Housing Supply and Elasticities

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March 30, 2025

Abstract

This paper examines whether Census Metropolitan Areas (CMA) with more elastic housing supplies experience a stronger supply-side response to monetary policy and whether this response moderates housing prices. Using Statistics Canada and Canadian Mortgage Housing Corporation Data, we first compute housing supply elasticities across 26 Canadian CMA. We then classify them into high- and low-elasticity groups and estimate a Structural Vector Autoregressive model for both groups. By analyzing impulse response functions and the Granger causality test results, we find that in the high-elasticity model, a contractionary monetary policy shock positively predicts housing supply at the 10% significance level. Then, an increase in housing supply negatively predicts prices, such that results are significant at the 5% level. Contrarily, the analysis completed on the low elasticity group yields no statistically significant results at any reasonable threshold. While the increase in housing supply in response to contractionary monetary policy is unexpected, this study still demonstrates that high- and low-elasticity cities react differently to monetary policy.

1 Introduction

There is a bidirectional relationship between the housing market and the macroeconomy (Topel & Rosen, 1988; Leamer, 2007). Thus, it is crucial to understand their joint dynamics to create a policy that ensures financial stability and affordable housing options. Although there is significant and conclusive research conducted on the demand-side transmission of monetary policy in the housing market, there is less research on the supply-side dynamics (Elbourne, 2008; Mohan et. al, 2019; Iacoviello, 2005). Thus we pose the following questions: Do cities with a more elastic housing supply experience a stronger supply-side response to monetary policy? Does this response help moderate housing prices? These questions are important because if the housing supply and price response to interest rate changes differs significantly between cities with high-and low-elasticity levels, then monetary policy is unintentionally creating inequality which may be remedied through local or provincial fiscal policy.

We address these questions by constructing a panel of data at the CMA level, with data spanning from 1992-2019. All data is sourced from Statistics Canada and the Canadian Mortgage and Housing Corporation. We utilize the producer price index, newly completed dwellings, housing price index, policy rate, population, and population density variables in our empirical analysis. After aggregating the data, 26 cities remain in the panel.

To establish heterogeneity across cities, we first compute the elasticities through a log-log regression. This model utilizes the logged values of housing supply, represented by the newly completed dwellings and the logged housing price index. Upon completing the regression across each city, we sort the cities into high- and low-elasticity groups, using the median as a threshold to classify the CMA's.

We then construct two separate Structural Vector Autoregressive models (SVAR) for the high- and low-elasticity cities. We implement the Cholesky decomposition to identify the structural shocks allowing us to draw causal inferences regarding the impact of monetary policy on housing supply across the high- and low-elasticity groups.

Our findings are determined through impulse response functions and Granger causality tests. We find that in high-elasticity cities, contractionary monetary policy temporarily increases housing supply and that this result is significant at the 10% level. Then, we find that an increase in housing supply temporarily decreases housing prices which is significant at a 5% level. When we further explore the relationship between interest rates and lagged housing supply, we find a negative relationship between contractionary monetary policy and housing supply which is significant at the 10% level. In contrast, we find no statistically significant relationships within the low-elasticity model. These results imply that low-elasticity regions are less likely to adjust their housing supply or prices in response to monetary policy changes.

Our research offers three main contributions. Firstly, we offer new housing supply elasticity calculations for Canadian cities. The majority of the research and computation associated with supply elasticities is completed in the United States. Saiz (2010) and the Wharton Land Use Index offer computed housing supply elasticities and building constraints across a diverse range of cities in the United States (Gyourko, Saiz & Summers, 2008). These figures are generally accepted in the literature, where authors frequently utilize their measurements to complete further housing market analysis (Aastveit & Anundsen, 2022; Hsieh & Moretti, 2019; Favilukis, Mabille, Van Nieuwerburgh, 2003). This common metric establishes a reliable baseline for future housing market research. In Canada, the elasticity computations are more sparse. Although Paixão (2021) proposes a list of housing supply elasticities across Canadian CMA's, there are few other resources and no widely accepted source of housing supply elasticities across Canada. We offer an additional point of reference in this limited literature.

Secondly, our research contributes by testing whether macroeconomic theory regarding housing production holds across Canadian CMA's. The monetary policy transmission mechanism suggests that a decrease in interest rates also reduces the cost of construction, thus increasing the housing supply and applying downward pressure on prices (Mishkin, 2007; McCarthy & Peach, 2002; DiPasquale, 1999). While multiple researchers explore these effects in the United States, there is a lack of research completed in Canada (Aastveit & Anundsen 2022; Aastveit & Anundsen 2023; Xie 2024). Notably, housing market findings from the United States cannot immediately be generalized to Canada because the mortgage market is governed by different policies and our macroeconomy is frequently modeled as a small open economy as opposed to a large closed economy which alters the transmission of monetary policy.

