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Gentrification and Cultural Capital: The Mural Art Program of Montréal City and Its Effect on Rent

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Abstract

The phenomenon of gentrification is observable in many urban centres in which it evolves due to multiple factors, one of which being the perceived attractiveness of neighbourhoods, as posited by literature on urban development. In 2007, the City of Montréal launched the Mural Art Program, a project subsidising the creation of art murals across neighbourhoods in the city with the objective of promoting access to art and culture, encouraging citizen engagement in improving their surroundings, maintaining and beautifying the city, and supporting and showcasing artistic creation. Over the years, Montréal has also been experiencing documented changes associated with the gentrification of particular neighbourhoods. This paper examines the effect of the publicly funded Mural Art Program on rent prices across neighbourhoods in the city of Montréal between 2010 and 2019. We find a significant yet minute effect of an approximately 0.13-percent increase in rent prices in a neighbourhood per mural unit accumulated. A 1-percent increase in mural stock is associated with an approximately 0.023-percent significant increase in rent prices. The positive effect is accompanied by a trend toward negative coefficients for the effect of receiving a first mural from the Program on rent prices for eventually treated neighbourhoods. This raises questions on the initial and subsequent objectives of the Program and on the criteria considered when choosing which neighbourhoods should be rolled into the project.

Keywords: Gentrification; Urban renewal; Art Initiatives; Rental Markets; Urban murals

JEL: R21, R31, R58, Z18, Z11

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Contents

I. Introduction

Gentrification, a term first defined by sociologist Ruth Glass (1964) when describing changes to the residential composition of London's inner city following private investors' acquisition of property, has, in the 21:st century, been used to explain patterns of low-income residential displacement as a result of both public and private investments in renewal projects of selected urban areas (Shaw, 2008). Today, gentrification is highlighted in the media as a global phenomenon ongoing in multiple parts of the world, with similar outcomes across cities such as New York, Berlin, Sydney, etc. (Lees et al. 2015; Shin, 2018).

An increase in perceived attractiveness of selected neighbourhoods in metropolitan cities causes an increase in property investment, spilling over into observed displacement of low-income residents and changes to neighbourhood aesthetics. (Shaw 2008; Hammel, 2009). Renovations and investments in businesses by private investors are made and steered towards higher-income residents, increasing rent prices and fuelling the gentrification process (Shaw 2008; Lees & Ley, 2008; Lees, 2016).

Publicly funded urban renewal programs have been researched in the context of gentrification, examined as drivers attracting private investment and capital into neighbourhoods with mainly low-income residents. A handful of studies show how policymaking targeting expansion of green areas, public transit systems, cycling lanes or aesthetics in low-income neighbourhoods can increase the risk of gentrification, or have a direct effect on neighbourhood composition (Chen et al., 2023; Gorjian, 2025; Kiani et al., 2024; Ezvan, 2025).

Literature has further focused on the role of art and aesthetics in attracting private capital to gentrifying areas. Building on Bourdieu's (1991) theory of cultural capital, studies argue for how possession and a high density of cultural capital may contribute to increasing a neighbourhood's perceived attractiveness and economic value (Seldin, 2025; Ley, 2003; Bridge, 2001a, 2001b; Cameron & Coaffee, 2005).

In this paper, we examine the effect the publicly funded Mural Art Program has had on rent prices across neighbourhoods in the city of Montréal between the years 2010 and 2019 through two strategies. First, our main specification is built as an OLS regression with a continuous measure of mural accumulation at the neighbourhood level as the independent variable. We observe rent price as the outcome variable, while accounting for neighbourhood, time and apartment type fixed effects. Second, as our identification strategy, we exploit the variation in the time each neighbourhood has received its first mural as part of the Program to build a staggered difference-in-differences design showcasing the effect of this first mural as treatment on a neighbourhood's rent prices. Our regressions include a set of control variables to account for time-variant characteristics of neighbourhoods. We perform a series of robustness checks for heterogeneity in the treatment effect.

On the one hand, we find that neighbourhoods with a larger mural stock have significantly higher rent prices. An additional mural installed in an area is suggestive of an approximately 0.13-percent increase in rent in that same area, an effect of very low magnitude when contextualised. A subsequent robustness test using the logarithmic transformation of the mural stock as the

independent variable reveals the likely non-linearity of the relationship of interest. A 1-percent increase in mural stock is associated with an approximately 0.023-percent significant increase in rent prices. In other words, a neighbourhood with one mural receiving an additional one would experience rent prices increasing by 2.3 percent, whereas the next mural in a neighbourhood with 10 already would only be linked to rent prices increasing by 0.23 percent.

On the other hand, our staggered DiD event study shows no significant effect post-treatment for the neighbourhoods having received at least one mural. Interestingly, we note systematically negative and downward-sloping coefficients after a neighbourhood has received its first mural, suggesting that rent prices would be driven down by the treatment, which steers away from previous literature, on top of being counterintuitive. Nonetheless, we attempt to dissect the effect by dividing treated areas into two arms based on the intensity of their exposure to murals. We find that the negative trend seems to be driven by neighbourhoods that have a low stock of murals at the end of our observation period. In parallel, we notice that the neighbourhoods having "many" murals are often among the ones having been treated the earliest by the Program.

We propose that these areas, mentioned in previous literature as having undergone major urban projects (Walks & Maaranen, 2008; Jolivet & Reiser, 2022; Maltais & Belanger, 2021; Laberge, 2025), might already have been in a gentrification process when their first mural was installed. This would explain their following of a different trajectory in the evolution of their rent prices in response to the treatment compared to neighbourhoods with fewer murals. Furthermore, we hypothesise a change in the rationale driving the choice of areas targeted by the Program over time. Hence, the implications of our event study results are not entirely conclusive.

We find, from our additional robustness checks, that the density of murals in a neighbourhood is also significantly linked to rent increases. Additionally, there appears to be no significant heterogeneity in the effect with regard to apartment types. Despite limitations in our sample due to the scope of our research and the availability of data at the neighbourhood level, among others, we find useful estimates in helping analyse gentrification trends in Montréal from a new angle.

As part of the City of Montréal's aim to 'improve quality of living environments' (City of Montréal, 2026), its Mural Art Program serves as a medium to examine if changes in neighbourhood aesthetics attract an influx of economic capital, spilling over into changes in neighbourhood composition. Linking to Bourdieu's theory of cultural capital (Bourdieu, 1986) and existing literature on how art drives perceived attractiveness of neighbourhoods (Cameron & Coaffee, 2005), this study adds to research on how publicly funded urban renewal projects may cause changes in social demographics through an indirect increase in economic value.

The rest of the paper is organized as follows: Section II presents the context of our research question and previous literature related to the topic, Section III provides an overview of our methodology in procuring data, Section IV describes our strategy for the econometric analysis of our question, Section V presents our results and subsequent robustness checks, Section VI gathers our interpretation of the results we obtained in relation to previous literature, and Section VII provides a summary of the paper and concluding thoughts on potential future research.

II. Background

A. Gentrification in Montréal

Gentrification in the city of Montréal has been documented both in causality of great, publicly funded urban renewal projects, as well an increase in private property investment following globalisation trends (Walks & Maaranen, 2008; Laberge, 2025; Paré, 2021; Fauveaud et al., 2021) Discourse has focused on how neighbourhoods having undergone deindustrialisation and urban reconstruction increase their risk of being exposed to gentrification, or see a direct rise in housing costs as a result. (Maltais & Bélanger, 2021; Laberge, 2025). Changes in social demographics as a result of globalisation and diversification have also been highlighted as contributing to gentrifying neighbourhoods of Montréal traditionally occupied by French-Canadian working classes. (Paré, 2021; Laberge, 2025).

Research generally mentions neighbourhoods Parc-Extension, Hochelaga-Maisonneuve, Verdun and Sud-Ouest as key areas having undergone gentrification, following the Lachine canal revitalisation project (1997 – 2002), the MIL campus project and globalisation causing social migration (Jolivet & Reiser, 2022; Maltais & Belanger, 2021; Laberge, 2025), see Appendix 1 for visual representation of the mentioned areas on the Montréal city map. Studies build on the theory of how urban development strategies can cause displacement of residents and increase house prices (Smith, 2002; Slater, 2004), resulting in numerous papers examining public policy as a driver of gentrification in Montréal (Jolivet & Reiser, 2022; Paré, 2021; Maltais & Bélanger, 2021; Kiani et al., 2024; Ezvan, 2025). Notable outcomes show how increases in median income, in parallel with increases in the share of residents with a higher-level education, have changed the social composition of residents at the neighbourhood level for the aforementioned areas, which have been the targets of urban renewal projects (Laberge, 2025).

The Government of Canada has further developed a map-based gentrification tool, "GENUINE", for modelling the unintended consequences urban renewal can have in metropolitan cities across the country, arguing for precautions and measures needed before installation of green areas or transit systems to avoid amplifying gentrification trends (Government of Canada, 2021). As it is in the Government of Canada's interest to improve both aesthetics and quality of life in the country's metropolitan cities – including Montréal, policymaking enabling such improvement should consider potential adverse effects (Government of Canada, 2021).

B. The Montréal Mural Art Program

In this context, we wish to draw attention to the publicly funded Mural Art Program, driven by the City of Montréal since 2007. The Murals Art Program aims to improve the quality of living environments, promote access to art and culture, encourage citizen engagement in improving their surroundings, maintain and beautify the city and support and showcase artistic creation. (City of Montréal, 2026). Since 2007, the City of Montréal has subsidised and funded art-led initiatives through installations of murals on public as well as private walls, see Appendix 2 for visual examples of artworks. Individual artists, as well as selected partner organisations, have been supported to finance the creation of public murals. (City of Montréal, 2026)

Three projects with similar outcomes in terms of installation of murals have been led: the Graffiti and Murals program (2007 – 2014), the Mural Art Pilot Project (2014 – 2015) and the Mural Art Program (2016 -). Although all projects share the same aim of "beautifying the city", the "Graffiti and Murals" program (2007 – 2014) was initially a state-led project aiming at preventing undesired graffiti from being painted on the city's public and private walls. The following "Mural Art Pilot Project" (2014 – 2015) is specified by the city to have contributed to "enriching the city's artistic heritage", besides also supporting local artistic creation. All murals installed between 2007 and 2015 through the two earlier projects were absorbed into the ongoing Mural Art Program (2016 -today) and can be tracked, as well as visualised, through data made public by the City of Montréal online (City of Montréal, 2026).

For one, the Mural Art Program's aim to improve the aesthetics of public spaces may raise concerns regarding possible adverse effects on population health and prosperity by causing displacement through similar channels as previous urban renewal processes have been argued to do (Maltais & Bélanger, 2021; Laberge, 2025; Kiani et al., 2024; Ezvan, 2025; Youngbloom et al., 2023; Government of Canada, 2021). For another, the program essentially aims to enrich Montréal's cultural capital, which may also increase the economic value of selected areas, causing a similar effect on housing costs as previous research associates with gentrification trends (Seldin, 2025; Ley, 2003; Bridge, 2001a, 2001b).

C. The Role of Cultural Capital in Increasing Economic Value

Research on the role art has played in revitalising degraded areas of a city (Zukin, 1982; Deutsche & Ryan, 1984; Sorkin, 1992) and how it has been instrumentalised through public policy as a tool for economic recovery in urban areas affected by deindustrialisation, (Bianchini and Parkinson, 1993; Evans, 2001) build on the idea presented by Pierre Bourdieu, (1991) regarding art's ability to attract political, economic and social attention (Bourdieu, 1986; 1991). Showcasing specific types of art or art spaces publicly has been, since the 1980's, considered a strategy for cities to gain more attention, attraction and investment globally, following 'capital of culture' trends which catalysed a need for cities to differentiate themselves when competing for foreign investment (Zukin, 1982; Seldin, 2017, 2025; Ley, 2003).

