How Does Monetary Policy Affect Household Indebtedness?

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Motivation

- Household debt increased faster than income in most countries over the past 40 years
- Household indebtedness high on policy agendas

- Debates on indebtedness typically center on primary deficits
  - Potentially misleading due to mechanical effects (I. Fisher, 1933):

$$\underbrace{\Delta b_{t+1}}_{\text{Change in debt-to-income}} \approx \overbrace{d_t}^{\text{Primary Deficit}} + \underbrace{(i_t - g_t - \pi_t) b_t}_{\text{Fisher Effects}}$$

  - Influence of monetary policy on debt-to-income is ambiguous due to responses of π_t and g_t (Svensson 2018)

Questions

1. How important are primary deficits vs. Fisher effects for the evolution of leverage over time and across different households h?

$$\Delta b_{h,t+1} = d_{h,t} + \left(\frac{i_{h,t} - g_{h,t} - \pi_t}{1 + g_{h,t} + \pi_t} \right) b_{h,t}$$

   - in particular among the highly leveraged and financially "vulnerable"

2. How does monetary policy affect the debt-to-income ratio among different households?
   - primary deficits or Fisher effects?

Our study: Answers from micro data covering all Norwegian households from 1993 to 2015

Main Findings

1. Accounting exercise over 1993-2015:
   - Aggregate: DTI mainly driven by primary deficits - ca. $65-75\%$
   - Heterogeneity: Fisher effects matter for households with high DTI
2. Monetary policy shocks - if $i \uparrow 1$ ppt:
   - Aggregate: DTI $\downarrow$ by $1-3$ ppt
     - Primary deficit channel dominates Fisher effect channel
   - Heterogeneity: Similar results across distributions of DTI, housing tenure, unemployment risk, ...
   - Upshot: Behavioral responses dominate mechanical effects

Literature

- Debt Dynamics
  - Macro: Mason and Jayadev (2014)
  - Micro: Bernstein and Koudijs (2021)
- Debt and macroeconomic crises
  - Empirical: Jorda, Schularick and Taylor (2013, 2015, 2016); Mian and Sufi (2013, 2014); Mian, Sufi and Verner (2017); Glick and Lansing (2010)
  - Theory: Farhi and Werning (2016); Korinek and Simsek (2016); Mian, Straub and Sufi (2020)
- Monetary policy and household debt-to-income
  - Macro evidence: Bauer and Granziera (2017)
  - Micro evidence: Di Maggio, Kermani, Keys, Piskorski, Ramcharan and Seru (2017)
  - Models and policy: Svensson (2018); Garriga, Sustek and Kydland (2018); Gelain, Lansing and Natvik (2018); Auclert (2019); Kinnerud (2020)
- Macroprudential policy: IMF, BIS, Norges Bank, Riksbanken, etc...

Population Tax Record Data

- Household level
- High-quality balance sheet data
  - Because Norway taxes wealth
  - End-of-year values (31 December)
  - Does not distinguish different types of debt (currently)
- Observables: income, assets, liabilities, household characteristics
- Third-party reporting: limited scope for strategic misreporting

Household Debt and Monetary Policy in Norway

Household debt:

- Primarily mortgages
- $>$ 90% of all mortgages have adjustable interest rates
- Household credit heavily regulated until mid 80s
- Home equity lines of credit introduced around 2002
- LTV requirements since 2010 (85% since 2012)

Monetary policy:

- De facto inflation targeting since 1999
- Increased emphasis on financial stability after 2009

Summary Statistics 1994–2015

		Debt-to-income Quintiles				
Variable	**All**	**1**	**2**	**3**	**4**	**5**
Age	53.61	67.46	55.75	51.83	47.67	43.24
Less than high school education	0.33	0.50	0.38	0.30	0.24	0.22
High school education	0.37	0.33	0.37	0.39	0.39	0.38
College education	0.30	0.17	0.25	0.31	0.37	0.40
Debt-to-income b in %	153.67	8.14	32.34	96.79	207.24	428.32
Debt B (USD 1,000)	99.66	4.19	19.88	64.94	151.30	260.90
Income Y (USD 1,000)	60.12	43.70	60.01	65.30	71.57	63.06
Interest rate r in %	5.21	5.34	4.86	5.35	5.21	5.20
Real income growth g in %	3.85	2.81	2.35	3.25	4.29	6.47
Inflation π in %	2.01					
Predicted job separation rate, %	5.60	5.66	5.37	5.40	5.47	5.95
Observations	30 mill					

