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The aggregate and heterogeneous effects of responding to shelter inflation

Michael Irwin

Financial Stability Department
Bank of Canada
mlrwin@bank-banque-canada.ca

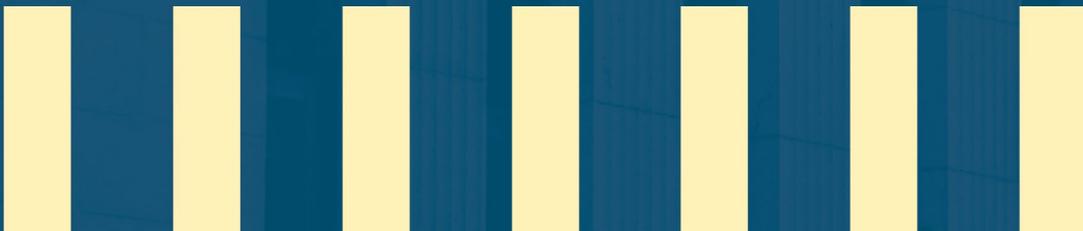
Matias Vieyra

Canadian Economic Analysis Department
Bank of Canada
mvieyra@bank-banque-canada.ca

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Introduction

Following the inflation spike in 2021-2022, shelter became a key source of persistently high inflation. By the fourth quarter of 2023, shelter accounted for nearly the entire deviation of inflation from the Bank of Canada's inflation target (Figure 1). This raises the question of how to conduct monetary policy when shelter inflation is persistently elevated.¹

This note examines how monetary policy responding to shelter inflation affects both the overall economy and different types of households. We utilize the Nexus-HANK model, which combines necessary features to answer our question. In the model, monetary policy impacts house prices, rents, and mortgage rates. The price dynamics have differential effects across the distribution of households. This allows us to quantify the welfare gains of responding to shelter inflation at the individual household level, while ensuring that aggregate responses are consistent with the data.

We have three main results:

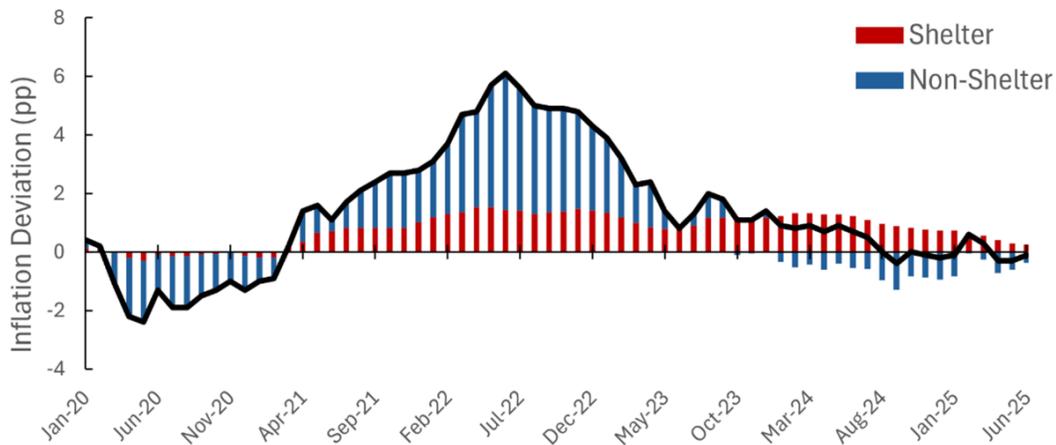
- **Renters and homeowners disagree about whether they benefit from the central bank responding to elevated shelter inflation.** Renters prefer that the central bank responds by raising interest rates, which lowers house prices and makes it easier to save for a downpayment. Homeowners prefer that the central bank “looks through” shelter inflation, which keeps mortgage interest costs lower and house prices higher.
- **The aggregate effects are much smaller than the redistributive effects.** This occurs because disagreements between households at the individual level partially cancel each other out in the aggregate.
- **Responding to large fluctuations in mortgage interest cost (MIC) inflation can create unnecessary oscillations** in economic activity because monetary policy “chases its own tail” in the sense that it tries to stabilize shelter costs induced by past monetary policy decisions.

