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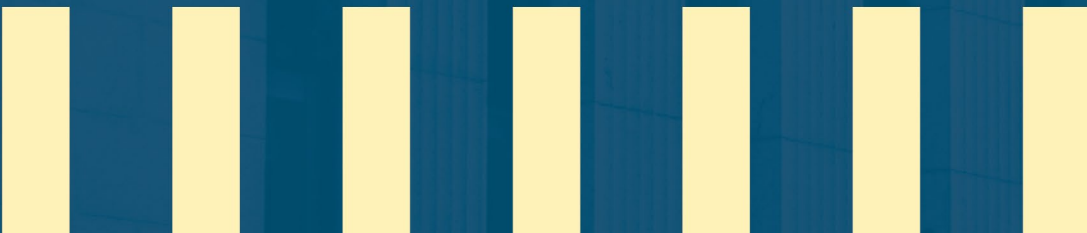
Demand roars, supply whispers: Monetary policy and housing in Canada

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Abstract

We examine the effects of monetary policy shocks on the Canadian housing market. Using high-frequency surprises around fixed announcement dates as an instrument in a Bayesian VAR, we estimate the responses of house prices, housing starts, building permits, resales, inventories, and mortgage origination to a contractionary monetary policy shock. An increase in the policy rate leads to a substantial and persistent decline in average house prices. Housing starts and building permits fall, but their implied effects on the future housing stock are both slow and modest. Interpreted through the lens of market equilibrium, these results are most consistent with a stronger response of housing demand than housing supply. Mortgage origination provides additional evidence in support of this interpretation.

Topics: monetary policy, housing, high-frequency identification, Bayesian VAR

JEL codes: E52, C32, R31

Résumé

Texte.

Sujets : Sujet

Codes JEL : Code

Introduction

Changes in interest rates affect housing market activity, financing conditions and residential investment, but they need not affect buyers and builders equally. If housing supply adjusts slowly while housing demand responds quickly, monetary policy may have large effects on house prices while having more limited effects on the future housing stock. This would also imply that monetary policy has a limited ability to address concerns about housing affordability.

Recent Bank of Canada work has examined related questions from different angles. Rao and Wang (2026) study the effects of monetary policy on house prices and rents, with a focus on the relative price of owning versus renting. Strauss, Surprenant, and Tuzcuoglu (forthcoming) study similar housing-market variables using nonlinear local projections to examine state dependence. This paper complements that work by focusing on the relative responses of housing demand and supply, using construction indicators linked to the future housing stock and measures of housing market tightness.

We study the effects of monetary policy shocks on the Canadian housing market using high-frequency surprises around fixed announcement dates as an instrument in a Bayesian VAR. A monetary policy tightening leads to a large and persistent decline in house prices. Building permits and housing starts also fall, but their implied effects on the future housing stock are gradual and modest. These results are most consistent with housing demand responding more strongly than housing supply. This interpretation is reinforced by the prolonged decline in mortgage originations, which points to weaker housing demand and tighter financing conditions rather than a supply-driven adjustment.

Methodology

We use the recently introduced high-frequency surprises (Sekkel, Stern, and Zhang 2025) for fixed announcement dates (FAD) as instruments to estimate the effects of monetary policy shocks on the housing market. These surprises reflect the part of interest rate changes which financial markets did not anticipate and therefore act as proxies for a monetary policy shock. In this paper, we specifically use BAX1 surprises because shorter maturity financial instruments load more heavily on the target rate shock as opposed to forward guidance (e.g., Swanson 2021).¹ Focusing only on FAD events also reinforces the interpretation of our results as primarily reflecting a change in the target rate. Following

¹ BAX1 refers to the three-month (i.e., one quarter) Canadian Bankers' Acceptance Futures.

Plagborg-Møller and Wolf (2021), we identify the effects of monetary policy in a VAR by using this proxy as an internal instrument.² The reduced-form VAR is

$$y_t = d_0 + \sum_{j=1}^p A_j y_{t-j} + u_t$$

with

$$u_t \sim N(0, e^{h_t} \Sigma),$$

and the common stochastic volatility process

$$h_t = \rho h_{t-1} + \epsilon_t^h, \epsilon_t^h \sim N(0, \sigma_h^2)$$

This specification follows Carriero, Clark, and Marcellino (2016). Relative to a standard Gaussian VAR, it introduces a common volatility factor that allows the model to distinguish between periods of low and high volatility. This is useful in our setting because the sample includes the COVID period, which featured unusually high levels of macroeconomic volatility. Without this adjustment, a few observations in high volatility periods can exert disproportionate influence on parameter estimates (Lenza and Primiceri 2022).

Our baseline specification includes the proxy, the Bank Rate, average house prices, building permits, housing starts, housing resales and inventories for Canada.³ All variables except the proxy and the Bank Rate are included in logarithms. The estimation sample runs from 1997M6 to 2025M10. This set of variables is chosen to capture both sides of the housing market, covering flows into the housing stock, house prices, and a measure of housing market tightness: inventories. We estimate the model in levels using Bayesian methods with $p = 12$ monthly lags using the Gibbs sampler of Chan (2020). Additional details on priors, posterior simulation, and implementation are reported in the Appendix.

Results

In this section, most of the analysis is based on the baseline specification. Baseline results are robust to using different numbers of lags or different subsamples (see **Figure A3** in the Appendix). We also consider an extension of the model featuring mortgage origination exclusive of refinancing and consumer expectations regarding future housing

² Plagborg-Møller and Wolf (2021) established that placing a proxy as the first variable in a VAR and applying recursive short-run restrictions is equivalent to IV local projection. In the present case, the proxy would be instrumenting the bank rate to isolate the effect of a (conventional) monetary shock.

³ The inventories series that we use is the ratio of active listings to sales and thus reflects the number of months it would take to sell current inventories given current selling rates.

price growth. These variables restrict our sample to 2016M5 to 2025M10, but the results are broadly similar.

House prices respond more strongly than stocks

Figure 1 displays the effect of a contractionary monetary policy shock which raises the bank rate by 100 basis points. The average house price falls by about 4.5% within 12 months, and the effect remains persistent, reaching about 5.5% and 6.25% after 24 and 36 months, respectively. Using a similar approach, Nsafoah and Dery (2024) and Rao and Wang (2026) find larger effects of around 10 and 11%, respectively, at the 24-month horizon.⁴ Williams (2015) finds effects of around 6.5% at the 24-month mark across 17 countries using the approach of Jordà, Schularick, and Taylor (2015).⁵ Hence, our estimates for housing prices are towards the lower end of available estimates. However, like our paper, all those studies report persistent effects of monetary policy on housing prices.

