost of apartment construction, I combined and trimmed the Data Advice tables in the same manner as in section 4.3, with the following key differences:

- Only Metro Vancouver had enough data to perform an analysis (and the construction cost data is most precise for Metro Vancouver, as discussed in section 4.4), so I trimmed the dataset to just the Metro Vancouver region.
- Instead of removing multi-unit residential buildings as I did before, I trimmed the dataset to condominium sales. There were some apartment sale records, but these were sales of entire buildings, and what I needed were sales of individual units.
- Even after I trimmed the dataset to just condominiums, there were still some whole-building sales, which recorded the entire building's sale price multiple times, once for each unit. As a further precaution I removed all records that were sold for the same price on the same day, thus eliminating these erroneous duplicates.

Calculating the marginal cost of apartment construction was easier than the marginal cost of land because no regression was required. However, I did need to differentiate between different building heights. The marginal cost of construction increases with building height. Also, concrete buildings carry a higher marginal construction cost than wood-frame buildings. Because my data did not explicitly specify the height or construction material for each property, I instead inferred these values by using apartment unit numbers to estimate the distribution of building heights in the city. For this process I used all but the final two digits of each apartment unit number: "412" would correspond to a 4^{th}-storey apartment and "1601" a 16^{th}-storey apartment. This admittedly rough method allowed me to model how many buildings of each height existed in the region, as a percentage of the total buildings. Per the building codes for the Province of B.C. and the City of Vancouver, I assumed that 100% of 3 to 4-storey buildings were wood-frame construction, 5 to 6-storey buildings were evenly split between wood and concrete construction, and 100% of 7-plus-storey buildings were of concrete construction.

Once I had finished estimating the distribution of building heights and construction materials, I grouped the data into the categories identified in the Altus Construction Cost Guide for multi-unit residential construction costs per square foot. These were: 3-4 Storey

Wood-Framed Condo, 5-6 Storeys (average of 5-6 Storey Wood-Framed Condo and Up to 6 Storeys Hybrid Construction), 7-12 Storeys, 13-39 Storeys, 40-59 Storeys, and 60+ Storeys. Developers generally build the maximum possible number of units on each floor to maximize profits under height constraints; therefore, constructing an additional unit at the margin entails expanding upward and adding an additional floor. For this reason, I aggregated the data by building instead of by unit and placed each building into a construction cost category corresponding to one floor higher than its current height. I assumed that buildings of different heights still tend to have similarly sized building footprints, and therefore roughly the same average number of units per floor.

Having calculated the distribution of building heights and construction materials, I then calculated the average marginal cost of construction. The Altus Cost Guides report a range of construction costs for each building height category, so I used the middle value of each category's price range. To summarize these values into a single average, I calculated a weighted mean of the values, weighted by each building height category's percentage of the total number of buildings. Finally, as I did with detached houses, I subtracted the marginal construction cost from the sale price to determine the zoning effect. I performed this entire process separately for each year from 2016-2022 to show the trend of how the zoning effect contributes to apartment sale prices over time.

7. Results

7.1. Results for Detached Houses

Because I conducted separate regressions for each municipality and each year (198 regressions in total), listing the full results of every regression would be impractical, so I will just provide some key summaries here. Tables detailing the R^2 values for each regression, and the coefficients and *P* values for the land area variable, can be found in Appendix 10.3. An in-depth description of the outputs of one of my regressions can be found in Appendix 10.4. In all but one of these regressions, more than 50% of the variation in house prices was described by the model. The mean R^2 of all 198 regressions was 0.77 (standard deviation 0.079) (Table 4, Appendix 10.3). The coefficients for the log(land area) variable ranged from less than 0.1 to more than 0.5, depending on the city, but the mean was 0.20 (standard deviation 0.093). The log(land area) coefficient was never negative (Table 5, Appendix 10.3). In all but four of the regressions, the *P* value for the log(land area) variable was less than 0.001 (Table 6, Appendix 10.3). The consistent reliability of

land area as a predictor of home sale price aligns with intuition; large lots tend to sell for more. However, it is surprising that this relationship is so weak: only 20% on average.

In total, I calculated the zoning effect for 30 municipalities and two metropolitan regions; these were all the jurisdictions that had enough yearly home sales to make my analysis statistically significant. The latest year for which every municipality had data was 2021, so in Table 2 below I show the zoning effect in each municipality for 2021. To make the table clearer for readers not familiar with the geography of British Columbia, I have colour-coded it; municipalities of Metro Vancouver are green, those of Greater Victoria are orange, and all other municipalities are blue. In most municipalities, the zoning effect makes up a large portion of the average sale price of detached houses. In absolute terms, it ranges from $59,000 for the average Fort St. John house to $3.6 million in West Vancouver. In percentage terms, the zoning effect is as low as 15% in Fort St. John and as high as 71% in Delta.

Table 2. Zoning effect in 2021 across British Columbia municipalities.

City/Metro Subregion	Average home sale price in 2021	Zoning effect in 2021	Zoning effect % of sale price	Subject to provincial 5-year housing targets
Abbotsford	$1,100,000	$720,000	67%	Yes - original 10
Burnaby	$1,900,000	$1,100,000	58%	Yes
Campbell River	$640,000	$270,000	43%	Yes
Chilliwack	$840,000	$470,000	55%	Yes
Coquitlam	$1,600,000	$970,000	60%	Yes
Courtenay	$700,000	$280,000	39%	No
Cranbrook	$410,000	$110,000	28%	No
Delta	$1,300,000	$950,000	71%	Yes - original 10
Fort St. John	$400,000	$59,000	15%	No
Kamloops	$650,000	$270,000	41%	Yes - original 10
Kelowna	$970,000	$420,000	44%	Yes
Langford	$950,000	$380,000	40%	Yes
Langley Township	$1,400,000	$640,000	47%	Yes
Maple Ridge	$1,100,000	$650,000	57%	Yes
Mission	$960,000	$610,000	63%	Yes
Nanaimo	$740,000	$360,000	48%	Yes
North Cowichan	$730,000	$380,000	52%	Yes
North Vancouver District	$2,200,000	$1,500,000	68%	Yes - original 10
Oak Bay	$1,900,000	$1,200,000	64%	Yes - original 10
Penticton	$690,000	$280,000	41%	No
Port Alberni	$440,000	$200,000	45%	No
Prince George	$440,000	$150,000	35%	Yes
Richmond	$1,900,000	$1,100,000	56%	Yes
Saanich	$1,200,000	$820,000	70%	Yes - original 10
Surrey	$1,500,000	$880,000	59%	Yes
Vancouver	$2,600,000	$1,300,000	49%	Yes - original 10
Vernon	$700,000	$280,000	40%	No
Victoria	$1,200,000	$820,000	70%	Yes - original 10
West Kelowna	$910,000	$370,000	40%	Yes
West Vancouver	$3,600,000	$2,400,000	68%	Yes - original 10
Greater Victoria Average	$1,400,000	$800,000	59%	
Metro Vancouver Average	$1,700,000	$1,000,000	59%	
Average of 30 jurisdictions	**$1,200,000**	**$660,000**	**51%**	

* Estimates are rounded and may not line up between columns.

In May 2023, the B.C. government selected ten municipalities experiencing urgent housing need and assigned them targets for provision of new housing, stating that if they failed to meet these targets the provincial government would intervene to get the additional units built ("Targets Released for 10 Municipalities to Deliver More Homes for People," 2023). As a percentage of home sale prices, these ten municipalities' zoning effects are among the largest in the province. Of the ten municipalities, seven have a zoning effect that accounts for more than 60% of the cost of detached homes in those municipalities, one (Port Moody) does not have enough data to calculate the zoning effect, and only two have a zoning effect below average (less than 51%). The only municipality with a zoning effect above 60% that was not named in the original list is the District of Mission. The municipalities with the highest percentage zoning effects are not the ones with the highest percentage of single-family zoned land as shown back in Figure 1; this confirms that single-family zoning alone does not explain the zoning effect.

When the zoning effect and other components of home sale prices are graphed over time, as I do over the following two pages in Figures 4 and 5, two patterns become visible: an increase in average home sale prices driven largely by the zoning effect, and a dichotomy between Metro Vancouver and the rest of the province. The first visible pattern in the graphs is the steady growth in housing prices from 2016 to 2021/22, driven largely by the zoning effect. With the exceptions of West Vancouver and the City of Vancouver, each municipality's average house is considerably more expensive at the end of the time period studied. This effect is strongest in the municipalities at the eastern edge of Metro Vancouver: Surrey, Langley, and Maple Ridge. It is less pronounced for municipalities closer to the inner core of Metro Vancouver, in which prices were already high at an earlier date. However, it is remarkably consistent for every municipality outside of Metro Vancouver, as shown on the second page of charts.

Figure 4.
Zoning effect graphs for Metro Vancouver and member municipalities (2016-2022, variable y-axis scales)

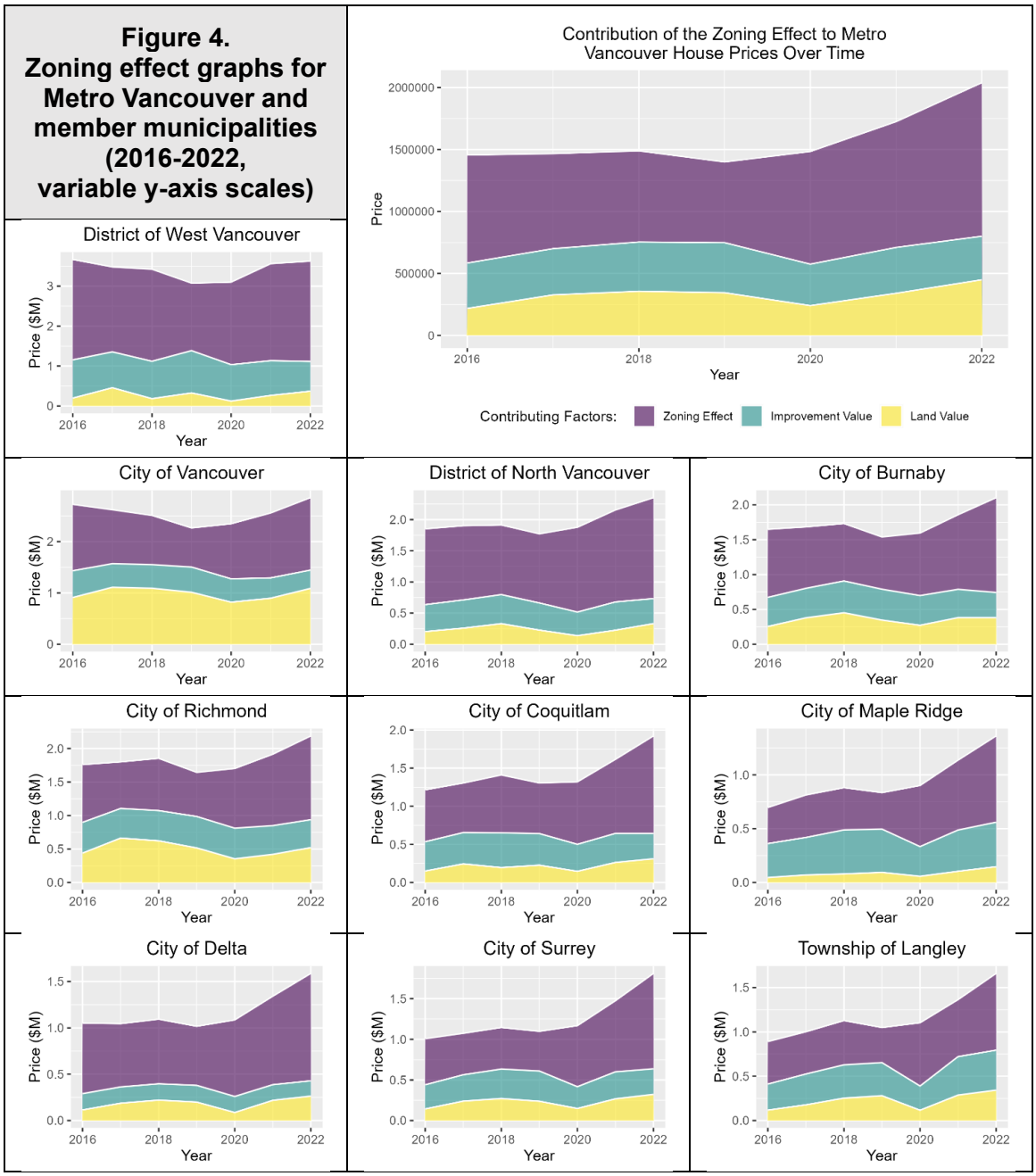

Figure 5.
Zoning effect graphs for jurisdictions outside of Metro Vancouver

(2016-2021, variable y-axis scales)

Fort St. John had too small of a sample size in years prior to 2021 so was excluded from the time series analysis.