Contemporary studies look at how art-driven initiatives within urban renewal projects affect the property value of targeted areas through increasing what Bourdieu refers to as the 'time-space' definition of cultural capital (Bourdieu, 1991; Seldin, 2025; Ley, 2003; Bridge, 2001). In particular, literature has studied how such initiatives may accelerate the gentrification process in a city through channels of increased rental prices, public discourse regarding perceived attractiveness and changes in the composition of social demographics. (Seldin, 2025; Cameron & Coaffee, 2005; Grodach et al., 2014; Butler & Robson, 2001). Case studies in settings ranging from construction sites in Berlin (Seldin, 2025) to comparative studies of metropolitan areas in the U.S. (Grodach et al., 2014) show similar outcomes with regard to the effects public and commercial art initiatives can have on gentrification indicators.

Further notable research on the topic discusses the role artists themselves play in catalysing gentrification, by being the first group of migrants into low-income areas (Ley, 2003). Theoretical discussions raised based on observations of qualitative data and existing literature (Zukin, 1982;

Bourdieu 1986, 1991) argue for how increasing diversity, cultural life and walkability in a neighbourhood can attract certain types of middle-class households into an area, which further results in increasing attractiveness on housing markets, as well as investments in property traditionally associated with gentrification outcomes (Bridge, 2001; Butler & Robson 2001). Studies argue that "*first-stage gentrifiers*" (Bridge, 2001): artists and a subset of middle-class households (Ley, 2003; Bridge, 2001) choose to move to selected neighbourhoods if their perceived characteristics in terms of urban development are moving in the direction of aforementioned lifestyle preferences. With regards to literature examining how art-led public policies can result in increased rent and displacement of low-income residents (Seldin, 2025; Cameron & Coaffee, 2005; Grodach et al., 2014), this additional theoretical research further provides arguments for how such publicly led "cultural projects" can attract the interest of a subset of gentrifiers (Ley, 2003; Bridge, 2001).

D. Review of Methodology

Modern research on gentrification currently falls short of a clear consensus for measuring gentrification as an outcome of private or public investments. Different measures have been developed to fit frameworks which narrow down specific outcomes within the gentrification pipeline, all showing some overlap between defined outcomes. Notable examples include the Ding & Hwang (2016), Freeman & Cheyne (2008) or Grube-Cavers & Patterson (2015) measures, tracking credit-score and median income changes, a simultaneous increase in residents of higher-education and housing prices, respectively average monthly rent, family income, percentage of degree holders, percentage of owner-occupied dwellings and percentage of people in professional occupations all increased following similar patterns as an indicator of gentrification (Ding & Hwang, 2016; Freeman & Cheyne, 2008; Grube-Cavers & Patterson, 2015). Indexes building on population, education, race, income, in-migrants, employment status, housing prices, rent prices, and density factors (Chen et al., 2023; Freeman, 2005) have also been used to measure gentrification.

For studies on how increases in cultural capital through public and private funding of art can accelerate gentrification processes, research has mainly attempted to link theory of "art-led gentrification" (Zukin, 1982; Bianchini and Parkinson, 1993; Evans, 2001) to existing discourse and qualitative data, resulting in mainly literature studies being produced on the topic (Seldin, 2025; Cameron & Coaffee, 2005; Grodach et al., 2014; Ley, 2003; Bridge, 2002). As specified by some scholars within the field (Grodach et al., 2014; Butler & Robson, 2001), the contemporary lack of data showing a *statistical* relationship between an increase in cultural capital and an observed effect on property values creates an opportunity for us to contribute to this field with such a correlation. Our contribution provides an econometric method of analysing the effects policies regarding art-led initiatives can have on residents in targeted areas, acting further as relevant literature for governments to consider when installing urban renewal programs in metropolitan cities.

Our econometric study focuses on measuring rent in particular, since it is both used as an outcome variable in traditional studies on gentrification, as well as in studies showing the effects of increases in cultural capital on property value. (Grodach et al., 2014, Walks & Maaranen, 2008; Freeman and Cheyne, 2008; Chen et al., 2023). Acknowledging how previous literature has included multiple variables tied to social demographics, such as *share of population with a bachelor's degree or higher*, *average household income* or *share of population employed* to measure gentrification

outcomes, (Chen et.al, 2023; Freeman and Cheyne, 2008; Freeman, 2005) we have chosen to narrow down on measuring housing market outcomes in terms of rent to capture the effect installation of public murals can have on the *economic value* of properties in Montréal. In our section III Data**,** we specify and discuss the econometric implications of choosing simply rent as our outcome variable, supporting our argument for its usage, besides its link to previous research and theory.

E. The Rental Market of Montréal

With rent as the outcome variable of our main specification, we look into how the Montréal housing market is governed and how it has historically responded to external shocks in the past.

Firstly, the housing market in the City of Montréal operates under Québec provincial laws and has further developed its own regulations, limiting the frequency of undesired rent hikes and diminishing potential outcomes of gentrification through public policy (City of Montréal, 2026). Some examples include the *By-law for a Diverse Metropolis* (City of Montréal, 2026), which prohibits development projects with a residential floor area of greater than 18 000 m² to be built without contributing to the supply of off-market affordable housing, social housing or family housing and the *Prohibition on the Purchase of Residential Property by Non-Canadians Act* (Government of Canada, 2023), applicable for the entire Quebec provenance, limiting non-Canadians from buying certain residential properties in Canada – namely buildings with three dwelling units or fewer located within Census Metropolitan Areas and Census Agglomerations. (City of Montréal, 2026; Government of Canada, 2022)

Furthermore, the *Tribunal Administratif du Logement* (TAL) organisation has, since 1979, been responsible for regulating increases in rent within Québec's metropolitan cities, specifically targeting eviction, displacement of low-income residents and gentrification. (TAL, 2026). Residential leases under which tenants are to pay rent to a property owner or landlord may be experience rent increases under following conditions: a) a fixed percentage increase to the current rent, established in the lease contract, b) an increase according to the consumer price index; or c) an increase is subject of negotiation between parties involved prior to the pre-established date of the increase (Eusepi et al., 2025). Increases in rent are only justified if they comply with the TAL calculation criteria of the respective municipality: municipal taxes, insurance costs, maintenance and repairs, major renovations, operating expenses and building services. If a tenant refuses to accept a given increase, the landlord must apply to the TAL, justifying the respective change with regard to the mentioned criteria. TAL then has administrative power to impose a lower increase than requested if calculation criteria are not met, protecting tenants against possible "*renoviction*" – eviction as a consequence of renovations to the property increasing its value. (TAL, 2026). Additionally, the TAL also holds governing power to postpone eviction dates under circumstances where immediate eviction would cause 'severe hardship'. (TAL, 2026).

With regards to how Montréal's rental market has historically responded to external economic shocks, we look at outcomes of the 2008 housing market bubble compared to the COVID-19 pandemic**.**

In years 2008 and 2009, following the financial crisis, investments in rental property and financialization of rental housing increased in Montréal (August 2020a; August and Walks 2018; St-Hilaire, 2021), building on trends of "assetization" of housing (Sassen, 2014) and government efforts to make investments in the rental sector more financially appealing through Real Estate Investment Trusts, REIT's (St-Hilaire, 2021; Nash, 2025). These trends became observable in terms of increased rental pressures beginning in late 2010, early 2011 (St-Hilaire, 2021; Nash, 2025), reflecting a delayed response in rent increases as a result of increased property investment.

For the effect of the COVID-19 pandemic on Montréal rental markets, a short-term weakening of rental demand was observable within months following the crisis, as rental listings began increasing sharply in 2020 (CMHC, 2020). Research suggests the temporary weakened demand stemmed from a change in downtown economic activity, as employers switched office work to remote locations, tourism declined, and students who occupied downtown condos or small apartments left the city (Shearmur et al., 2021; CMHC, 2020).

By February 2022, the Canadian Mortgage and Housing Corporation could report a partial recovery of downtown economic activity, with vacancies returning to previous, stable rates, highlighting Montréal as a particular example of recovered stability. (CMHC, 2022). In terms of effect on rent, what available reports and studies find is that the COVID-19 pandemic did not disrupt trends on suburban and family-oriented housing markets (CMHC, 2021, 2022), but was rather limited to the mentioned short-term fluctuations in rent and vacancy rates for student-oriented housing, downtown condos and temporary rental units, such as Airbnb's (Shearmur et al. 2021; CMHC, 2020, 2021, 2022).

In summary, contemporary literature and reports examining rent trends in Montréal acknowledge the city's specific regulatory framework and argue that the observed stability of rental markets, measured in long-term increases, is sustained through government efforts to prevent spikes (St-Hilaire, 2021; Shearmur et al., 2021; Nash, 2025; Government of Canada, 2023; TAL, 2026). Contemporary research further exhibits a tendency to argue for government and globalisation-driven initiatives, such as REIT's, being the main drivers behind financialization in the housing market, essentially contributing to a nationwide economic framework which encourages long-term, stable and consistent increases in rent (August 2020a; August and Walks 2018; St-Hilaire, 2021; Nash, 2025). It is within this framework that studies on gentrification, both as a result of globalisation trends, and through channels of public policy, contribute to broader theory of how government policy can impact housing markets, social demographics and residential displacement (St-Hilaire, 2021; Jolivet & Reiser, 2022; Walks & Maaranen, 2008; Laberge, 2025; Paré, 2021; Maltais & Bélanger, 2021).

What is essential to be acknowledged when comparing outcomes of the 2008 financial crisis with outcomes of the COVID-19 pandemic on Montréal's rental markets is that the former is argued to have spurred the currently ongoing long-term rent-increase rate (St-Hilaire, 2021; Nash, 2025), by making housing markets more appealing to investors, while the latter affected residential composition and rental vacancy trends directly, only in the short-term (Shearmur et al., 2021; CMHC, 2021, 2022). Furthermore, the effects of the 2008 financial crisis could not be observed, nor analysed, until two years following the housing market crash (St-Hilaire, 2021; Nash, 2025), highlighting how shocks indirectly targeting the investor side of the housing market have

historically had *delayed* effects. Conversely, effects of the COVID-19 pandemic could be observed within months, as the shock appears to have mainly targeted the tenant side of the housing market through channels of decreased downtown economic activity (Shearmur et al., 2021; CMHC, 2020**).**

Throughout our empirical research, we acknowledge how Montréal's existing governance framework may diminish possible adverse effects on rent (Government of Quebec, 2023), but simultaneously how, despite its presence, research has shown that public urban renewal projects in the city can contribute to gentrifying processes and changes in social demographics (Maltais & Bélanger, 2021; Laberge, 2025; Kiani et al., 2024; Ezvan, 2025; Youngbloom et al., 2023; Jolivet & Reiser, 2022). We further acknowledge how an increase in perceived attractiveness of a selected neighbourhood as a result of state-led initiatives targets the investor side of housing markets (Shaw 2008; Hammel, 2009), and consider the effect increased property investment may have on rent as being subject to a delay, as highlighted by outcomes of the 2008 financial crisis (St-Hilaire, 2021; Nash, 2025). Lastly, we consider the short-term, immediate effects of the COVID-19 pandemic on Montréal's rental market (CMHC, 2020, 2022) as a potential source of bias to our regression and, although their insofar measured limited impact on rent (CMHC, 2021, 2022), exclude data on rental prices after October 2019 from our research.

Taking these existing governance conditions and outcomes of previous shocks into account, we thus aim to capture a posed effect of the publicly funded Mural Art Program on rental prices, following what reports and research has shown may occur on Montréal's rental market when government-led initiatives increase attractiveness of property investment (Jolivet & Reiser, 2022; Laberge, 2025; Paré, 2021; Maltais & Bélanger, 2021; St-Hilaire, 2021; Nash, 2025)

III. Data

This section presents our data and our methodology for processing it. We also present summary statistics for our main outcome variables and baseline control variables.