Model Description

We utilize the Nexus-HANK model, a quantitative heterogeneous-agent New Keynesian (HANK) model, for our analysis. The model features micro-founded markets for owned housing, rental housing, and mortgages. This yields endogenous responses of house prices, rent, and mortgage interest costs (MIC) to aggregate shocks. Households differ in terms of income, which in turn influences their choices of consumption, liquid savings, and whether to rent or own a house. When buying a house, the buyer can take out a

¹ See Bianchi et al. (2025), Barsky et al. (2019), and references therein for a discussion of the role of the housing market in optimal monetary policy.

Figure 1: Shelter contribution to deviation from 2% inflation target



Notes.- Deviation of inflation from the 2% target. Red bars represent the contribution of shelter inflation to the deviation, and blue bars represent the contribution of non-shelter inflation.

mortgage that is slowly repaid over time. Differences across income, savings, mortgage debt, and homeownership give rise to a rich distribution of households that can be mapped back to micro data on the Canadian economy. Given the focus of this note, we only describe here assumptions related to mortgage payments, rents, and monetary policy, and refer the reader to Irwin and Vieyra (2025) for a full description of the model.

Mortgages are nominal debt obligations that: 1) are subject to loan-to-value and debt service ratio constraints at origination; 2) get amortized on average over 25 years; and 3) have outstanding interest rates that are slow moving, with an autocorrelation chosen to replicate the average fixation length in the data. Mortgages are originated by financial intermediaries that charge a fixed spread over the short-term rate chosen by the central bank.

Households who decide not to own a house must pay rent every period. The stock of housing available for rent is decided by heterogeneous landlords that differ in their productivity. A selection effect based on productivity differences generates departures of the price-to-rent ratio from the standard user cost formula. Following Greenwald and Guren (Forthcoming), we calibrate the model to generate a large degree of segmentation between the rental and owning markets, which yields a large decoupling in the response of house prices and rents to aggregate shocks.

The central bank sets the short-term nominal rate following a Taylor rule that depends on the deviation of inflation from its target, the output gap, and the rate in the previous period. Inflation is a weighted sum of non-shelter inflation and three shelter-related components: house price inflation, rent price inflation, and mortgage interest cost (MIC)

inflation.² When evaluating the effects of “looking through” shelter inflation, we set the weights of the shelter components to zero.

The Transmission of Monetary Policy

To understand the model predictions, it is informative to first look at the effects of a 25 basis points (100bps annual) unexpected increase in the nominal interest rate set by the central bank. We consider three different regimes:

1. The central bank includes shelter components in the inflation target (Headline).
2. MIC is excluded from the inflation target (ex-MIC).
3. All shelter components are excluded from the inflation target (ex-Shelter). The ex-Shelter regime depicts the case where the central bank “looks through” shelter inflation.

Figure 2 depicts the impulse response functions (IRFs) of macroeconomic variables and prices following the monetary shock for the three regimes. Output and consumption are measured as a percentage deviation from their respective steady state values. Prices are annualized and measured as a percentage point (pp) deviation from steady state.