The zoning effect accounts for the majority of the growth in home prices over this time period in the 30 municipalities surveyed. Of the 28 municipalities whose average home sale price increased from 2016 to 2021, 24 of them had over 50% of this increase explained by the zoning effect. In none of these 28 municipalities did the zoning effect decrease in size over this time period. Averaging the trends of these 28 municipalities, the zoning effect accounts for 74% of home price growth. Improvements and physical land represent 15% and 11% of the growth, respectively. In the absence of the zoning effect, the average home price across all 30 municipalities would have grown by $100,000 from 2016 to 2021. However, because of the additional influence of zoning, it actually grew by $300,000.

The growth of the zoning effect can also be seen in static comparisons. In nearly every municipality surveyed, the zoning effect accounted for more of the average home sale price at the end of the study period than at the beginning. The lone exception was the Township of Langley, where the zoning effect decreased from 54% to 52% from 2016 to 2022 (although it still nearly doubled in absolute terms). The zoning effect increased in absolute terms everywhere except West Vancouver, where it stayed constant. This growth in the zoning effect demonstrates that zoning is actively constraining housing demand everywhere in this province, and the amount of demand that can't be met without increasing prices is growing with each passing year.

The other visible pattern is the difference between how the zoning effect plays out in Metro Vancouver vs. the rest of the province. Metro Vancouver municipalities generally have home sale prices upwards of $1 million, with the zoning effect accounting for 50-70% of that cost. The largest zoning effects are to be found in the most expensive and affluent municipalities: Vancouver, North Vancouver District, and West Vancouver. Burnaby and Richmond, which both directly adjoin Vancouver, have the next-largest zoning effects in absolute terms, and as one moves east towards Maple Ridge and Langley the zoning effect gradually decreases. This gradual lessening of the zoning effect from west to east can be seen in Figure 6. The trend continues eastwards into the Fraser Valley municipalities of Abbotsford, Mission, and Chilliwack, which lie outside of the Metro Vancouver Regional District but are still within its sphere of influence (Figure 7). In Metro Vancouver municipalities, all three components of home sale prices have a role to play, but the zoning effect tends to dominate, as seen in purple in the graphs of Figure 4.

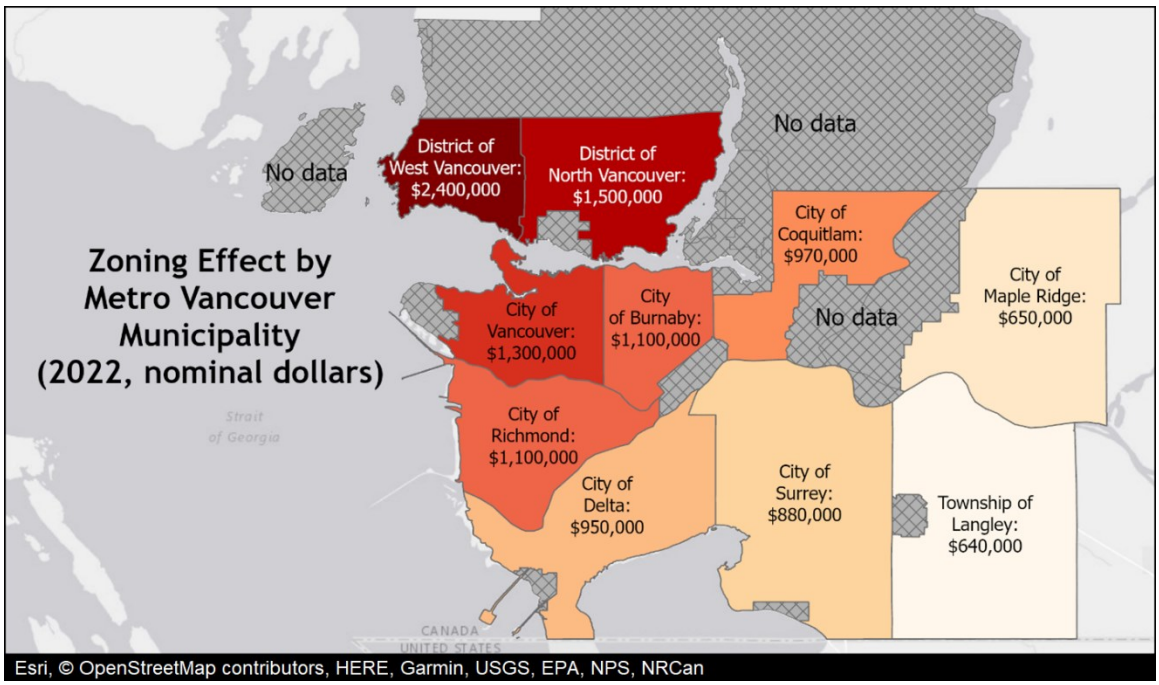

Figure 6. Map of the zoning effect across Metro Vancouver.

Outside of Metro Vancouver, the situation is very different. Most municipalities outside of Metro Vancouver have sale prices below $1 million, with the zoning effect explaining around 40% of that cost (Figure 5). Structure values make up a larger proportion of sale prices in these municipalities; they are fairly consistent throughout the province, ranging between $200,000 and $500,000 in most cities. However, physical land is not highly valued outside of Metro Vancouver; Figure 5 shows that it contributes less than $100,000 to the price of an average lot in most cities. In these cities, structure values make up the majority of the average home sale price, although the zoning effect has overtaken structure values in some places. As shown below in Figure 7, the provincewide trend is that the zoning effect radiates outward from three primary centres: Vancouver, Victoria, and Kelowna. The zoning effect decreases with distance from these centres, with the smallest zoning effects found in the most remote cities. This implies that people who are pushed out of primary population centres by high prices still want to stay close to their hometowns.

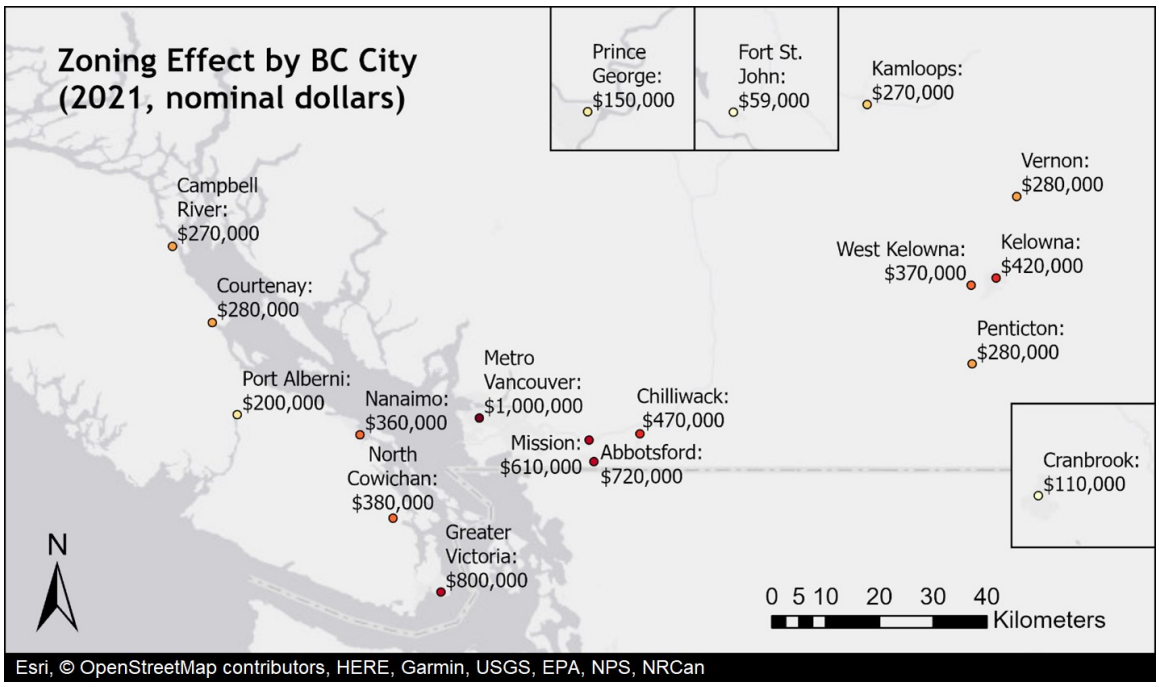

Figure 7. Map of the zoning effect across B.C.

Most cities, particularly outside of Metro Vancouver, show a dip in structure values in the year 2020, with a corresponding boost in the zoning effect, as seen in Figure 5. This appears to be due to BC Assessment having expected a lull in the housing market which never materialized. They reduced their assessments of structure values, but sale prices remained high. For this reason, it is best to disregard the 2020 estimates of the zoning effect. By 2021, structure value estimates had returned to normal, and this gap was mostly nullified, although a sharp increase in sale prices in most cities meant that the zoning effect remained higher than in previous years.

7.2. Results for Apartments

As seen below in Table 3, the average Metro Vancouver apartment price has risen by over $250,000 since 2016, mostly due to the zoning effect. Construction costs increased in Metro Vancouver from 2016 to 2022, but growth in the already large zoning effect explains the bulk of the rise in apartment sale prices; while construction costs have only increased $60,000, the zoning effect has increased by nearly $200,000. As a percentage of sale price, the zoning effect has remained roughly constant, growing from 66% to 69%.

Table 3. Zoning effect for Metro Vancouver apartments from 2016 to 2022.

Year	Average sale price	Construction cost	Zoning effect	Zoning effect % of sale price
2016	$500,000	$170,000	$330,000	66%
2017	$560,000	$190,000	$370,000	66%
2018	$650,000	$210,000	$440,000	68%
2019	$620,000	$200,000	$420,000	68%
2020	$620,000	$220,000	$390,000	64%
2021	$670,000	$230,000	$440,000	66%
2022	$760,000	$230,000	$520,000	69%

* Estimates are rounded and therefore may not line up between columns.

My estimates of the zoning effect for apartments are less precise than those for detached houses because they rely entirely on construction cost estimates, which are vaguer than assessed structure values. This is because structure values are assessed individually for each house, whereas construction costs are estimated for Metro Vancouver as a whole, making them less specific. Notwithstanding any locational imprecision, these construction cost estimates still allow me to provide an accurate picture of the overall magnitude of the zoning effect for apartments. The large gap between apartment construction costs and sale prices indicates a zoning effect on the scale of hundreds of thousands of dollars. Zoning materially constrained Metro Vancouver's supply of apartments in 2016, and continues to do so today.

8. Discussion

8.1. Findings

My analysis finds that zoning appears to account for between 40 and 60 percent of the average detached home sale price in most B.C. cities, increasing home prices by hundreds of thousands of dollars. Similar to the trend in Australian cities (Kendall & Tulip, 2018), the zoning effect has increased in recent years, and this increase accounts for much of the recent rise in B.C.'s housing prices. While the absolute size of the zoning effect is highest in the municipalities closest to downtown Vancouver, the zoning effect has grown at a faster rate in the suburbs. Structure values have also generally grown, for two potential reasons. One is that construction costs have increased, making new buildings more expensive. The other is that, as land values increase, the homes built on

them tend to be more high-end as the additional construction costs involved become smaller relative to the lot purchase price (Pettit, 1993).

While this extra spending on housing is not a net cost to society, since it is recouped by land sellers, there is still an economic loss from forgone housing stock in a given locality. In addition, these higher housing costs mean each new household gets a lower level of housing quality than what they could otherwise afford. Existing households who make profits cannot capitalize on them without leaving for another region or downsizing to an apartment (to trade the large zoning effect on houses for the slightly smaller zoning effect on apartments).

The zoning effect is lower in absolute terms for apartments than houses, but still high in percentage terms, accounting for 69% of the average apartment sale price in 2022. This reflects that zoning not only reduces the number of apartments on the market, but also makes those that are approved more expensive to build. Higher apartment sale prices are capitalized into higher apartment rents. Although rents are slower to adjust due to provincial controls, they rise as the rental stock is renewed and as lease agreements are terminated and reset. (In British Columbia, rent controls do not carry over when a new tenant moves into an existing unit and starts a new lease.)

