Beyond the Aggregate: Heterogeneous Effects of Monetary Policy on Credit Allocation

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[0]*Disclaimer:* The views expressed are those of the authors and do not necessarily reflect those of Bank Negara Malaysia.

Motivation: Studying the Transmission Mechanism

- Monetary policy makers always interested on the monetary policy transmission to the economy.
- Traditionally, we look at the overall effects.
- Since the Global Financial Crisis, more demand for assessments on the distributional consequences of policy. (Bonifacio et al., 2021; BIS, 2021)
- Recent (largely US-based) evidence from monetary stimulus (McKay & Wolf, 2023):
  - Low income: benefit via labor market
  - Middle income: benefit via lower mortgage rates
  - High income: benefit from capital gains on assets
- These channels are conditional on financial structures: fixed vs floating rates, access to credit, contract design.

▸ Literature

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Our Research Question

How does monetary policy affect mortgage allocation across the income distribution?

- Mortgages are the largest household liability in many countries—and a central conduit for monetary policy transmission.
- Heterogeneous agents differ in liquidity constraints, leverage, and borrowing intent.
- Floating-rate mortgages expose borrowers immediately to policy shocks, affecting incentives and search

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What We Do & Contribution

- **Data:** Malaysian credit registry (2017–2023) with exact application, approval and origination dates.
- **Identification Strategy:** Event study (+/- 14 days window) over 42 monetary policy meetings
- **Five outcome margins** • *Demand* (application value) • Approval probability • *Origination size* • *Maturity* • *Search probability*
- **Distribution:** Heterogeneity by income decile

Our contribution

- Transmission mechanism in credit market across income distribution using high frequency analysis.
- Better identification of impact on credit due to the exact dates of applications, approvals and originations.
- Potential role for search channel.

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Literature Review

- **Distributional macro effects**: Coibion et al., 2017; Amberg et al., 2022; Leahy & Thapar, 2022; Samarina & Nguyen, 2024; Bartscher et al., 2022; Andersen et al., 2023; McKay & Wolf, 2023; BIS, 2021; Bonifacio et al., 2021
- **Credit-registry evidence**: Jiménez et al., 2012; Jiménez et al., 2014; Abuka et al., 2019; Ligonniere & Ouerk, 2024; Jasova et al., 2021; Elliott et al., 2019
- **Housing / mortgage channels**: Di Maggio et al., 2017; Cloyne et al., 2020; Ringo, 2023; Campbell & Cocco, 2003; Fuster et al., 2021; Calza et al., 2013; Greenwald, 2016; Carozzi et al., 2024
- **Borrower search and credit allocation**: Agarwal et al., 2024; Hortaçsu & Syverson, 2004
- **Shock identification**: Kuttner, 2001; Miranda-Agrippino & Ricco, 2021; Gürkaynak et al., 2005; Ho & Karagedikli, 2021

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Preview of Main Findings

- **Average impact:** Decline in *application value*, and *origination value*.
- **Distributional impact:** Top 40% income deciles absorb ≈all the contraction; bottom 60% largely inelastic.
- **Approval rate:** Falls slightly only for middle deciles (−3–4pp)
- **Loan maturities**: Stay flat (contract standardisation).
- **Search probability**: Some evidence of an increase in the probability of search, particularly among higher-income applicants.

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Data

- **Credit-registry universe:** mortgage *applications*, *approvals*, *rejections* and *originations*.
  - ∼3.4 million mortgage applications. ∼1.4 million originations (2017–23)
  - ∼99 % *floating-rate* mortgages
  - Borrower characteristics include income decile, repeat-borrower flag, age, location, sector of employment etc.
  - Loan terms include amount, maturity and LTV.
  - Monthly reports with specific dates of loan applications, status updates (approval) and originations
- **Monetary policy indicators:** High-frequency (daily) surprises: Ho & Karagedikli (2021) *a la* Kuttner (2001)
  - Adjusted for central bank information effect (Miranda-Agrippino & Ricco (2021))
- **Household income deciles:** Mapped to official national thresholds