Lastly, we contribute to the existing empirical literature on the impact of monetary policy and elasticities on housing supply and, subsequently, prices. The majority of the research on the impact of monetary policy on the housing market is focused on demand-side analysis. Empirical work considering the demand channel through which monetary policy impacts housing prices uses variables such as oil prices, retail sales, short-term interest rate, GDP, unemployment, and the consumer price index to determine the impact of monetary policy on the housing price index (Elbourne, 2008; Mohan et. al, 2019; Iacoviello, 2005). These studies consistently find that an increase in interest rates decreases housing prices. However, on the supply side, results are mixed. Some research finds that expansionary monetary policy shocks have a greater price impact when the housing supply is elastic (Aastveit & Anundsen, 2022; Xie, 2024). However, other studies find that housing prices are not moderated by supply elasticities (Davidoff, 2013). More broadly, Louie, Mondragon & Wieland (2025), find that housing supply elasticities have no impact in predicting quantity and prices when accounting for income and population growth. It is important to establish the role of housing supply elasticities, and the impact of monetary policy, on housing quantity and prices. In proving that monetary policy has a heterogeneous impact across cities, targeted fiscal policy may address any undesirable inequalities.

The remainder of the paper proceeds as follows: section 2 presents a literature review, section 3 provides a description of the data, section 4 describes the methodology, section 5 explains the results, section 6 discusses our findings, and finally, section 7 concludes.

2 Literature Review

2.1 Theoretical Foundations

There is a robust body of literature presenting theoretical housing market models to explore the impact of monetary policy and other determinants on housing supply. McCarthy & Peach (2002), find that monetary policy is transmitted through both the supply and demand side of the housing market where an increase in interest rates raises the cost of a mortgage and construction. Mishkin (2007) derives the same conclusion, finding that this initial change further perpetuates a decline in construction, driving a decrease in aggregate demand in the economy as a whole. Theoretical research also explores the impact of lags on housing market responses to interest rate changes. Leamer (2007) argues that interest rate changes pull construction activity forward. Monetary policy is determined endogenously by the performance of other macroeconomic variables, consequently, interest rates decrease in slow economic periods. Since lower interest rates decrease the cost of borrowing, this spurs construction and housing starts. Then, as the economy recovers, the central bank increases interest rates as the housing construction projects are completed. Leamer (2007) further demonstrates the lagged effects of housing construction by showing that there was a significant increase in housing starts in the low interest rate period from 2003-2005, however, by the time the houses were produced from 2006-2008, the economy and housing demand was weakened by the recession. The supply-side monetary policy transmission mechanism as described by McCarthy & Peach (2002) informs the variable selection in our empirical analysis. Then, we acknowledge the lagged effects of the housing supply responses in interpreting our results.

There is a known bidirectional relationship when considering the interaction between the macroeconomy and housing prices. In terms of the impact of the macroeconomy on housing prices, Topel & Rosen (1988) found that cyclical movements in housing construction are demand-driven, where investment costs combined with expected returns converge to determine housing prices. Adam, Kuang, and Marcet (2012) found that housing prices are determined by macroeconomic factors and individuals' consumption choices. The reverse direction is more contentious. Li & Yao (2005) argue that changes in housing prices do not impact the broader macroeconomy. However, Adam, Kuang, and Marcet (2012) find that housing prices impact borrowing and consumption and that economic shocks affect economic stability. While these results are mainly demand-driven, they suggest that there is an endogenous relationship between macroeconomic and housing market variables which we account for in the selection of our empirical model.

2.2 Housing Supply Elasticities & Monetary Policy Response

In analyzing housing supply, researchers consider elasticities because they measure the market response to a change in price, however, the determinants of housing supply are inconclusive. We hypothesize that when markets are elastic, demand shocks are absorbed by more housing construction. Whereas, in inelastic markets, the lack of supply-side response contributes to a further increase in prices. Green, Malpezzi & Mayo (2005), compute housing supply elasticities across 45 metropolitan statistical areas in the United States. They find that population density, house price level, and more housing regulations are all associated with lower elasticities. In contrast, population and log-population are positive and statistically significant predictors of elasticity (Green, Malpezzi & Mayo, 2005). Topological constraints such as hills and bodies of water, high taxes, and elevated immigration levels are also associated with lower housing elasticity levels (Saiz, 2008). Contrarily, Broxterman, Liu & Yezer (2019) find that reductions in available land do not impact supply elasticities. Utilizing an urban spacial model, Broxterman et al.(2024), find that supply elasticity decreases with city size and distance from the city center and elasticities increase with agricultural reservation prices and the cost of structure inputs. Paixão (2021) found that median elasticity levels in the United States and Canada are similar. In general, research shows that housing supply elasticities vary significantly across cities (Ball, Meen & Nygaard, 2010; Green, Malpezzi & Mayo, 2005; Paixão, 2021). While construction constraints are frequently cited as drivers of housing elasticity, Louie, Mondragon & Wieland (2025) find that these constraints fail to predict changes in housing quantity and price. Alternatively, they find that these changes are demand-driven where both supply and prices are impacted by income and population growth.