In Australia, the zoning effect began contributing noticeably to home prices around the year 2000, albeit slightly earlier in Sydney (Kendall & Tulip, 2018). The authors state that this period was when exurban growth began butting up against “urban consolidation” boundaries, which prevent suburban development beyond a given boundary at the edge of a city. Since Australian cities could no longer grow outward, zoning, which already limited upward growth, became a stronger factor constraining housing supply. Like Australian cities, B.C. cities are constrained in their outward growth due to mountainous geography and the Agricultural Land Reserve. Because of this constraint, and since the rate of home price escalation increased in Metro Vancouver around the same time as in Australia, it is possible that B.C.’s zoning effect has followed a similar trajectory to Australia’s since 2000 (McElroy, 2016). However, BC Assessment data from prior to 2016 is not available to confirm this.

In a few cities, structure values remain the dominant contributor to home sale prices, and land values (even with the zoning effect included) are low. Low land values as a percentage of structure value are more historically normal than what we see in most

B.C. municipalities. As a rule of thumb, structure values are normally 2.5 to 3.5 times higher than land values in unconstrained cities (*Marshall Valuation Service*, 2018). In B.C., only Fort St. John, Cranbrook, and Prince George remain close to the 2.5-3.5:1 ratio. The zoning effect of these cities may in fact be desirable, since without it land in these cities would be nearly worthless. Rather than acting as a prohibitive barrier to homeownership, the zoning effect in these cities could be seen as a source of stability.

One interesting finding from my empirical analysis of apartment buildings is that, despite the overall trend of increasing densification in Metro Vancouver, there appear to be roughly 150 *fewer* low-rise apartment buildings in 2022 than there were in 2016. Figure 8 below shows that most categories of apartment buildings have increased in number since 2016, apartment buildings of 4 or fewer storeys (in blue) have decreased. This observation lends support to the concept of “transit-induced gentrification”. Transit-induced gentrification is a term used by social geographers to describe a process through which low-income individuals are evicted from older apartments to make room for new towers near rapid transit stations (Jones & Ley, 2016). The term was coined in response to the idea of “transit-oriented development” (TOD), a form of urban growth management that has been used by the Metro Vancouver Regional District and its member municipalities for decades. Under TOD, planners aim to concentrate all population growth in the vicinity of rapid transit stations, in order to encourage people to take public transportation instead of driving. These “TOD areas” are often areas with existing low-rise apartment buildings, which are usually older and more affordable for low-income individuals. When TOD zones are redeveloped, the older, cheap apartments are replaced with new, expensive ones, and the low-income residents are priced out.

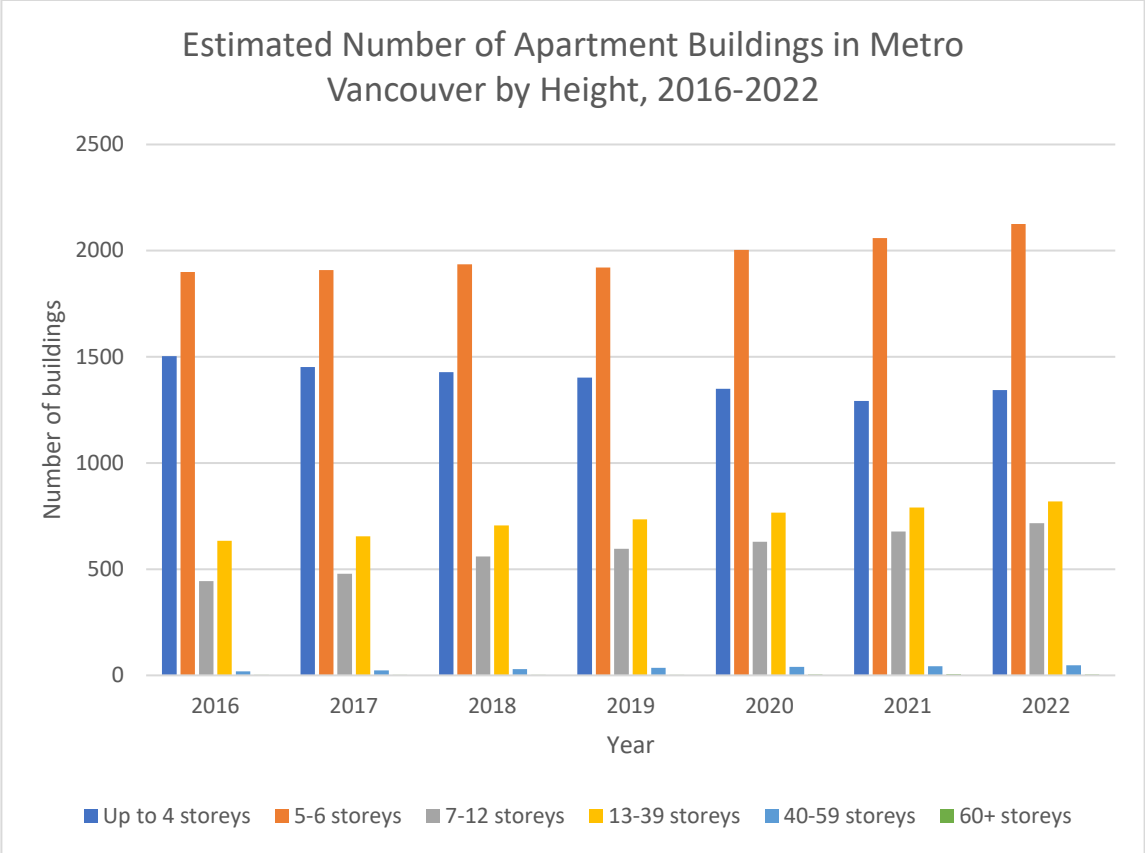

Figure 8. Changes in Metro Vancouver's apartment inventory over time.

Although the term "transit-induced gentrification" is evocative, it is also misleading, since it is not the transit infrastructure itself that leads to evictions, but the way that zoning is used around it. The construction of new rapid transit is simply a trigger that regional and municipal planners use to justify their zoning decisions. Furthermore, the up-zoning of TOD neighbourhoods is not the root cause of displacement; it is just the salient phenomenon that is most obvious to residents and observers. The real problem is the restrictive zoning of surrounding single-family neighbourhoods. Because single-family-zoned neighbourhoods have been kept off-limits for years, not enough low-rise apartments have been built to replace those that are demolished in the TOD area. In addition, even if developers wanted to spare low-rent dwellings, they are denied that option because the only sites where new towers are allowed are the sites of old apartment buildings in TOD zones. The drop in low-rise apartments is a telling illustration of the impacts of TOD on the region.

Since TOD is a regional government initiative, the provincial government has the ability to overrule it. Interestingly, the recently proposed provincial reform allowing duplexes in single-family neighbourhoods may have an effect contrary to the aims of TOD, as it opens up more development possibilities outside of rapid transit-adjacent neighbourhoods. However, a separate provincial act reinforces the goals of TOD by mandating high-density zoning specifically near rapid transit stations (Little, 2023a, 2023b). It is unclear what combined effect these two measures will have on the rate of transit-induced gentrification.

8.2. Implications

The central finding of my research is that zoning likely contributes substantially to B.C. cities' high housing prices. While my research does not pinpoint exactly which policies have the largest effects in each municipality, my results indicate that zoning materially constrains housing supply almost everywhere in the province. In the largest cities of Vancouver and Victoria, this constraint is primary; these cities are growing fast, and zoning significantly alters settlement patterns in high-demand single-family neighbourhoods that are prevented from reaching commensurate levels of growth and densification. In smaller cities the effect is likely secondary. While local population growth alone doesn't push the limits of their zoning, people out-migrating from Vancouver and Victoria are increasing local housing demand beyond what these towns' zoning commissioners anticipated. In the most remote cities of Fort St. John, Prince George, and Cranbrook, zoning is hardly binding currently. This does not mean, however, that these cities' zoning bylaws are more permissive or flexible; they are just operating under slower growth scenarios.

The zoning effect is preventable. It is created by policies enacted by municipalities, and municipalities can repeal or rework all of these policies. Municipalities in B.C. are required to produce an Official Community Plan (OCP) with a zoning plan, but restrictive zoning designations are not required. The B.C. Building Code, which ensures basic safety requirements are met, is accounted for in my research under construction costs; all other design guidelines are at the municipality's discretion. There are no provincial requirements for parking spaces, and the province only mandates wheelchair-accessible parking spaces when a local bylaw already prescribes a parking minimum (*Regulatory Changes to Accessible Parking Requirements*, 2018). Public hearings, while recommended by the Province for filling gaps in local knowledge, are not required for site-by-site rezonings. In fact, to clarify that the Province does not want municipalities to hold public engagements

for every new building, it has introduced legislation to phase them out for individual developments, shifting the time for feedback to the updating of OCPs (Office of the Premier, 2023). This allows neighbourhood concerns to be heard at an earlier stage and stops them from holding up developments already in progress.

My research also refutes the claim that zoning reforms will be ineffective because the construction sector is already working at capacity (Penner, 2023). While construction is more expensive in Vancouver than in other cities in Canada (Altus Group, 2023), my research shows that reducing the zoning effect would reduce house prices by hundreds of thousands of dollars before hitting the minimum price allowed by construction costs. It is true that supply-side zoning reforms like those proposed by the Province will result in increased construction demand, and this will drive up the costs of contracts in the short term. However, this will in turn provide a signal for more construction firms to enter into the market, tempering this effect.

In addition, reforms of zoning can reduce construction costs by eliminating bureaucratic obstacles. For example, many building design guidelines now exceed minimum safety requirements and aspire to shape the aesthetic of neighbourhoods. These guidelines are generally held in high regard by planners, and some have even won awards (*PIBC Announces Winners of 2023 Awards for Excellence in Planning*, 2023). However, building design guidelines can make new developments cost-prohibitive and thereby maintain the exclusivity of neighbourhoods. While no provincial reforms have yet targeted municipal building design guidelines, this would be a logical step for B.C. to take in the future if their upzoning legislation fails to quell land price increases, or if municipalities make their design standards more complex in order to block developments that could change the character of neighbourhoods.

Higher land prices reverberate through all sectors of the economy, not just housing. The commercial sector is also constrained by zoning, which strictly regulates commercial building heights and prohibits mixed-use developments in most areas. This results in rising commercial space rents, which translates into higher prices for goods and services. High land prices have also created pressure to redevelop industrial land as high-density residential, which is politically less difficult than introducing high-density housing in existing residential neighbourhoods. While some of this redevelopment is no doubt due to B.C.'s decades-long trend of deindustrialization, the continued need to make use of limited

industrial land has led to workarounds like two-storey warehousing (McLean, 2020), an environmentally efficient but cost-intensive form of construction.

Although office space is less constrained than commercial or industrial space due to the rise of remote work (C. Wilson, 2023b), it is still affected by high land prices. Because of the post-pandemic reduction in demand for office space, some have called for office-to-residential building conversions as a salve for the housing crisis. The real estate firm Avison Young has identified that many office buildings in Vancouver are suitable for conversion to apartments (C. Wilson, 2023a). However, this is an expensive option unlikely to provide a paradigm-changing amount of additional housing units (Loh et al., 2023). This process would also reduce the availability of low-cost office space, which is essential for fledgling businesses to get off the ground (Jacobs, 1961). The current surplus of office space is a window of opportunity for B.C. start-ups. Widespread office-to-residential conversions would eliminate this opportunity in order to provide only a small amount of additional housing with a high conversion cost.

8.3. Limitations and Considerations

In section 3.5 I listed the assumptions I made to simplify my methods and make this analysis possible. Those assumptions primarily concerned variables which I did not consider because they were too difficult to accurately assess and their contributions were either negligible or irrelevant. Here I will discuss further assumptions regarding the quality of my data.

The most important assumption I made is that BC Assessment's estimates of structure values accurately reflect their true value (except from 2015 onward, as explained in section 4.4). In Australia, Kendall and Tulip (2018) averaged estimates from three different sources to mitigate potential inaccuracies in each individual source. However, for B.C. only two sources were available, BC Assessment and Altus Group, and the latter of those was only available for recently constructed homes. Overall, BC Assessment's estimates are extremely accurate, deviating no more than 1% from actual residential sale prices on average (2022-23 to 2024-25 Service Plan, 2022). However, this average might obscure potential areas of systematic deviation within a largely accurate whole; severe underestimates might be cancelling out severe overestimates. One concerning possibility is that homeowners systematically challenge high estimates of their home values but not low values, leading to an undervaluation of structures and thus an overestimation of the

zoning effect. By including Altus Cost Guide figures, I eliminate this concern where it is most obvious, in the post-2014 years, but those estimates themselves are broad and may obscure regional anomalies, particularly outside of Metro Vancouver.