Accounting Framework

Law-of-motion for nominal debt:

$$P_t B_{t+1} = P_t D_t + (1 + i_t) P_{t-1} B_t$$

Define $b_{t+1} = \frac{P_t B_{t+1}}{P_t Y_t}$ and $d_t = \frac{P_t D_t}{P_t Y_t}$:

$$b_{t+1} = d_t + \frac{1 + i_t}{1 + \pi_t} \frac{1}{1 + g_t} b_t$$

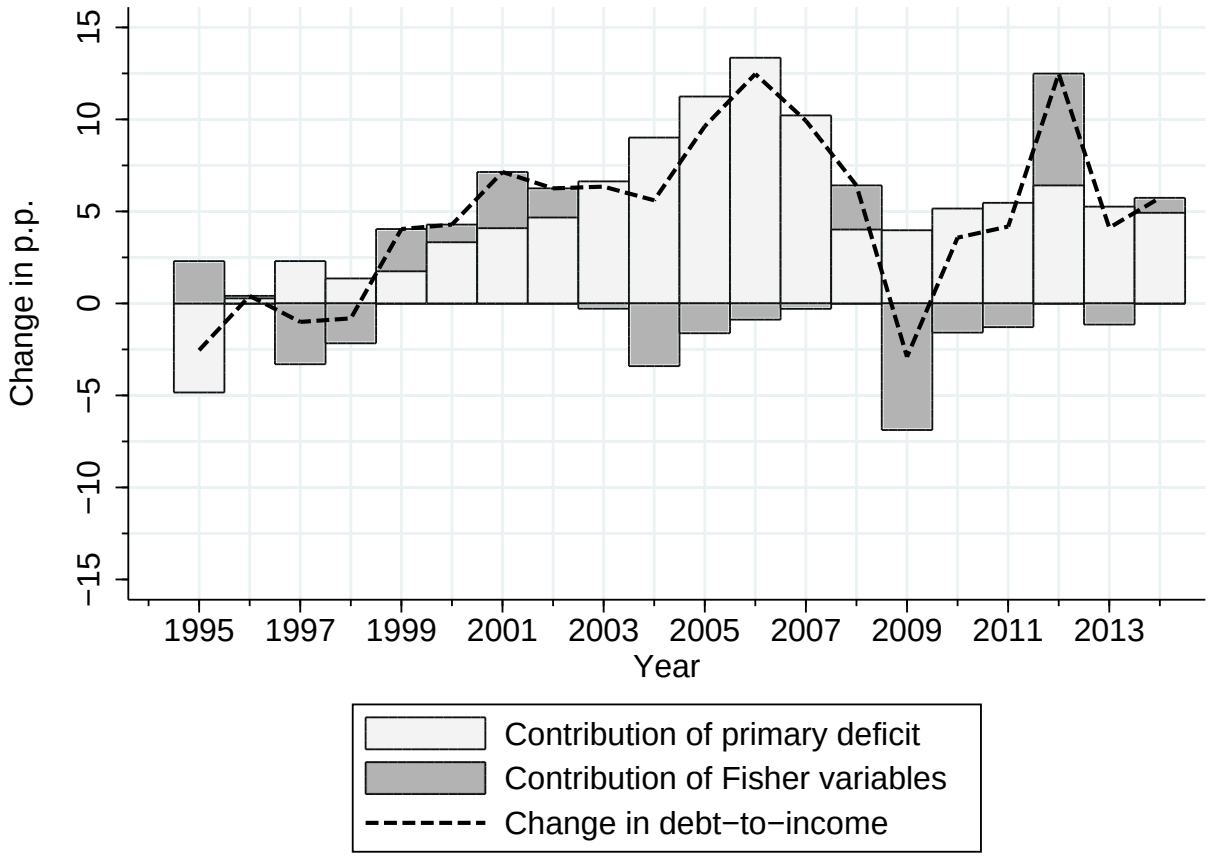
Linearize to isolate the different Fisher effects:

$$\Delta b_{t+1} \approx d_t + (i_t - g_t - \pi_t) b_t$$

Accounting - Fisher Effects vs. Primary Deficit over Time

DTI variation primarily driven by primary deficits - ca. 65 – 75%

Figure: Change in DTI, the primary deficit and Fisher variables

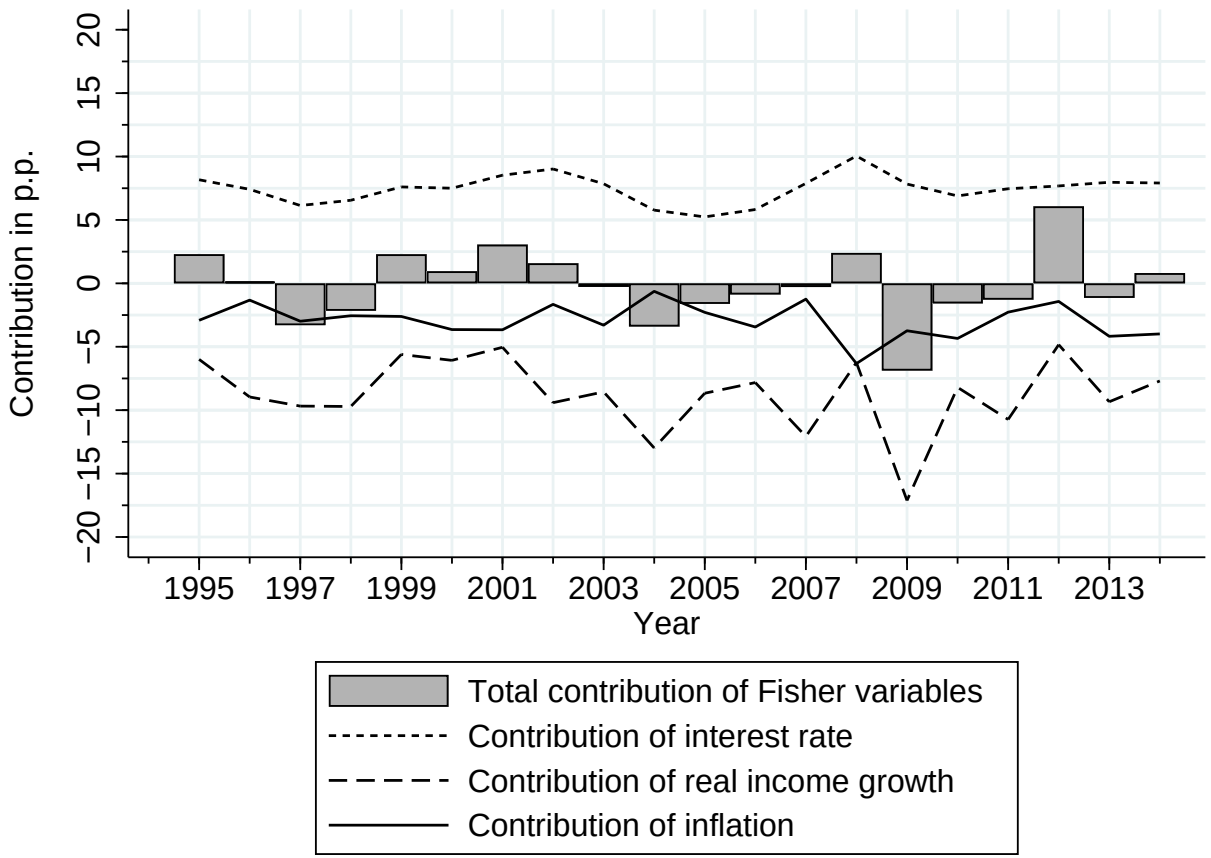


Accounting - Fisher Effects Decomposed

Among the Fisher variables explaining remaining $25 - 35\%$;

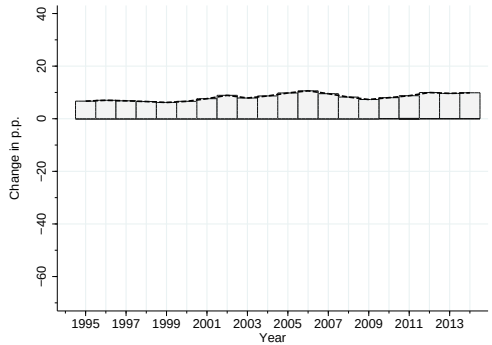
g-**effects** $\approx$ i-**effects** $>$ π-**effects**