Housing starts initially rise on impact, but this increase reverses quickly and turns into a decline within a few months, reaching roughly 10% below baseline within the first year. Because housing starts are recorded once construction has already begun, this short-lived increase may reflect the acceleration of projects already underway rather than a genuine strengthening in new supply. This interpretation is supported by the response of building permits, which fall by about 8% on average during the first year and recover only gradually thereafter. While these responses may seem large, their implied effects on the future housing stock are small. For instance, a 10% fall in housing starts in a month implies a roughly 0.01% decline in the future housing stock.⁶ Cumulating the estimated effects over 24 months, the future housing stock is lower by around 0.15%.

Inventories rise to about 12% above baseline after five months and remain elevated well into the second and third year. Given that inventories average about five months over the sample, this corresponds to roughly 18 additional days needed to absorb the existing stock of homes for sale.⁷ Although this is not a large change, it points to a

⁴ Nsafoah and Dery (2024) find that a 25 basis points cut in the policy rate leads to a 2.3% increase in real house prices and a roughly 0.5% increase in the CPI. We infer the effect for a 100-basis-point increase on nominal house prices as $11.2 = -4 \times 2.8$.

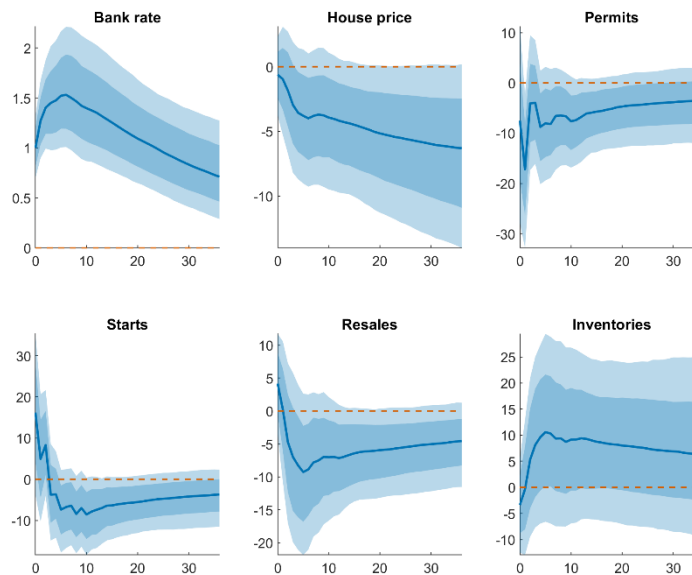
⁵ Williams (2015) says that the effect of a 100-basis-point exogenous change in the interest rate is over 6% on real house prices and the point estimate for inflation is less than 0.5%, so we approximate the effect on nominal house prices as 6.5%.

⁶ As of 2025Q4, there is an estimated 17.4 million dwelling units in Canada (see Table 36-10-0688-01, Statistics Canada, 2026). Seasonally adjusted housing starts have averaged around 21 300 units per month over 2021-2025. A 10% fall thus maps into a roughly 0.01% fall in the future housing stock.

⁷ If we take a month to have 30 days, 12% of 5 months works out to 0.6 months or 18 days. Given that the sample standard deviation is at around 1.4 months, this is less than half of a standard deviation.

loosening in market conditions, consistent with a larger response of buyers rather than sellers in the housing market.⁸

Figure 1: The effects of a rate increase on housing in Canada



Note: Contractionary monetary policy shock of a 100 basis points. Effects are in percent on the level, except for the bank rate which is in percentage points on the level. Shaded areas show 68% and 90% credible intervals.

Overall, the baseline evidence points to relatively modest effects on the future housing stock alongside large and persistent effects on prices and market tightness. Interpreting this through the lens of market equilibrium, the combination of falling prices, lower housing market activity, and small effects on housing stocks suggests that monetary policy primarily affects the housing market through housing demand rather than housing supply. This interpretation is also consistent with results in Booth and Terajima (forthcoming) who find that monetary policy has larger effects on the demand-driven component of house price inflation than the supply-driven component.⁹

Construction responds early, but the stock adjusts slowly

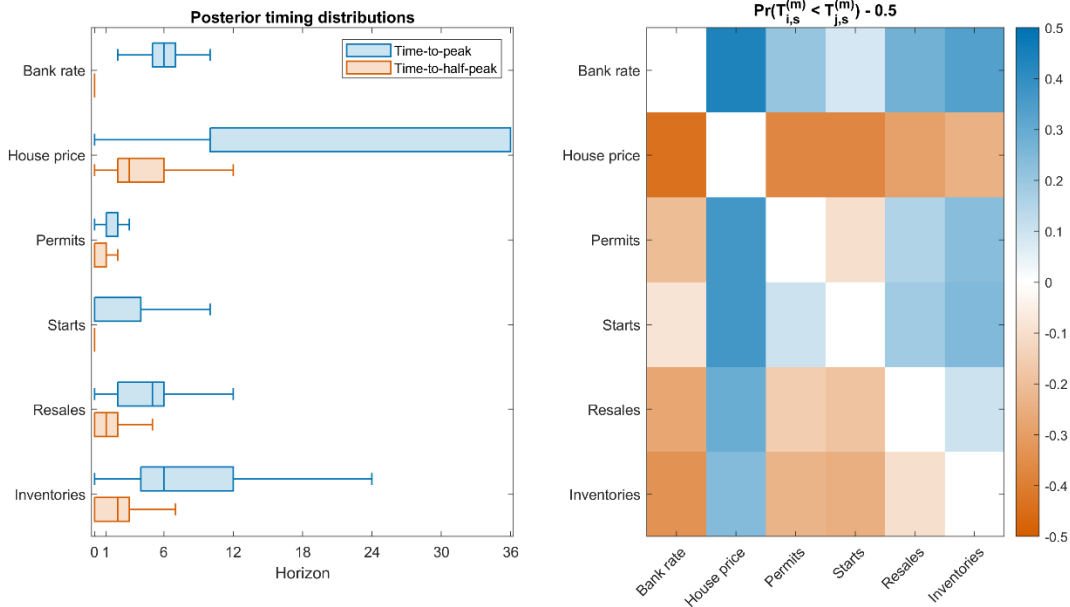
Figure 1 is informative about the size of the effects at each horizon. To study the timing of the adjustment, however, we need to look at the full response paths jointly rather than one horizon at a time. We define the peak of a response as its maximum absolute value over a 36-month horizon and compute the posterior distributions of both the time-to-peak and the time-to-half-peak. The left panel of **Figure 2** reports these distributions. The right panel reports pairwise comparisons based on time-to-half-peak: a positive

⁸ We interpret the average time required to sell current inventories as inversely related to housing market tightness, defined as the ratio of buyers to sellers. Hence, if higher interest rates lead some prospective buyers to exit the market and some sellers to pull their listings, the effect on buyers must dominate for the buyer-to-seller ratio to fall and for our inventory indicator to rise.