▸ Details

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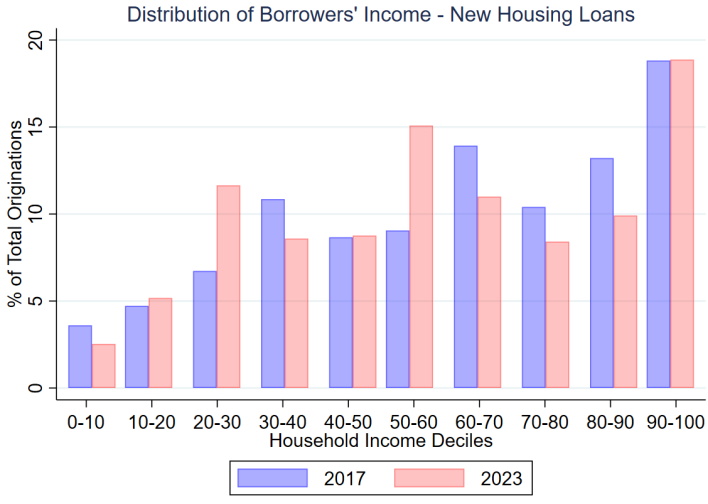
Profile of mortgage borrowers



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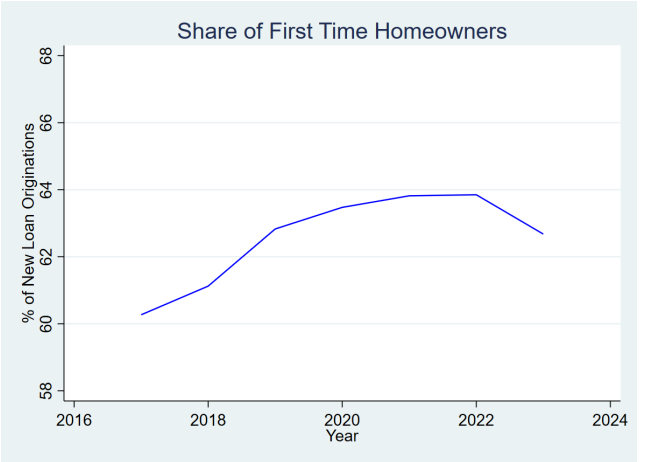
Details

Profile of mortgage borrowers



Details

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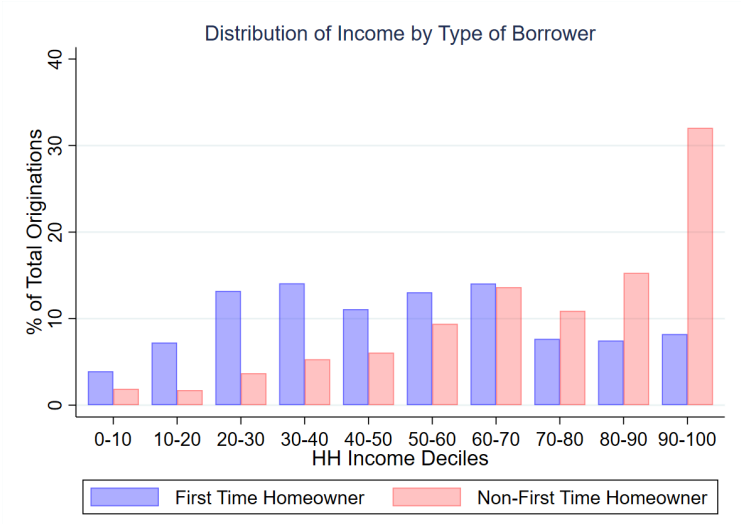
Profile of mortgage borrowers