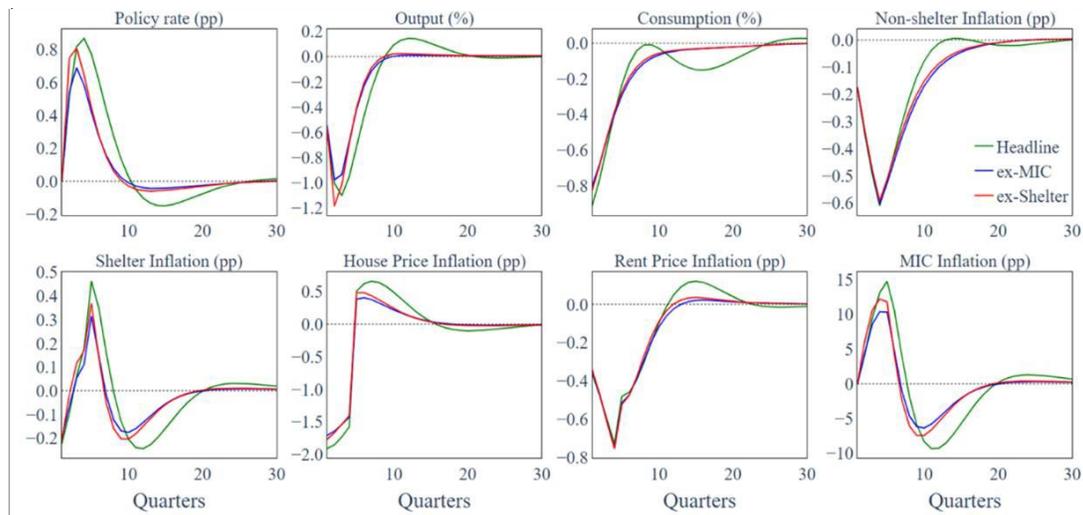
The responses of aggregate variables and prices to a monetary policy shock are within the range of estimates we expect to see in the data. There is approximately a 1.1% drop in aggregate output, a 0.8% drop in consumption, a 0.4pp drop in annual inflation, and almost a 2pp drop in annual house price inflation. The drop in house prices is weaker than what is typically estimated in the data but larger than the response in most linearized, representative-agent DSGE models.

The Nexus-HANK model generates larger responses of house prices than most models for two main reasons. First, houses are bought and sold discretely, meaning that in response to a shock, households must buy or sell an entire house. In most representative-agent DSGE models with housing, households can buy or sell a small portion of a house (e.g., brick by brick). Second, the presence of hand-to-mouth homeowners, who are financially constrained from having no liquid savings, increases the aggregate income elasticity of housing demand.

The first main result from this note is that responding to significant fluctuations in MIC inflation can create oscillations in aggregate consumption and output along the transition back to steady state. When responding to Headline inflation in Figure 2, there is initially a larger drop in consumption compared to the ex-MIC regime. Consumption then rises

² Weights are taken from Statistics Canada (2025) for the year 2025. The weights for “Homeowners’ replacement cost” and “Other owned accommodation expenses” are summed and used for house price inflation in the model.

Figure 2: Aggregate Effects of a 100bps Monetary Policy Shock



Notes.- Response to a 25bps (100bps annual) unexpected monetary policy shock. Inflation variables and the policy rate are annualized.

more quickly but then falls again around quarter 10. These oscillations occur because the central bank is trying to respond to fluctuations in MIC inflation created by past interest rate decisions. Responding to MIC inflation has a destabilizing impact on the aggregate economy because, for example, raising interest rates when MIC inflation is high creates more MIC inflation which must be offset with a contraction in aggregate demand to lower goods prices. These results show that there are benefits to a policy where the central bank looks through fluctuations in MIC inflation to avoid an effect where it “chases its own tail”. For the remainder of this note, we study the differences between the ex-MIC and ex-Shelter regimes. We choose to focus on ex-MIC rather than Headline inflation to study the impact of responding to changes in house prices and rent.

Aggregate Effects of Responding to Shelter Inflation

We now study how responding to shelter inflation via the interest rate setting rule of the central bank impacts aggregate fluctuations. We conduct this analysis following two different shocks to the economy: a housing demand shock and an aggregate supply shock. To measure the impact of responding to shelter inflation, we compare the IRFs in the model economy where the central bank uses Headline ex-MIC in the inflation target of the Taylor Rule to the economy where the central bank uses Headline ex-Shelter.