⁹ The demand-driven and supply-driven component were built using the method developed by Shapiro (2026).

entry means that the row variable tends to reach half of its peak response earlier than the column variable.

Figure 2: Timing



Note: Pairwise comparisons on the right are performed using time-to-half-peak. Positive values mean the row variable moves faster than the column variable. Ties are attributed evenly in both directions, so the matrix is antisymmetric by construction, i.e. $P_{i,j} = -P_{j,i}$ and $P_{i,i} = 0$.

Our model suggests that construction-related variables respond early following a monetary policy shock. The peak responses of building permits and housing starts are likely to occur within 12 months, with half of the total movement occurring within the first six months with high probability.¹⁰ The right panel also suggests that these variables move broadly contemporaneously and earlier than most of the rest of the system, aside from the bank rate. However, the resulting change in the housing stock materializes only with a substantial delay: in Canada, the average construction period is about 17.5 months.¹¹

In contrast, house prices display a more gradual and persistent response, with a high probability that the peak effect occurs only in the third year, even though half of the total movement is likely to occur within the first year.¹² Resales and inventories show a similar pattern: a substantial portion of the adjustment occurs early, but the full

¹⁰ The posterior probabilities of a peak response for building permits, housing starts, and resales within 12 months exceed 80%.

¹¹ This is the average construction time across Canada for all dwelling types as of April 2026 (Canada Mortgage and Housing Corporation 2026).

¹² The posterior probability of the peak response of house prices occurring after 35 months exceeds 75%.

response unfolds more gradually.¹³ Taken together, these results suggest that housing demand contracts rapidly following a contractionary monetary policy shock. Combined with the persistent decline in house prices shown in **Figure 1**, this pattern is most consistent with housing demand responding more strongly than housing supply over this horizon.

Mortgages and expectations point to weaker demand

In this section, we extend the baseline model to include mortgage origination excluding refinancing, consumer expectations about future house price growth, and the spread between the mortgage rate and the bank rate.^{14,15} These variables help assess two demand-side channels of monetary policy transmission: the financing channel, through which higher rates reduce the inflow of new buyers, and the expectations channel, through which households revise down expected capital gains from housing. However, the extension restricts the sample because consumer expectations are available starting in May 2016.

Figure 3 reports impulse responses for the extended model. For comparison, it also reports baseline estimates for the full sample used in **Figure 1** and for the restricted sample used in the extended model. The overall pattern remains similar to the baseline specification, though the response of house prices differs at longer horizons.¹⁶

A 100-basis-point increase in the bank rate leads to a pronounced decline in mortgages, with the posterior median response reaching about 15% after seven months and recovering only near the end of the third year. The mortgage rate moves in the same direction as the bank rate, although its response peaks at about 50 basis points after three months. The decline in mortgage originations means that fewer households are entering the market following the rate increase. As mortgages are complementary to housing purchases, this is consistent with a contraction in housing demand and reflects the same story that can be seen in falling prices and resales, as well as rising inventories.

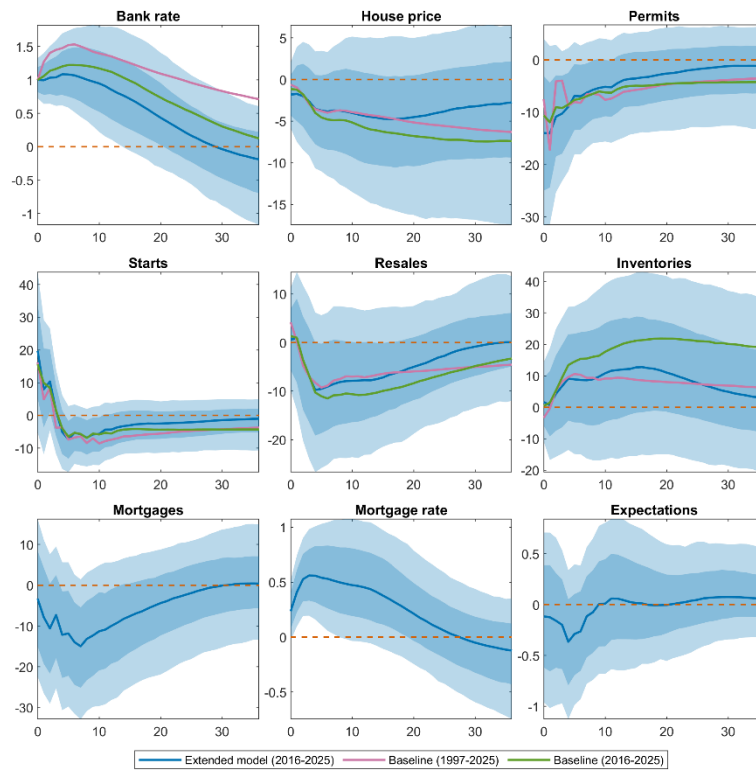
¹³ Given that inventories are measured as the ratio of active listings to sales, and that many listings are for the resale market, it is not surprising that resales and inventories respond similarly, albeit with the opposite sign.

¹⁴ Using the spread doesn't affect our results, but it makes the decompositions presented in **Figure 4** easier to interpret.

¹⁵ Details on the construction of consumer expectations data are provided in the Appendix.

¹⁶ Exploratory analysis suggests that the change in the response of house prices is due to the inclusion of expectations. Adding other variables and changing the sample did not produce this result.

Figure 3: Extended model



Note: Contractionary monetary policy shock of a 100 basis points. Effects are in percent on the level, except for the bank rate which is in percentage points on the level. Shaded areas show 68% and 90% credible intervals. The mortgage rate response equals the sum of the mortgage spread and bank rate responses.