A. CMHC Rental Price Survey

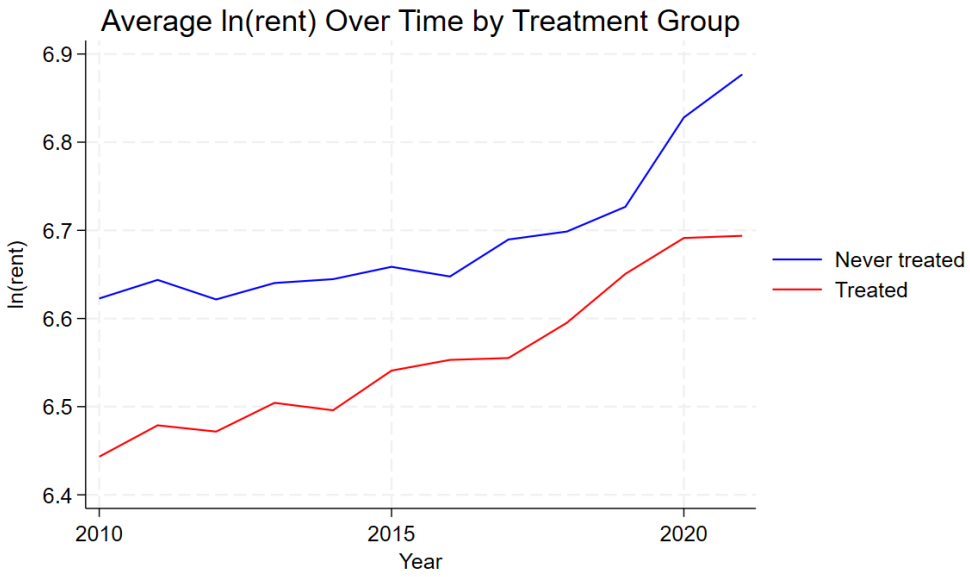
We collected data from the Canada Mortgage and Housing Corporation (CMHC) Rental Price Surveys conducted twice per year between 2006 and 2021 (Canada Mortgage and Housing Corporation, 2024). The surveys are conducted in April and October of each year. The unavailability of neighbourhood-level data led us to restrict the selection of surveys we used. For one, only the October surveys were conducted at the neighbourhood level. Plus, rent prices by neighbourhood were available only starting from October 2010.

Figure 1 shows the evolution of rent prices in Montréal neighbourhoods over time by treatment group. We see an upward-sloping trend both for treatment and control neighbourhoods, which ties in with the increase in mural installations over the years shown in the next section. We also note that until 2020, both slopes have been somewhat converging, but the trend is clearly disrupted, and they seem to diverge from that point. This point in time corresponds to the beginning of the global spread of COVID-19, and while we cannot posit with certainty what the cause of the shock is, we omit the years 2020 and onward from our observation, focusing on

finding a possible explanation for the convergence of rent prices until 2019. Ultimately, we used survey data from October 2010 to October 2019 for our neighbourhood-level analysis.

The survey results are presented for studio apartments, one-bedroom apartments, two-bedroom apartments and three-bedroom apartments, as well as an average for all. This feature is relevant for the heterogeneity analysis of our results.

Figure 1. Time Trend of the Average Rent Price by Treatment Group



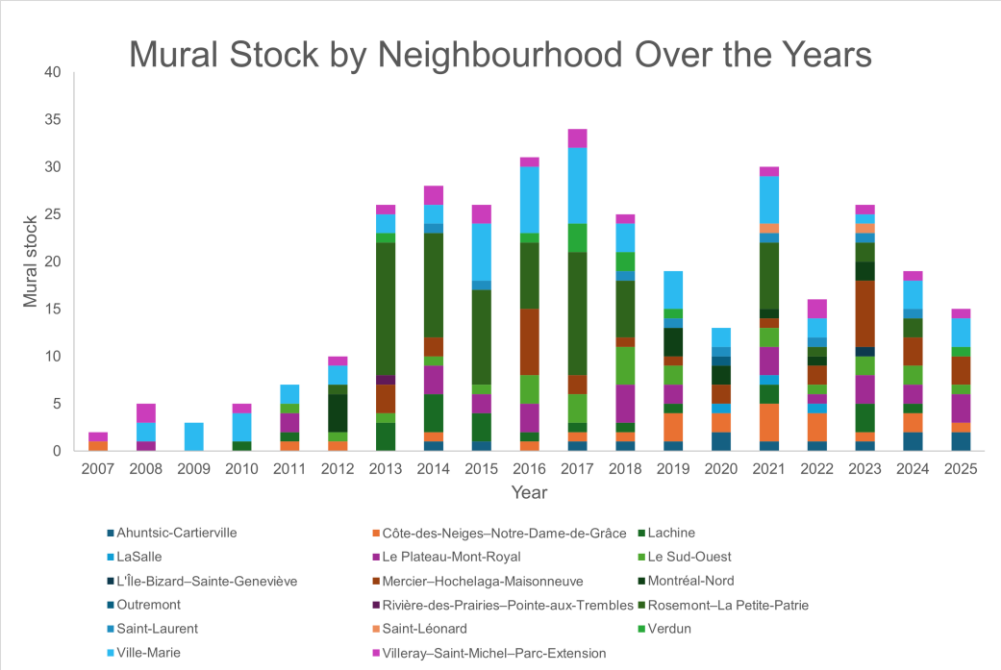
Note: The figure shows the evolution of the natural logarithm of rent price averaged across all neighbourhoods within a treatment group for every year between 2010 and 2021. The treatment for a neighbourhood is defined as having had at least one mural installed. Source: Authors' rendering of CHMC Rental Price Surveys data (2010-2021)

The CMHC marks its rent price data according to a ranking of the level of reliability of its sampled data (Excellent, Very Good, Good or Poor), which is determined based on the coefficient of variation of its estimates (Canada Mortgage and Housing Corporation, 2024). To conduct an honest analysis and avoid introducing external variation due to the lack of precision of our main outcome data, we dropped any rent price data with a Poor reliability level. As a result, a total of 67 observations were dropped.

B. Panel Data with Murals and Neighbourhoods

We accessed open data from the Ville de Montréal containing the location and year of all murals subsidised by the city since 2007 (City of Montréal, 2026). The variation in the neighbourhood division between the murals and the rent prices data was addressed by matching each mural to a neighbourhood as specified in the rent prices data by using each mural's geolocation coordinates. Appendix 3 shows scatter plots of rent and mural data across the years.

Figure 2. Mural Stock by Neighbourhood Over Time



Note: The figure shows variation in the timing of the Program's rollout. It also shows variation in the treatment intensity between neighbourhoods, with some having received many more murals than others. Source: Authors' rendering of the City of Montréal's murals data (2007-2025)

Figure 2 presents the rollout of murals by neighbourhood across the years. There is variation in the timing of each neighbourhood receiving murals. Hence, there is a case for murals being the independent variable, as the exposure time varies between the neighbourhoods. Moreover, having received murals early does not necessarily mean a neighbourhood has received more, and variation is also observable in the quantity of mural stock an area has accumulated. Finally, we produced panel data by merging rent prices and murals data by neighbourhood and year, with 37 neighbourhoods from 2010 to 2019.

An important characteristic of Montréal is the administrative division of its neighbourhoods. The City of Montréal consists of a set of neighbourhoods under the administration of the Montréal mayor, and the Agglomeration of Montréal includes independent neighbourhoods having their own city hall (See Appendix 1). The Mural Art Program was a project put in place by the City of Montréal and thus targeted only its neighbourhoods. This means that independent neighbourhoods could not get murals installed as part of the Program. Despite that, we decided to still include them in our analysis.

For one, the independent neighbourhoods act as a useful comparison group since they are naturally excluded from the scope of the Program, yet they are subjected to comparable housing market and population dynamics as administrative neighbourhoods by proximity. This offers us a quasi-experimental setting useful for identification. Furthermore, the inclusion of these neighbourhoods in our analysis broadens our sample size, likely improving the precision of our results. It is still possible that independent neighbourhoods have systematically different characteristics from administrative areas that would impact their trends in rent prices, which is why our specifications include neighbourhood fixed effects.

C. Canadian Census of Population

Statistics Canada releases data from its national census conducted every five years. For 2006, 2011 and 2016, the City of Montréal ordered a detailed report breaking down the census results at the neighbourhood level (City of Montréal, 2014; City of Montréal, 2016; City of Montréal, 2019). In order to introduce this data into our panel, we first matched the neighbourhood division variants to those in the panel. 14 of the 37 neighbourhoods were merged into larger entities in the census data. However, their geographical delimitation still corresponded to that of the panel data equivalent when combined. We therefore computed a weighted average of each variable for those neighbourhoods.

We computed values for the years between 2006, 2011 and 2016 by interpolating the data from the censuses. We extrapolated the data post 2016 to obtain values spanning until 2019. The accuracy of the interpolated and extrapolated values could be compromised by the 5-year gap between the data points. We considered using additional census data from 2001 and 2021 to improve the accuracy of the data points. However, as previously mentioned, the COVID-19 pandemic had effects that would skew the data for years 2020 and onwards, hence why we excluded the 2021 census. Moreover, income data from the 2001 census is computed as an average, which does not match the later census incomes computed as a median. The interpolation and extrapolation allow us to use the census data for controls in our regression.

We also use area measures from the censuses to compute the mural density variable used in our robustness checks. We used a geographic information system software and official geographic information files of Montréal to obtain the individual exact areas for these neighbourhoods that are combined in the census, for a total of 37 area measures.

D. Key Variables

Our main outcome variable is the rent price. We use logarithmic rent due to the large magnitude of the values compared to the independent variable, to obtain a coefficient which is not sensitive to this difference. We measure both aggregated effects and effects across apartment types in our specifications. Although the literature discussed in Section II gives a clear indication of the phenomena of gentrification and urban renewal being associated with the sociodemographic composition of a neighbourhood, the lack of data available with yearly observations at the neighbourhood level makes it challenging for us to study further outcome variables.

With census data available only for every five years, interpolating and extrapolating the missing years would risk providing us with imprecise estimates that might lack economic meaning since the outcome variables would be largely not rooted in real observations. Instead of analysing estimates of estimations, we prefer conducting a narrower study with rent prices as the sole outcome.

For our main regression, the independent variable is the stock of murals a neighbourhood has accumulated over time. Thus, the treatment is the intensity of exposure to murals measured as the total amount observable in a neighbourhood in a given year.

As a robustness test, we performed a staggered difference-in-difference regression, with the installation of a first mural as the treatment for a neighbourhood. The post-treatment period, therefore, corresponds to the time following the first year a neighbourhood has received a mural. The length of the post-treatment period varies across the neighbourhoods, allowing for a staggered DiD. We classify the neighbourhoods with dummies for no exposure, low exposure, or high exposure to murals based on the maximum mural stock they have.

We include in our regressions controls for characteristics of each neighbourhood that might vary with time. We consider the share of households renting their housing and population density, as well as median household income and the share of the population above 25 years old with at least a college degree to capture the socioeconomic characteristics of a neighbourhood.

E. Description

Our final dataset is a panel of data observed per neighbourhood, per year, per apartment type, containing a total of 1480 observations, reduced down to 1303 when omitting observations with missing rent data. There are observations for 37 neighbourhoods spanning between 2010 and 2019, across four apartment types. The extent of the use of generative AI for the treatment of our data is detailed in the appendix (see AI Disclosure).