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Details

Empirical Strategy

(1) Baseline:

$$Y_{imst} = \alpha + \beta_1 \, \mathrm{MP}_t \times \mathrm{D}_t + \sum_{k=1}^{10} \beta_{2k} \, \mathrm{IQ}_{ik} + \gamma X_{it} + \nu_{m,t} + \psi_{s,t} + \varepsilon_{imst}$$

Y_{imst}	Loan outcome: log real application value, approval dummy, log origination value, or loan maturity.
MP_t	One-day Monetary Policy surprise.
D_t	Indicator $= 1$ for days $[0, +14]$; 0 for days $[-14, -1]$.
IQ_{ik}	Borrower in income decile k.
X_{it}	Borrower covariates.
$\nu_{m,t}$	Bank $\times$ time fixed effects: *absorbs bank-window specific factors.*
$\psi_{s,t}$	State $\times$ time fixed effects: *absorbs state-window specific factors.*

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Empirical Strategy

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(2) With Income Interaction:

$$Y_{imst} = \alpha + \beta_1 \, \mathrm{MP}_t \times \mathrm{D}_t + \sum_{k=1}^{10} \beta_{2k} \, \mathrm{IQ}_{ik} \times \mathrm{MP}_t \times \mathrm{D}_t + \gamma X_{it} + \nu_{m,t} + \psi_{s,t} + \varepsilon_{imst}$$

Y_{imst}	Loan outcome: log real application value, approval dummy, log origination value, or loan maturity.
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$\nu_{m,t}$	Bank $\times$ time fixed effects: *absorbs bank-window specific factors.*
$\psi_{s,t}$	State $\times$ time fixed effects: *absorbs state-window specific factors.*

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Baseline

Table 1: Summary of Baseline Regressions

	Application	Probability of Approval	New Mortgage Originations	Maturity
Monetary Policy Surprise × D	−0.0145*	−0.0287	−0.0850***	−0.127
	(0.0079)	(0.0177)	(0.0272)	(0.221)
Fixed effects				
Bank × Time	Yes	Yes	Yes	Yes
State × Time	Yes	Yes	Yes	Yes
Observations	1,448,448	1,409,506	582,119	580,247
R^2	0.353	0.113	0.282	0.378

Notes: Standard errors (in parentheses) are clustered at the bank level. All specifications include borrower–level controls (income deciles, age, gender, employment-sector dummies, civil-servant indicator, first-loan and first-housing-loan flags) and income-decile dummies. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

