

When Tariffs Meet Oil: Optimal Monetary Policy with Household Debt

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Working paper – guy-djolaud.github.io

Motivation

- ▶ A foreign tariff and a higher oil price send **conflicting signals** to the central bank of a commodity exporter
 - tariff $\Rightarrow$ weaker demand for domestic production
 - oil $\Rightarrow$ higher consumption and input costs, *but also* higher export receipts
- ▶ Consumer prices can rise while domestic demand and production weaken
- ▶ With **nominal household debt secured by housing**, the policy response also decides *who bears the adjustment*:
 - real value of inherited liabilities
 - cost of servicing them (gradual mortgage repricing)
 - collateral available to borrowers

Which inflation should policy accommodate, and who absorbs the shock?

This paper

Question. Optimal monetary policy, and its distributional consequences, when a loss of foreign market access coincides with a higher oil price.

What I do.

- ▶ Two-household small open economy: savers and collateral-constrained borrowers, nominal mortgage debt, sticky domestic prices, oil in consumption and production, oil-endowment export income
 - ▶ Calibrated to **Canada**: 75.9% of 2024 merchandise exports to the US; net oil exporter; mortgage rates on outstanding debt reprice gradually
 - ▶ Compare **Ramsey** (commitment) with a CPI Taylor rule, domestic price stability, and an episode-optimized CPI rule
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Headline answer. Ramsey *cuts* the rate, roughly halves the output decline, and keeps borrower consumption at its no-shock level – at the cost of higher headline CPI inflation. The stakes are mainly **redistributive**.

Three pieces of Canadian evidence discipline the model

1. **Mortgage repricing is slow and partial.** Quarterly projection, 2016Q4–2025Q4: adjustment speed $\rho = 0.327$, long-run amplitude $\kappa_m = 0.500$. Tightening cycle 2021Q4–2023Q4: outstanding-balance rate $2.35 \rightarrow 4.49\%$, while the rate on new funds rose $1.69 \rightarrow 6.40\%$
2. **Production $\neq$ purchasing power.** 2014–16 oil collapse: real GDP $+1.9\%$ but real gross domestic income -2.1% (terms of trade -11.3%) – trading gains must be tracked separately
3. **Oil news appreciates the Canadian dollar.** After a Känzig (2021) oil-supply-news shock, CAD appreciates by 1.50 log points; the imported-consumer-goods price *falls* in CAD and rises only 0.23 log points relative to US CPI

Model in one slide

Households

- ▶ Savers: deposits, foreign assets, firm profits, resident oil income
- ▶ Borrowers ($\lambda = 0.30$): housing collateral $b_t \leq m q_t H_{B,t}$, nominal debt
- ▶ Borrowing rate: R_t^m adjusts to the policy rate with speed ρ , amplitude κ_m

Firms

- ▶ Labor + oil inputs, Rotemberg pricing on domestic goods

Open economy

- ▶ Foreign tariff $\Rightarrow$ lower export demand; Canadian counter-tariff $\Rightarrow$ dearer imports
- ▶ Fixed oil endowment: income to savers; oil in CPI and in production

Policy

- ▶ Short nominal rate under commitment (Ramsey) vs. simple rules
- ▶ Timeless perspective; common initial state and inherited promises

The experiment

- ▶ Unanticipated joint shock, persistence 0.95:
 - US tariff: +5% • Canadian counter-tariff: +1.5% • oil price: +20%
- ▶ Four policies from the *same* physical state and inherited commitments:
 - CPI rule ($\rho_R = 0.8$, $\phi_\pi = 1.5$) • domestic price stability ($\pi_{h,t} = 0$)
 - Ramsey • CPI rule with coefficients optimized for this episode
- ▶ Each response measured against that policy's own no-shock transition; nonlinear deterministic paths

Finding 1 – The policy regime decides who bears the shock

Impact response	CPI rule	Dom. price stab.	Ramsey	Optim. CPI
Policy rate (annual pp)	+0.33	−0.02	− 0.14	+0.96
Real GDP (%)	−1.03	−0.59	− 0.49	−1.19
Borrower consumption (%)	−1.13	−0.11	+0.06	−1.61
Saver consumption (%)	−0.25	−0.04	+0.01	−0.30
CPI inflation (ann. pp)	+1.10	+1.85	+2.02	+1.17
Domestic inflation (ann. pp)	−0.56	0.00	+0.12	−0.45