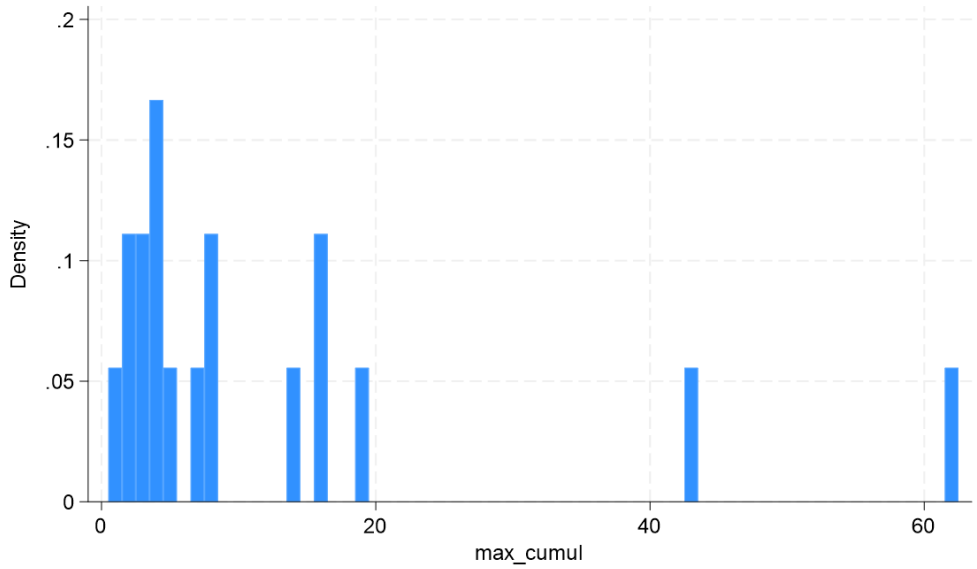
Table 1 presents summary statistics for the main variables in our panel data. For our variables of interest, we observe that relative to their respective units, variation in maximum mural stock is much stronger than the variation in rent prices. The observations are spread over a wide range, but most neighbourhoods have accumulated few murals, resulting in a right-skewed distribution (Figure 3). Still, the considerable variation in both variables indicates that there is a possibility of identifying a meaningful correlation between them.

Table 1. Baseline Summary Statistics

	mean	Sd	min	max	count
ln(rent)	6.591	0.290	6.040	7.640	1303
Max mural stock	5.973	12.437	0.000	62.000	1480
ln(median household income)	10.967	0.306	10.439	11.809	1480
College education	0.397	0.155	0.080	0.768	1480
Rental housing	0.542	0.171	0.082	0.749	1480
Population density	4844.918	2811.186	219.100	13058.545	1480

Note: The table reports mean, standard deviation, minimum and maximum statistics for all observations in our sample. Source: Authors' rendering of CHMC Rental Price Surveys data (2010-2019), the City of Montréal's murals data (2010-2019) and the City of Montréal's census data (2006, 2011, 2016)

Figure 3. Treated Total Mural Stock Distribution



Note: The figure shows the distribution of the final (maximal) mural stock for treated neighbourhoods in 2019. The distribution is right-skewed and has a median of 6. Source: Authors' rendering of the City of Montréal's murals data (2010-2019)

Across the control variables, we also observe moderate to high variation, notably in college education, rental and population density. These baseline observations suggest that neighbourhoods differ considerably from each other and over the years, which calls for the inclusion of neighbourhood and year fixed effects in our empirical strategy. Moreover, the fact that there is variation in the control variables themselves is a good sign for the relevance of their inclusion in our specifications.

Table 2 presents summary statistics for our observations based on whether a neighbourhood has ever received a mural or not. We note that rent levels and variation are similar between never-treated and treated neighbourhoods, although slightly higher in the former. Additionally, comparing the summary statistics for the control variables supports the observation that neighbourhoods that have never received murals seem to be of higher socio-economic status overall, having higher average median household income, college education ratio and ownership ratio. Never-treated neighbourhoods are also, on average, less densely populated than treated ones. We observe similar characteristics when comparing observations depending on their treatment status in a given period (See Appendix 4). Considering the baseline differences consistent with the treatment of a neighbourhood, the inclusion of fixed effects in our specifications is necessary, since there may be endogenous variation in the treatment linked to neighbourhood characteristics.

Table 2. Baseline Summary Statistics by Treatment Group (Ever)

	mean	Sd	min	max	count
Never treated					
ln(rent)	6.658	0.286	6.109	7.640	633
ln(median household income)	11.157	0.295	10.599	11.809	760
College education	0.418	0.176	0.080	0.768	760
Rental housing	0.434	0.156	0.082	0.674	760
Population density	3325.773	1986.626	299.200	7315.645	760
Treated					
ln(rent)	6.527	0.280	6.040	7.523	670
ln(median household income)	10.767	0.149	10.439	11.160	720
College education	0.375	0.124	0.128	0.644	720
Rental housing	0.657	0.094	0.356	0.749	720
Population density	6448.461	2660.001	219.100	13058.545	720

Note: The table reports mean, standard deviation, minimum and maximum statistics for all observations in our sample based on the neighbourhoods' treatment group. Treated neighbourhoods have had at least one mural installed during the observation period. Source: Authors' rendering of CHMC Rental Price Surveys data (2010-2019), the City of Montréal's murals data (2010-2019) and the City of Montréal's census data (2006, 2011, 2016)

IV. Empirical Strategy

Our empirical strategy is based on the hypothesis that urban renewal efforts drive new interest in targeted neighbourhoods, which increases demand in the rental market, driving prices up. (Shaw 2008; Hammel, 2009; Smith, 2002; Slater, 2004) We look at the installation of subsidised art murals as an urban renewal strategy to transform the attractiveness of an area by increasing its cultural capital (Bianchini and Parkinson, 1993; Evans, 2001; Seldin, 2017, 2025; Ley, 2003). We have designed our empirical strategy to investigate the effect of art murals on rent prices in Montréal neighbourhoods.

A. Main Specification

$$(1)\ \ln(r_{int}) = \beta murals + \gamma X_{nt} + \omega_i + \delta_n + \alpha_t + \varepsilon_{int}$$

Equation 1 describes our main specification. The model captures the correlation between the accumulation of murals and the logarithm of the rent in a neighbourhood.

r_{int} is our main outcome variable of the continuous log of rent prices for an apartment type *i* in a neighbourhood *n* in year *t*; *murals* represents our treatment variable of the continuous total of murals accumulated in a neighbourhood *n* in a given year *t*; X_{nt} represents our set of controls, described in the previous section, per neighbourhood *n* per year *t*. $\omega_i, \delta_n, \alpha_t$ describe respectively apartment-type, neighbourhood and year fixed effects included in our regression. ε_{int} represents unobserved errors.

The coefficient of interest β captures the correlation between accumulated murals and rent prices, considering time variant and invariant neighbourhood and apartment type characteristics.

All standard errors are clustered at the neighbourhood level to account for the possible correlation of errors between observations within the same neighbourhood over time.

B. Identification Strategy

Our identification strategy exploits the variation in the time the mural program was introduced in each neighbourhood, that is, the year each neighbourhood received its first mural. Since the first year varies from neighbourhood to neighbourhood, we attempt to apply a staggered difference-in-differences model to try to identify a causal effect of mural exposure on rent prices. The treatment event is a neighbourhood getting a mural installed for the first time. Our sample is divided into a control group and a treatment group: the control group consists of never-treated and not-yet-treated neighbourhoods, and the treatment group consists of treated neighbourhoods, given the year of observation.

The validity of our DiD identification strategy relies on the assumption that control and treatment groups follow parallel trends pre-treatment. In other words, if no murals were ever installed, the control and treatment groups should follow similar trends. We test this assumption for our staggered DiD with an event study.

C. Event Study

We test the validity of our identification strategy by identifying parallel trends using the following specification for an event study:

$$(2)\ \ln(r_{int}) = \omega_i + \delta_n + \alpha_t + \varepsilon_{int} + \sum_{\tau \neq -1} \beta_\tau \cdot 1[t - T_n^* = \tau]$$

τ represents the time relative to a neighbourhood getting its first mural; T_n^* represents the time a neighbourhood has received its first mural. We use $1[t - T_n^* = \tau]$ as an indicator for whether a neighbourhood is τ periods away from receiving its first mural. When that is the case, β_τ, our coefficient of interest, captures the effect of mural exposure on the logarithm of rent prices in a neighbourhood, relative to the time from the event.

To avoid multicollinearity, $\tau \neq -1$ is omitted, as it constitutes the reference period for our event study. We therefore consider the effects of mural relative to the period just before they were installed. Having the year before the first mural as our baseline, pre-treatment trends can be interpreted as the changes in rent relative to the year before the first mural in a neighbourhood, which, if the parallel trends assumption is valid, should not be significantly different from zero. Consequently, the treatment effect is computed relative to $\tau = -1$, allowing us to consider the effects in comparison to just before treatment.

We note in our sample that very few observations have an event time $\tau \neq -5$, which might skew the study and make the estimate for that period less precise. Hence, we trimmed our event study period by assigning all $\tau \neq -5$ observations to have $\tau \neq -4$ instead, to produce a smoother and more meaningful graph. 4 out of 720 observations had $\tau \neq -5$ and had the event time replaced with $\tau \neq -4$.

D. Treatment Intensity

We conduct a robustness check to see whether the effect of murals accumulation on rent prices varies depending on the intensity of the treatment, that is, the total amount of murals a neighbourhood has received at the end of the observation period. We classify neighbourhoods based on whether they have high or low maximum mural exposure by introducing the dummy variables Few_n *and* $Many_n$ for the intensity of mural exposure. From the analysis of the distribution of our sample data, we determine a sensible threshold for the number of murals required for a neighbourhood to be classified as high exposure.

$$\text{(3)}\ \ln(r_{int}) = \beta_1(Few_n \times Post_{nt}) + \beta_2(Many_n \times Post_{nt}) + \gamma X_{nt} + \omega_i + \delta_n + \alpha_t + \varepsilon_{int}$$

The dummy $Post_{nt}$ indicates whether the observation occurs before or after a neighbourhood has received its first mural. β_1 and β_2 capture the effect of the treatment on rent prices relative to the intensity of mural exposure of the neighbourhood.

E. Identification Concerns

Our empirical strategy raises some concerns that we attempt to mitigate in our analyses, but that still call for cautious interpretation of our results.

First, the main limitation in our identification strategy is that the installation of murals might not be exogenous. As the treatment is initiated by a program whose efforts are aimed at urban renewal, it is possible that murals were more likely to be introduced in neighbourhoods already experiencing some form of transformation due to other municipal programs with the same aim. Our results may therefore reflect underlying trends, which challenge the causal explanation power of our estimates. We use controls, fixed effects and the event study to try to mitigate the potential endogeneity, but the concern remains a factor to be considered.

Secondly, our treatment fails to capture aspects of the murals which may undermine the assumed intensity of exposure and introduce measurement error. In our empirical strategy, the intensity of treatment is only determined by the quantity of murals a neighbourhood has accumulated. In reality, however, the size and placement of murals may vary, they may have unique

styles and messages, and older pieces may fade over time due to weather conditions. These characteristics might very well make the impact of two murals differ in ways that should be considered when computing the intensity of exposure.

This potential limitation can further be linked to existing research on the impact public art has on housing markets, suggesting that the channels through which art is exposed (e.g. social media, publications, etc.) matter for the magnitude of its respective impact (Seldin, 2025). Our strategy does not account for possible media strategies or trends aimed at increasing public exposure of selected murals, thus creating room for biased estimates. Furthermore, accounting only for the quantity and not also the quality of murals might bias our estimate downwards and imply a misinterpretation of our intensity classification. We have omitted to take into account these characteristics, as they are difficult to observe outside of a field study.

Thirdly, our empirical strategy does not take into account potential spillover effects between neighbourhoods. We rely on the geographical border between neighbourhoods to determine the treatment units, as it corresponds to the observation units for the rent data. Murals installed close to an adjacent neighbourhood are expected to affect the mural exposure of that neighbourhood as well, yet, with this harsh delimitation, our specifications do not consider this spillover as treatment. This limitation might induce downward bias for our estimate, and it introduces interference, which challenges the stable unit treatment value assumption in our DiD.