Figure: Fisher effects decomposed

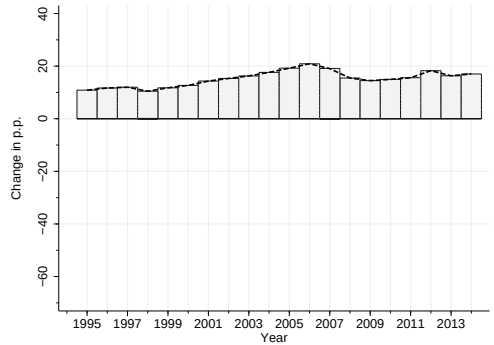


Accounting - Primary Deficits vs Fisher Effects by DTI level

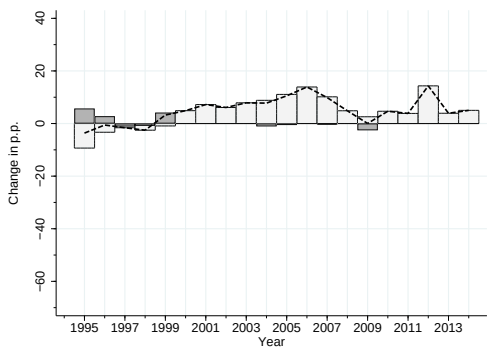
Fisher effects matter only among the high-DTI households