Notably, there is no consensus regarding the impact of monetary policy on housing supply, nor the impact of housing supply on the broader market. McCarthy & Peach (2002) research argues that changes in the volume of residential investment respond to monetary policy and that these effects have been similar over time. Aastveit et al. (2023) further contribute, finding that supply elasticities have been decreasing over time which encourages a stronger house price response to interest rate shocks. These effects have also been found to be asymmetric where a decrease in interest rates imposes a larger price increase in inelastic markets, whereas a contractionary policy causes a greater price decrease in cities with higher elasticities (Aastveit & Anundsen, 2022). Contrairly, Davidoff (2013), finds no evidence supporting the claim that housing elasticities impacted the severity of the housing price cycles in the 2000s. Paixão (2021) takes a more moderate position, finding that housing supply has no impact in the short run, however, it is correlated with long-run growth in housing prices. Our research further contributes to this literature.

2.3 Overview of Housing Supply Research and Results

The table below displays a list of recent studies exploring the impact of monetary policy and supply elasticities on housing production and prices.

Table 1: Housing Supply - Literature Overview & Findings

Paper	Research Question and Answer	Model Used	Key Variables
Ball, Meen & Nygaard (2010)	Cross country comparisons find that elasticities have a greater impact on housing supply than on price level.	Structural Vector Autoregressive Model with block decomposition.	Real house price, housing transactions as a proportion of total housing stock, housing starts and the change in construction costs.
Davidoff (2013)	There is no evidence to suggest that housing prices were moderated by supply elasticities in the 2000s.	Regression Analysis	Interest rates, appreciation expectations, mortgage underwriting standards, population, employment, market supply elasticity, land availability, regulations and state.
Aastveit & Anundsen (2022)	Expansionary policy shocks have a greater impact on prices when supply elasticities are low, however supply elasticity is an insignificant predictor of price under contractionary monetary policy.	SVAR model with exogenous monetary shocks from Romer and Romer (2004) with impulse responses by city specific elasticity bins.	House prices, interest rates, CPI, disposable income, Saiz (2010) elasticity, Wharton Land Use Index, MSA-specific data (1983–2007).

Paper	Key Finding	Model Used	Key Variables
Aastveit, Albuquerque & Anundsen (2023)	Housing supply has become more inelastic overtime, yielding stronger monetary policy effects.	Panel VAR using time-varying supply elasticities	Building permits, house prices, local GDP, regulation indices, interest rates.
Xie (2024)	Information frictions contribute to the delayed change in house prices in response to monetary policy. High housing supply elasticities moderate the price increase in response to expansionary monetary policy.	Panel local projection yielding nonparametric IRF estimates	Housing supply elasticity, lagged house price, location fixed effects, change in policy rate and cumulative house price growth.
Forster & Sun (2024)	Supply and demand conditions including housing permits, income, employment and population all influence the magnitude of housing returns when mortgage rates change.	Interacted Panel VAR	Mortgage rate, real housing returns, MSA fixed effects.
Louie, Mondragon & Wieland (2025)	Income and population growth yield the same housing and price predictions, irrelevant of housing supply elasticities.	Demand-and-Supply framework	Real House Price Growth, Real Median House Value, Real Total Income Growth, House Quantity Growth, Population Growth, Change in Average Rooms per Person, Construction Constraint Dummy Variable

3 Data Description

For the construction of our model, we collected data on housing permits, the Industrial Product Price Index (IPPI), the policy rate, and new housing supply from Statistics Canada. Housing permit data is sourced from Statistics Canada and provides monthly information on dwelling units by type of structure from 1976 to 2017 at the CMA level. The IPPI is used to capture the cost of housing construction from 1956 to 2025, while the Bank of Canada's published policy rate covers the period from 1935 to 2025. Data on new housing supply, including absorptions and unabsorbed inventory of newly completed dwellings, are obtained from the Canada Mortgage and Housing Corporation (CMHC) for major CMA regions from 1988 to 2025. After data cleaning, 26 CMA regions remain, each with varying data lengths.

3.1 Descriptive Statistics

We explore the graphical relationship between housing supply and the policy rate in Canada to detect comovement in the timeseries, which forms the basis for our hypothesis.