Lastly, our specifications assume that the effects of the installation of murals are experienced immediately. The timing of the variation of rent prices as a result of mural exposure might be lagged from the treatment. As shown by historical trends, such as outcomes of the 2008 financial crisis, rent prices likely react with a delay, considering the nature of rental markets (St-Hilaire, 2021; Nash, 2025). Thus, treatment effects from a given year might be recorded in observations from subsequent years, potentially introducing noise in our estimates.

We consider these concerns in our analysis through control variables, fixed effects and robustness checks, but we remain careful and do not interpret our estimates as strictly causal.

V. Results

In this section, we present our main empirical estimates for the relationship between mural exposure and rent prices in Montréal neighbourhoods. We begin by reporting our baseline estimates, followed by our event study to establish causality. Finally, we conduct a series of robustness checks to test the validity of our results.

A. Main Results

Table 3 presents the OLS results from variants of our main specification that compute the relationship between mural accumulation and rent prices in neighbourhoods. Column 1 reports the results of the naïve OLS absent all controls. Columns 2-4 report the results of OLS regressions that include different sets of controls relevant to rent prices. All regressions include neighbourhood, year and apartment fixed effects.

Column 1 shows that a one-unit increase in the mural stock of a neighbourhood is associated with a significant 0.138 percent increase in rent prices in a neighbourhood. When controlling for the share of rental housing in a neighbourhood and its population density, the magnitude of the effect decreases to 0.126 percent, but it remains significant at the 5-percent level, as shown in Columns 2 and 3.

However, once we include socioeconomic control variables (i.e. median household income and share of college-educated population), we see in Column 4 that our estimate loses all significance. Appendix 5 reports the coefficients of the control variables, which are all insignificant. When considering the results in Column 4, this suggests that the socioeconomic variables might be correlated with the murals themselves, which would support our early suspicion that murals have a preexisting link to gentrification. The larger standard error could also imply multicollinearity and the limited presence of within-neighbourhood variation after including fixed effects, which negatively impacts the statistical power of our results.

Table 3. Effect of Mural Stock on Natural Logarithm of Rent

	ln(rent) prices across apartment types			
	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)
Mural stock	0.00138**	0.00126**	0.00126**	0.00101
	(0.000545)	(0.000605)	(0.000589)	(0.000643)
Observations	1303	1303	1303	1303
R-squared	0.935	0.935	0.935	0.935
Adj. R-squared	0.932	0.932	0.932	0.932
Rental share	No	Yes	Yes	Yes
Population density	No	No	Yes	Yes
Socioeconomic characteristics	No	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our OLS regression of ln(rent) on mural stock. All our results take into account neighbourhood, year and apartment-type fixed effects. We test for four different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing. Column 3 adds population density to the set. Finally, Column 4 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

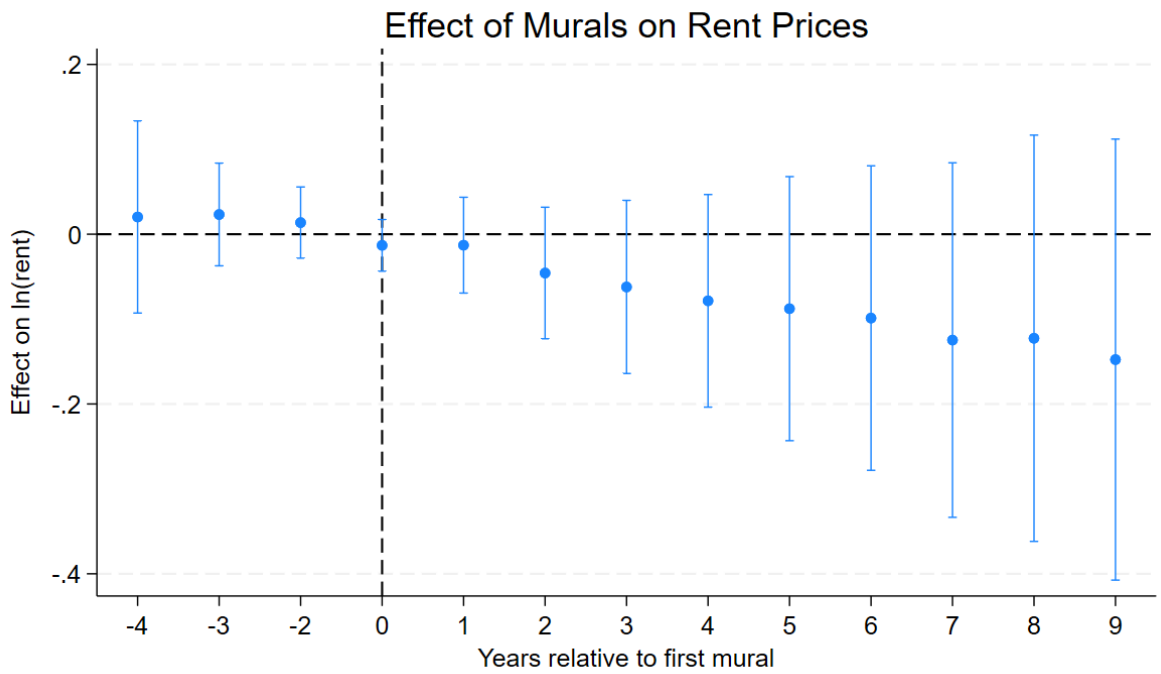
B. *Effect of Installing a First Mural*

To investigate the causality of our results, we run a staggered difference-in-differences regression, the results of which are shown in the event study in Figure 4. Appendix 6 reports the coefficients for each event time. For the event times preceding the reference period -1, we observe no effect of murals on rent significantly different from zero, implying parallel trends and somewhat supporting our DiD design choice, although the confidence interval at event time -4 is quite large.

Interestingly, we note a downward-sloping trend once a neighbourhood has received its first mural. Event times following the reference period -1 are marked by negative effects of murals on rent prices, although insignificant.

Still, this trend is seemingly contradictory to our OLS results. Considering our time trend in Figure 4 shows rent prices increasing on average over time for both treatment groups, the downward slope could be due to it capturing a different trend in how rent prices evolve in treated neighbourhoods compared to never-treated ones. This suggests the possible presence of selection bias if, for example, murals were installed in neighbourhoods having already undergone a transformation phase that positively impacted rent prices and is now stabilising. If that is the case, our OLS estimate would have picked up the positive correlation between the evolution of rent prices in the neighbourhoods that do end up receiving murals, which would be the ones already experiencing rent increases. Our event study thus suggests that our OLS estimate might hide underlying heterogeneity playing a role in the interpretation of our results.

Figure 4. Event Study of the Effect of Murals on Rent Prices in Neighbourhoods

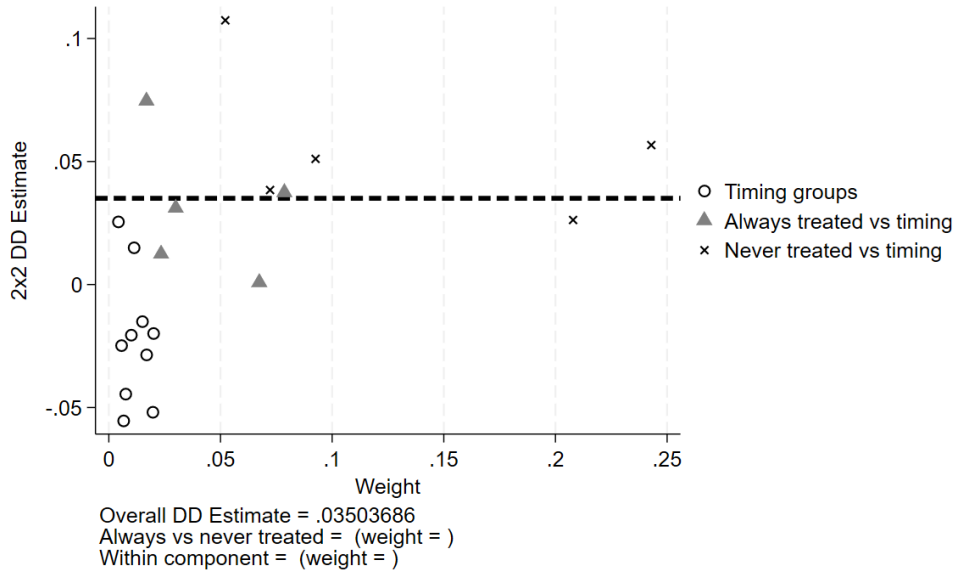


Note: The graph shows the effect of a neighbourhood receiving its first mural at event time 0. The reference period -1 is omitted. The specification does not include any controls. Standard errors are reported on the graph. Data sources: CMHC, City of Montréal

C. Goodman-Bacon Decomposition

Considering the timing of treatment in our staggered DiD design, we identify which components of our treatment arms drive the effect on rent prices. We use the Goodman-Bacon decomposition as a diagnostic test for potential difference sets that might bias our estimate. The results of the Goodman-Bacon decomposition are presented in Figure 5 and show that the effect coming from the difference between treated and untreated observations is positive across the board, which matches our main specification estimates. However, almost all the estimates for the difference in timing between the treated units are negative, which might be contradictory to our main findings, but not to our event study. Though the negative estimates are crowded close to zero in terms of weight in the decomposition, the event study in Figure 5 picks up specifically the within variation in the treated group, hence the negative trend we observe in the post-treatment period. As the overall estimate sums up to a weighted average of all the coefficients, the negative effects are drowned out. Still, our Goodman-Bacon decomposition reveals important heterogeneity in the treatment effect of murals on rent. The aggregated estimate is suggestive of a positive effect of mural installation on a neighbourhood's rent prices, but the suggested negative relationship between murals and rent when an area has been treated compared to when it has not is much less intuitive; yet, it cannot be ignored.

Figure 5. Goodman-Bacon Decomposition



Note: The figure presents a diagnostic test of the composition of the difference-in-differences effect we measure. Apartment-type fixed effects were dropped, and the panel was collapsed to obtain a 2x2 DD design needed for the Goodman-Bacon decomposition. Timing groups represent the within-group variation in the treated units. Never treated vs timing captures the variation between treatment and never-treated units. Always treated vs timing captures the variation between early treated units and other treated neighbourhoods. Data sources: CMHC, City of Montréal

Nonetheless, one limitation of the event study and DiD design is that it relies only on the installation of the first mural as the determinant for treatment. The current treatment fails to capture the potentially differential effect of the quantity of murals in a neighbourhood on how

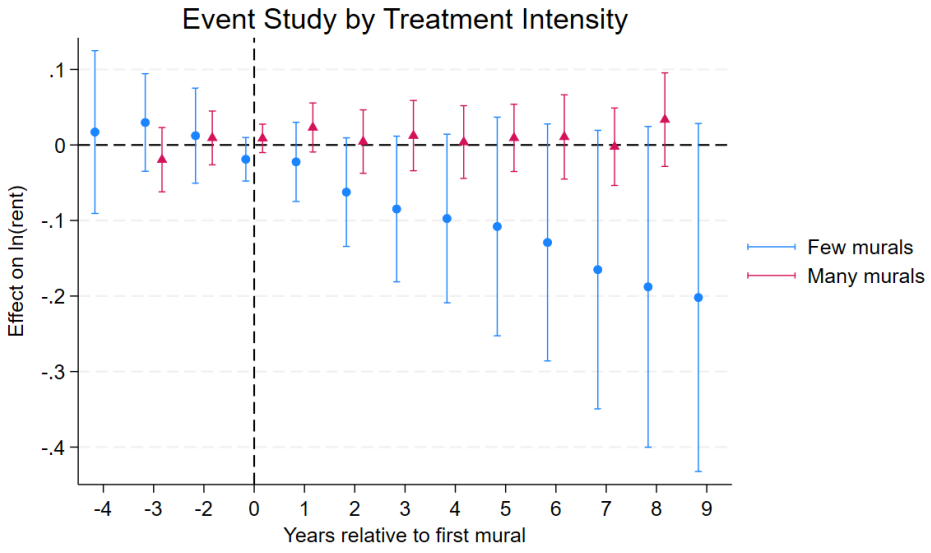
each additional unit affects rent prices. The next section explores our attempt at dissecting that effect.