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Application Values

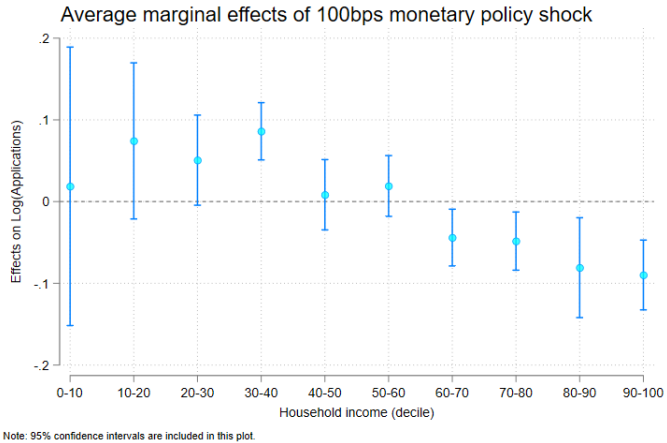

Figure 1: Values of Applications for New Mortgages

Probability of Approval

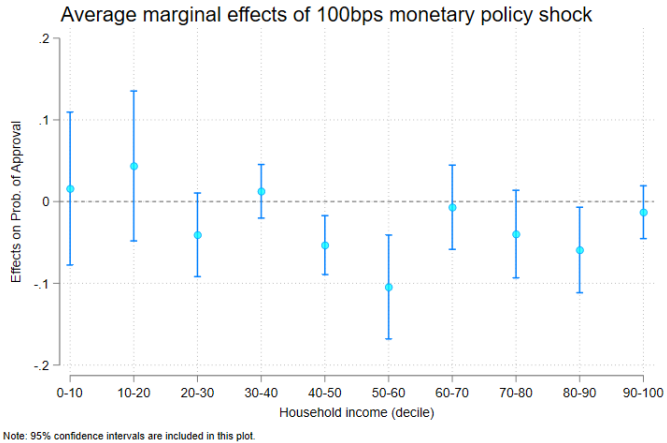

Figure 2: Probability of loan approvals

New Mortgage Originations

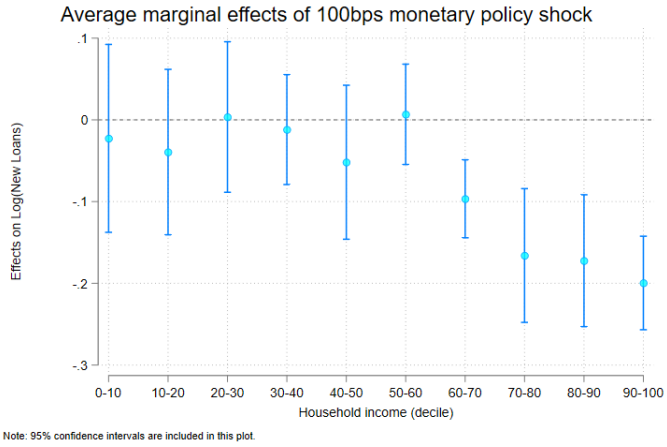

Figure 3: New mortgage loan

Maturity

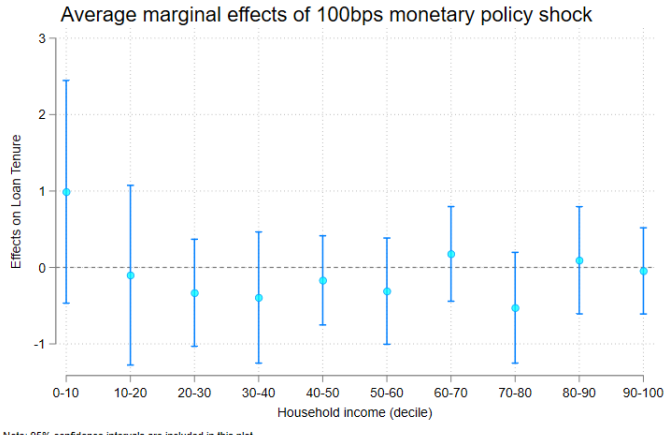

Figure 4: Loan tenure

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Borrower Search

- **Why search?** $\rightarrow$ Some borrowers may search for better terms and conditions from other banks.

$$Y_{it} = \alpha + \beta_1 MP_t \times D_{it} + \sum_{k=1}^{K} \beta_{2k} IQ_{ik} \times MP_t \times D_{it} + \gamma \mathbf{X}it + \psi_{s,t} + \varepsilon_{it} \qquad (1)$$

- **Key difference in specification:**
  - Dependent variable: Binary variable (Applying to more than one bank (1) vs Applying to only one bank (0))
  - No bank fixed effects as search involves multiple banks.