- ▶ Under the CPI rule, borrowers absorb **over four times** the savers' decline
- ▶ Ramsey **accepts the relative-price component of inflation** to protect domestic production and exposed households; domestic producer inflation barely moves
- ▶ Most of the accommodation comes from the tariff; oil alone calls for a cut of only ~2 bp

Finding 2 – The welfare stakes are mainly distributional

vs. CPI rule (consumption equiv., %)	Borrowers	Savers	Social
Domestic price stability	+0.042	−0.004	−0.00002
Ramsey	+0.112	−0.018	+0.0022
Optimized CPI rule	+0.011	−0.001	−0.0001

- ▶ Aggregate gain from Ramsey: **negligible** (0.0022% of permanent consumption)
- ▶ The choice between policies is about **how the burden is shared**, not aggregate efficiency
- ▶ The episode itself is uneven: savers (who own the oil income) gain under both policies; borrowers lose under both – but their loss is $\sim 10\times$ larger under the CPI rule

Finding 3 – Channels: income and debt revaluation, not collateral

- ▶ Three channels support borrowers under Ramsey:
 - smaller decline in **labor income**
 - surprise CPI inflation **erodes inherited nominal debt**
 - the policy-rate path feeds into **future** mortgage payments (impact debt service is inherited)
- ▶ Indexing debt to inflation shuts the revaluation channel: borrower consumption falls **deeper** ($-1.18 \rightarrow -1.32\%$) under the CPI rule
- ▶ House prices barely move under Ramsey; freezing the collateral price changes little

Finding 4 – Mortgage repricing changes the required rate movement

- ▶ Estimated repricing law $(\rho, \kappa_m) = (0.327, 0.500)$ vs. slow unit-amplitude benchmark $(0.05, 1)$:
 - initial Ramsey cut **shrinks** from 26 to 14 basis points. . .
 - . . . yet the mortgage rate falls **more** on impact (2.3 vs. 1.3 bp), because adjustment is faster
- ▶ The policy rate is an **incomplete measure** of the relief reaching indebted households
- ▶ Faster repricing lets a smaller rate cut deliver larger immediate relief

Finding 5 – Which inflation enters the rule matters most

- ▶ Share of the Ramsey improvement (commitment criterion) captured by simple rules:
 - **domestic price stability: 55%** • optimized CPI rule: **6%**
- ▶ The optimized CPI rule *raises* the rate by 96 bp and deepens the borrower decline to -1.61% : re-tuning coefficients cannot fix targeting the wrong price index
- ▶ In this experiment, **the inflation measure in the rule matters more for incidence than how strongly the rule responds**

An analytical result on imported inflation

- ▶ With log utility and Cobb–Douglas consumption, a rise in the *specific* foreign price of the imported consumption basket admits an exact transformation of equilibrium and planner conditions
- ▶ It lowers purchasing power and import volumes for both households, but leaves the **Ramsey interest-rate path and domestic allocations unchanged**
- ▶ An import-cost shock can turn borrowers' impact consumption negative *without* changing optimal policy
- ▶ A CPI rule does **not** share this invariance – the transformed CPI inflation enters its feedback directly

Robustness and limits

- ▶ **Robust:** the **direction** of the Ramsey response (easing) across nine calibrations – including when borrowers become a negligible share: debt shapes strength and incidence, not the sign
- ▶ **Conditional:** the sign of borrowers' impact consumption
 - half of oil income owned abroad: -0.07% • less persistent oil shock ($\rho_o = 0.8$): -0.18%
 - supply–use energy shares or positive import-cost exposure also flip it
- ▶ Cutting the policy rate does **not by itself** guarantee that indebted households are protected

Conclusion

- ▶ When tariffs and oil prices rise together, the central bank of a commodity exporter faces a **redistribution problem**, not just a stabilization problem
- ▶ In the Canadian calibration, optimal policy **cuts** the rate, halves the output loss, and shields borrowers – accepting higher headline CPI inflation while domestic producer inflation stays flat
- ▶ Aggregate welfare gains are small; the gains and losses across households are an order of magnitude larger
- ▶ Mortgage repricing and the ownership of oil income govern how much rate movement redistribution requires – and who is actually protected

Paper and replication material: guy-djolaud.github.io