D. Dissecting the Effects of Treatment Intensity

To observe whether rent prices are affected differently in neighbourhoods with a high exposure compared to a low exposure to murals, we run a difference-in-differences analysis, separating our sample into three treatment arms: never-treated, few murals and many murals.

Figure 6 shows the plot of the event study for our staggered DiD for each treatment intensity group. Both groups show no effects of murals on rent prices significantly different from zero prior to the year before they received their first mural, supporting the parallel trends assumption in both cases, which suggests our subsequent difference-in-differences analysis could be causally meaningful. The years following the reference period are marked by statistically null effects in the case of both groups. Particularly, for the treatment group with few murals, there seems to be a concentration of negative coefficients in a trend reminiscent of Figure 4 with the single treatment. We can therefore hypothesise that the negative relationship in the combined event study is driven by neighbourhoods with few total murals installed at the end of our observation period. On the other hand, for neighbourhoods with many accumulated murals, the within-treatment effect follows a clearer flat trend around zero post-treatment.

Figure 6. Event Study of the Effect of Murals on Rent Prices in Neighbourhoods by Treatment Intensity



Note: The graph shows the effect of a neighbourhood receiving its first mural at event time 0. The reference period -1 is omitted. The specification does not include any controls. The treated group is divided into neighbourhoods having few murals (<= 6 total mural stock) or many (> 6). Standard errors are reported on the graph. Data sources: CMHC, City of Montréal

Another thing to note is how the confidence intervals for neighbourhoods with few murals explode as the years since the treatment increase, marking the potential scarcity of observations treated this early. In other words, neighbourhoods with fewer murals seem to be more likely to have received their first mural later than neighbourhoods with many of them. This is likely to

create noise in our standard errors, which might challenge the statistical power of our estimates, as it is also shown in the combined event study. This highlights the relevance of considering the murals as a continuous treatment rather than a binary one.

Table 4. Treatment Intensity Heterogeneity Test for the Effect of Mural Stock on ln(rent)

	ln(rent) prices across apartment types	
	(1)	(2)
Few × Post	0.0230*	0.0311***
	(0.0128)	(0.0112)
Many × Post	0.0309**	0.0217
	(0.0120)	(0.0135)
Observations	1303	1303
R-squared	0.935	0.935
Adj. R-squared	0.932	0.932
Rental share	Yes	Yes
Population density	Yes	Yes
Socioeconomic characteristics	No	Yes
Neighbourhood FE	Yes	Yes
Time FE	Yes	Yes
Apartment FE	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our DiD regression of ln(rent) on the post-treatment period interaction terms for the intensity dummies. The treated group is divided into neighbourhoods having few murals (<= 6 total mural stock) or many (> 6). The table only reports the coefficients for the interaction terms, which are those of interest in this heterogeneity analysis. All our results take into account neighbourhood, year and apartment-type fixed effects. We test two different cases, each including a different set of control variables. Column 1 presents our estimate with controls for the share of households in rental housing and population density. Column 2 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

In Table 4, we show the estimates for the interaction between the neighbourhood treatment based on the maximum number of murals accumulated and the post-treatment factor marking the installation of the first mural in an area. We report our results, which include our set of control variables, with Column 2 also including socioeconomic characteristics. From Column 1, we see that neighbourhoods with a small mural stock experience an increase in rent prices of approximately 2.3 percent after the treatment event relative to never-treated areas, compared to about 3.1 percent for neighbourhoods with many murals.

These results imply that there is heterogeneity in the effect of murals on rent prices, with the effect seeming larger in neighbourhoods with few of them. When adding socioeconomic controls, the magnitude of the coefficient for the Few × Post interaction grows larger, to approximately 3.1 percent, while that of the Many × Post interaction becomes smaller and statistically insignificant.

Comparing the estimates in Columns 1 and 2 shows the presence of downward bias, which is mitigated when controlling for socioeconomic characteristics, suggesting that worse-off neighbourhoods might ultimately receive fewer murals than better-off ones. This supports that there may be selection bias in our sample, an obstacle to causality. In other words, the effect's heterogeneity might be due to baseline socioeconomic differences between areas with few and many murals, which determine rent prices, tying back to our observation that neighbourhoods receiving murals might already be on an improvement trajectory. This robustness check strengthens this conclusion, as those better-off neighbourhoods are more likely to be the product of these urban renewal efforts.

We have chosen to define the threshold for the intensity of the exposure to murals as the median quantity of murals accumulated across neighbourhoods. As shown by Figure 3, our sample's median is six murals; therefore, neighbourhoods with at least one mural but fewer than four are classified as having few, and neighbourhoods with at least four murals are classified as having many. Appendix 7 shows the sensitivity of our results to changes in the threshold *w*. As the threshold becomes lower, the coefficients of the interaction with few murals lose statistical power, and as the threshold becomes larger, they become more significant at the expense of the interaction with many murals. Although not perfect, this comparison helps support our decision to use the median as the threshold, as it mitigates the instability of the standard errors in an unbalanced sample, while there are no theoretical grounds for what constitutes a high or low intensity of mural accumulation.

Still, another explanation for the fact that murals in neighbourhoods with more accumulation have a lower effect on rent prices could be that there are diminishing effects to additional murals, driving the treatment effect down. We test this hypothesis with a logarithmic expression of accumulated murals.

E. Diminishing Effects on Rent

Since neighbourhoods in the control group have no murals, we adjust each observation as shown in Equation 4 to obtain the natural logarithm of the mural stock for each area, giving us a normalised measure of mural accumulation. We obtain the specification shown in Equation 5, which allows us to test the non-linearity of its relationship against normalised rent prices.

$$(4)\quad \ln(murals) = \ln(mural\ stock + 1)$$

$$(5)\quad \ln(r_{int}) = \beta \ln(murals) + \gamma X_{nt} + \omega_i + \delta_n + \alpha_t + \varepsilon_{int}$$

We re-run our main regression, this time with $\ln(mural\ stock)$ as the independent variable. Table 5 presents the new results, without controls in Column 1 and with controls in Columns 2 and 3. Column 1 shows that a 1 percent in mural stock significantly increases rent prices by approximately 0.023 percent. The estimate remains significant and relatively stable when adding the sets of controls in Columns 2 and 3. Comparing these results to those from our previous regression in Table 3, we note that the estimates for $\ln(mural\ stock)$ are more stable than those for mural stock in how they respond to the inclusion of control variables. Whereas Table 3 estimates lose statistical power as rental share and population density controls are added, and

become completely insignificant when including socioeconomic controls, those in Table 5 keep a consistent significance level.

Table 5. Effect of Natural Logarithm of Mural Stock on Natural Logarithm of Rent

	ln(rent) prices across apartment types		
	OLS	OLS	OLS
	(1)	(2)	(3)
ln(mural stock)	0.0233***	0.0244***	0.0231**
	(0.00685)	(0.00810)	(0.00951)
Observations	1303	1303	1303
R-squared	0.935	0.935	0.935
Adj. R-squared	0.933	0.933	0.933
Rental share	No	Yes	Yes
Population density	No	Yes	Yes
Socioeconomic characteristics	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our OLS regression of ln(rent) on ln(mural stock). All our results take into account neighbourhood, year and apartment-type fixed effects. We test for three different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing and population density. Finally, Column 3 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

The stronger significance levels for the logarithmic specification suggest that the relationship between mural accumulation and rent prices might in fact be non-linear. More specifically, as the mural stock in a neighbourhood gets larger, the effect of an additional piece becomes weaker. This finding is consistent with our finding in Table 4 that murals drive rent prices more strongly in neighbourhoods with fewer of them.

However, our specifications so far have yet to take into account the variation in area of each neighbourhood, which is why we also perform the same analyses with mural density instead of simple mural count.

F. The Effects of Mural Density

$$(6)\quad mural\ density = \frac{mural\ stock}{area}$$

We compute the density of murals accumulated in a neighbourhood in a square kilometre as per Equation 6. Our results running the main regression using this new variable are reported in

Appendix 8. We observe no difference in the stability of the estimate when exposed to control variables compared to the results from Table 3. We do note, however, that the magnitudes of the new estimates are approximately ten times larger. When including all controls except socioeconomic characteristics, an increase of one mural per km^2 is linked to an approximately 1.9 percent increase in rent prices in a neighbourhood. However, the scales of mural density and simple mural count are not comparable, so the difference between the coefficients is not particularly telling of whether increases in rent prices correlate more with murals' concentration or quantity, though the results suggest the former might also act as a mechanism.

G. Subsample of Neighbourhoods Under the Montréal Municipal Administration

We run the non-linear regression in Equation 5 again, this time with a subsample excluding independent neighbourhoods, which are structurally excluded from the murals programme. We report our results in Appendix 9. The coefficients obtained are of magnitude comparable to those in Table 5. Estimates in Columns 1 and 2 remain significant at the 1-percent level, but when adding socioeconomic controls, the estimate in Column 3 becomes slightly less statistically powerful, with significance at the 5-percent level. This, however, is likely due to the smaller sample size, since the coefficient has a smaller standard error than when regressing on the full sample. Our results suggest that the reported effects are not driven by a systematic difference between administrative and independent Montréal neighbourhoods.

H. Apartment Type Heterogeneity

So far, all our regressions have included apartment-type fixed effects to account for time-invariant effects of the size of apartments on rent prices. We conduct a robustness check to investigate whether the extent of the murals' effects on rent prices differs depending on the apartment types. The results of our regressions are reported in Table 6. We note that the interaction coefficients are insignificant across all specifications, suggesting that there are no differentiated effects of murals on rent prices between apartment types. Our apartment-type fixed effects absorb the variation coming from apartment sizes, leaving none that interact with the variation in mural stock.

I. Placebo Test

We perform a placebo test to assess the robustness of our DiD setting by assigning treatment to each neighbourhood two years before the actual first mural was installed. The results, presented in Table 7, show a statistically insignificant negative effect for both neighbourhoods with few and many murals across all our specifications in Columns 1-3. The results suggest the first mural treatment is at the origin of the variation reported from our estimates, since rent prices seemingly do not vary when we set the treatment at a period when the neighbourhoods should have had no murals installed.