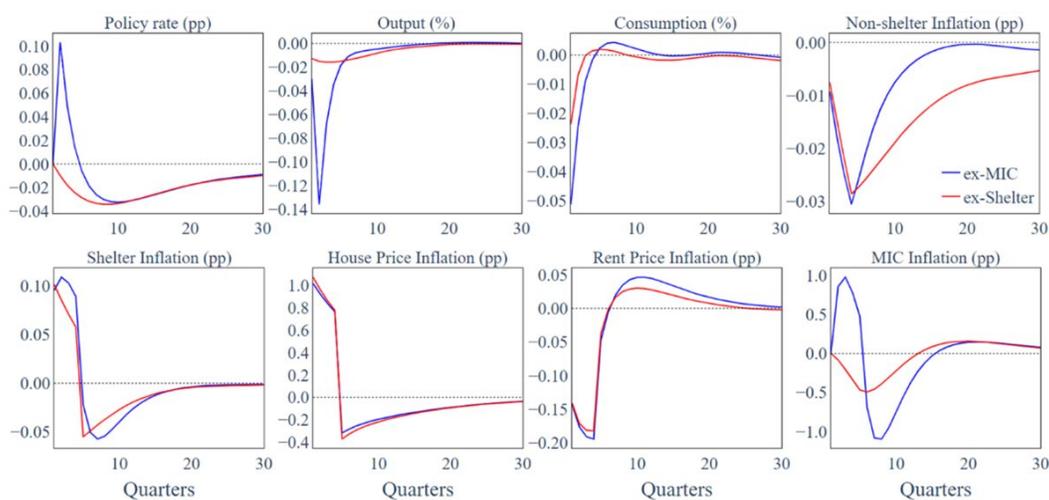
Housing Demand Shock

The housing demand shock is a persistent increase in the utility of owning a house. The shock generates a 1pp rise in house price inflation. We assume that the shock has an autocorrelation of 0.9, which allows us to study the impact of monetary policy following a persistent rise in shelter inflation. Figure 3 depicts the response of the economy

following the housing demand shock dependent on the interest rate setting rule of the central bank.³

Following the housing demand shock, the increase in house prices generates approximately a 0.1pp increase in shelter inflation. There is also a small persistent decline in goods prices. Responding to shelter inflation (ex-MIC) generates contractionary monetary policy where the central bank raises the nominal interest rate by approximately 0.1pp. When the central bank looks through shelter inflation (ex-Shelter), there is a small and persistent decline in nominal interest rates.

Figure 3: Aggregate Effects of a Positive Housing Demand Shock



Notes.- Response to an unexpected increase in the utility of owning a house. Inflation variables and the policy rate are annualized.

Overall, responding to shelter inflation has a relatively small effect on the aggregate economy following the housing demand shock. When responding to shelter inflation, aggregate output falls by approximately 0.12%. The impact on consumption is even smaller. When the central bank responds to elevated house prices, there is a peak fall in aggregate consumption of 0.05%, compared to a 0.02% fall in consumption when “looking through” shelter inflation. These small aggregate effects yield a small difference in the response of non-shelter (goods) inflation.