I also assumed that the Altus Cost Guide estimates were not systematically biased in a particular direction. This assumption was particularly important for my analysis of the zoning effect for apartments, since that analysis used the Altus Guide as the primary resource for construction costs. I used multiple statistics from within each yearly release of the guide, which helped limit the influence of any particular statistic; however, I could not avoid making the underlying assumption that the guide was reliable. However, I have no reason to doubt the reliability of the guide; Altus Group is a major consulting firm with an international reputation, and its primary purpose is to provide accurate information on the Canadian real estate sector (Smith, 2016). It has no stake in systematically over- or underestimating prices; on the contrary, doing so would harm its business reputation.

Notably, my research quantifying the zoning effect produced a much larger figure than Dachis and Thivierge's 2018 study, which quantified essentially the same thing using the term "regulation burden". For the year 2016, they reached a figure of $600,000 in Metro Vancouver, while my estimate exceeds $800,000. The reason for this discrepancy is the method of valuing structures. Dachis and Thivierge use the cost of new construction, while I instead take the value of existing structures, as did Kendall and Tulip (2018). Because construction costs have increased, new construction is valued more highly than older buildings. This results in a higher proportion of sale prices being attributed to structure values, thus a lower amount attributed to the regulation burden than was ascribed to the zoning effect. Both methods are valid for different purposes. My methods essentially calculate how much more expensive housing is because of the historical, cumulative impact of zoning; theirs can be interpreted as describing how much less expensive housing might be if zoning immediately ceased to exist (but had existed historically). The difference between the costs of forgone past construction and forgone present construction accounts for the difference between these two numbers.

8.4. Policy Options for Municipal Governments

In my suggestions below, I follow the premise that reducing the zoning effect is desirable. This may not necessarily be the case; in the past, many cities have prioritized increasing property values instead of making housing less expensive (Pogodzinski &

Sass, 1990). However, at present all levels of government affecting B.C. municipalities have stated a preference for making housing more affordable (Aiello, 2023; Chan, 2023; Little, 2023a). Reducing the zoning effect can be desirable even without the imperative to decrease house prices. This is because it is better for land to be expensive because it has high inherent worth (due to physical land value) than because of an artificial scarcity (the zoning effect). Therefore, I only discuss policies that have the potential to reduce the zoning effect.

It would be remiss of me not to start with the most economically efficient and socially equitable option, which would be to eliminate density zoning entirely. Zoning should be reserved for controlling land uses with serious proven externalities, such as heavy industrial. Planners would do well to eliminate economically inefficient policies such as minimum lot sizes, parking minimums, and site-specific public engagement processes. Density bonusing and CACs, which are entirely dependent on the producer surplus created by zoning, could be replaced by increased property taxes, or preferably land value taxes.

However, recommendations like those I made in the previous paragraph are insensitive to the political realities of zoning. Much like in other fields like climate politics, the most efficient or equitable policy options are not necessarily those most likely to resonate with voters. Most people are suspicious of developers and resistant to change in their neighbourhoods, therefore zoning remains popular. In addition, studies like this one indicating the existence and magnitude of the zoning effect are sparse and recent, meaning that even planners may be unaware of the economic consequences of their policies. If planners are unaware of zoning's adverse effects, the average voter is almost certainly unaware. Trying to push drastic zoning reforms is a dangerous gamble for a politician, especially a municipal politician, if they hope to get re-elected. Therefore, for the benefit of anyone seeking to slow or reverse home price increases in B.C., I propose more innocuous and creative policy options instead.

One option available to municipalities that compromises between the need for more permissive land-use codes and the public's resistance to sudden change is introducing flexibility into zoning bylaws. While most people living in suburban areas would be shocked to see a skyscraper built next door, they also recognize that cities need to grow, and could be open to incremental increases in neighbourhood density. One way to encode dynamism in zoning codes would be to set maximum building heights based on

the existing buildings in an area; a block with mostly 2-storey buildings could allow a maximum of 4 storeys, mostly 4-storeys could allow a maximum of 6, 6 could allow a maximum of 10, and so on. This would allow neighbourhoods to grow naturally over generations, but retain consistency and predictability for longtime residents.

Another option could be to tie density increases to indicators of population growth or rising land value. This too would prevent neighbourhoods from being permanently frozen at low-density as they are now. However, guaranteeing future land lift would also exacerbate the issue of speculation. For now, provincial legislation requires that cities revisit Official Community Plans more frequently and plan for housing needs further in the future (Little, 2023a). This is not truly embedding flexibility in zoning bylaws, but it at least provides more opportunities for manual adjustment. With the help of informed planners and city councils, these adjustments can prevent land-use rules from becoming too disconnected from on-the-ground realities.

Recent provincial interventions have left many municipalities scrambling to update their Official Community Plans in time to comply with the province's new housing standards. While this process is challenging for many planners, it is also an opportunity for them to make their own jobs easier by trimming back self-imposed obstacles. One easy fix would be to change the approval of certain housing types from discretionary to as-of-right. For example, Abbotsford has a designated infill zone intended to be for "missing middle housing", but residents in that zone must apply for an additional rezoning to actually build any of the housing types it is intended to enable: garden suites, duplexes, and secondary suites (*City of Abbotsford Official Community Plan - Urban Structure and Growth Plan*, 2016). This is an unnecessary barrier since the area the infill zone covers has already been established as suitable for these housing types. Allowing the area's intended housing types as-of-right would ease workloads for owner-developers and City staff alike.

Reducing the complexity of zoning codes is a viable and attractive option for those seeking to reduce the zoning effect. Highly granular land-use regulations have proliferated in B.C. Influential planners like Larry Beasley have defended the need for "daunting" layers of policy, claiming "cities are complicated, so the regulations that shape them inevitably need to also be complicated" (Beasley, 2019). An extreme example of this approach to planning is the City of Victoria, whose zoning code is so extraordinarily complex I was unable to even measure how much of the city allows multi-family housing (see Figure 2).

Many of these regulations cities use to produce unique and vibrant neighbourhoods are only needed to counter other regulations that achieve the opposite effect – regulations like minimum parking requirements and segregation of land uses. Contrary to some planners' fears, cities may function effectively as self-organizing systems which can achieve incredible results when guided by a few clear and simple rules. By reducing the number of distinct zoning classifications and providing citizens with tools to navigate zoning bylaws, cities can not only unlock new housing options but reduce their own staff workloads in the process.

Finally, municipalities should remember that new supply does not need to be itself inexpensive to reduce prices overall. In fact, by requiring developers to include below-market housing that is cross-subsidized by charging more for the market units, municipalities are exacerbating the problem. When those in need of rental assistance begin to outnumber those capable of providing it, privately supplied below-market units will never be enough to meet demand, and allocating them via lottery is not an equitable long-term solution to housing deprivation (Bertaud, 2018; Cseke, 2015). Rather than pushing private below-market supply, it is more effective for municipalities to allow as many privately built units as possible to drive down the market price, and bring older units back into an affordable range. By decreasing the cost of land, this also makes it possible for nonprofits and the public sector to build more below-market housing using the same amount of revenue.

8.5. Policy Options for the Provincial Government

Given the inherent incentives for municipal governments to limit growth and development (see section 2.2.), it may make sense for the provincial government to override municipalities on plans that clearly fail to meet anticipated housing needs. Because localized effects have a smaller relative bearing on provincial elections than municipal elections, provincial governments have more political leeway to push housing reforms.

In November of 2023, the B.C. government advanced several supply-side reforms that are in alignment with lessening the zoning effect. One of these reforms is a blanket up-zoning to allow triplexes and four-plexes as-of-right (i.e. with just a building permit, instead of having to seek additional approval from the municipal government). This applies in all B.C. municipalities of over 5000 people, in all residential lots except those outside

urban containment boundaries (Office of the Premier, 2023). Other reforms include higher-density up-zonings near transit hubs, restructuring of public engagement processes, and controls on the levying of CACs to ensure consistency (Duffy, 2023; Little, 2023a, 2023b). The first two of these policies focus on zoning, and because they allow increased density in areas which have been seen to be constrained by zoning, it follows that the zoning effect will likely decrease as a result. The restructuring of public engagements will also reduce delays in the development process, since public engagement will no longer be a part of every site-by-site rezoning; this will likely reduce the zoning effect as well. The final policy, concerning CACs, will not directly affect the zoning effect, because CACs do not contribute directly to the zoning effect. However, it may still indirectly reduce the zoning effect, since it will make the development process more streamlined and reduce the incentive for municipalities to "under-zone" properties to gain a bargaining chip for CACs.

Because all of these policies directly or indirectly target municipal policies that contribute to the zoning effect, together they have a strong potential to reduce housing prices. However, it is also possible that other municipal regulations not addressed by these policies, like parking minimums and restrictions on medium-density buildings, will continue to push up prices. To mitigate this, the province can pursue demand-side reforms in addition to the supply-side reforms mentioned above. Early demand-side reforms, such as a tax, and then partial ban, on foreign buyers, have been criticized as largely ineffective (Brend, 2023). However, my analysis suggests that there is room for demand-side reforms in B.C.'s housing policy, as long as they do not detract from the more crucial supply-side interventions. This is because high demand is necessary to push the zoning effect as high as it's gotten; efforts to cut out "nonessential" demand will reduce the zoning effect (although governments must be careful when deciding which demand is nonessential). One such policy is a proposed short-term rental reform, which aims to return short-term rental units to the long-term rental market (Shen, 2023). Such reforms could be used to provide some temporary relief to renters in B.C. The danger is that governments may become too reliant on these policies and fail to introduce all the supply-side reforms needed to ensure long-term housing success.

The provincial government could also seek to emulate Germany's system of land-use codes. In Germany as in Canada, local governments are responsible for their land-use plans. However, rather than each municipality inventing their own zones and setting unique specifications for each, they are required to pick from a standardized list developed

by the federal government and set out in a statute called the *Baunutzungsverordnung,* or *BauNVO* for short (Hirt, 2007). There are only eleven zones in the *BauNVO,* all of which are more permissive and flexible than most zones developed by B.C. municipalities. For instance, there is no single-family residential zone; there is an “exclusively residential” zone which allows all levels of residential density, or a “small-scale residential” zone which only allows one- and two-family dwellings but also retail, restaurants, and workshops as-of-right.

No doubt zoning’s restrictiveness contributes to a substantial share of the zoning effect, but zoning’s complexity, bureaucracy, and interjurisdictional inconsistency likely also plays a role. A zoning system like the *BauNVO* would ameliorate both concerns by allowing more flexibility and simplifying land use categories both within and between municipalities. To start, the provincial government could develop a standardized system of zones and make it optional for municipalities to use. This would likely be adopted by the smallest municipalities first, since they would have fewer internal resources and might prefer to adopt a provincial zoning classification scheme rather than hire a consultant to create one from scratch. If the standardized zoning scheme proved successful, the provincial government could then extend it to all municipalities. Having simple and uniform zoning classifications would ease planners’ workloads, remove a source of costly confusion for developers, and make it possible for more small-scale owner-developers to enter the housing market on the supply side.

8.6. Application for Evaluating Municipalities’ Progress

British Columbia’s new legislative measures introduced in the fall of 2023 aim to combat rising housing prices by overriding municipalities on certain applications of zoning and CACs (Duffy, 2023; Little, 2023a, 2023b). Similar reforms were first tried very recently in a handful of places around the world, and while the reforms were too recent to have spawned an academic literature, there is some anecdotal evidence of their success (Clark, 2023; Millsap, 2023). However, sometimes the largest impacts have come from unexpected sources. While a sweeping zoning reform in Minneapolis allowed a modest increase in “missing middle” housing, a repeal of parking minimums appears to have been what truly unlocked a wave of new construction (Blumgart, 2022). When assessing a municipality’s success in meeting housing needs, it is important to account for the impacts of all regulations, lest a development-resistant city council attempt to counteract a provincial zoning reform by imposing harsher parking requirements or overly prescriptive

building design guidelines. One way provincial and federal governments could holistically monitor municipalities' efforts is by using the very methods described in this research paper.