The response of consumer expectations provides another demand-side transmission mechanism. Because housing is both a consumption good and an asset, lower expected price growth reduces the perceived return to buying and can reinforce the pullback in demand caused by higher borrowing costs. As a reference point, we can derive a measure of model-consistent expectations for year-over-year house price growth using the impulse responses of house prices. The peak posterior median response of consumer expectations implies expected growth of -0.36% between months four and sixteen, while the corresponding estimate derived from the response of house prices is -1.31%. Consumer expectations also return to their average after 12 months, broadly consistent with the return of year-over-year house price growth to zero after 24 months. Thus, while the response of expectations is smaller than the model-implied change in future price growth, it has the expected sign and appears informative about subsequent price movements.¹⁷

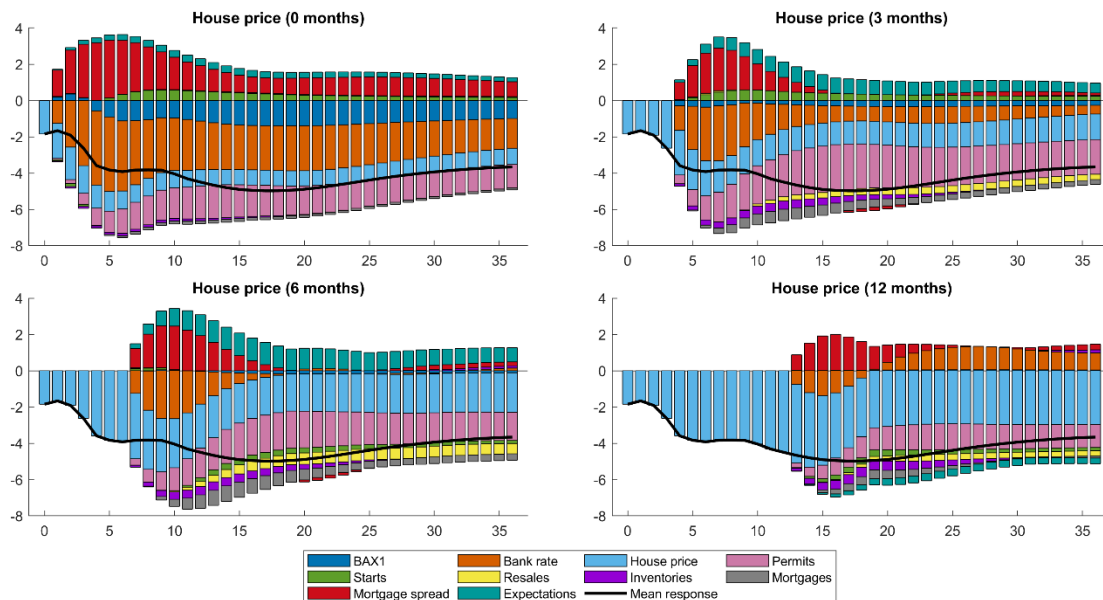
¹⁷ The right panel of **Figure A1** in the Appendix shows the cross-correlations between year-over-year house price growth and consumer expectations. While maximal correlations indicate that expectations move contemporaneously with house prices, there is a peak at exactly 12 months ahead – exactly where it should be.

Overall, **Figure 3** reinforces the interpretation that monetary policy affects housing primarily through demand. Higher rates reduce mortgage activity and are associated with lower expected price growth, while the response of construction remains too small, and too delayed in its effect on the housing stock, to offset the decline in demand.

Demand drives the price decline

In this section, we use the decomposition introduced by Dufour and Wang (2025) to examine how different variables mediate the transmission of monetary policy to the housing market over time. Intuitively, the decomposition attributes the total response of house prices to the variables through which the shock propagates within the VAR.¹⁸

Figure 4: House price decomposition



Note: Dufour and Wang (2025) decompositions for the responses to a 100-basis-point increase in the policy rate. Values are evaluated at the posterior mean to preserve additivity.

Figure 4 presents this decomposition for the response of average house prices to a monetary policy shock at 0, 3, 6, and 12 months.¹⁹ Negative bars indicate variables that contribute to the decline in house prices, while positive bars offset it. On impact, the effect of monetary policy operates mainly through the increase in the policy rate itself. Because the mortgage rate rises by less than the bank rate, the mortgage spread declines and partly offsets the direct effect of the policy-rate increase.

¹⁸ Additional technical details on how these decompositions are performed are provided in the Appendix, along with a simple example.

¹⁹ By construction the decomposition attributes the whole impulse response to the variable itself for all horizons at or before the selected period. Moreover, the internal instrument approach means that the dynamic behavior of the proxy is left unrestricted. Even though it is statistically indistinguishable from a white noise process, it shows up in early decomposition.

The construction-related contributions are negative across the horizons shown, especially for building permits. In a simple supply-and-demand framework, a large inward shift in the supply curve would reduce quantities but put upward pressure on prices. If the declines in permits and starts were mainly operating through this supply channel, their contributions to house prices should eventually become positive. Instead, they remain negative. This suggests that the construction response is better interpreted as part of the endogenous adjustment to weaker demand rather than as an offsetting supply-side force. The negative contributions of resales and inventories point in the same direction since fewer resales and increased inventories are signs of looser market conditions.

Conclusion

In this paper, we asked whether monetary policy is transmitted to the housing market mainly through supply or demand channels. Interpreted through the lens of market equilibrium, the results point to a stronger response of housing demand than housing supply.

We find that house prices fall substantially and persistently, while the implied effects of lower construction activity on the future housing stock are small. Construction indicators respond relatively early, but the stock adjustment they imply is slow. At the same time, mortgage originations fall and expectations of future house price growth decline, both pointing to weaker demand. Finally, the decomposition of house price responses suggests that the decline in prices is driven primarily by demand-side forces rather than by supply-side forces.

For policy, this distinction is important. Monetary policy can materially affect housing-market conditions by weakening demand. But its direct influence on housing supply is limited and operates only gradually. Although these results do not rule out potentially important distributional effects, they suggest that monetary policy has limited scope to address housing affordability concerns through supply adjustments.

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Appendix

Estimation details

Stacking the equations, the VAR model can be written as

$$Y = ZA + U, \quad U \sim N(0, \Sigma \otimes \Omega)$$

where $\Omega = \text{diag}(e^{h_1}, \dots, e^{h_T})$. Following common practice, we model the variables in levels and log levels. We estimate this model using the efficient Gibbs sampler of Chan (2020). A normal-inverse Wishart prior is used for the covariance matrix and the slope parameters

$$\Sigma \sim IW(\nu_0, S_0)$$

$$\text{vec}(A) | \Sigma \sim N(\text{vec}(A_0), V_{A_0} \otimes \Sigma)$$

which he structures similarly to a Minnesota prior, i.e.

$$\begin{aligned} E(A_{l,i,j}) &= \begin{cases} a_{0,i,i} & \text{if } i = j, l = 1 \\ 0 & \text{otherwise} \end{cases} \\ V(A_{l,i,j}) &= \frac{c_1}{l^2 \sigma_i^2} \\ V(d_{0,i}) &= \frac{c_2}{\sigma_i^2}. \end{aligned}$$