Table 6. Apartment-Type Heterogeneity Test for the Effect of ln(Mural Stock) on ln(Rent)

	ln(rent) prices across apartment types		
	OLS	OLS	OLS
	(1)	(2)	(3)
ln(mural stock)	0.0286	0.0298	0.028
	(0.0172)	(0.0184)	(0.0193)
One bedroom × ln(mural stock)	-0.0111	-0.0111	-0.0112
	(0.0146)	(0.0147)	(0.0146)
Two bedrooms × ln(mural stock)	-0.0142	-0.0142	-0.0141
	(0.0274)	(0.0274)	(0.0274)
Three bedrooms × ln(mural stock)	0.00729	0.00730	0.00736
	(0.0217)	(0.0217)	(0.0216)
Observations	1303	1303	1303
R-squared	0.936	0.936	0.936
Adj. R-squared	0.933	0.933	0.933
Rental share	No	Yes	Yes
Population density	No	Yes	Yes
Socioeconomic characteristics	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Apartment FE	No	No	No

Standard errors in parentheses clustered at the neighbourhood level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports results from our OLS regression of ln(rent) on ln(mural stock) interaction terms with the apartment type dummies. The table only reports the coefficients for the interaction terms, which are the ones of interest. All our results take into account neighbourhood and year fixed effects. We test for three different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing and population density. Finally, Column 3 includes median household income and college education variables in the specification. The coefficients for Studio apartments were null and were hence excluded from the table. Data sources: CMHC, City of Montréal

Table 7. Placebo Test for the Effect of Mural Stock on ln(Rent)

	ln(rent) prices across apartment types		
	(1)	(2)	(3)
Few × Post	-0.00685	-0.00574	-0.00761
	(0.0182)	(0.0177)	(0.0154)
Many × Post	-0.0141	-0.0123	-0.00966
	(0.00854)	(0.00785)	(0.00914)
Observations	1303	1303	1303
R-squared	0.934	0.934	0.935
Adj. R-squared	0.932	0.932	0.932
Rental share	No	Yes	Yes
Population density	No	Yes	Yes
Socioeconomic characteristics	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our DiD regression of ln(rent) on the post-treatment period interaction terms for the intensity dummies, after having set the post indicator two years prior to its real time. The treated group is divided into neighbourhoods having few murals (<= 6 total mural stock) or many (> 6). The table only reports the coefficients for the interaction terms, which are those of interest in this heterogeneity analysis. All our results take into account neighbourhood, year and apartment-type fixed effects. We test for three different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing and population density. Finally, Column 3 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

VI. Discussion

As our seemingly contradictory results hold up in their respective econometric settings, we are left with an economic explanation for the effect of the City of Montréal's Mural Art Program on rent that is not as straightforward as hypothesised based on existing literature (Maltais & Bélanger, 2021; Laberge, 2025; Kiani et al., 2024; Ezvan, 2025; Youngbloom et al., 2023; Jolivet & Reiser, 2022; St-Hilaire, 2021). This section aims to delve into the possible mechanisms which could explain our findings as well as their implications for Montréal's municipal policymaking.

On one hand, our results in the previous section suggest that the effect of murals on rent prices in neighbourhoods is split into two, with some additional nuances. For one, the overall variation between treatment groups is suggestive of a positive treatment effect in all specifications but the event studies. Concretely, the simple accumulation of mural artworks in targeted neighbourhoods seems to drive rent prices up approximately 0.1 percent per additional mural installed. In a vacuum, this finding corresponds to our expectations with regard to what previous research has argued to be an observable outcome of urban renewal projects (Maltais & Bélanger, 2021; Jolivet & Reiser, 2022; Walks & Maaranen, 2008; Seldin, 2025; Cameron & Coaffee, 2005).

However, this effect would translate to a mere 80-cent increase on an 800-dollar rent, which is minuscule in a yearly span such as which we have based the mural rollout in our analysis. Economically speaking, the effect we found does not seem to be as meaningful. We find from our robustness check in Table 5 convincing evidence that the effect of murals on rent is not linear, which would further suggest that rent prices respond more drastically when a neighbourhood receives its first few murals and stabilise as they keep installing more.

Our heterogeneity analysis in Table 4 reveals the presence of a selection bias where neighbourhoods having had fewer murals installed are worse-off socioeconomically than those having had many. Most of the early treated neighbourhoods are also among those having received the most subsidised murals at the end of our observation period; notably, they almost all have in common that they have been studied in existing literature as gentrified areas in Montréal (Appendix 1; Jolivet & Reiser, 2022; Maltais & Belanger, 2021; Laberge, 2025).

Having already undergone large urban development projects, such as the Lachine canal revitalisation or the MIL campus project, with reported effects on gentrification outcomes (Jolivet & Reiser, 2022; Maltais & Belanger, 2021; Laberge, 2025), it is subject to speculation that the installation of murals in these neighbourhoods does not affect rent to the same extent as neighbourhoods which have not been documented to undergo significant gentrification processes. In other words, the heterogeneity may suggest previous trends of gentrification in a certain neighbourhood, following publicly installed urban renovations, may make the respective area more resilient to additional projects aimed at achieving similar outcomes. Taking into account the differences in exposure to previous urban development projects between neighbourhoods with respectively few or many murals may provide an argument for the observed heterogeneity presented in Table 4.

With regards to the observed selection bias, publicly available information does not allow us to say with certainty if the concrete purpose of the Mural Art Program has shifted from its

beginning over time, which could explain the expansion of the Program to low-income, ungentrified neighbourhoods. Available information, however, mentions how, between years 2007 and 2014, the Mural Art Program operated under the name the "Graffiti Program", with the scope of preventing unwanted graffiti from being painted on public and private walls, alongside the aim to improve city aesthetics (City of Montréal, 2026). Taking this into account, an argument can be built that murals were first installed in neighbourhoods exhibiting demographics associated with an upper-middle class, such as higher median household income and level of education, in order to improve their appeal for this specific social demographic by preventing unwanted graffiti. Following the Graffiti Program, the City of Montréal specifies the "Mural Art Pilot Project" (2014 – 2015) and the ongoing Mural Art Program to have the additional aim of 'enriching the city's cultural heritage' (City of Montréal, 2026), creating room for speculation that its scope exhibited changes which catalysed the increase in murals being installed within neighbourhoods of lower-income residents as a result.

Although the mechanisms behind choosing where to install murals remain undefined, we can draw a parallel between the observed selection bias of our results and the changed espoused targets the City of Montréal expresses the Mural Art Program and its earlier variations have had. The changes in scope of the program and "targeted" neighbourhoods as observed by our data may also explain the results of the Goodman-Bacon decomposition presented in Figure 5, where the timing of receiving a mural is presented as the main source of the negative bias discussed.

On the other hand, our event study results seem to tell a different story. Both Figure 4 and Figure 6 show a clear, yet statistically insignificant, down-sloping trend for rent prices in a neighbourhood following the first year a mural has been installed. Considering the magnitude of our confidence intervals, we think it is still worth investigating possible explanations for our observations. Compared to the year before its first mural, a neighbourhood will have its rent prices decrease in the following years, and the correlation seems to be concentrated within neighbourhoods with few murals. Again, these results may be explained by previously mentioned possible changes to the scope of the Mural Art Program, causing a bias triggered by the timing of treatment and how neighbourhoods which have received few murals have not undergone notable gentrification outcomes in the past.

The event study presented in Figure 6 suggests that, within the treated group having received few murals, the installation of a public artwork decreases perceived attractiveness of the respective neighbourhood, a claim incongruent with what previous literature would argue for the art-led initiative to have as an outcome (Seldin 2017, 2025; Ley 2003; Cameron & Coaffee 2005). Although we lack a theoretical framework to explain this observed trend in detail, we note that the event study only takes into account the correlation between rent and the installation of one mural: the first mural. When looking at outcomes of accumulated mural installations on rent, all regressions run show a significant effect, suggesting causality. However, due to the endogeneity concerns discussed, we cannot claim the presence of a causal effect.

VII. Conclusion

In light of the ongoing discourse on the main drivers of gentrification in metropolitan cities across the globe (Lees et al. 2015; Shin, 2018), the implication of increases in cultural capital for neighbourhoods which exhibit residential displacement and changes in social demographics has been raised as a key factor to consider by contemporary research (Seldin, 2025; Ley, 2003; Bridge, 2001). Discourse further highlights how public policies aimed at improving urban environments may unintentionally cause adverse effects to population health and prosperity (Chen et al., 2023; Gorjian, 2025; Kiani et al., 2024; Ezvan, 2025). In this study, we examine whether the publicly funded Mural Art Program in Montréal may contribute to such adverse effects by measuring a recognised outcome of the gentrification process: increases in rent.

We provide econometric research and empirical evidence suggesting an observable, positive effect between the accumulation of the number of murals at the neighbourhood level and an increase in rent for 4 different apartment types in 37 neighbourhoods of Montréal through an OLS regression. Built using data on rental prices from the Canada Mortgage and Housing Association, census data from the City of Montréal and, further, panel data on mural locations provided by the city, our main regression remains robust to rental price and population density controls, but loses significance when controls for socioeconomic variables are introduced, suggesting a possible non-linearity to the observed trend. The suggested non-linearity is sustained by running our main specification using the natural logarithm of mural accumulation, showing how results remain positive and statistically significant across all added controls. Essentially, our main specification highlights how receiving a public artwork can have an economically small, but significant effect on rental prices, and how this effect may diminish in terms of magnitude as the number of installed public artworks increases. However, our causal claim remains weak.

When further examining the relationship between a neighbourhood receiving its first mural and rental prices through a staggered difference-in-difference event study, results appear contradictory to our main regression, with the observed correlation being negative. Dissecting these results using the Goodman-Bacon decomposition as a diagnostic tool, and further into two separate treatment groups: neighbourhoods having received few or many murals, we find observable differences in the correlation specified between respective groups, which we argue stem from the timing (i.e. the year the first mural was received).

Interestingly, neighbourhoods that have received many murals and their first mural in the early years of the Program do not exhibit the same negative correlation between treatment and rent as neighbourhoods with few murals receiving their first mural in the later years of the Program. Rather, the treatment effect defined is close to zero for neighbourhoods pertaining to the many-murals group. Furthermore, we observe and acknowledge that the neighbourhoods having received many murals earlier have also been subject to urban renewal projects in the past, resulting in documented gentrification outcomes. Our decomposed event-study results thus suggest the Mural Art Program may have, without making its specific aims publicly clear, firstly targeted installation of public artworks in neighbourhoods already having exhibited changes to social demographics associated with gentrification trends and in later years expanded financing of public artworks to neighbourhoods which, until then, had not undergone similar socioeconomic changes.

The two paths our empirical study follows provide two seemingly different observable outcomes of the effect that an increase in cultural capital may have on rent. Nonetheless, when decomposing and examining their inner mechanisms, our research provides interesting remarks on how pre-existing gentrification trends can have implications for the way art-led urban renewal projects affect rent. Our first research path provides an econometric relationship between publicly financed art projects and rent, which is congruent with existing theory. It can thus be used, alongside accumulated literature, by shapers of public policy as an example of a possible adverse outcome to be aware of when aiming to improve the aesthetics of public places. Our second path leaves room for further discussion of how existing gentrification trends and socioeconomic conditions may come into play when cities attempt to beautify their public spaces.

Lastly, we propose that future research extend the measurement of how cultural capital can increase the perceived attractiveness of residential areas to multiple variables associated with gentrification outcomes. This would allow for nuanced discussions of the implications art-driven, public projects may have on social demographics in metropolitan cities, limited in our research by the lack of publicly accessible data. We would also propose studying channels through which art installations may cause a repulsion in perceived attractiveness, as the negative correlation observed in our second path leaves room for speculation on how specific conditions interfering with the art installation may alter the expected outcomes contemporary literature suggests.