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Search

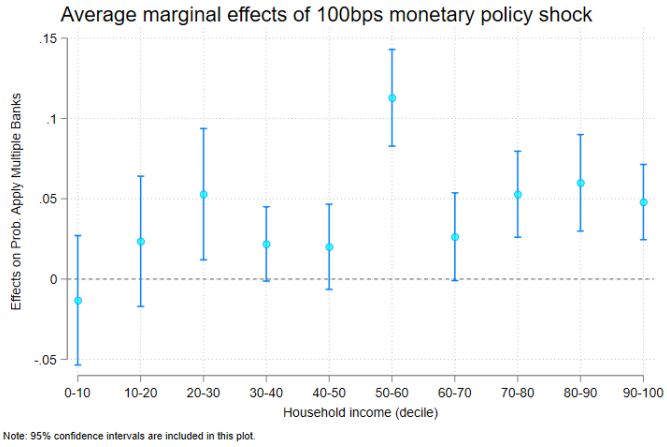

Figure 5: Probability of applying to more than one bank

Robustness

1. Alternative Size of Event Windows: $\pm$ 21 days
2. Alternative Measures of Household Income and Income Cutoffs
   - Easterly (2001), Middle class as households with incomes between the 20th and 80th percentiles of the income distribution.
   - Krueger (2012): Middle class as households with incomes between 50 percent and 150 percent of the median income.
   - Local definitions in Malaysia: B40, M40, T20
3. Alternative Measure of Monetary Policy : Change in the policy rate
4. Bank controls (capital, liquidity etc)

▸ MP

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Mechanism Hypothesis: Repeat Borrowers as Marginal Adjusters

- **Repeat buyers / Investors:** Engage in discretionary purchases (e.g., upgrades, investment properties) $\Rightarrow$ more sensitive to borrowing costs.
- **Higher-income borrowers:** More likely to be repeat buyers
- **Hypothesis:** Monetary tightening should reduce borrowing **more** among high-income repeat borrowers due to the discretionary nature of their purchases and increased sensitivity to interest rates.

▸ House Price

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Empirical Strategy for Mechanism Test

$$
\begin{aligned}
Y_{i,t} = \beta_0 &+ \beta_1 MP_t \times D_t + \beta_2 HighIncome_i + \beta_3 NonFirst_i + \beta_4 (MP_t \times D_t \times HighIncome_i) \\
&+ \beta_5 (MP_t \times D_t \times NonFirst_i) + \beta_6 (HighIncome_i \times NonFirst_i) \\
&+ \beta_7 (MP_t \times D_t \times HighIncome_i \times NonFirst_i) + X_{i,t}\Gamma + \nu_{m,t} + \psi_{s,t} + \varepsilon_{i,t} \qquad (2)
\end{aligned}
$$

- **Interaction model:**
  - High-income dummy (Top 40 percent of income)
  - Repeat borrower dummy (Non first-time buyer)
- **Outcomes tested:** Loan applications, approval probability, loan origination value.

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Mechanism: First-Time vs. Repeat Borrowers and Income Groups