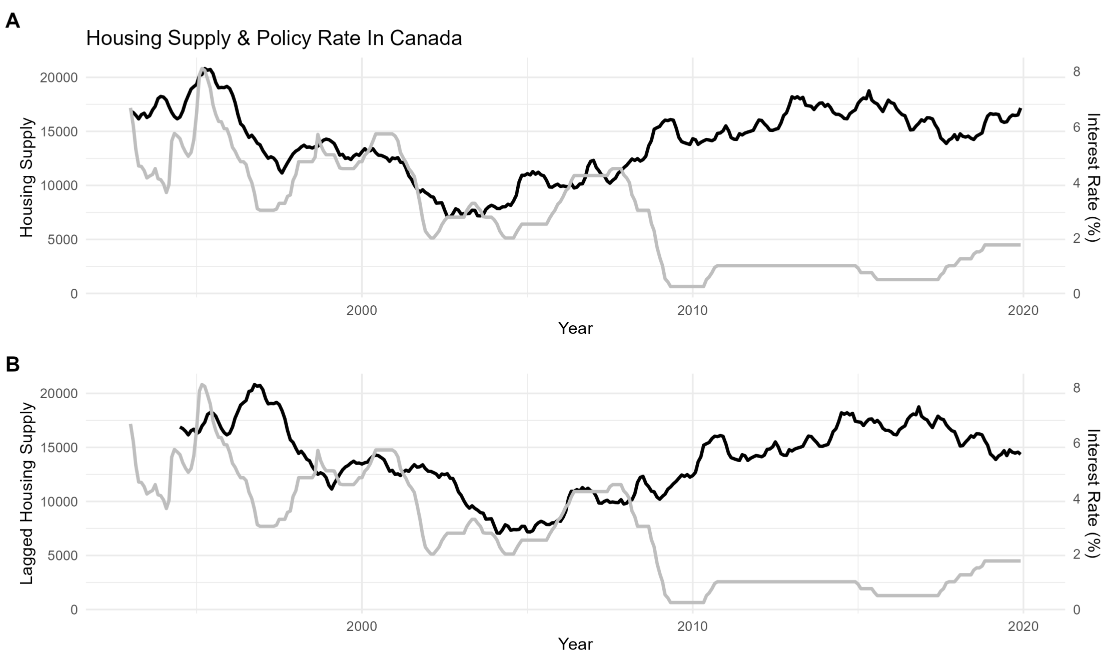

Figure 1: Comparison of 18-Month Lagged vs Current Housing Supply in Relation to the Policy Rate in Canada

Legend: Black Line = Housing Supply; Grey Line = Policy Rate

Figure 1 illustrates the relationship between the policy rate to the housing supply and the lagged housing supply from 1992 to 2019. In graph A we see positive comovement between the policy rate and housing supply from 1992-2007. Then, in August 2007, the central bank began lowering interest rates due to the financial crisis and rates remained at a lower level from that point. From 2010-2017, both interest rates and housing supply remain relatively stable before both increased from 2017-2019. Graph B displays negative comovement between the policy rate and lagged housing supply. While there is a significant divergence between housing supply and the policy rate, this is attributable to the financial crisis. Then, similar to Figure A, we see that both the housing supply and policy rate are relatively stable from 2010-2017. Then from 2017-2019, the Central Bank began increasing the policy rate and lagged housing supply declined.

4 Method

4.1 Log-Log Regression and Elasticity Interpretation

We apply a log-log regression to estimate the elasticity of housing prices with respect to the new housing supply. To avoid taking the log of zero, we dropped all zero values in our calculations which excluded Charlottetown.

City specifc log-log model is:

$$\log(\text{New\_Housing\_Supply}_{it}) = \beta_i \log(\text{Housing\_Price\_Index}_{it}) + \varepsilon_{it} \tag{1}$$

unit i represents the 26 difference CMA regions at time t,

4.1.1 Why Use Log Transformations?

log-log regression has several advantages.

- First, log linearizes exponential growth relationships and transfers it into a percentage term, which is required in an elasticity calculation.
- Second, it stabilizes variance which improves the reliability of inference.

4.1.2 Elasticity Interpretation

The coefficient β in a log-log model can be interpreted directly as an elasticity. Specifically, β measures the percentage change in Y associated with a one-percent change in X. This can be seen by taking the total derivative of both sides:

$$\frac{d\log(Y)}{d\log(X)} = \beta \tag{2}$$

Since $\frac{d\log(Y)}{d\log(X)} = \frac{dY/Y}{dX/X}$, we obtain the classic definition of elasticity:

$$\text{Elasticity} = \frac{\Delta Y/Y}{\Delta X/X} = \beta \tag{3}$$

Therefore, if $\beta = 0.5$, a 1% increase in the housing price index is associated with a 0.5% increase in new housing supply.

4.1.3 City Specific log-log Regression Results

In the context of housing markets, the log-log regression framework provides a natural way to estimate the price elasticity of housing demand or supply. By regressing the logarithm of housing prices on the logarithm of new housing supply across different CMA's and over time, we can infer how sensitive housing prices are to changes in housing availability. This information is crucial for policymakers looking to improve housing affordability through supply-side interventions.