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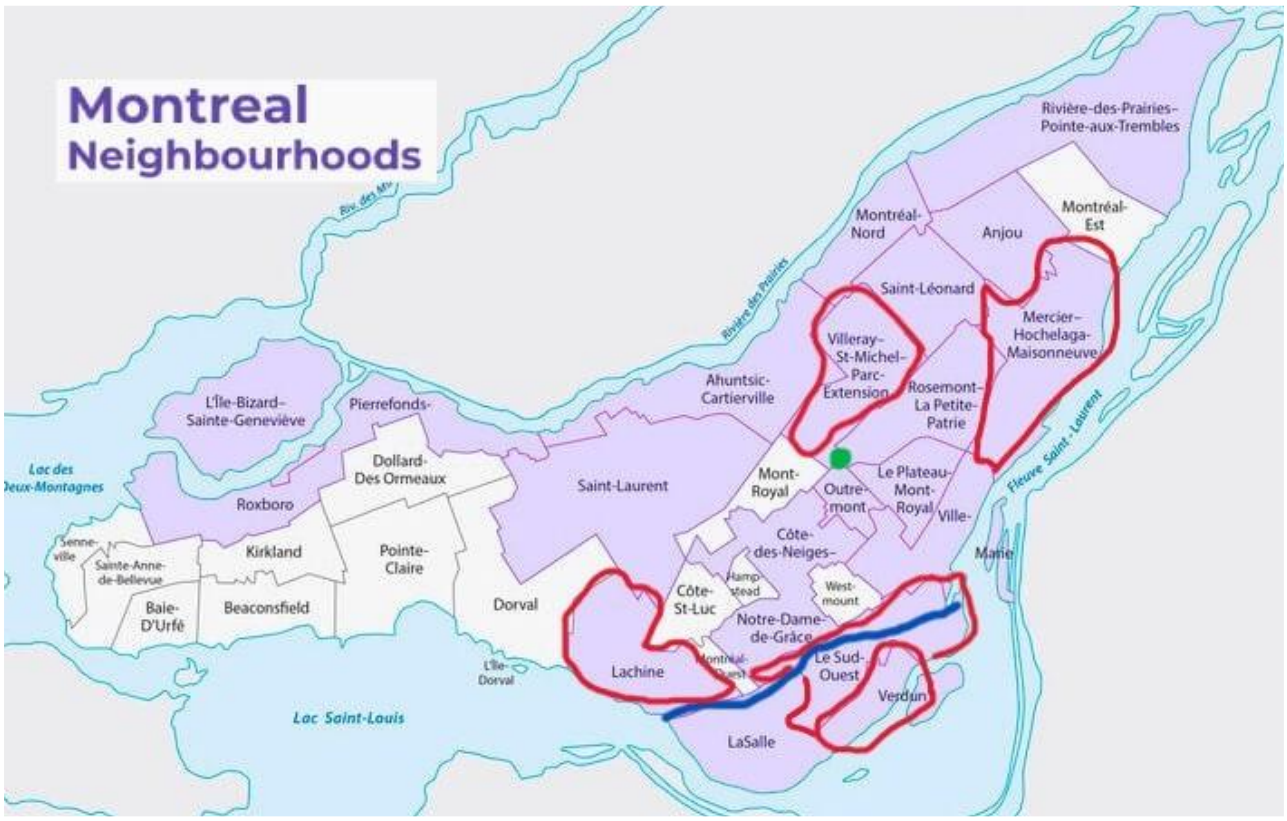
IX. Appendix

Appendix 1

Montréal city map, with gentrified neighbourhoods highlighted, alongside geographical locations of major urban development projects: the Lachine canal and the MIL campus revitalisation



Appendix 2

Source: City of Montréal
Artist: Sophie Wilkins

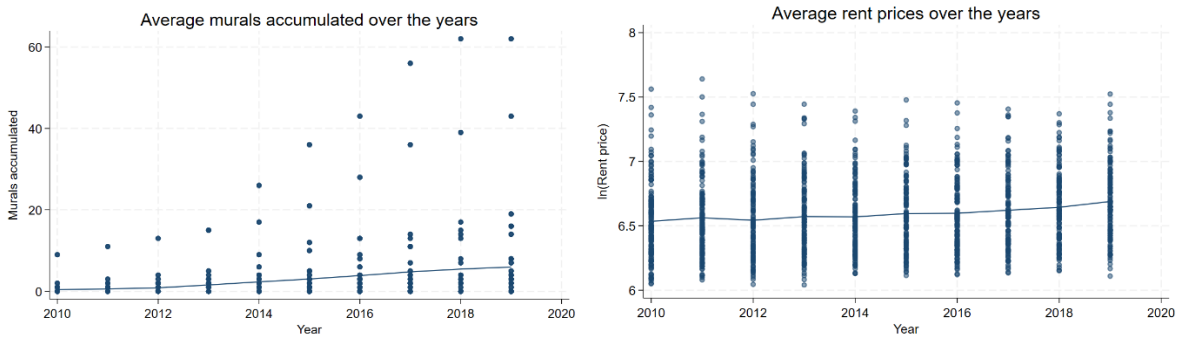
Source: City of Montréal
Artist: Jason Botkin

Source: City of Montréal
Artist: Mono Gonzales

Source: City of Montréal
Artist: Kevin Ledo

Appendix 3

Figure 7. Scatter Plots of Average Mural Accumulation and Rent Prices over Time



Note: The scatter plots both show upward-sloping trends over time, suggesting the possibility of correlating the two variables in the study. Source: Authors' rendering of the City of Montréal's murals data (2010-2019) and CHMC Rental Price Surveys data (2010-2019)

Appendix 4

Table 8. Baseline Summary Statistics by Treatment Group

	mean	sd	min	max	count
Control					
ln(rent)	6.620	0.289	6.045	7.640	765
ln(median household income)	11.088	0.320	10.488	11.809	900
College education	0.407	0.170	0.080	0.768	900
Rental housing	0.464	0.164	0.082	0.740	900
Population density	3628.701	2150.201	219.100	8456.700	900
Treated					
ln(rent)	6.551	0.287	6.040	7.523	538
ln(median household income)	13.207	15.772	1.000	62.000	580
College education	10.781	0.151	10.439	11.160	580
Rental housing	0.382	0.127	0.134	0.644	580
Population density	0.664	0.091	0.356	0.749	580

Note: The table reports mean, standard deviation, minimum and maximum statistics for all observations in our sample based on the neighbourhoods' treatment group. Treated neighbourhoods have had at least one mural installed during the observation period. Source: Authors' rendering of CHMC Rental Price Surveys data (2010-2019), the City of Montréal's murals data (2010-2019) and the City of Montréal's census data (2006, 2011, 2016)

Appendix 5

Table 9. Effect of Mural Stock on ln(Rent)

	OLS (1)
Mural stock	0.00101
	(0.000643)
Share of rental housing	0.0469
	(0.383)
ln(median household income)	-0.114
	(0.219)
Share of college-educated	0.593
	(0.384)
Population density	-0.00000315
	(0.0000102)
Observations	1303
R-squared	0.935
Adj. R-squared	0.932
Neighbourhood FE	Yes
Time FE	Yes
Apartment FE	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our OLS regression of ln(rent) on mural stock with all our control variables. The table presents the coefficients for each control variable. All our results take into account neighbourhood, year and apartment-type fixed effects. Data sources: CMHC, City of Montréal

Appendix 6

Table 10. Event Study Coefficients

	(1) ln(rent)
Event time -4	0.0203 (0.0536)
Event time -3	0.0232 (0.0287)
Event time -2	0.0137 (0.0199)
Event time 0	-0.0131 (0.0144)
Event time 1	-0.0129 (0.0267)
Event time 2	-0.0457 (0.0367)
Event time 3	-0.0621 (0.0483)
Event time 4	-0.0785 (0.0594)
Event time 5	-0.0877 (0.0737)
Event time 6	-0.0988 (0.0850)
Event time 7	-0.125 (0.0990)
Event time 8	-0.123 (0.113)
Event time 9	-0.148 (0.123)
Observations	670
Adjusted R-squared	0.941
Neighbourhood FE	Yes
Time FE	Yes
Apartment FE	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Note: Event time -1 is the omitted baseline period. Data sources: CMHC, City of Montréal

Appendix 7

Table 11. Sensitivity to the Threshold for the Intensity of Mural Treatment

	ln(rent) prices across apartment types							
	$w = 6$ (Baseline)	$w = 1$	$w = 2$	$w = 3$	$w = 4$	$w = 5$	$w = 7$	$w = 10$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Few × Post	0.0311***	0.000972	0.0195	0.0384***	0.0299***	0.0311***	0.0296***	0.0299***
	(0.0112)	(0.00982)	(0.0141)	(0.0184)	(0.0128)	(0.0112)	(0.0106)	(0.00970)
Many × Post	0.0217	0.0297***	0.0291**	0.0201*	0.0251**	0.0217	0.0223	0.0178
	(0.0135)	(0.0102)	(0.0109)	(0.0114)	(0.0123)	(0.0135)	(0.0159)	(0.0175)
Observations	1303	1303	1303	1303	1303	1303	1303	1303
R-squared	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935
Adj. R-squared	0.932	0.932	0.932	0.932	0.932	0.932	0.932	0.932
Rental share	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neighbourhood FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports the estimates for the interaction terms of the post-treatment period with different thresholds w for classifying a neighbourhood as having few or many murals. The treated group is divided into neighbourhoods having few murals (<= w total mural stock) or many (> w). The table only reports the coefficients for the interaction terms, which are those of interest in this heterogeneity analysis. All our results take into account neighbourhood, year and apartment-type fixed effects as well as all sets of controls. Data sources: CMHC, City of Montréal

Appendix 8

Table 12. Effect of Mural Density on ln(Rent)

	ln(rent) prices across apartment types		
	OLS	OLS	OLS
	(1)	(2)	(3)
Mural stock per km^2	0.0203**	0.0189**	0.0150
	(0.00789)	(0.00904)	(0.0108)
Observations	1303	1303	1303
R-squared	0.935	0.935	0.935
Adj. R-squared	0.932	0.932	0.932
Rental share	No	Yes	Yes
Population density	No	Yes	Yes
Socioeconomic characteristics	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Note: The table reports results from our OLS regression of ln(rent) on the density of murals in a neighbourhood per square kilometre. All our results take into account neighbourhood, year and apartment-type fixed effects. We test for three different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing and population density. Finally, Column 3 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

Appendix 9

Table 13. Effect of ln(Mural Stock) on ln(Rent) when Excluding Independent Neighbourhoods

	ln(rent) prices across apartment types		
	OLS	OLS	OLS
	(1)	(2)	(3)
ln(mural stock)	0.0225***	0.0197***	0.0165**
	(0.00675)	(0.00707)	(0.00697)
Observations	968	968	968
R-squared	0.940	0.940	0.941
Adj. R-squared	0.938	0.938	0.938
Rental share	No	Yes	Yes
Population density	No	Yes	Yes
Socioeconomic characteristics	No	No	Yes
Neighbourhood FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Apartment FE	Yes	Yes	Yes

Standard errors in parentheses clustered at the neighbourhood level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The table reports results from our OLS regression of ln(rent) on ln(mural stock) with a reduced sample excluding independent neighbourhoods, which are structurally ineligible to receive murals as part of the Art Mural Program. All our results take into account neighbourhood, year and apartment-type fixed effects. We test for three different cases, each including a different set of control variables. Column 1 presents our estimate without any controls. Column 2 includes controls for the share of households in rental housing and population density. Finally, Column 3 includes median household income and college education variables in the specification. Data sources: CMHC, City of Montréal

AI Disclosure

This appendix discloses the extent of our usage of generative AI in our thesis writing process.

We have used in parallel up-to-date versions of ChatGPT and Claude to generate Stata code for the analysis of our data. The models were prompted to provide the code in the correct syntax to be used in our file to run our regressions. In the same vein, we have used the models to troubleshoot errors in our code during the process.

The use of generative AI has been extremely valuable in streamlining the data analysis process at the core of our econometric question. It has been helpful for us in producing figures properly conveying the potential meaning of the numbers from our data. We have saved precious time which would have been spent on debugging our code, exploring different specifications and robustness checks and deepening our understanding of gentrification in the context of Montréal.

The use of generative AI for our purposes was generally cautious. To avoid missing errors hidden in a black box, we did not upload our data for the models to generate output to be used directly in the thesis. We prompted the models iteratively according to each specific section of code needed and inputted ourselves the lines of code in our software to produce our own outputs, thus including constant human feedback in the process.

Ultimately, the use of generative AI in the thesis writing process has made us realize the importance of keeping a hands-on approach with the models despite the very confident tone they adopt in their answers. It is often worth questioning the models on their answers, as well as remaining vigilant and assessing the outputs ourselves.