Chan (2020) uses an independent (truncated) normal inverse gamma prior for the volatility process

$$\begin{aligned} \rho &\sim N(\rho_0, V_{\rho_0}) 1\{|\rho| < 1\} \\ \sigma_h^2 &\sim IG(\nu_{h,0}, S_{h,0}). \end{aligned}$$

The truncation enforces stationary variance which can be used to close the model with a stationary prior on the initial value for the stochastic volatility process, i.e. $h_1 | \rho, \sigma_h^2 \sim N(0, \frac{\sigma_h^2}{1-\rho})$. We set $a_{0,i,i} = 1$ for all variables, except for the proxy for which we use $a_{0,i,i} = 0$. This centers the VAR process on independent random walks and a white noise process for the proxy. As usual, σ_i^2 are obtained as the residual variance of AR(p) processes estimated by OLS on each variable. We also follow Chan (2020) and set ν_0 to 2, $S_0 = \text{diag}(\sigma_1^2, \dots, \sigma_n^2)$, as well as $c_1 = 0.2^2$ and $c_2 = 100$. Those are standard values. For the stochastic volatility process, we follow Chan (2020) and set $\rho_0 = 0.9$, $V_{\rho_0} = 0.2^2$, $\nu_0 = 5$, and $S_{h,0} = 0.01(\nu_0 - 1)$. Those priors encode the belief that volatility varies relatively smoothly (i.e., the prior implies strong serial correlation and small shocks), but they are not particularly tight.²⁰ We sample parameters from the posterior distribution using the

²⁰ We note that h_t is centered on zero such that the scale of the data is captured by Σ . Hence, those hyperparameters migrate from one dataset to another.

Gibbs sampler proposed by Chan (2020) which builds on the precision sampler of Chan and Jeliazkov (2009) for sampling the time series of common volatility.

Data

The data used in this study is summarized in **Table A1**. Details on the construction of the monthly household expectations series for house price growth in the following year are provided below.

Table A1: Data Summary

	Period used	Source	Code
Monetary policy shock (BAX1, basis points)	June 1997 – October 2025	Sekkel, Stern, and Zhang (2025)	n/a
Bank rate (percentage points)	June 1997 – October 2025	Statistics Canada	V39076
Mortgage rate (percentage points)	January 1990–October 2025	Statistics Canada	V733833
Average house prices (\$)	June 1997 – October 2025	Haver Analytics	CACERPSM@CREA
New building permits (units)	January 2018 – October 2025	Haver Analytics	VK117265@CANADAR
New building permits (units) (seasonally adjusted, spliced)	June 1997 – December 2017	Haver Analytics	V14098@CANADA
Housing starts (units)	June 1997 – October 2025	Haver Analytics	GM00001@CANADAR
Resales (units)	June 1997 – October 2025	Haver Analytics	CACERUSM@CREA
Inventories (months)	June 1997 – October 2025	Haver Analytics	CACERMSM@CREA
Mortgage purchases (units)	January 2014 – October 2025	Bank of Canada	n/a
Expected house price growth in the next year (percentage points)	May 2016 – October 2025	Bank of Canada (author's calculations)	CES-C7

Household expectations

The Canadian Survey of Consumer Expectations provides quarterly data on household expectations for how much they expect housing prices to grow in the next year. To obtain a monthly version of this time series, we apply a version of the MIDAS-based temporal aggregation method of Guay and Maurin (2015). We model the unobserved monthly change in expectations as

$$\Delta y_{t_m-j} = y_{t_m-j} - y_{t_m-j-1} = \delta_0 + \beta_j x_{t_m-j} + v_{t_m-j}$$

where t_m is monthly time and x_{t_m-j} is the change in year-over-year prices. Taking the sum over a quarter (i.e., over $j \in \{0,1,2\}$), we obtain a MIDAS regression representation of the change in expectations:

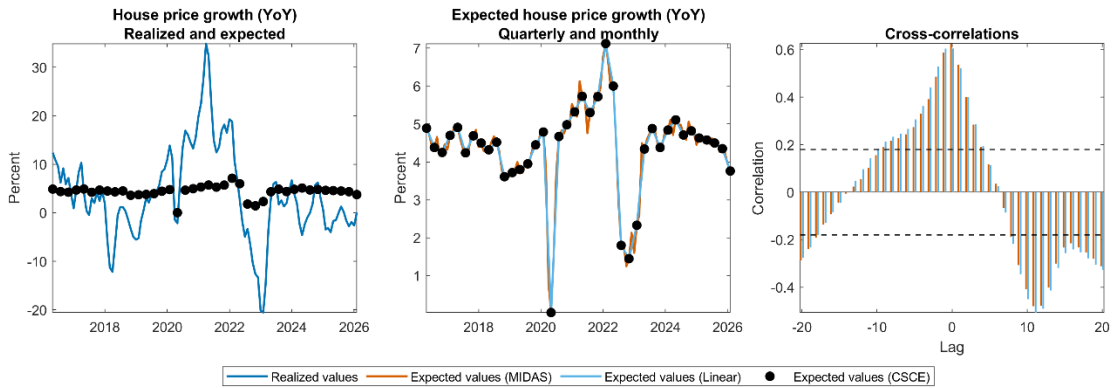
$$\begin{aligned} \Delta_3 y_{t_m} &= y_{t_m} - y_{t_m-3} = 3\delta_0 + \sum_{j=0}^2 \beta_j x_{t_m-j} + \sum_{j=0}^2 v_{t_m-j} \\ \Leftrightarrow \Delta_3 y_{t_m} &= \alpha_0 + \sum_{j=0}^2 \beta_j x_{t_m-j} + \eta_{t_m}. \end{aligned}$$

Given the small number of parameters, we follow Foroni et al. (2015) and estimate model parameters, $(\alpha_0, \beta_0, \beta_1, \beta_2)'$, and the shocks, v_{t_m} , by OLS. We then apply the following mapping to recover estimates of monthly changes

$$\Delta \hat{y}_{t_m-j} = \frac{\hat{\alpha}_0}{3} + \hat{\beta}_j x_{t_m-j} + \frac{\hat{\eta}_{t_m}}{3}$$

where we implicitly used $\hat{\delta}_0 = \frac{\hat{\alpha}_0}{3}$ and $\hat{v}_{t_m-j} = \frac{\hat{\eta}_{t_m}}{3}$. To recover monthly expectations, note that $\hat{y}_{t_m} = \hat{y}_{t_m-1} + \Delta \hat{y}_{t_m}$. Since the survey is usually carried out in the middle of the quarter, we assign quarterly values to the second month in each quarter and apply this method to fill in the missing monthly values. The results are shown in **Figure A1**.