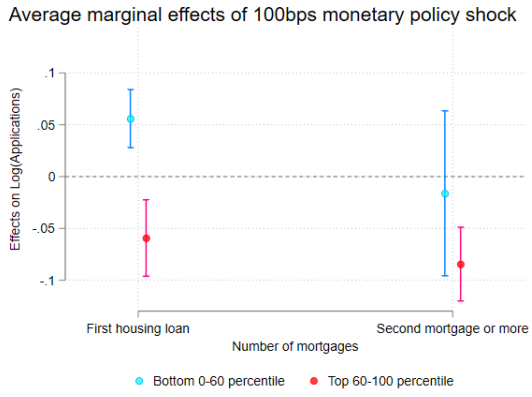

Figure 6: Loan Applications

Mechanism: First-Time vs. Repeat Borrowers and Income Groups

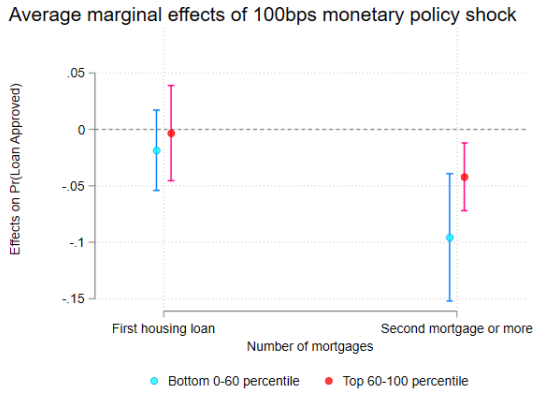

Figure 7: Probability of Loan Approved

Mechanism: First-Time vs. Repeat Borrowers and Income Groups

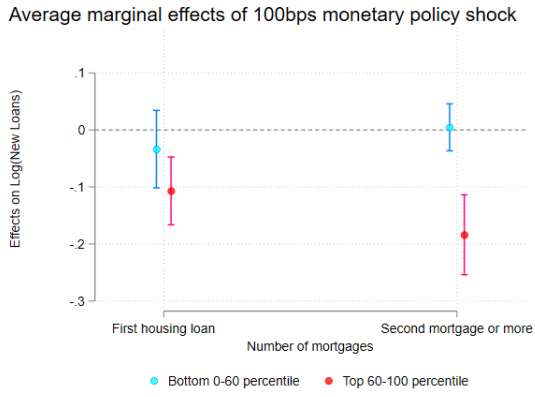

Figure 8: New Loans Originated

Conclusion

In the mortgage market, monetary policy transmits through discretionary margins at the top, with limited aggregate credit effects for the lower-income population.

- **Top 40% of income distribution**: contraction on intensive margin—driven by repeat / investment borrowers.
- **Bottom 60%**: minimal response; appears inelastic, likely due to necessity and support from housing policy.
- **Search activity**: increases post-monetary policy surprise - more prominent among higher income borrowers.

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Appendix

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Institutional Setting

- **Policy instrument & cadence**
  - Overnight Policy Rate (OPR) set by the Monetary Policy Committee of Bank Negara Malaysia (BNM)
  - Fixed calendar: 6 MPC meetings / year $\Rightarrow$ 42 monetary policy statements in 2017–23 ($\approx$ every 8 weeks)
  - Statement released **3 pm** local time on Day 2 of each meeting
- **Transmission features**
  - $\sim$99 % *floating-rate* mortgages $\rightarrow$ quick pass-through to reference rate

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Literature Review

- **Distributional macro effects**: Coibion et al., 2017; Amberg et al., 2022; Leahy & Thapar, 2022; Samarina & Nguyen, 2024; Bartscher et al., 2022; Andersen et al., 2023; McKay & Wolf, 2023; BIS, 2021; Bonifacio et al., 2021
- **Credit-registry evidence**: Jiménez et al., 2012; Jiménez et al., 2014; Abuka et al., 2019; Ligonniere & Ouerk, 2024; Jasova et al., 2021; Elliott et al., 2019
- **Housing / mortgage channels**: Di Maggio et al., 2017; Cloyne et al., 2020; Ringo, 2023; Campbell & Cocco, 2003; Fuster et al., 2021; Calza et al., 2013; Greenwald, 2016; Carozzi et al., 2024
- **Borrower search and credit allocation**: **Agrawal2024SearchingApproval**; Hortaçsu & Syverson, 2004
- **Shock identification and communication**: Kuttner, 2001; Miranda-Agrippino & Ricco, 2021; Gürkaynak et al., 2005; Ho & Karagedikli, 2021

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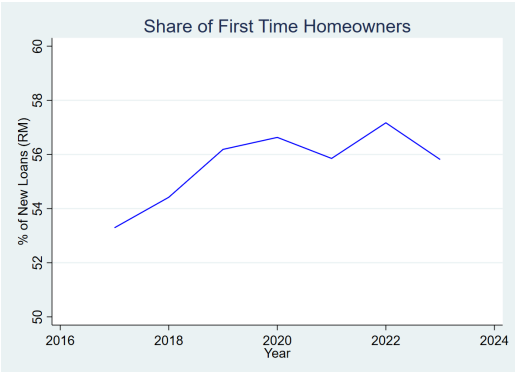
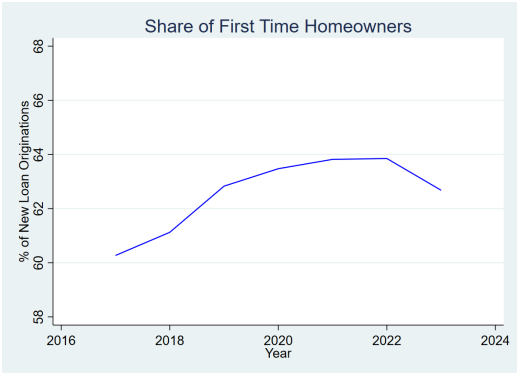
Profile of mortgage borrowers