One of the primary weaknesses of this study's methods – that they do not separate out the impacts of different land use regulations – is a strength when the methods are used to assess the effects of land use regulation in aggregate. Calculating a city's zoning effect allows an independent observer to see how strongly that city's affordability pressures are linked to its land use policies. For example, even though the Township of Langley and the City of Delta have similar average home sale prices, Langley has a much higher physical value of land, whereas Delta's home prices are driven more by the zoning effect, suggesting that artificial scarcity plays a stronger role there than innate desirability (see Table 2). By extension, this means that Delta's zoning regulations are inflating prices more than Langley's, and there is more potential for zoning reforms to reduce housing prices in Delta than in Langley.

The zoning effect described in this study is a simple, workable metric for higher-level jurisdictions to assess municipalities' progress in meeting housing needs. Rather than setting a target average home sale price or rental rate for municipalities to achieve, which would have to be individually calibrated for each municipality and would constantly be subject to external factors beyond a municipality's control, the province could prescribe a target zoning effect level – perhaps 40% of the average home sale price within 5 years, with a long-term goal of 20% – to give municipalities a meaningful objective that is within their power to achieve. This method would add quantitative precision to British Columbia's list of housing targets for municipalities (DeRosa, 2023a), and would allow for periodic check-ins to verify each municipality's progress. Failure to meet the target level for the zoning effect could result in direct provincial intervention to override the most obstructive policies, as determined by analysts within the provincial Ministry of Housing.

8.7. Future Challenges

If the province of B.C. successfully implements effective zoning reforms, municipalities will need to alter their financing methods. Historically, municipalities made most of their money from property taxes. While economically efficient, these taxes are politically unpopular due to their lump-sum nature (Andelson, 2000; Hemingway, 2023). This has led municipalities to steadily cut property taxes in order to please voters. Property

tax rates in B.C. are among the lowest in North America and have declined in recent decades (Hemingway, 2023), leaving the vast majority of B.C.'s ballooning land wealth untaxed.

To fill this funding gap, municipalities have turned to community amenity contributions (CACs) and density bonusing. These are now well-established policies in the urban planning world, and have been promoted as "growth paying for growth", since they tap into the profits earned by developers. This rhetoric obscures the fact that these profits are created by municipalities restricting development opportunities through zoning, resulting in a small number of successful developers making windfall profits as in a quota system (as I discussed in section 3.5). Thus the costs of amenities which serve the community as a whole are ultimately passed down to new homebuyers and renters through increased housing prices, instead of being shared by everyone. Recognizing the affordability challenges posed by reliance on CACs, the B.C. government has capped the amount municipalities can charge and mandated consistency in their fee schedules (Duffy, 2023).

B.C. municipalities have become dependent on CACs and density bonusing to fund their operations, but more permissive zoning would erode the producer surplus that municipalities tap into through these programs, since it would allow developers to build some new forms of housing without pursuing a rezoning. The province has anticipated this potential funding shortfall and so has introduced a replacement tool called an amenity cost charge, which can be used for the same purpose but must be standardized in advance rather than negotiated on a case-by-case basis (DeRosa, 2023b). As a result, municipalities still stand to miss out on some revenue, since they cannot vary their CAC rates in order to extract the entire producer surplus from each project.

This reform is good news for housing supply advocates but bad news for elected leaders, as raising property taxes to make up for the difference is likely to anger voters. This political conundrum constitutes one of the greatest challenges faced by proponents of zoning reform. If municipalities do not want to cut their services, one option for raising revenue would be to replace property taxes with a "speculation tax". This "speculation tax" would be a way of reframing the established concept of land value taxes, which are the more efficient counterpart of property taxes (Andelson, 2000). Governments could emphasize the elimination of tax on improvements in order to compensate for the increased tax on land. Another would be to collect property taxes as a monthly surcharge

on utility bills, to eliminate the unpleasant reminder residents face annually. Even if municipalities are too worried about a public backlash to raise property taxes, they will at least need to reconsider perpetually cutting them. By restricting the use of CACs and density bonusing, the province has foreclosed this option.

9. Conclusion

In this study, I set out to estimate the extent to which zoning influences B.C. home prices. I found that in some cities the zoning effect is relatively small, and in other cities it is the dominant contributor to the sale price of the average home. The zoning effect is strongest close to high-demand, large cities like Vancouver and Victoria. It is not caused just by zoning, but by a mix of related policies that make it more difficult to supply new housing at a rate matching how much of it people desire. Because the zoning effect is entirely caused by municipal government policies, it follows that municipal governments are responsible for much of the recent rise in B.C. housing prices. In some municipalities, zoning has caused housing to be more than three times as expensive as it would have been otherwise.

This study indicates that zoning reform has the potential to substantially lower housing prices, and that the provincial government can take measures to enable more supply when municipal governments choose not to act. It demonstrates that demand-side factors like immigration are not the main cause of price increases, that that construction sector is not working at capacity, and that land use regulations are not costless. It contradicts the fallacy, which prevails even in high-level forums like Vancouver City Council meetings, that building new housing will increase prices (Chan, 2022). It suggests that B.C. municipalities can improve housing affordability by auditing their land use bylaws and removing outdated or excessively rigid requirements. Finally, it points out that well-designed demand-side interventions can be effective at containing the highest price spikes.

While there is room for nuance regarding what kind of housing supply is most badly needed in B.C. cities, unlocking more supply by removing zoning barriers would be in any case a step in the right direction. If zoning continues to substantially limit housing supply, prices will continue to rise faster than necessary in growing cities. Fortunately, the range of possible reforms is broad, and there are many different angles to approach this problem

from. This study adds to a growing body of literature suggesting important steps planners and politicians can take to improve affordability in their jurisdictions.

Adjustments to urban built form have never been instantaneous, but zoning further impairs cities' flexibility. The long lead times and lifespans of constructed buildings inherently reduce the ability of cities to adapt to new economic realities, a fact that is costly for residents. Zoning reinforces this innate inflexibility by adding additional layers of unresponsiveness to urban real estate markets. As B.C. cities try to make housing less expensive for their citizens, it is important for them to recognize the role that their own bylaws play in driving up housing prices. In its current form, zoning is a major barrier preventing cities from achieving their affordability goals, but substantial zoning reform is achievable, and all levels of government have policy options available to them for reducing the zoning effect.

References

2022-23 to 2024-25 Service Plan. (2022). BC Assessment. https://info.bcassessment.ca/about/Publications/2022-23%20to%202024-25%20Service%20Plan.pdf

Abramson, B. (2023, February 14). Why Is It So Difficult To Build Walkable Places? *Strong Towns*. https://www.strongtowns.org/journal/2023/2/14/why-so-difficult-build-walkable-places

Aiello, R. (2023, December 12). “We are living in a housing crisis”: Canada consulting on reviving “wartime housing” design catalogue. *CTV News*. https://www.ctvnews.ca/politics/we-are-living-in-a-housing-crisis-canada-consulting-on-reviving-wartime-housing-design-catalogue-1.6683763

Altus Group. (2023). *2023 Canadian Cost Guide*.

Andelson, R. V. (2000). Land-Value Taxation around the World. *American Journal of Economics and Sociology*, *59*(5). https://www.jstor.org/stable/3487821

Bawuah, P. (2024). *Can Ontario’s housing crisis be fixed? Understanding the origins and proposed solutions to an ongoing crisis in housing affordability.* [University of Windsor]. https://scholar.uwindsor.ca/cgi/viewcontent.cgi?article=1345&context=major-papers

BC Residential Building Statistics & Trends Report. (2020). BC Housing Research Centre.

Beasley, L. (2019). *Vancouverism*. On Point Press.

Bertaud, A. (2018). *Order Without Design*. MIT Press.

Bipartisan Policy Center. (2023). *Small City Zoning Reforms in Auburn, ME*. https://bipartisanpolicy.org/blog/auburn-maine-comprehensive-zoning-reform/

Blumgart, J. (2022, May 26). How Important Was the Single-Family Zoning Ban in Minneapolis? *Governing*. https://www.governing.com/community/how-important-was-the-single-family-housing-ban-in-minneapolis

Bogart, W. T. (1993). “What Big Teeth You Have!”: Identifying the Motivations for Exclusionary Zoning. *Urban Studies*, *30*(10), 1669–1681.

Bozikovic, A. (2023, August 19). Small buildings won’t solve the housing crisis. Canada’s cities need to go big. *The Globe and Mail*. https://www.theglobeandmail.com/canada/article-small-buildings-wont-solve-the-housing-crisis-canadas-cities-need-to/

Brend, Y. (2023, December 26). *Why Canada’s ban on foreign buyers hasn’t made homes more affordable*. CBC News. https://www.cbc.ca/news/canada/british-columbia/canada-foreign-buyer-ban-housing-affordability-1.7058154

Buchanan v. Warley, 245 U.S. 60. (1917).

Canseco, M. (2019, June 21). Most Vancouverites Open to Changes in Single-Family Zoning. *Research Co.* https://researchco.ca/2019/06/21/our-house-in-the-middle-of-our-street/

Carcasson, M. (2020). Between Thick and Thin: Improving Public Engagement through a Wicked Problems Lens. *National Civic Review*, *109*(3), 6–14.

Chan, K. (2022, August 4). Two new towers with 212 rental homes approved by Vancouver city council. *Daily Hive Vancouver*. https://dailyhive.com/vancouver/3600-3680-east-hastings-street-vancouver

Chan, K. (2023, October 12). Mayor Ken Sim outlines seven "bold" strategies to grow Vancouver's housing supply. *Daily Hive Vancouver*. https://dailyhive.com/vancouver/vancouver-housing-supply-strategy-mayor-ken-sim

City of Abbotsford Official Community Plan—Urban Structure and Growth Plan. (2016). City of Abbotsford. https://laws.abbotsford.ca/civix/document/id/coa/coabylaws/ocp21

Clark, E. (2023, September 24). Australia has long debated this housing idea, but in Auckland it's already working. *ABC News*. https://www.abc.net.au/news/2023-09-25/nz-auckland-house-supply-experiment-results-in-dramatic-change/102846126

Clingermayer, J. C. (2004). Heresthetics and Happenstance: Intentional and Unintentional Exclusionary Impacts of the Zoning Decision-making Process. *Urban Studies*, *41*(2), 377–388. https://doi.org/10.1080/0042098032000165307

Cseke, A. (2015). *Municipal Planning and Market Interventions: Community Amenity Contributions in British Columbia* [University of Manitoba]. https://mspace.lib.umanitoba.ca/server/api/core/bitstreams/eb24e5d0-c1a5-461a-beb9-a34250080901/content

Cyca, M. (2023, June 15). The End of Homeownership. *Macleans*. https://macleans.ca/longforms/the-end-of-homeownership/

Dachis, B., & Thivierge, V. (2018). Through the Roof: The High Cost of Barriers to Building New Housing in Canadian Municipalities. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3179859

Davidoff, T., & Somerville, T. (2021). *The Economics of Community Amenity Contributions and Real Estate Taxes*. BC / Federal Expert Panel on Housing Supply and Affordability. https://engage.gov.bc.ca/app/uploads/sites/121/2021/06/Economics-of-CACs.pdf

DeRosa, K. (2023a, June 6). B.C. government documents reveal all 47 municipalities on housing "naughty list." *Vancouver Sun*. https://vancouversun.com/news/local-news/b-c-government-documents-reveal-all-47-municipalities-on-housing-naughty-list

DeRosa, K. (2023b, November 8). B.C. NDP proposes overhaul of the way municipalities collect fees from developers. *Vancouver Sun*. https://vancouversun.com/news/ndp-proposes-overhaul-of-the-way-municipalities-collect-fees-from-developers

Duffy, A. A. (2023, November 8). New housing law aims to address concerns about parks, other amenities. *Times Colonist*. https://www.timescolonist.com/local-news/new-housing-law-aimed-at-concerns-about-parks-other-amenities-7801377

Einstein, K. L., Glick, D. M., & Palmer, M. (2019). *Neighborhood Defenders: Participatory Politics and America's Housing Crisis*. Cambridge University Press. https://doi.org/10.1017/9781108769495

Einstein, K. L., Ornstein, J. T., & Palmer, M. (2022). Who Represents the Renters? *Housing Policy Debate*, 1–15. https://doi.org/10.1080/10511482.2022.2109710

Elvin, M. (1998). The Environmental Legacy of Imperial China. *The China Quarterly*, *156*, 733–756.