Figure A1: Temporal disaggregation



Note: The expectations are about house price growth in the next 12 months. The linear method refers to linear interpolation. Cross-correlations are between each monthly expectations series and the realized house price growth. A maximum at a positive lag would indicate that the expectations lead house price growth.

Dufour and Wang (2025) decompositions

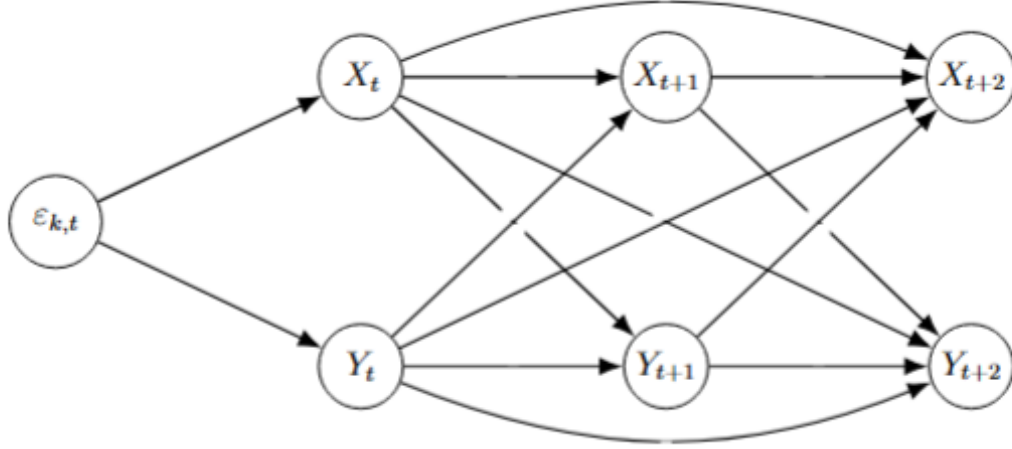
For simplicity, we can look at a bivariate VAR model with two lags:

$$W_t = (X_t, Y_t)' = A_1 W_{t-1} + A_2 W_{t-2} + u_t$$

We let $u_t = D \epsilon_t$, as usual, and we will arbitrarily focus on the first shock and the response of X_t . When we perturb the VAR with an exogenous shock, it gets propagated

through endogenous interactions between the variables as shown in **Figure A2**. All of this generalizes to more variables and lags.

Figure A2: Dynamic interactions in a bivariate VAR(2)



Suppose that we are interested in the response of X to the structural shock $\epsilon_{k,t}$. Impulse responses reflect all the dynamic interactions which follow the initial shock, so they sum over all the arrows coming at a particular node for X .

Dufour and Wang (2025) ask a slightly different question: how much of this total effect passes through a particular node? This amounts to forcing the propagation to only go through Y for periods $t, t+1, \dots, t+n$, then letting all the variables move freely for period $t+n+1, \dots, t+h$. In terms of **Figure A2**, at period $n=0$, the mediating contribution of X is computed by refusing to let Y_t move. At period $n=0$, neither Y_t , nor Y_{t+1} are allowed to move. Cleverly selected weights make everything add up to the impulse responses.

To compute those decompositions, let $C_{k,h}^{(n)}$ be the contribution of variable k to the response of variable X at horizon h from period n onwards. The general formula is

$$C_{k,h}^{(n)} = \sum_{s=0}^n [A_{n+1-s}^{(h-n)}]_{X,k} D_{X,k}$$

where $A_{n+1-s}^{(h-n)}$ correspond to “higher order impulse responses.”²¹ To evaluate this expression, we need a few definitions. The reduced-form moving average representation of the VAR is

$$W_t = \sum_{j=0}^{\infty} \Psi_j u_{t-j}$$

²¹ Dufour and Renault (1998) refer to them as “generalized impulse response functions.” Pesaran and Shin (1998) introduced a different concept under the same name. In the interest of avoiding any confusion, Dufour uses this alternative name when presenting his more recent work.

and straight-forward calculations would show that

$$\Psi_h = \begin{Bmatrix} I_K \\ A_1 \\ A_1^2 + A_2 \end{Bmatrix}.$$

Structural impulse responses are given by $\Theta_h = \Psi_h \Theta_0$ where $\Theta_0 = D$. Next, the higher order impulse responses are given by the following recursion $A_j^{(q+1)} = A_{j+1}^{(q)} + A_j^{(q)} A_j$

$$A_j^{(1)} = \begin{cases} A_1 & j = 1 \\ A_2 & j = 2 \\ 0 & j > 2 \end{cases}$$

$$A_j^{(2)} = \begin{cases} A_1^2 + A_2 & j = 1 \\ A_1 A_2 & j = 2 \\ 0 & j > 2 \end{cases}$$

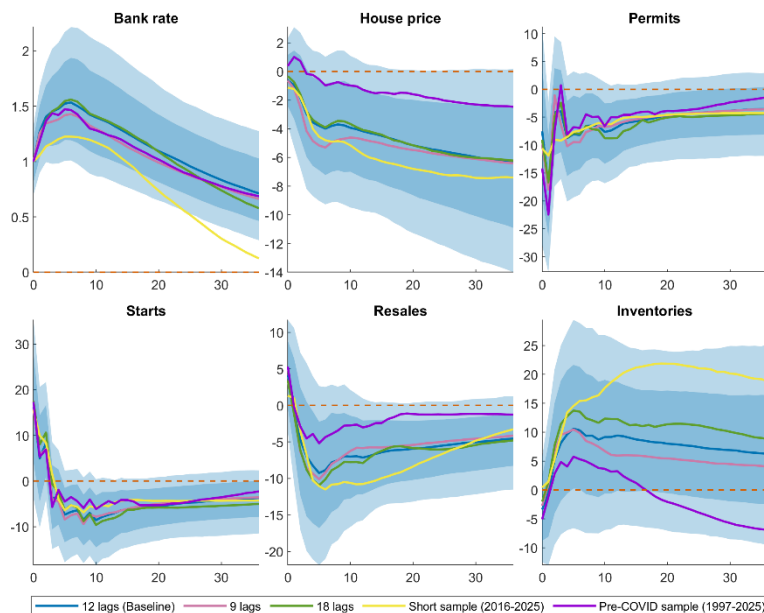
and $A_j^{(q)} = 0$ for $q > 2$. To see how these decompositions play out, **Table A2** contains results for the mediating effects of both X and Y on X at periods 0 and 1 for horizons 0, 1, and 2. Since the method trivially attributes the full IRF to a variable's own movement when $n \geq h$, the decomposition for period 2 is trivial. Naturally, the first two columns add up to the impulse response of X in the third column at each horizon.