Low Elasticity Cities	**High Elasticity Cities**
Oshawa (0.58)	Saskatoon (1.17)
Sudbury (0.59)	Hamilton (1.18)
Saint John (0.66)	Kitchener-Waterloo (1.18)
Guelph (0.69)	Ottawa-Gatineau (1.29)
Trois Rivières (0.82)	London (1.3)
St. John's (0.88)	Winnipeg (1.31)
Windsor (0.96)	Quebec (1.35)
Sherbrooke (0.99)	Calgary (1.6)
Halifax (1.08)	Edmonton (1.63)
St. Catharines-Niagara (1.08)	Toronto (1.65)
Regina (1.09)	Vancouver (1.68)
Victoria (1.13)	Montreal (1.71)
Kelowna (1.14)	

Table 2: Cities Grouped by Housing Supply Elasticity (Median = 1.14)

The log-log regression results suggest a positive relationship between population density and elasticity which contradicts the findings in the literature. Thus, we attempt a few additional econometric methods. After conducting the regression with stationary data and attempting the delta method, the positive relationship between population density and elasticities. Thus we present our original results and defend these findings in the discussion section.

4.2 Structural VAR & Cholesky Decomposition

As described by Kilian (2011), a Structural VAR is an extension of the VAR model that introduces restrictions on contemporaneous interactions between variables.

Consider the following equation for a general VAR model:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + ... + A_p Y_{t-p} + \epsilon_t$$

Where Y_t is an endogenous variable at time t and ϵ_t is the error term which is uncorrelated across equations. The SVAR imposes additional restrictions:

$$Bu_t = \epsilon_t$$

In this expression above, we define:

- B = Lower triangular matrix of structural restrictions under Cholesky Decomposition.
- $u_t \sim N(0, \Sigma)$, such that u follows a multivariate normal distribution with a mean of 0 and variance-covariance matrix Σ.

Notably we can re-arrange the expression above yielding:

$$u_t = B^{-1}\epsilon_t$$

Under the assumption that $\epsilon_t \sim N(0, I)$, the variance-covariance matrix becomes:

$$\Sigma = E[u_t u_t'] = E[B^{-1}\epsilon_t \epsilon_t'(B^{-1})'] = B^{-1} I B^{-1'}$$

In implementing Cholesky decomposition, we assume that:

$$\Sigma = BB'$$

Under this system, vectors are impacted contemporaneously by shocks to variables to their left in the matrix, then react in future periods when variables to the right are changed. Given that the shocks are identifiable, we can distinguish between different structural shocks, allowing for economic interpretation.

To identify the structural shocks, we impose the following order:

$$Y_t = \begin{bmatrix} \Delta \log(\text{Supply}_t) \\ \Delta \text{PPI}_t \\ \Delta \text{PR}_t \\ \Delta \log(\text{HPI}_t) \end{bmatrix}$$

Furthermore, we define:

$$B = \begin{bmatrix} 1 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 \\ b_{41} & b_{42} & b_{43} & 1 \end{bmatrix}$$

4.3 Justification for Variable Ordering

In our VAR model, we ordered the variables based on this order of slowest-responding to fast-responding variables.

Housing Supply (Ordered First). Housing supply is placed first in the Cholesky ordering due to its slow response to the policy rate change. Housing construction is a long-term project as it may take months or even years to complete. Therefore, it is unable to respond in the same period to changes in PPI, policy rate, or housing prices.

Producer Price Index (Ordered Second). The PPI is ordered second, as it may respond weakly to housing supply conditions within the same period. However, it is less likely to respond immediately to the change in policy rates. The economic intuition is that the policy rate does not directly impact the PPI but rather impacts it through several economic steps. First, the policy rate will impact the cost of borrowing, which will further impact investment and demand. From there, the change in investment and demand will impact the PPI.

Policy Rate (Ordered Third). Third, housing prices are highly responsive and fast-moving variables, as noted in the literature review. They are flexible and can change on a day-to-day basis, often reacting instantaneously to changes in the policy rate. Therefore, in the model, the policy rate should be ordered before housing prices. However, the central bank can observe housing supply and the producer price index when setting the interest rate, and it typically adjusts interest rates more quickly than housing supply can respond.

Housing Prices (Ordered Last). Housing prices are ordered last in the Cholesky ordering as they are the most responsive to changes in the policy rate. Housing prices can change daily based on economic news and monetary policy. Such monetary policy will impact mortgage rates and then change housing demand, leading to changes in housing prices. Considering this responsiveness, housing prices are assumed to be contemporaneously affected by all other variables in the system; therefore, they are placed last.

4.4 Impulse Response Analysis & Granger Causality Tests

We analyze the response of housing supply and house prices to a one-standard-deviation shock in the policy rate. Impulse Response Functions (IRF) are computed over a 20-period horizon with 95% confidence intervals via bootstrapping.