Farhan, B. Y. (2024). Canada's leadership and housing affordability: Evidence from the Canadian real estate market. *Journal of Urban Management*, *13*(1), 52–61. https://doi.org/10.1016/j.jum.2023.11.001

Femia, V. (2023, January 22). Kelowna, B.C. is facing a housing affordability crisis, city report says. *Global News*. https://globalnews.ca/news/9428795/kelowna-bc-housing-affordability-crisis-report/

Fischel, W. A. (2001). *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land-Use Policies*. Harvard University Press. https://doi.org/10.2307/j.ctv1p6hp64

Fischler, R. (1998). Health, Safety, and the General Welfare: Markets, Politics, and Social Science in Early Land-Use Regulation and Community Design. *Journal of Urban History*, *24*(6), 675–719. https://doi.org/10.1177/009614429802400601

Galloway, L. (2023, July 26). World's most liveable cities for 2023. *BBC News*. https://www.bbc.com/travel/article/20230725-the-worlds-most-liveable-cities-for-2023

Glaeser, E. L., & Gyourko, J. (2002). The Impact of Zoning on Housing Affordability. *National Bureau of Economic Research Working Paper Series*. https://doi.org/10.3386/w8835

Glaeser, E. L., & Gyourko, J. (2018). The Economic Implications of Housing Supply. *Journal of Economic Perspectives*, *32*(1), 3–30. https://doi.org/10.1257/jep.32.1.3

Glaeser, E. L., Gyourko, J., & Saks, R. (2005). Why Is Manhattan So Expensive? Regulation and the Rise in Housing Prices. *The Journal of Law and Economics*, *48*(2), 331–369. https://doi.org/10.1086/429979

Gold, K. (2020, August 21). Taking a closer look at the legacy of Harland Bartholomew and his plan for Vancouver. *The Globe and Mail*. https://www.theglobeandmail.com/real-estate/vancouver/article-taking-a-closer-look-at-the-legacy-of-harland-bartholomew-and-his-plan/

Gordon, J. (2016). Lunacy in Lotusland. *Inroads*, *39*, 82–94.

Gougeon, A., & Moussouni, O. (2021, October 7). *Residential real estate sales in 2018: The relationship between house prices and incomes*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/46-28-0001/2021002/article/00003-eng.htm

Gyourko, J., & Molloy, R. (2014). *Regulation and Housing Supply*. 78. https://doi.org/10.3386/w20536

Harland Bartholomew and Associates. (1928). *Future Population* [Map]. Vancouver Town Planning Commission; City of Vancouver Archives. https://www.theglobeandmail.com/real-estate/vancouver/article-taking-a-closer-look-at-the-legacy-of-harland-bartholomew-and-his-plan/

Hasegawa, R. (2022, October 5). Vancouver beach becomes makeshift campground amid affordability and housing crisis. *CTV News*. https://bc.ctvnews.ca/vancouver-beach-becomes-makeshift-campground-amid-affordability-and-housing-crisis-1.6097983

Hemingway, A. (2023, August 30). Taxing land wealth for the public good: Provincial policy options. *Policy Note*. https://www.policynote.ca/property-tax-reform/

Hilber, C. A. L., & Vermeulen, W. (2016). The Impact of Supply Constraints on House Prices in England. *The Economic Journal*, *126*(591), 358–405. https://doi.org/10.1111/ecoj.12213

Hirt, S. (2007). The Devil Is in the Definitions. *Journal of the American Planning Association*, *73*(4), 436–450. https://doi.org/10.1080/01944360708978524

Hudes, S. (2023, November 13). *Canadian rent prices hit new high for 6th month in a row: Report*. CBC News. https://www.cbc.ca/news/canada/british-columbia/rental-prices-canada-report-1.7027296

Ivanova, I., & Hemingway, A. (2023, November 15). Affordability crisis will persist until we get a handle on runaway housing costs. *Policy Note*. https://www.policynote.ca/affordability-crisis/

Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House.

Jones, C. E., & Ley, D. (2016). Transit-oriented development and gentrification along Metro Vancouver's low-income SkyTrain corridor: Transit-oriented development. *The Canadian Geographer / Le Géographe Canadien*, *60*(1), 9–22. https://doi.org/10.1111/cag.12256

Kendall, R., & Tulip, P. (2018). The Effect of Zoning on Housing Prices. *Reserve Bank of Australia*, 41.

Lauster, N., & von Bergmann, J. (2020). *City of Vancouver Zoning Maps, 1931-2020* [Map]. UBC Sociology Zoning Project. https://zoning.sociology.ubc.ca/historical/

Lees, K. (2017). *Quantifying the impact of land use regulations: Evidence from New Zealand.* https://thehub.swa.govt.nz/assets/documents/Impact_land_use-fullreport_110717.pdf

Lee-Young, J. (2022, April 19). Vancouver is the third least-affordable city in the world: Survey. *Vancouver Sun*. https://vancouversun.com/news/local-news/vancouver-third-least-affordable-city-demographia

Lens, M. C. (2022). Zoning, Land Use, and the Reproduction of Urban Inequality. *Annual Review of Sociology*, *48*(1), 421–439. https://doi.org/10.1146/annurev-soc-030420-122027

Lewyn, M. (2016, October 30). Collective Action Problems Are Similar For Land Use And Schools. *Market Urbanism*. https://marketurbanism.com/2016/10/30/collective-action-problems/

Ley, D. (2017). Global China and the making of Vancouver's residential property market. *International Journal of Housing Policy*, *17*(1), 15–34. https://doi.org/10.1080/14616718.2015.1119776

Little, S. (2023a, November 1). B.C. legislation would legalize small-scale multi-family homes provincewide. *Global News*. https://globalnews.ca/news/10064203/multi-unit-zoning-ndp-legislation/

Little, S. (2023b, November 8). New B.C. law would force cities to allow density near transit hubs. *Global News*. https://globalnews.ca/news/10079416/bc-transit-hub-housing-law/

Lloyd, M. (2023, November). Dismal attitudes toward Metro Vancouver homeownership, but glimmers of hope. *CityNews Vancouver*. https://vancouver.citynews.ca/2023/11/17/metro-vancouver-housing-attitudes-study/

Loh, T. H., Terplan, E., & Rowlands, D. W. (2023, April 27). Myths about converting offices into housing—And what can really revitalize downtowns. *Brookings*. https://www.brookings.edu/articles/myths-about-converting-offices-into-housing-and-what-can-really-revitalize-downtowns/

Lucas, J. (2022). Do "Non-Partisan" Municipal Politicians Match the Partisanship of Their Constituents? *Urban Affairs Review*, *58*(1), 103–128. https://doi.org/10.1177/1078087420958074

Mackie, J. (2023, October 15). Beloved Vancouver corner store Union Market to close after three decades. *Vancouver Sun*. https://vancouversun.com/news/local-news/beloved-union-market-corner-store-to-close-after-three-decades

Manville, M., Monkkonen, P., & Lens, M. (2020). It's Time to End Single-Family Zoning. *Journal of the American Planning Association*, *86*(1), 106–112. https://doi.org/10.1080/01944363.2019.1651216

Mark, J. H., & Goldberg, M. A. (1981). Land use Controls: The Case of Zoning in the Vancouver Area. *Real Estate Economics*, *9*(4), 418–435. https://doi.org/10.1111/1540-6229.00252

Mark, J. H., & Goldberg, M. A. (1986). A study of the impacts of zoning on housing values over time. *Journal of Urban Economics*, *20*(3), 257–273. https://doi.org/10.1016/0094-1190(86)90019-7

Marshall Valuation Service. (2018). Marshall & Swift. https://www.boe.ca.gov/CountyPortal/Training/Uploads/Course%20002B/Class%20Materials/Marshall%20and%20Swift/Marshall%20&%20Swift.pdf

McElroy, J. (2016). One chart shows how unprecedented Vancouver's real estate situation is. *Global News*. https://globalnews.ca/news/2531266/one-chart-shows-how-unprecedented-vancouvers-real-estate-situation-is/

McLean, S. (2020, December 17). Oxford begins building two-storey Burnaby industrial facility. *Real Estate News Exchange*. https://renx.ca/oxford-begins-building-two-storey-burnaby-industrial-facility

Metcalfe, B. (2023, November 2). *Report recommends City of Nelson get into housing business*. Nelson Star. https://www.nelsonstar.com/local-news/report-recommends-city-of-nelson-get-into-housing-business-6831204

Millsap, A. A. (2023). New Studies Provide Further Evidence That Zoning Reforms Work. *Forbes*. https://www.forbes.com/sites/adammillsap/2023/08/28/new-studies-provide-further-evidence-that-zoning-reforms-work/

Minifie, J., Chisholm, C., & Percival, L. (2017). *Competition in Australia: Too little of a good thing?* (2017–12). Grattan Institute. https://grattan.edu.au/wp-content/uploads/2017/12/895-Competition-in-Australia-Too-little-of-a-good-thing-.pdf

Murray, C., & Limb, M. (2020). *We zoned for density and got higher house prices: Supply and price effects of upzoning over 20 years*. https://doi.org/10.31219/osf.io/zkt7v

National Household Survey. (2021). *Homeownership and Shelter Costs in Canada* (99-014-X2011002). Statistics Canada. https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-014-x/99-014-x2011002-eng.cfm

Office of the Premier. (2023, November 1). *More small-scale, multi-unit homes coming to B.C., zoning barriers removed*. BC Government News. https://news.gov.bc.ca/releases/2023PREM0062-001706

Olsen, A. (2024, January 2). We can't just build our way out of the housing crisis. *Canada's National Observer*.

https://www.nationalobserver.com/2023/12/28/opinion/build-housing-crisis-private-sector-CMHC

Penner, D. (2023, December 25). Analysis: B.C.'s new housing density only one factor in building more homes. *Vancouver Sun*. https://vancouversun.com/business/real-estate/analysis-bc-new-housing-density-only-one-factor-in-building-more-homes

Pettit, B. A. (1993). *Zoning and the single-family landscape: Large new houses and neighbourhood change in Vancouver* [University of British Columbia]. https://doi.org/10.14288/1.0086386

PIBC Announces Winners of 2023 Awards for Excellence in Planning. (2023, June 1). Planning Institute of British Columbia. https://www.pibc.bc.ca/sites/default/files/internal_pages_pdfs/awards/PIBC2023-Award-Winners-NewsRelease-FINAL.pdf

Pogodzinski, J. M., & Sass, T. R. (1990). The Economic Theory of Zoning: A Critical Review. *Land Economics*, *66*(3), 294. https://doi.org/10.2307/3146731

Pogodzinski, J. M., & Sass, T. R. (1991). Measuring the Effects of Municipal Zoning Regulations: A Survey. *Urban Studies*, *28*(4), 597–621.

Rajagopal, B. (2023). *Report of the Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context*. United Nations General Assembly. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N23/240/69/PDF/N2324069.pdf?OpenElement

Real Estate Foundation of BC, & Vancouver Foundation. (2014, September 29). BC Public Opinion Study Shows Strong Support for Local Farmland. *Real Estate Foundation of BC*. https://refbc.ca/bc-public-opinion-study-shows-strong-support-local-farmland/

Regulatory Changes to Accessible Parking Requirements. (2018). BC Building and Safety Standards Branch. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/bulletins/b18-09_accessible_parking_requirements_bulletin.pdf

Shen, N. (2023, December 9). Time's up for some short-term rentals in B.C. as new housing rules look set to transform scene. *CBC News*. https://www.cbc.ca/news/canada/british-columbia/airbnb-bc-housing-1.7053382

Silver, C. (1991). The racial origins of zoning: Southern cities from 1910–40. *Planning Perspectives*, *6*(2), 189–205. https://doi.org/10.1080/02665439108725726

Smith, S. (2016, June 1). Canadian firm drags world's real estate players into the future. *The Globe and Mail*. https://www.theglobeandmail.com/report-on-business/economy/growth/canadian-firm-drags-worlds-real-estate-players-into-the-future/article30010828/

Spalteholz, L. (2019, November 29). Here's How Unaffordable Victoria Really Is. *Capital Daily*. https://www.capitaldaily.ca/news/victoria-unaffordable-house-hunt-real-estate

Stokes, D. (2021, November 10). Canada's unhinged housing market, captured in one chart. *National Post*. https://nationalpost.com/news/canada/canadas-unhinged-housing-market-captured-in-one-chart

Sullivan, P. (2018). *Addicted to taxes: Government fees represent 26 per cent of new home price*. Urban Development Institute. https://udi.bc.ca/wp-content/uploads/2018/05/Real-Estate-Fees-and-Taxes-Media-Release-Final.pdf

Talen, E. (2012). Zoning and Diversity in Historical Perspective. *Journal of Planning History*, *11*(4), 330–347. https://doi.org/10.1177/1538513212444566

Targets released for 10 municipalities to deliver more homes for people. (2023, September 26). *BC Gov News*. https://news.gov.bc.ca/releases/2023HOUS0123-001505

Todd, D., & Hein, S. (2023, September 11). Douglas Todd: How to really change zoning to increase housing affordability. *Vancouver Sun*. https://vancouversun.com/opinion/columnists/douglas-todd-how-to-really-change-zoning-to-increase-housing-affordability

Village of Euclid v. Ambler Realty Co., 272 U.S. 365. (1926).