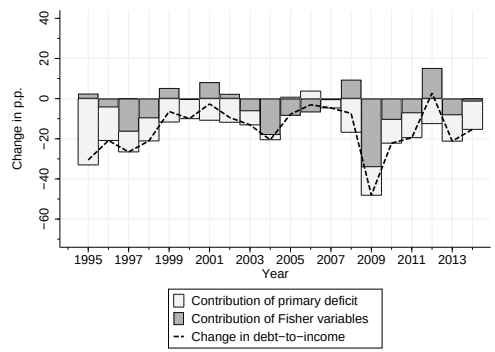
(a) Quintile 1



(b) Quintile 2

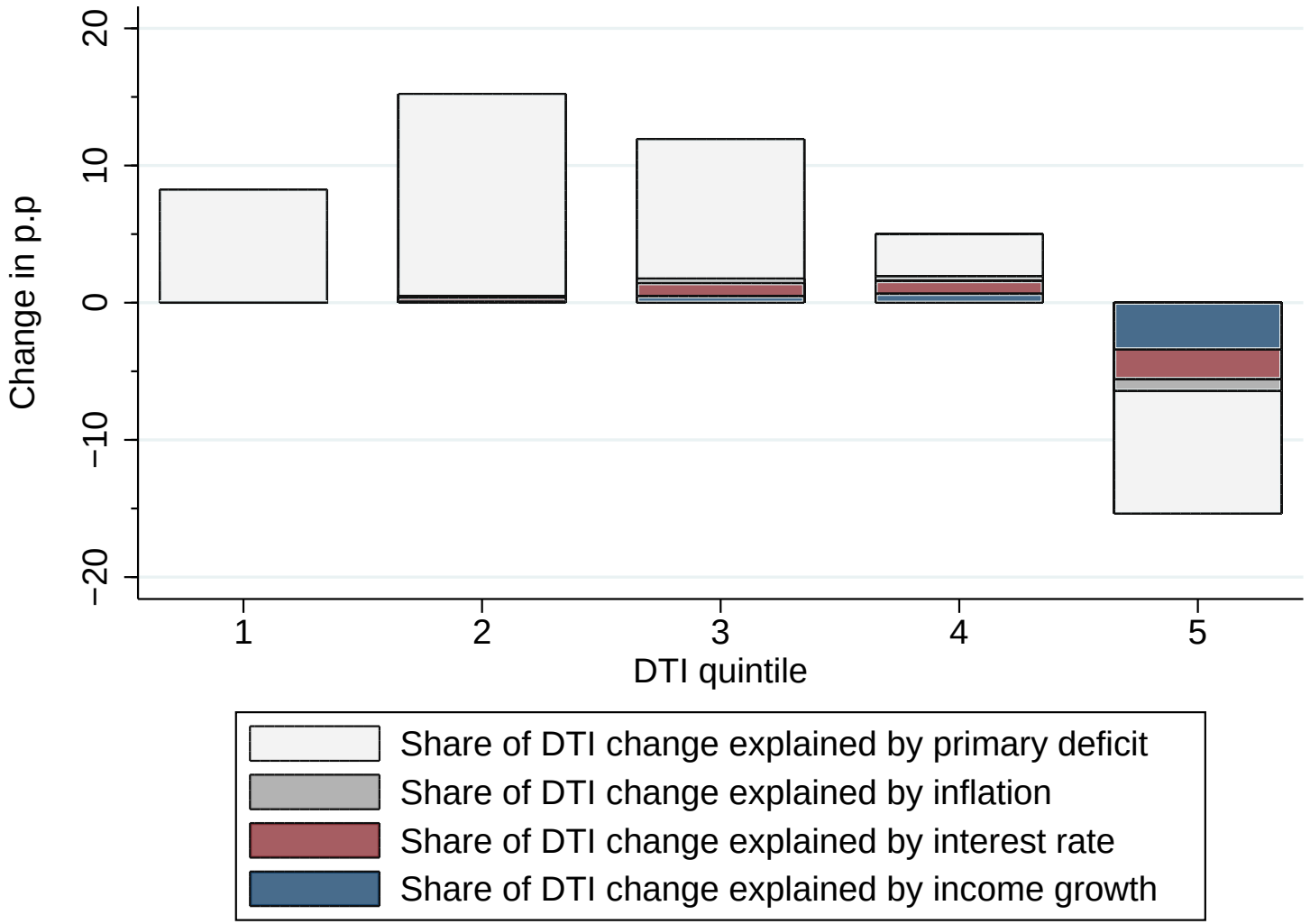


(c) Quintile 4



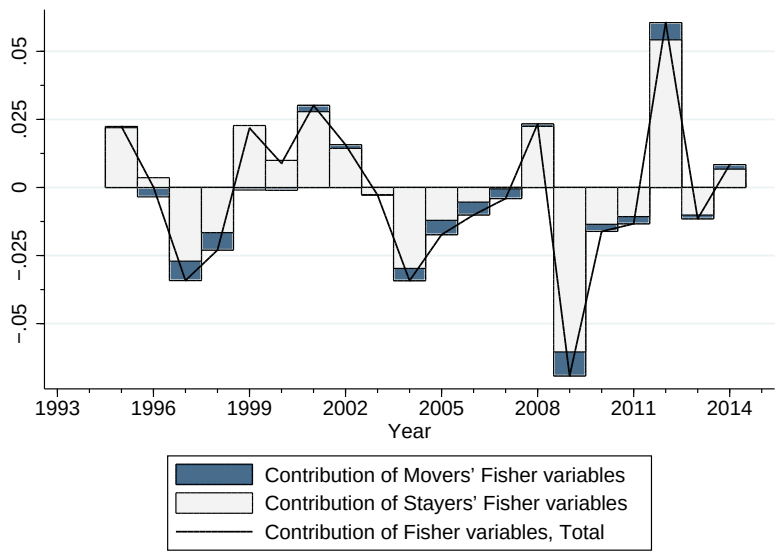
(d) Quintile 5

Accounting - Decomposition of DTI Growth by DTI level

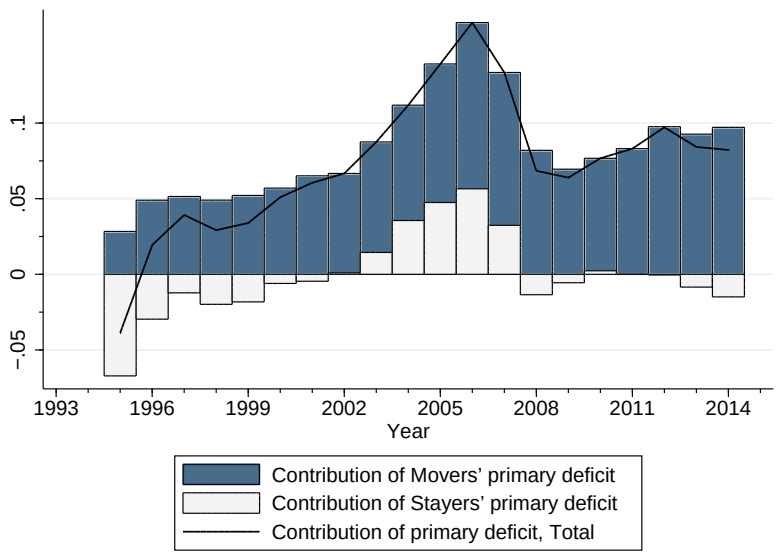


Accounting - Movers vs. Stayers

Fisher effects come from stayers.
Primary deficits come from movers



(a) Fisher Effects



(b) Primary Deficits

Accounting - Summary

- Aggregate DTI movements mainly driven by primary deficits
- ... but Fisher effects are important among highly indebted households (who don't move)

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- ... but Fisher effects are important among highly indebted households (who don't move)

Does this carry over to the effects of monetary policy on DTI?

Monetary Policy Responses