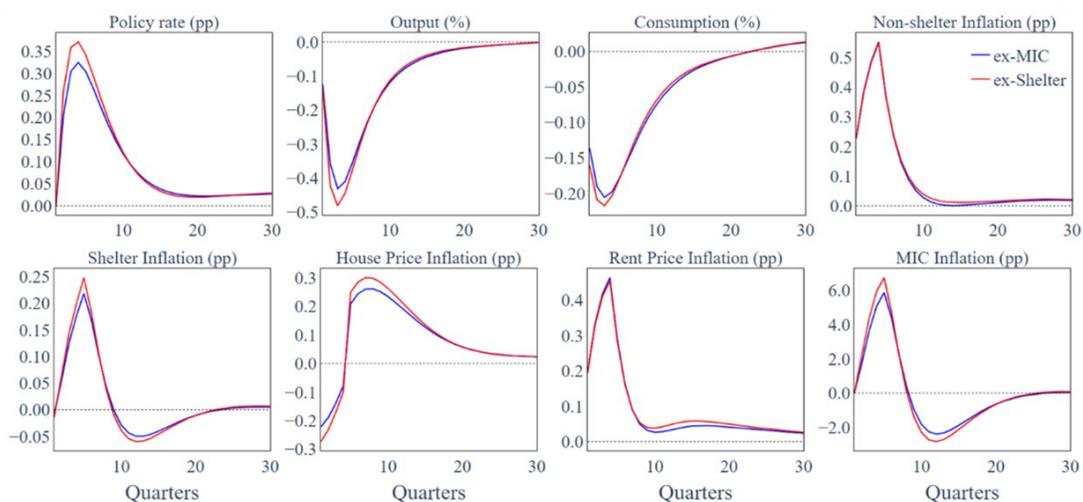
Aggregate Supply Shock

We now study the effect of a negative aggregate supply shock. Specifically, this is a 1% fall in total factor productivity (TFP) with an autocorrelation of 0.8. This shock allows us to study how responding to shelter inflation impacts the aggregate economy following a productivity driven recession. Figure 4 depicts the IRFs following the supply shock.

³ In the appendix, we quantify the response of the economy to an aggregate demand shock.

We also find that there are relatively small effects on the aggregate economy from the central bank responding to shelter inflation following an aggregate supply shock. When shelter components are included in the inflation target, the central bank has a smaller increase in the policy rate and the peak fall in aggregate output is 0.42%. When the central bank looks through shelter inflation, output falls by about 0.48%. Similarly, there is a slightly larger fall in aggregate consumption when looking through shelter inflation.

Figure 4: Aggregate Effects of a Negative Supply Shock



Notes.- Response to an unexpected decrease in total factor productivity. Inflation variables and the policy rate are annualized.

Takeaways from the Aggregate Effects

Whether including the shelter components in the inflation target increases or decreases the total deviation of output from its steady state value depends on whether the economy is experiencing a supply shock or a housing demand shock. We find that responding to shelter inflation increased the deviation of output for the housing demand shock and it decreased the deviation for the aggregate supply shock. We studied each shock in one direction. If we simulated a long time series of shocks, the average impact on macroeconomic variables would be zero. However, the interest rate setting rules that generate smaller deviations in output in our IRFs would generate less volatility over the time series.

We found that the aggregate effects are relatively small for both shocks. If we were to conclude the analysis at the aggregate level, the interpretation would be that whether the central bank responds to shelter inflation or not has a relatively small effect on the economy. We show in the next section that the welfare results across the distribution of households are much larger than the average effect, and households disagree significantly about whether the central bank should include the shelter components in the inflation target.

Heterogeneous Effects of Responding to Shelter Inflation

We now measure which households in the distribution benefit from the central bank responding to shelter inflation. Due to the richness of the Nexus-HANK model, we can quantify welfare effects based on homeownership status, income, mortgage debt, and savings. We study the heterogeneous effects in response to the same two shocks analyzed in the previous section: a positive housing demand shock and a negative aggregate supply shock.

To measure the welfare gains of the central bank responding to shelter inflation, we use equivalent variations: the amount of income that households would be willing to trade to keep the shelter components in the inflation target of the Taylor Rule. Therefore, a positive value means the household prefers that the central bank responds to shelter inflation, and a negative value means the household prefers the central bank “looks through” shelter inflation. The welfare measurement is calculated at the individual level and expressed as a percentage of steady state annual income. Moving forward, we quantify the average welfare gain for renters and homeowners who are high and low income, meaning they are in quartiles one or four of the income distribution. We also measure the average welfare gain for hand-to-mouth households who are budget constrained at the time of the shock, and for homeowners in the top quartile of mortgage debt. Table 1 depicts the welfare effects of responding to shelter inflation following a housing demand shock.