Wegmann, J. (2020). Death to Single-Family Zoning…and New Life to the Missing Middle. *Journal of the American Planning Association*, *86*(1), 113–119. https://doi.org/10.1080/01944363.2019.1651217

Whitnall, G. (1931). History of Zoning. *Annals of the American Academy of Political and Social Science*, *155*(2), 1–14. https://doi.org/10.1177/000271623115500202

Wilson, C. (2023a, May 2). Vancouver ripe for converting office buildings to residences: Avison Young. *Business in Vancouver*. https://biv.com/article/2023/05/vancouver-ripe-converting-office-buildings-residences-avison-young

Wilson, C. (2023b, September 28). Downtown Vancouver office vacancies hit highest level in nearly 20 years: Colliers. *Business in Vancouver*. https://biv.com/article/2023/09/downtown-vancouver-office-vacancies-hit-highest-level-nearly-20-years-colliers

Wilson, E. K. (2016). *The New School Segregation* (SSRN Scholarly Paper 2742328). https://papers.ssrn.com/abstract=2742328

Wilson Van Voorhis, C. R., & Morgan, B. L. (2007). Understanding Power and Rules of Thumb for Determining Sample Sizes. *Tutorials in Quantitative Methods for Psychology*, *3*(2), 43–50. https://doi.org/10.20982/tqmp.03.2.p043

Wood, R. (2017). What Motivated Vancouver's First Zoning Codes? *Abundant Housing Vancouver*. https://www.abundanthousingvancouver.com/vancouvers_first_zoning_code

Yoder, J. (2020). Does Property Ownership Lead to Participation in Local Politics? Evidence from Property Records and Meeting Minutes. *American Political Science Review*, *114*(4), 1213–1229. https://doi.org/10.1017/S0003055420000556

Zeidler, M. (2023, July 2). As housing costs soar, some financial analysts advise to scrap the 30% rule. *CBC News*. https://www.cbc.ca/news/canada/british-columbia/housing-costs-soar-financial-analysts-30-per-cent-rule-1.6894375

Zivo, A., Waldkirch, P., & Lombardi, E. (2023, September 21). Adam Zivo: Vancouver's housing reform is a hollow gesture. *National Post*. https://nationalpost.com/opinion/vancouvers-housing-reform-is-a-hollow-gesture

Appendix A. Sources for Zoning Datasets

To estimate the percentage of land zoned for detached and duplex housing in each city, I downloaded their zoning plans as GIS data, then looked through their zoning bylaws to sort out each zoning designation into single-detached/duplex, multi-family, or non-residential. I calculated the total amount of land in each of the first two categories to arrive at the ratio between them. I excluded agriculturally zoned land, the ALR being beyond a municipality's control. However, I counted "rural residential" zoned land as single-detached, because rural zoning is just single-family zoning with a larger minimum lot size. All other housing types I counted as multi-family, including manufactured home parks. I included "mixed use" designations as multi-family residential, but excluded "comprehensive development" (CD) zones (except in Metro Vancouver, where they were already broken down by specific land-use designation). Although CD zones are increasingly used by municipalities to facilitate higher-density developments, they are also used for single-family subdivisions, industrial land, golf courses, and other unique projects. Therefore, there was too much variation and granularity in the application of CD zones, and to do a site-by-site inspection was beyond the scope of this analysis. In addition, the high degree of control municipalities take over CD sites can negate the flexibility provided by allowing increased housing density.

The data I used for Metro Vancouver municipalities came from the Metro Vancouver Open Data catalogue and was already aggregated into single-detached/duplex and multi-family categories I was able to use. All other zoning datasets came from the respective municipalities' Open Data catalogues or through individual correspondence with municipal staff. I was unable to obtain zoning data from the cities of Fort St. John, Cranbrook, and Port Alberni. Zoning bylaws were downloaded from municipal websites, the most recent version available as of January 2024. While zoning data was available from the City of Victoria, their zoning bylaw was too complex to be usable for this analysis.

Open Data Catalogues:

- City of Abbotsford: https://opendata-abbotsford.hub.arcgis.com/datasets/Abbotsford::zoning/explore
- City of Burnaby: https://data.burnaby.ca/datasets/zoning/explore

- City of Campbell River: https://data-crcc.opendata.arcgis.com/datasets/8fb81d974d4b4a2cb6749a6750258c9f_0/explore?location=50.007663%2C-125.260661%2C13.00
- City of Chilliwack: https://www.chilliwack.com/main/page.cfm?id=2331&odAction=viewItem&odID=169
- City of Coquitlam: https://data.coquitlam.ca/datasets/Coquitlam::zoning-1/explore
- City of Courtenay: https://data-courtenay.opendata.arcgis.com/datasets/Courtenay::zoning-map/explore?location=49.693594%2C-124.981989%2C13.00
- City of Kamloops: https://mydata-kamloops.opendata.arcgis.com/datasets/zoning/explore?location=50.740493%2C-120.286600%2C11.34
- City of Kelowna: https://opendata.kelowna.ca/datasets/kelowna::zoning/explore
- City of Maple Ridge: https://opengov.mapleridge.ca/datasets/mapleridge::zoning-bylaw/explore
- City of Mission: https://map.mission.ca/Html5Viewer/?viewer=External#
- City of Nanaimo: https://www.nanaimo.ca/open-data-catalogue/DataBrowser/nanaimo/Zoning#param=NOFILTER--DataView--Results
- City of Penticton: https://open.penticton.ca/datasets/d6c0def107a44da88fc2dab285ed459b_203/explore
- City of Prince George: https://data-cityofpg.opendata.arcgis.com/datasets/CityofPG::zoning-bylaw-7850-class/explore?location=53.926995%2C-122.751450%2C11.80
- City of Surrey: https://data.surrey.ca/dataset/zoning-boundaries
- City of Vancouver: https://opendata.vancouver.ca/explore/dataset/zoning-districts-and-labels/information/?disjunctive.zoning_classification&disjunctive.zoning_category&disjunctive.zoning_district
- City of Vernon: https://cov-open-data-vernon.hub.arcgis.com/datasets/vernon::vernon-zoning/explore?location=50.235194%2C-119.323667%2C12.14

- City of Victoria: https://opendata.victoria.ca/datasets/VicMap::zoning-boundary/explore?location=48.424472%2C-123.337224%2C12.86
- City of West Kelowna: https://www.westkelownacity.ca/en/building-business-and-development/open-data.aspx
- District of North Cowichan: https://catalogue.data.gov.bc.ca/dataset/north-cowichan-zoning
- District of North Vancouver: https://www.geoweb.dnv.org/data/
- District of Saanich: https://www.saanich.ca/EN/main/local-government/data-catalogue-1.html
- District of West Vancouver: https://mapping.westvancouver.ca/OD/dbo_OPENDATA_FILES_list.php?page=list
- Metro Vancouver Regional District: https://open-data-portal-metrovancouver.hub.arcgis.com/datasets/28de9170a9434974bffc24c1192613101/explore?location=49.257573%2C-123.230365%2C14.05
- Township of Langley: https://data-tol.opendata.arcgis.com/datasets/TOL::zoning/explore

The municipalities of Delta, Highlands, Langford, North Vancouver City, Oak Bay, Pitt Meadows, Port Coquitlam, Richmond, and View Royal do not have open data catalogues with zoning data available. Thanks to Laura Beckett (Highlands), Onkar Buttar (Richmond), Gordon Gillespie (Pitt Meadows), Janusz Krawczynski (Oak Bay), Shawn Miller (Langford), Snead Prasad (Delta), Stirling Scory (View Royal), Khim Thanasack (Port Coquitlam), and Emma Wagner (North Vancouver City) for providing me with zoning data from their respective municipalities.

Appendix B. Sources for Zoning Bylaws

For municipalities in Metro Vancouver, the zoning classification data already included a breakdown of allowable housing types. For other municipalities, I had to consult their zoning bylaws. The zoning bylaws I used are listed below:

Municipal Zoning Bylaw Sources:

City of Cranbrook Zoning Bylaw No. 3977. (2019). City of Cranbrook. https://cranbrook.civicweb.net/filepro/documents/573/

City of Fort St. John Zoning Bylaw No. 2470. (2019). City of Fort St. John. https://www.fortstjohn.ca/assets/Documents/Bylaws/Planning~Development/Zoning-Bylaw.pdf

City of Kelowna Zoning Bylaw No. 12375. (2022). City of Kelowna. https://www.kelowna.ca/homes-building/zoning-land-use/zoning-bylaw

City of Nanaimo Zoning Bylaw 2011 No. 4500. (2011). City of Nanaimo. https://www.nanaimo.ca/bylaws/ViewBylaw/4500.pdf

City of Prince George Zoning Bylaw No. 7850. (2007). City of Prince George. https://www.princegeorge.ca/media/1420#AR1

City of Vernon Zoning Bylaw No. 5000. (2003). City of Vernon. https://www.vernon.ca/homes-building/construction-renovating/zoning-land-use

City of West Kelowna Zoning Bylaw No. 0265. (2022). City of West Kelowna. https://www.westkelownacity.ca/en/city-hall/resources/Documents/B0265-Zoning-Bylaw.pdf

District of Mission Zoning Bylaw 5949-2020. (2020). City of Mission. https://www.mission.ca/wp-content/uploads/Zoning-Bylaw-5949-2020-COMPLETE.pdf

Langford Zoning Bylaw. (1999). City of Langford. https://langford.ca/wp-content/uploads/2020/10/Zoning-Bylaw-20210621.pdf

Zoning Bylaw. (1986). District of Oak Bay. https://www.oakbay.ca/sites/default/files/municipal-services/bylaws/Consolidated%20Zoning%20Bylaw%20as%20of%20May%208%202017.pdf

Zoning Bylaw. (2003). District of Saanich. https://www.saanich.ca/assets/Local~Government/Documents/Planning/zone8200.pdf

Zoning Bylaw 1997, No. 2950. (1997). District of North Cowichan. https://www.northcowichan.ca/media/252

Zoning Bylaw 2020, No. 5000. (2020). City of Chilliwack. https://www.chilliwack.com/main/attachments/Files/377/ZBA%205000%20%2D%20Zoning%20Bylaw%202020%2Epdf

Zoning Bylaw No. 55. (2021). City of Kamloops.

Zoning Bylaw No. 2017-08. (2017). City of Penticton. https://www.penticton.ca/sites/default/files/uploads/bylaws/2017-08%20Zoning%20Bylaw%20-%20Consolidated_3.pdf

Zoning Bylaw No. 2500. (2007). City of Courtenay. https://www.courtenay.ca/assets/Departments/Development~Services/OCP~Update/OCP-DPAs-Zoning~July~2022/Zoning%20Bylaw%202500,%202007%20-May2023.pdf

Zoning Bylaw No. 3250. (2006). City of Campbell River. https://www.campbellriver.ca/docs/default-source/document-library/bylaws/zoning-bylaw-3250-2006-(schedule-a-text).pdf?sfvrsn=fe716508_48

Zoning Bylaw No. 5074. (2023). City of Port Alberni. https://www.portalberni.ca/sites/default/files/users/cfoden/Port%20Alberni%20Zoning%20Bylaw%205074%20-%202023.pdf

Zoning Regulation Bylaw. (2019). City of Victoria. https://www.victoria.ca/building-business/permits-development-construction/zoning/zoning-regulation-bylaw

Appendix C. Regression Results

Table C.1. Adjusted R-squared values for each regression.