Comparing IRF's across elasticity groups reveals how responsiveness varies when facing supply-side shocks, helping to assess rigidity in construction across urban areas.

We then conduct Granger causality tests to provide formal statistical evidence determining whether there is a the predictive relationship between variables. Notably, a statistically significant result implies that past values of the shocked variable assists in predicting future values of the responding variable. Together the impulse response functions and Granger Causality tests allow us to observe the magnitude of the change after a shock while testing for robustness.

5 Results

This section describes our main findings utilizing the SVAR analysis for both high- and low-elasticity groups. We display impulse response functions to evaluate the impact of a policy rate on housing supply, then consider the consequences of a housing supply shock on prices. Finally, we discuss the confidence intervals and Granger causality test results to assess the significance of our findings. Across all graphs both housing supply and housing prices are measured through logged differences. Thus the impulse response functions display a change in growth rates in response to a shock.

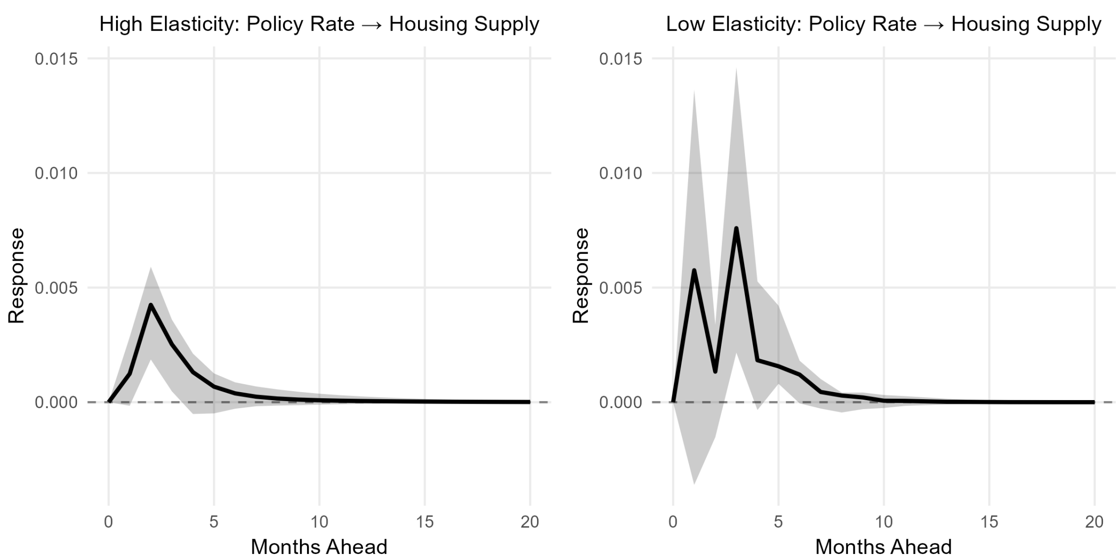

Figure 2: Impulse Response Functions: Policy Rate → Housing Supply

Figure 2 demonstrates the impact of a contractionary monetary policy shock on the housing supply growth rate in high- and low-elasticity cities. In the high-elasticity model, we see an initial increase in the growth rate of housing supply, which then converges to its original value. While the majority of the confidence interval is above zero, the Granger causality test yields a p-value of 0.09, indicating that the result is not statistically significant at the 5% level. However, this result is significant at the 10%. Then, in the low elasticity graph, we see an increase, a small decrease and then another increase in housing supply growth rates, before the growth rate converges to its natural level. This result is not statistically significant as the confidence interval falls below zero and the Granger causality test yields a p-value of 0.26. These positive supply responses may be indicative of a lagged supply response which we will elaborate on in the discussion section.