Table A2: Mediation decomposition in a bivariate VAR(2)

	Effects through X	Effects through Y	Total effect (IRF)
Period 0 ($n = 0$)			
Horizon 0	$C_{X,0}^{(0)} = D_{X,k}$	$C_{Y,0}^{(0)} = 0$	$\Theta_{0,X,k} = D_{X,k}$
Horizon 1	$C_{X,1}^{(0)} = A_{1,XX} D_{X,k}$	$C_{Y,1}^{(0)} = A_{1,XY} D_{Y,k}$	$\Theta_{1,X,k} = A_{1,XX} D_{X,k}$
Horizon 2	$C_{X,2}^{(0)} = (A_1^2 + A_2)_{XX} D_{X,k}$	$C_{Y,2}^{(0)} = (A_1^2 + A_2)_{XY} D_{Y,k}$	$\Theta_{2,X,k} = (A_1^2 + A_2)_{XX} D_{X,k}$
Period 1 ($n = 1$)			
Horizon 0	$C_{X,0}^{(1)} = D_{X,k}$	$C_{Y,0}^{(1)} = 0$	$\Theta_{0,X,k} = D_{X,k}$
Horizon 1	$C_{X,1}^{(1)} = \Theta_{1,X,k}$	$C_{Y,1}^{(1)} = 0$	$\Theta_{1,X,k} = A_{1,XX} D_{X,k}$
Horizon 2	$C_{X,2}^{(1)} = A_{2,XX} D_{X,k} + A_{1,XX} \Theta_{1,X,k}$	$C_{Y,2}^{(1)} = A_{2,XY} D_{Y,k} + A_{1,XY} \Theta_{1,Y,k}$	$\Theta_{2,X,k} = (A_1^2 + A_2)_{XX} D_{X,k}$

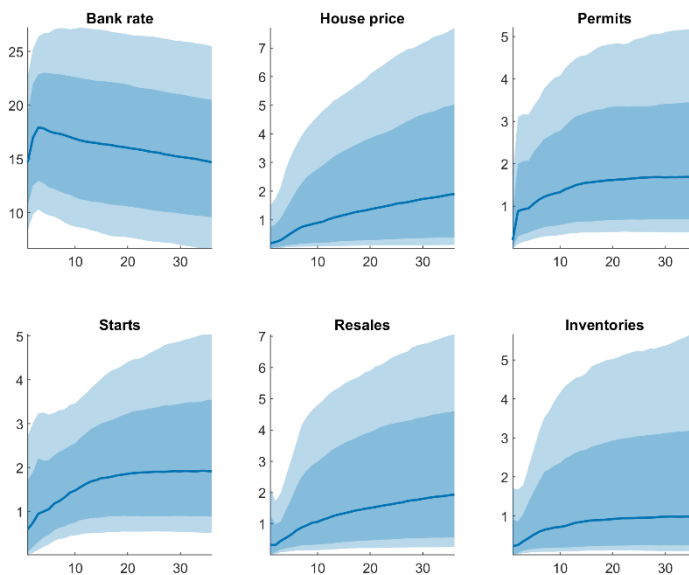
Supplementary results

Figure A3: Model comparison



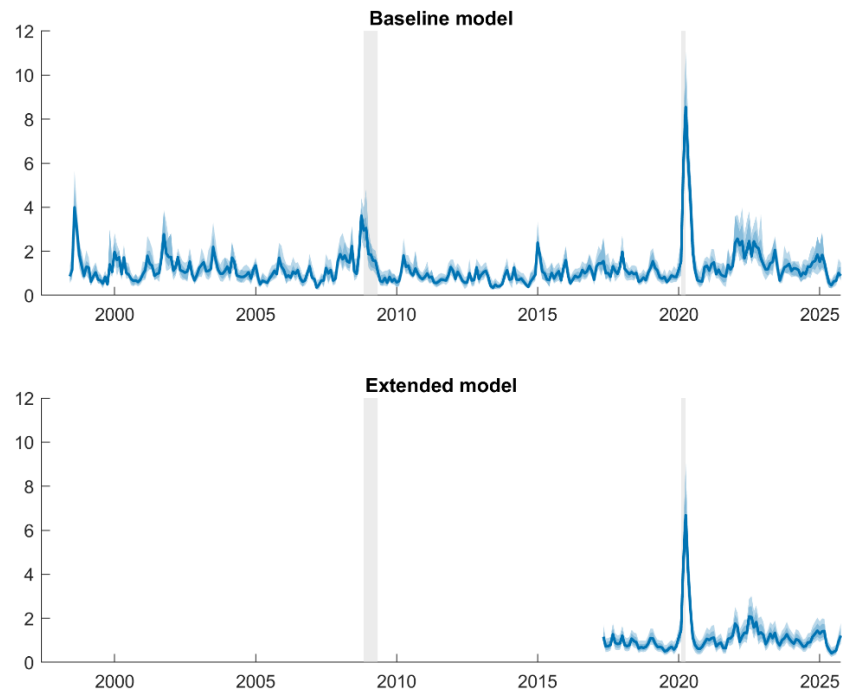
Note: Contractionary monetary policy shock of a 100 basis points. Effects are in percent on the level, except for the bank rate which is in percentage points on the level. Shaded areas show 68% and 90% credible intervals.