Table 1: Welfare Effects from a Housing Demand Shock

	Income Quartiles			
	Q1	Q4	Hand-to-Mouth	Highly Indebted
Renters	0.26	0.35	-0.08	NA
Homeowners	-0.46	-0.21	-0.58	-0.65
Average for all Households = -0.10				

Notes – Welfare effects are equivalent variations: income a household would trade for the central bank to continue responding to shelter inflation. Positive values mean they prefer the central bank to respond to shelter inflation. They are expressed as a percentage of steady-state annual incomes. Hand-to-mouth are constrained households. Highly indebted are households with mortgage debt in the top 25%.

There is significant disagreement across households about whether they benefit from the central bank responding to high shelter inflation. Renters prefer that the central bank responds to shelter inflation, and homeowners prefer that it looks through shelter inflation. The disagreement is largely driven by the response of interest rates and house

prices.⁴ When responding to shelter inflation, interest rates rise, and house prices increase by less. These price dynamics make renters better off because they are saving for a downpayment on a house. Higher interest rates increase the return on savings, and relatively lower house prices mean a smaller downpayment. Homeowners, on the other hand, are worse off from higher mortgage interest costs and relatively lower house prices. Hand-to-mouth renters are almost indifferent between the two policies because responding to shelter inflation causes a decrease in output, which offsets the benefits from higher interest rates and lower house prices. Hand-to-mouth households are more sensitive to changes in output that affect their labor income because they have a high MPC out of changes in income.

The average welfare effect hides much larger effects across the distribution of households. On average, households would trade 0.1% of their income for the central bank to look through the high shelter inflation. Households prefer this policy on average because almost two-thirds of households are homeowners who do not want to see interest rates increase. However, the average effect is much smaller than the redistributive effects. Hand-to-mouth and highly levered homeowners can have a welfare response over 6 times larger than the average. These homeowners have large mortgage balances and no liquid savings, making them very sensitive to changes in interest rates.

We now quantify the welfare effects of the central bank including shelter components in the inflation target following the aggregate supply shock discussed in the previous section. The results are summarized in Table 2.

Table 2: Welfare Effects from an Aggregate Supply Shock

	Income Quartiles		Hand-to-Mouth	Highly Indebted
	Q1	Q4		
Renters	-0.38	-0.50	-0.01	NA
Homeowners	0.38	0.17	0.49	0.48
Average for all Households = 0.02				

Notes – Welfare effects are equivalent variations: income a household would trade for the central bank to continue responding to shelter inflation. Positive value means they prefer the central bank to respond to shelter inflation. They are expressed as a percentage of steady-state annual incomes. Hand-to-mouth are constrained households. Highly indebted are households with mortgage debt in the top 25%.

⁴ Rent prices add to the disagreement between renters and homeowners. When responding to shelter inflation, rent prices decrease by more. However, the impact of rent prices is quite small. In a decomposition exercise, we find that less than 10% of the disagreement between renters and homeowners is due to rent prices.

Again, we find that households disagree significantly about whether they want the central bank to include shelter inflation in the inflation target. When the central bank responds to shelter inflation, there is a smaller drop in house prices and a smaller increase in interest rates, which is preferred by homeowners but not by renters. We also find that the average welfare response is quite small and hides significant redistributive effects across households. Constrained and highly levered households have welfare effects more than 20 times larger than the average. The individual effects are much larger than the average because disagreements across households partially cancel each other out at the aggregate level. Finally, hand-to-mouth households have a preference towards the central bank responding to shelter inflation because of the impact on aggregate output.

Conclusion

We use the Nexus-HANK model to measure the aggregate and heterogeneous effects of including shelter components in the inflation target of the central bank. This analysis has become particularly crucial as the Bank of Canada looks to renew its inflation target following a period where high inflation was driven largely by the shelter components of the inflation target.

Our results highlight that there is disagreement among households about whether it is preferred for the central bank to respond to the shelter components of the inflation target. Even in instances where the aggregate effects of responding to shelter inflation are small, there are large and contrasting welfare effects at the individual level. This result highlights the importance—and challenges—of central banking accountability to communicate the impacts of its policy: there is only one monetary policy tool, but it impacts households in heterogeneous ways, and the impact may depend on how monetary policy is implemented.