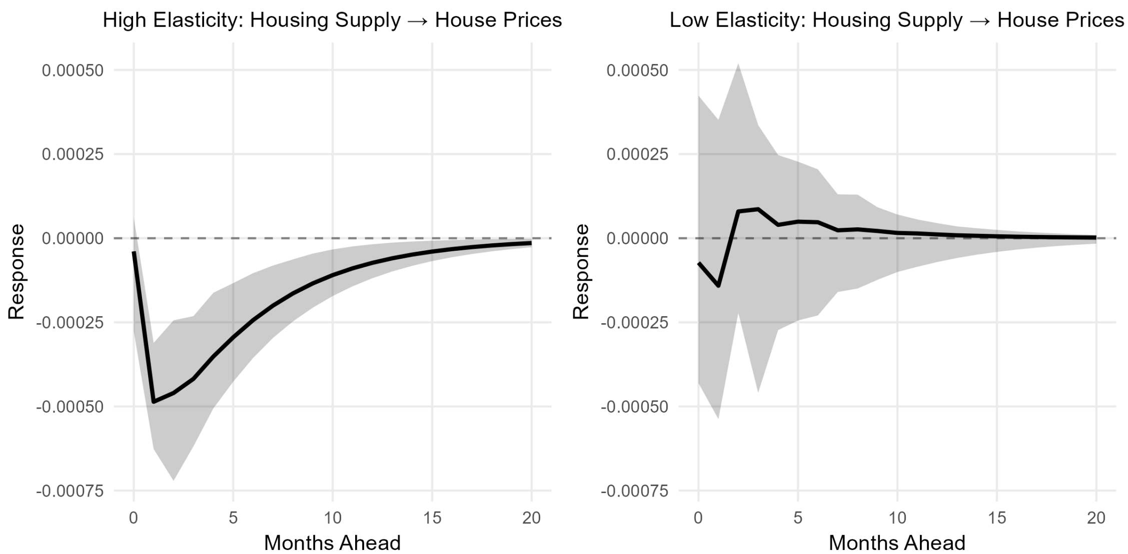

Figure 3: Impulse Response Functions: Housing Supply $\rightarrow$ Housing Prices

In Figure 3, we present the impact of a housing supply shock on housing prices. In the graph depicting the effects in high-elasticity cities, we see that an increase in the growth rate of supply decreases the growth rate of housing prices. The Granger causality test yields a p-value of 0.013 which is statistically significant. This supports the argument that housing supply moderates the growth of house prices. Then, in low-elasticity cities, we also see that an increase in the growth rate of supply decreases the growth rate of housing prices. However, the confidence interval rises above zero, and the Granger causality test yields a p-value of 0.72, suggesting that the housing supply time series is not a relevant predictor of housing prices in this category.

6 Discussion

6.1 Regression Results

The positive relationship between housing supply elasticities and population density falls in disagreement with the majority of the literature. Green, Malpezzi & Mayo (2005), compute housing supply elasticities across 45 metropolitan statistical areas in the United States and cite that population density is a highly important and negative predictor of elasticity. However, they also find that population growth and log-population are positive and statistically significant predictors of supply elasticity. While Green, Malpezzi & Mayo (2005) argue that this is an inaccuracy in their model, there are arguments to be made that this is a valid result. We argue that in cities with a higher population there is more incentive to construct new homes when prices are higher because there is greater available demand. Furthermore, high-population regions tend to exhibit higher house price levels and a larger pool of available labour. Therefore, it is easier to access labour for the construction process and it yields a greater return on investment. Moreover, population and density factors are not the unique determinants of elasticities. Broxterman et al.(2024) find that housing supply decreases with distance to the city center. While each city listed is technically considered a CMA, there are significant spillover effects where larger cities tend to behave as central business districts and smaller ones as suburbs. For example, Oshawa and St. Chatherines-Niagra are both considered a part of the GTA commuting zone. Moreover, in Windsor, there is an established employment corridor to Detroit which has a significant social and cultural impact (Workforce WindsorEssex, 2016, p.6). It is common for residents to live in Windsor, yet commute to Detroit for work and education opportunities (Workforce WindsorEssex, 2016, p.6). Although this does not entirely explain the positive relationship between population density and elasticities, it demonstrates that there are additional factors impacting the results.

6.2 Categorization of Cities

There are some methodological concerns with the segmentation of cities into high- and low categories. Firstly, the median cutoff is arbitrary and perhaps with a larger sample of cities, we would find that our list is skewed in the high or low direction. Moreover, through segmentation, we lose the ability to gauge whether elasticity has a continuous impact on housing supply and subsequently prices. However, we insist on moving forward with this categorization instead of inserting elasticities into the SVAR model because it is difficult to pose an argument regarding its position along the monetary policy transmission mechanism. While it is tempting to argue that elasticity is exogenous, it is determined through both housing prices and quantities which combines values from a slow and fast-moving variable. Therefore, in future research, we insist on continuing with the categorization of CMA's into high- and low-elasticity groups. However, results would be more robust with more elasticity categories and a larger number of cities.

6.3 Structural VAR's

As shown in the descriptive statistics, we find that there is a positive correlation between current interest rates and current housing supply. This result is captured in the first SVAR model, figure 2. Leamer (2007), argues that the housing supply increases immediately after a policy change due to the endogeneity of monetary policy. An increase in the interest rate implies that it was previously lower. Consequently, lowering borrowing costs motivates more housing starts. By the time the interest rate rises, those houses are developed and we see the effects of the lower interest rate.