	2016	2017	2018	2019	2020	2021	2022
Abbotsford	0.71	0.72	0.70	0.74	0.72	0.66	
Burnaby	0.45	0.58	0.66	0.71	0.72	0.68	0.66
Campbell River	0.79	0.81	0.76	0.82	0.78	0.73	
Chilliwack	0.79	0.77	0.76	0.78	0.79	0.73	
Coquitlam	0.67	0.59	0.72	0.77	0.77	0.68	0.65
Courtenay	0.87	0.84	0.80	0.89	0.86	0.84	
Cranbrook	0.82	0.87	0.78	0.81	0.83	0.85	
Delta	0.65	0.52	0.59	0.60	0.70	0.60	0.51
Fort St. John						0.85	
Kamloops	0.82	0.83	0.83	0.80	0.77	0.77	
Kelowna	0.82	0.83	0.81	0.79	0.83	0.81	
Langford	0.86	0.84	0.91	0.88	0.79	0.75	
Langley Township	0.79	0.77	0.82	0.74	0.83	0.88	0.71
Maple Ridge	0.74	0.70	0.81	0.85	0.82	0.70	0.54
Mission	0.75	0.79	0.75	0.79	0.78	0.67	
Nanaimo	0.80	0.82	0.79	0.81	0.77	0.77	
North Cowichan	0.78	0.76	0.80	0.78	0.79	0.69	
North Vancouver District	0.61	0.59	0.64	0.80	0.77	0.74	0.73
Oak Bay	0.70	0.77	0.71	0.75	0.79	0.77	
Penticton	0.78	0.76	0.76	0.73	0.81	0.80	
Port Alberni	0.76	0.78	0.70	0.67	0.72	0.68	
Prince George	0.77	0.76	0.74	0.80	0.72	0.75	
Richmond	0.62	0.68	0.82	0.81	0.86	0.77	0.80
Saanich	0.75	0.73	0.73	0.79	0.79	0.73	
Surrey	0.79	0.76	0.77	0.76	0.77	0.73	0.63
Vancouver	0.86	0.85	0.82	0.87	0.87	0.86	0.85
Vernon	0.84	0.84	0.84	0.87	0.87	0.81	
Victoria	0.73	0.72	0.70	0.76	0.79	0.78	
West Kelowna	0.84	0.82	0.83	0.81	0.82	0.86	
West Vancouver	0.61	0.67	0.68	0.78	0.75	0.75	0.74
Greater Victoria	0.86	0.84	0.85	0.88	0.86	0.86	
Metro Vancouver	0.88	0.86	0.86	0.88	0.88	0.82	0.78

Table C.2. Log land area coefficients for each regression.

	2016	2017	2018	2019	2020	2021	2022
Abbotsford	0.1707	0.1825	0.2247	0.1993	0.1832	0.2101	
Burnaby	0.2577	0.2668	0.3165	0.2585	0.2709	0.3020	0.2494
Campbell River	0.1821	0.1912	0.2111	0.1739	0.1916	0.1880	
Chilliwack	0.1566	0.1625	0.1425	0.2277	0.1647	0.1661	
Coquitlam	0.2351	0.2621	0.1919	0.2211	0.2268	0.2669	0.2448
Courtenay	0.2310	0.1435	0.1732	0.1152	0.1885	0.1436	
Cranbrook	0.1178	0.1662	0.1428	0.1907	0.1495	0.1559	
Delta	0.1928	0.2129	0.2465	0.2193	0.1478	0.2431	0.2220
Fort St. John						0.2047	
Kamloops	0.1506	0.1265	0.1255	0.1351	0.1012	0.1625	
Kelowna	0.1713	0.1541	0.1680	0.1603	0.1421	0.1862	
Langford	0.1531	0.0852	0.1361	0.1367	0.1297	0.1698	
Langley Township	0.2802	0.2934	0.3388	0.3536	0.2824	0.3633	0.3232
Maple Ridge	0.1589	0.1603	0.1525	0.1602	0.1942	0.1835	0.1858
Mission	0.1524	0.1749	0.1826	0.1463	0.2043	0.1971	
Nanaimo	0.1494	0.1225	0.1730	0.1396	0.1358	0.1664	
North Cowichan	0.1312	0.1401	0.1077	0.1409	0.1431	0.1095	
North Vancouver District	0.1846	0.1723	0.2156	0.1521	0.1269	0.1633	0.1951
Oak Bay	0.2527	0.3752	0.2944	0.2631	0.2409	0.2573	
Penticton	0.1365	0.1445	0.1400	0.2046	0.1207	0.2225	
Port Alberni	0.2100	0.1892	0.2243	0.1166	0.1996	0.1637	
Prince George	0.1172	0.0996	0.0761	0.0969	0.0691	0.1540	
Richmond	0.4322	0.4542	0.4201	0.3609	0.3595	0.3271	0.3294
Saanich	0.1163	0.1623	0.1692	0.1402	0.1566	0.1572	
Surrey	0.2646	0.3108	0.3232	0.2780	0.2862	0.3059	0.2639
Vancouver	0.5060	0.4912	0.4984	0.4972	0.5014	0.4965	0.4903
Vernon	0.1036	0.1138	0.1253	0.0798	0.1475	0.1668	
Victoria	0.1582	0.1851	0.2029	0.0718	0.2154	0.1703	
West Kelowna	0.0917	0.1121	0.1356	0.0887	0.0473	0.1190	
West Vancouver	0.0920	0.1606	0.0634	0.1261	0.0609	0.1223	0.1406
Greater Victoria	0.1270	0.1314	0.1605	0.1556	0.1670	0.1317	
Metro Vancouver	0.2584	0.2885	0.3062	0.2960	0.2945	0.3118	0.3119

Table C.3. Log land area *P* values for each regression.

	2016	2017	2018	2019	2020	2021	2022
Abbotsford	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Burnaby	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Campbell River	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Chilliwack	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Coquitlam	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Courtenay	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Cranbrook	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Delta	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fort St. John						<0.001	
Kamloops	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Kelowna	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Langford	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Langley Township	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Maple Ridge	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mission	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Nanaimo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
North Cowichan	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
North Vancouver District	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Oak Bay	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Penticton	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Port Alberni	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Prince George	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Richmond	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Saanich	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Surrey	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vancouver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vernon	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Victoria	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
West Kelowna	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	
West Vancouver	0.002	<0.001	0.184	<0.001	0.072	<0.001	<0.001
Greater Victoria	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Metro Vancouver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Appendix D. Sample Regression Summary

Data: Prince George, 2022

Table D.1. Residuals:

Minimum	1st quartile	Median	3rd quartile	Maximum
-1.45020	-0.08213	0.00511	0.08902	0.67271

Table D.2. Coefficients:

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	7.803827	0.19252	40.53505	4.29E-236
log(LAND_AREA)	0.153979	0.012767	12.06113	6.78E-32
log(TOTAL_FINISHED_AREA + 1)	0.369495	0.026311	14.04322	6.24E-42
log(BASEMENT_FINISH_AREA + 1)	-0.00656	0.003189	-2.05631	0.039944
log(DECK_SQ_FOOTAGE + 1)	0.003039	0.001891	1.607265	0.108229
NUM_BEDROOMS	0.008194	0.005565	1.472565	0.1411
POOL	0.113873	0.05382	2.115821	0.034542
SCENIC_VIEW	0.043373	0.07992	0.542707	0.58742
Q_1	0.083118	0.014255	5.830843	6.88E-09
Q_2	0.0892	0.014344	6.218534	6.67E-10
Q_3	0.084773	0.014992	5.654389	1.90E-08
DECADE_BUILT_1910	-0.33735	0.122662	-2.75021	0.006035
DECADE_BUILT_1920	-0.16266	0.071194	-2.2848	0.022478
DECADE_BUILT_1930	-0.33	0.089332	-3.69406	0.000229
DECADE_BUILT_1940	-0.41606	0.044586	-9.33172	4.10E-20
DECADE_BUILT_1950	-0.38533	0.033937	-11.3542	1.32E-28
DECADE_BUILT_1960	-0.35035	0.029335	-11.9431	2.46E-31
DECADE_BUILT_1970	-0.29503	0.027699	-10.6515	1.69E-25
DECADE_BUILT_1980	-0.23897	0.029614	-8.06949	1.54E-15
DECADE_BUILT_1990	-0.11714	0.027087	-4.32446	1.64E-05
DECADE_BUILT_2000	-0.00982	0.030913	-0.31775	0.750725
DECADE_BUILT_2010	0.124259	0.028171	4.410815	1.11E-05
NEIGHBOURHOOD_CODE_226120	-0.10415	0.060242	-1.72884	0.084065
NEIGHBOURHOOD_CODE_226251	-0.01853	0.104256	-0.1777	0.858988
NEIGHBOURHOOD_CODE_226252	-0.05653	0.037688	-1.49994	0.133862
NEIGHBOURHOOD_CODE_226253	-0.07601	0.130162	-0.58396	0.559345
NEIGHBOURHOOD_CODE_226254	-0.03497	0.042289	-0.82701	0.408377
NEIGHBOURHOOD_CODE_226255	-0.14165	0.051158	-2.76895	0.0057
NEIGHBOURHOOD_CODE_226256	0.112452	0.036886	3.048619	0.002343
NEIGHBOURHOOD_CODE_226257	0.06214	0.039295	1.581367	0.114027
NEIGHBOURHOOD_CODE_226258	0.09419	0.04012	2.347711	0.019032
NEIGHBOURHOOD_CODE_226711	0.13377	0.071141	1.880363	0.060273
NEIGHBOURHOOD_CODE_226713	0.102277	0.039876	2.564915	0.010427
NEIGHBOURHOOD_CODE_226715	0.106749	0.040442	2.639564	0.008396
NEIGHBOURHOOD_CODE_226716	0.092732	0.037428	2.477602	0.013348
NEIGHBOURHOOD_CODE_226731	0.072408	0.044843	1.614695	0.106609

NEIGHBOURHOOD_CODE_226732	0.124577	0.046894	2.656536	0.007987
NEIGHBOURHOOD_CODE_226734	-0.15704	0.044684	-3.51443	0.000455
NEIGHBOURHOOD_CODE_226735	-0.12082	0.05604	-2.15588	0.031268
NEIGHBOURHOOD_CODE_226736	0.040833	0.043711	0.934141	0.350397
NEIGHBOURHOOD_CODE_226737	0.056698	0.039719	1.427474	0.153673
ACTUAL_USE_DESCRIPTION_Duplex_ Non_Strata_Side_by_Side_or_Front_Back	0.137018	0.069485	1.971927	0.048821
ACTUAL_USE_DESCRIPTION_Duplex_ Strata_Side_by_Side	-0.01737	0.135893	-0.12785	0.898284
ACTUAL_USE_DESCRIPTION_ Fourplex	0.606687	0.182521	3.323933	0.000911
ACTUAL_USE_DESCRIPTION_ Residential_Dwelling_with_Suite	0.046777	0.065953	0.709245	0.478294
ACTUAL_USE_DESCRIPTION_Single_ Family_Dwelling	0.010536	0.066229	0.159087	0.873624
CONVEYANCE_TYPE_4	1.490127	0.087842	16.9638	1.09E-58
CONVEYANCE_TYPE_7	1.409564	0.044335	31.79362	2.82E-166

Residual standard error: 0.1647 on 1358 DF

Multiple R-squared: 0.7623, adjusted R-squared: 0.754

This regression, like all 197 others, predicted sale price from all other variables using a log-log formulation. The first four variables after the intercept in Table 7b are all spatial variables, and are therefore log-transformed as described in Section 5.1. For the latter three of these, I added 1 to each of their values before log-transforming them so that zeroes in the data did not disrupt the log-transformation. All variables after the SCENIC_VIEW variable are dummies. The amount of dummy variables varied between cities. For example, all of the NEIGHBOURHOOD_CODE dummies shown in Table 7b represent different neighbourhoods in the city of Prince George. A different municipality would have more or fewer neighbourhood dummy variables depending on how many neighbourhoods it has, as counted by BC Assessment. The Q variables represent the quarter of sale (Q_4 serving as a baseline). The ACTUAL_USE_DESCRIPTION variable refers to the dwelling type (e.g. single family dwelling), and the CONVEYANCE_TYPE refers to whether a transaction is for single or multiple properties, and whether the properties are improved or vacant.

It is worth noting that the regression for Prince George, 2022 has some statistically significant predictor variables (primarily land area, finished area, quarter of sale, decade built, and conveyance type) and some variables that do not add significant predictive power to the model. This is true for all regressions I performed, with each regression having a different set of statistically significant predictors. This situation was a necessary

by-product of using the same set of variables for 198 different regressions. In order to ensure that model over-fitting was not distorting my estimate of the land area variable's coefficient (the only important result from the regression), I took several of my regressions and compared them with regressions of the same data subsets with only statistically significant predictor variables. The land area coefficient was unchanged in each case. Therefore, I do not believe that the inclusion of statistically insignificant predictor variables adversely affected my calculation of the marginal value of land, and my subsequent calculation of the zoning effect.