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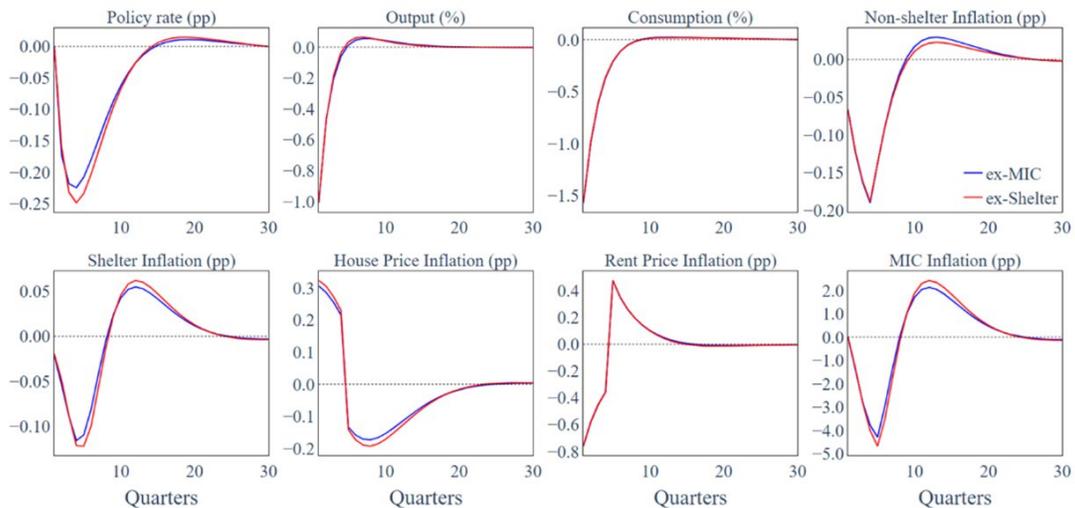
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Appendix – Aggregate Demand Shock

We now quantify the aggregate and heterogeneous effects of the central bank responding to shelter inflation following an aggregate demand shock to the economy. Specifically, the demand shock is modeled as a shock to the discount factor of households, which lowers the demand for consumption goods.

Figure A-1 depicts the response of aggregate variables and prices following the aggregate demand shock. Monetary policy responding to the shelter inflation has a small impact on the aggregate economy. There is an insignificant difference in the peak response of consumption and output between the two regimes. The aggregate effects are small because house prices and rents move in opposite directions following the shock. Consequently, the total change in shelter inflation is close to zero, and there is only about a 0.03 annual percentage point difference in the minimum policy rate between the two regimes.

Figure A-1: Aggregate effects following an aggregate demand shock



Notes.- Response to an unexpected decrease in aggregate demand. Inflation variables and the policy rate are annualized.

Although the aggregate effects of responding to shelter inflation are quite small, we still see disagreement between different households in the economy about whether they prefer the shelter components to be included in the inflation target. As seen in Table A-1, renters prefer that the central bank responds to shelter inflation, and homeowners prefer that the central bank looks through shelter inflation. The difference mainly comes from the change in house prices and interest rates. When shelter is included in the inflation target, there is a smaller increase in house prices. Renters prefer this because it makes it easier to afford a home. Homeowners would prefer that the central bank looks through

shelter inflation in this case because it results in lower interest rates and higher house prices.

Table A-1: Welfare Effects from an Aggregate Demand Shock

	Income Quartiles		Hand-to-Mouth	Highly Indebted
	Q1	Q4		
Renters	0.05	0.25	-0.01	NA
Homeowners	-0.13	-0.06	-0.15	-0.21
Avg for all Households = -0.03				

Notes – Welfare effects are equivalent variations: income a household would trade for the central bank to continue responding to shelter inflation. Positive value means they prefer the central bank to respond to shelter inflation. They are expressed as a percentage of steady-state annual incomes. Hand-to-mouth are constrained households. Hand-to-mouth are constrained households. Highly indebted are households with mortgage debt in the top 25%.