Notably, there are insufficient degrees of freedom to capture the effects of an interest rate shock a year and a half into the future. Thus, we impose an 18-month lag on the housing supply variable to serve as a proxy for housing permits because there is insufficient data on housing permits across cities which significantly decreases the sample size. The 18 months represents the average amount of time to acquire a housing permit, gather materials, construct a dwelling, and then put it on the market as a new home. In doing this, we make the argument that if the interest rate is adjusted on January 1, 2000, the supply side effect becomes visible in the data on June 1, 2001. This analysis is completed in the graph below:

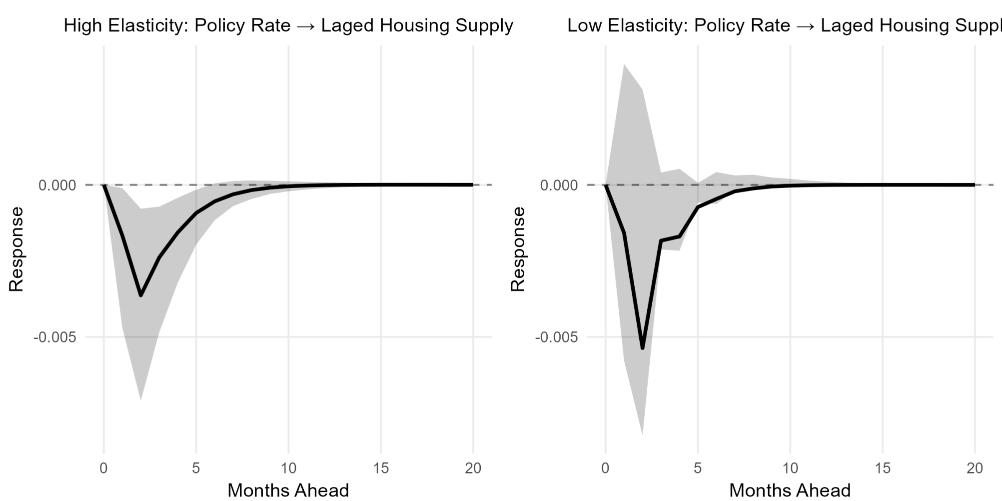

Figure 4: Impulse Response Functions: Policy Rate → Lagged Housing Supply

In Figure 4, we predict the 18-month lagged housing supply utilizing the policy rate. In the high elasticity graph, we see that contractionary monetary policy causes an initial decrease in the growth rate of housing supply, then, the growth rate converges to its initial value. The Granger causality test yields a p-value of

0.09 which falls within the 10% significance threshold. While this does not attain the traditional significance level of 5%, it still offers some support for the theory that the housing supply decreases with interest rates. Then, the low elasticity graph also displays a decrease in the growth rate of housing supply in response to an increase in the policy rate. However, the Granger causality test yields a p-value of 0.22 which is not statistically significant under any reasonable threshold.

Notably, these results exhibit comparable levels of significance to those in Figure 1. While this is not strong evidence, it supports the hypothesis that the monetary policy transmission mechanism impacts housing supply with lags.

7 Conclusion

This paper explores the relationship between housing supply elasticities and the impact of monetary policy across Canadian cities. Through a log-log regression and SVAR models, we find evidence that interest rates impact housing markets differently depending on the local supply elasticities.

Our log-log regression results differ from those found in the literature, where we find a positive correlation between housing supply elasticities and population and population density. Across the literature, research finds that population density is a negative and statistically significant predictor of elasticities. Notably, there are multiple more complex methods of calculating density, where there is consideration for distance from the central business district (Green, Malpezzi & Mayo, 2005). Moreover, these studies analyze a broader range of cities with more heterogeneity across city size (Green, Malpezzi & Mayo, 2005; Paixão, 2021; Saiz 2008). Thus, future research regarding elasticities should consider finding data with a broader range of cities. Moreover, it should implement more advanced methods of computing population density.

Then, through our analysis utilizing SVAR models, we find that contractionary monetary policy shocks have a positive impact on housing supply across both high- and low-elasticity groups. However, these results are statistically insignificant in the low elasticity group and are significant at the 10% level in the high elasticity group. In line with the theoretical and empirical literature, our results show that an increase in housing supply leads to a statistically significant decrease in housing prices in high-elasticity areas. However, in low-elasticity cities, the results are not statistically significant. Finally, to further consider the lagged response of housing supply to the interest rate, we utilize an SVAR model where housing supply is lagged by 18 months to represent the time it takes to decide to pursue a housing project to have a new home on the market. We find that in high-elasticity cities, contractionary monetary policy shocks decrease lagged housing supply growth and that this result is significant at the 10% level. However, this model yields statistically insignificant results in the low-elasticity cities.

Our findings suggest that monetary policy has a heterogeneous effect on housing markets, dependent on local supply elasticities. Moreover, we find that housing supply plays a greater role in moderating prices when elasticities are high. Therefore, monetary policy is more likely to influence housing construction and affordability in high-elasticity areas. Ultimately, these results emphasize the importance of considering the heterogeneous housing supply response to fiscal and monetary policy.

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