Figure 9: Share of First Time Homeowners





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1. Credit Registry Data (CCRIS)

- Every loan application/loan in every FI with no threshold 2017-2023
- The first source: "Mortgage Origination Data," - 1.4+ million
- The second: source "Mortgage Application Data," - 3.4 + million mortgage applications - Only Spain (Jiménez et al. (2012) and Jiménez et al., 2014) and Uganda (Abuka et al., 2019)
- Borrower characteristics (age, gender, income, sector of employment etc), loan features (amount, term), property details (location, type, value) and FI characteristics
- "Number" and "date" of applications/decisions/settlement made by each applicant across all financial institutions, a feature that allows us to analyze search behavior.

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2. Monetary Policy Indicator(s)

- High-frequency (daily) surprises: Ho & Karagedikli (2021) *a la* Kuttner (2001) and Gürkaynak et al. (2005)
  - Adjusted for central bank information effect Miranda-Agrippino & Ricco (2021)
- Regress the Kuttner surprise on lagged and central bank forecasts of GDP growth and inflation.
- The residuals: monetary policy shocks, purged of anticipatory effects and the central bank's 'private information'.

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3. Household Incomes

- Official income thresholds not the Credit Registry Incomes.
- "Joint income" from the credit registry as a proxy for household income where available.
- Assumption that joint applicants for mortgages typically represent a household unit.
- For individual mortgage applications, use the "individual income" data as a proxy for household income.
- Deciles: Household Income and Expenditure Survey twice within any period of 5 years.

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Household Income Groups

Table 2: Thresholds of monthly (net) household income across years in Malaysian Ringgit

Year	Bottom 20	20 - 40	40 - 60	60 - 80	Top 20
2016	<2917	2917 - 4360	4360 - 6223	6223 - 9620	>9620
2019	<3090	3090 - 4748	4748 - 6970	6970 - 10670	>10670
2022	<3359	3359 - 5150	5150 - 7544	7544 - 11539	>11539
Growth	15%	15% - 18%	18% - 21%	21% - 20%	>20%

Source: Department of Statistics, Malaysia, Authors' calculations

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Applying to buy less expensive houses

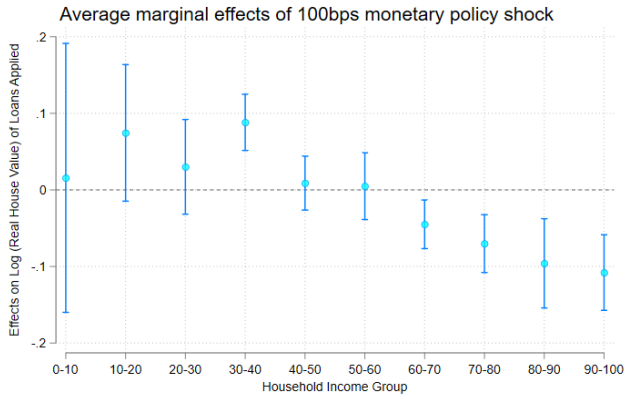

Figure 10: House Prices associated with Loan Applied

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Loan Demand: Application I

Table 3: Effect on Log Real Loan Value Applied

Dependent variable	Log(Real Loan Value Applied)					
	(1)	(2)	(3)	(4)	(5)	(6)
Monetary Policy Surprise X Post	-0.0284**	-0.0122	-0.00949	-0.0218**	-0.0166**	-0.0145*
	(0.0119)	(0.0096)	(0.0097)	(0.0081)	(0.0080)	(0.0079)
Deciles	No	No	No	Yes	Yes	Yes
Other controls	No	No	No	Yes	Yes	Yes
Fixed effects						
Time	Yes	No	No	Yes	No	No
Bank-Time	No	Yes	Yes	No	Yes	Yes
State-Time	No	No	Yes	No	No	Yes
N	1,481,069	1,481,024	1,481,024	1,448,493	1,448,448	1,448,448
R-squared	0.007	0.099	0.166	0.280	0.319	0.353