Figure A4: Variance explained by monetary policy shocks



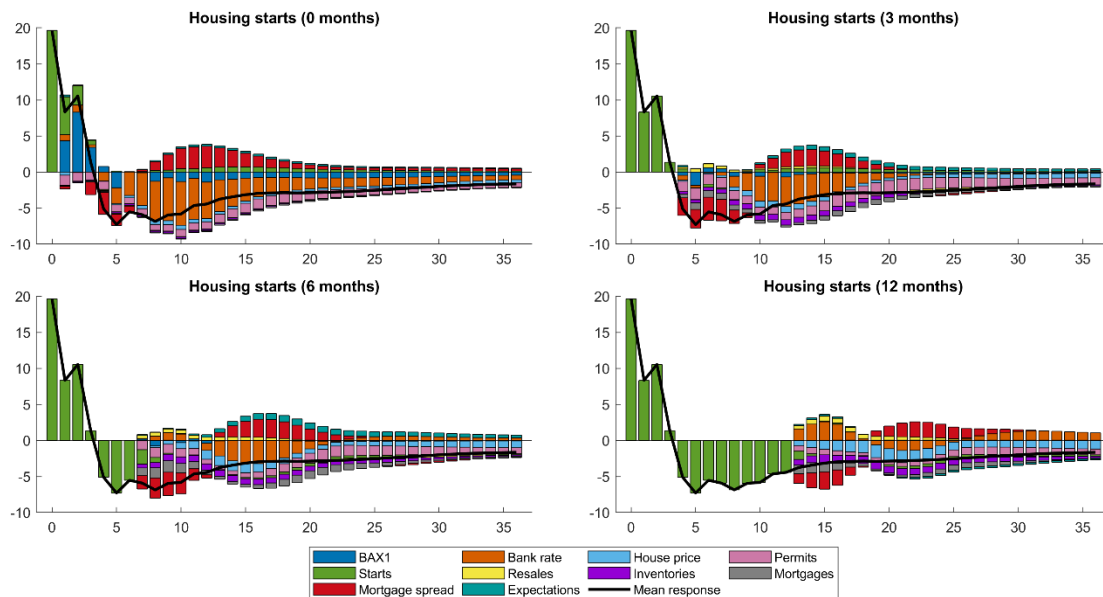
Note: Shares of the monetary policy shocks in the forecast error variance in percentage points. Shaded areas show 68% and 90% credible intervals.

Figure A5: Common stochastic volatility estimates



Note: Posterior distribution of the common stochastic volatility process for the baseline (bottom) and extended (top) models. Bands correspond to C.D. Howe recession dates.²² Shaded areas show 68% and 90% credible intervals.

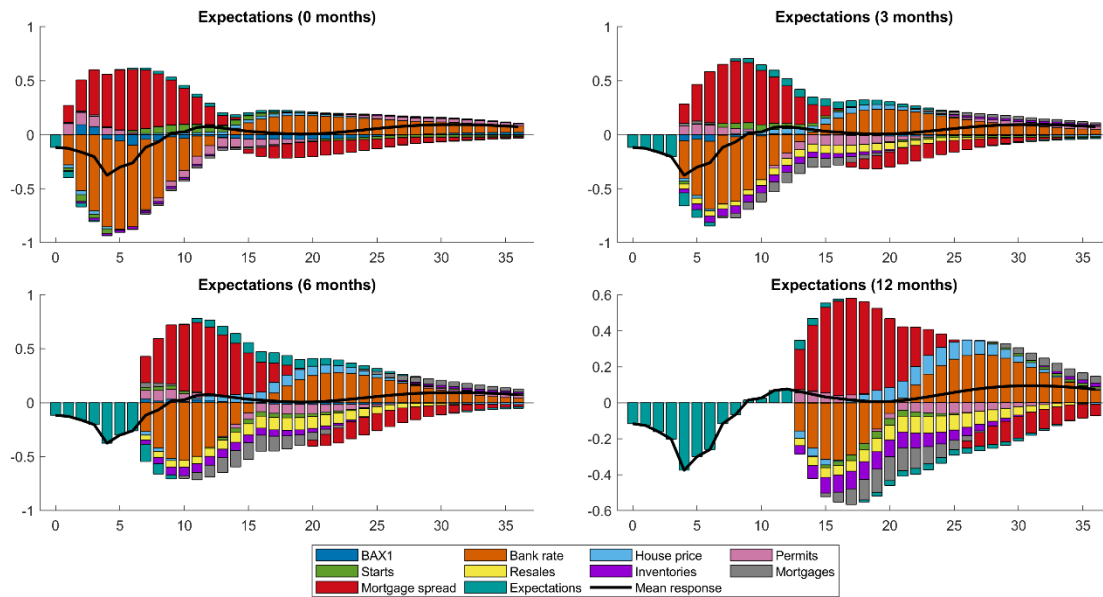
Figure A6: Housing starts decomposition



Note: Extended model. Dufour and Wang (2025) decompositions for the responses to a 100-basis-point increase in the policy rate. Values are evaluated at the posterior mean to preserve additivity.

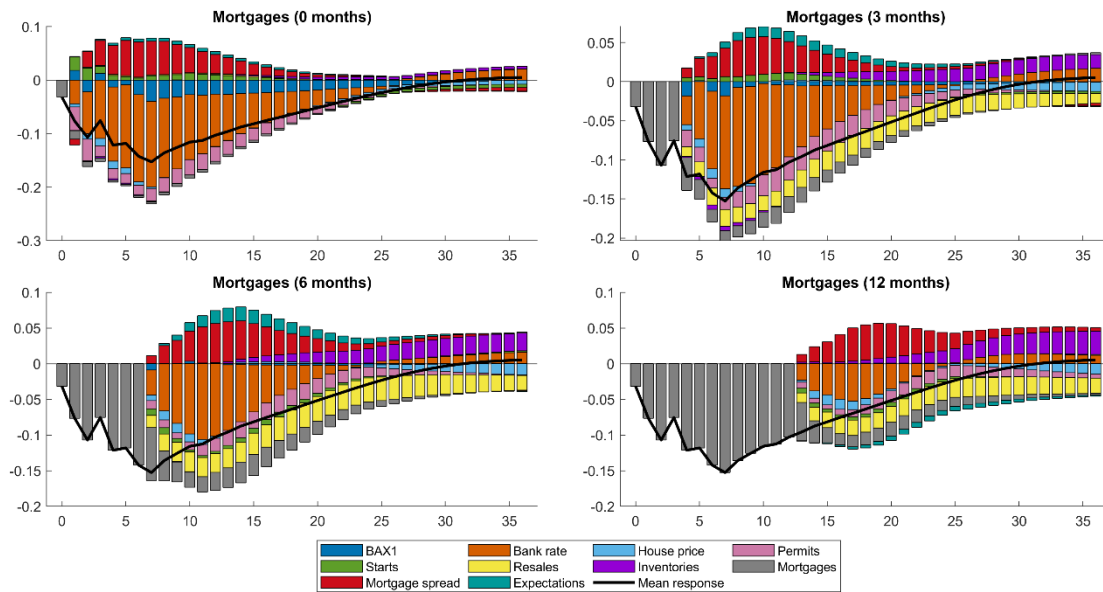
²² See Cross and Bergevin (2012).

Figure A7: Expectations decomposition



Note: Extended model. Dufour and Wang (2025) decompositions for the responses to a 100-basis-point increase in the policy rate. Values are evaluated at the posterior mean to preserve additivity.

Figure A8: Mortgage decomposition



Note: Dufour and Wang (2025) decompositions for the responses to a 100-basis-point increase in the policy rate. Values are evaluated at the posterior mean to preserve additivity.