Note: Standard errors are clustered at the bank level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

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Probability of Approval I

Table 4: Effect on Loan Approval Probability

Dependent variable	Loan Approved					
	(1)	(2)	(3)	(4)	(5)	(6)
Monetary Policy Surprise X Post	-0.0242	-0.0294	-0.0297	-0.0224	-0.0284	-0.0287
	(0.0188)	(0.0186)	(0.0183)	(0.0180)	(0.0180)	(0.0177)
Deciles	No	No	No	Yes	Yes	Yes
Other controls	No	No	No	Yes	Yes	Yes
Fixed effects						
Time	Yes	No	No	Yes	No	No
Bank-Time	No	Yes	Yes	No	Yes	Yes
State-Time	No	No	Yes	No	No	Yes
Observations	1,440,954	1,440,911	1,440,911	1,409,549	1,409,506	1,409,506
R-squared	0.002	0.099	0.102	0.016	0.111	0.113

Note: Standard errors are clustered at the bank level in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

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New Mortgage Originations I

Table 5: Impact on Log(Real value of new loans)

Dependent variable	Log (Real value of new loans)					
	(1)	(2)	(3)	(4)	(5)	(6)
Monetary Policy Surprise X Post	-0.112**	-0.109**	-0.0968**	-0.0892**	-0.0955***	-0.0850***
	(0.0459)	(0.0416)	(0.0407)	(0.0339)	(0.0284)	(0.0272)
Deciles	No	No	No	Yes	Yes	Yes
Other controls	No	No	No	Yes	Yes	Yes
Fixed effects						
Time	Yes	No	No	Yes	No	No
Bank-Time	No	Yes	Yes	No	Yes	Yes
State-Time	No	No	Yes	No	No	Yes
Observations	622,767	622,719	622,713	582,174	582,125	582,119
R-squared	0.006	0.104	0.146	0.195	0.258	0.282

Note: Standard errors are clustered at the bank level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

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Maturity I

Table 6: Effect on Loan Maturity

Dependent variable	Maturity					
	(1)	(2)	(3)	(4)	(5)	(6)
Monetary Policy Surprise X Post	-0.293	-0.490	-0.297	-0.135	-0.322	-0.127
	(0.289)	(0.359)	(0.288)	(0.228)	(0.281)	(0.221)
Deciles	No	No	No	Yes	Yes	Yes
Other controls	No	No	No	Yes	Yes	Yes
Fixed effects						
Time	Yes	No	No	Yes	No	No
Bank-Time	No	Yes	Yes	No	Yes	Yes
State-Time	No	No	Yes	No	No	Yes
Observations	620,338	620,386	620,332	580,253	580,302	580,247
R-squared	0.103	0.009	0.110	0.374	0.325	0.378

Note: Standard errors are clustered at the bank level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

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Purchase less expensive houses

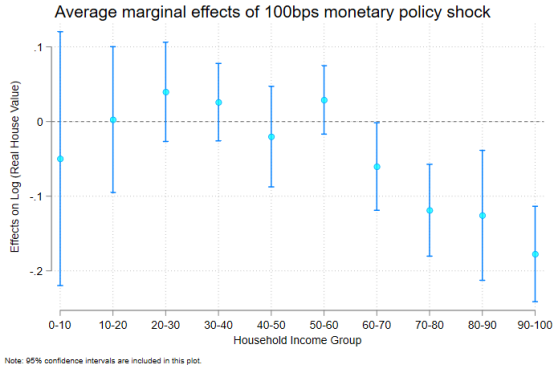

Figure 11: House Prices associated with New Loan Originated

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