$$\underbrace{\Delta b_t}_{\text{Change in debt-to-income}} \approx \overbrace{d_t}^{\text{Primary Deficit}} + \underbrace{(i_t - g_t - \pi_t) b_t}_{\text{Fisher Effects}}$$

Q: how do interest changes affect DTI?

$$i_t \uparrow \Rightarrow \text{ Primary deficit } \downarrow \text{ and Fisher effects } \uparrow$$

- Are Fisher effects so important among the highly indebted that interest rate hikes raise their DTI?

Responses to Monetary Policy

ϵ_t^{MP} is the MP shock series from Holm-Paul-Tischbirek (2020)

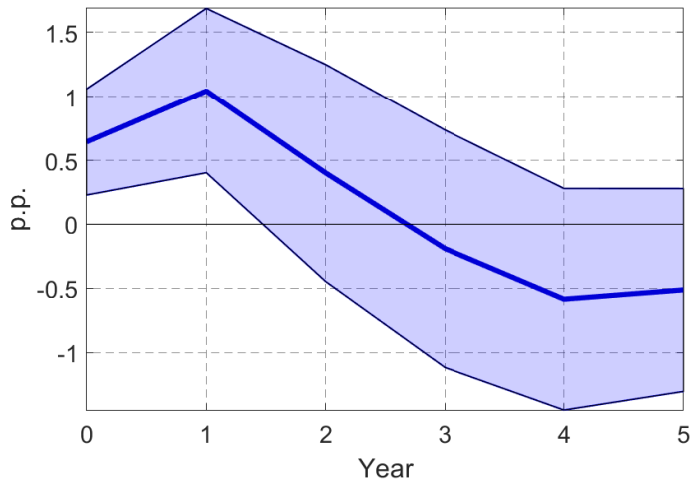
- **Local projection:** For household i and time period t

$$y_{i,t+h} - y_{i,t-1} = \delta_i^h + \beta^h \cdot \epsilon_t^{MP} + \gamma' \mathbf{X}_{i,t-1} + u_{i,t}^h$$

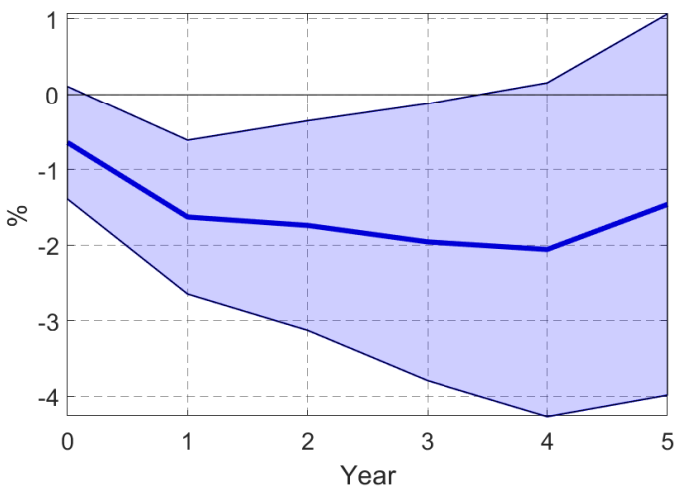
- **Within-group estimation:** For household i in group g

$$y_{i,t+h} - y_{i,t-1} = \delta_i^h + \beta_g^h \cdot \epsilon_t^{MP} + \gamma_g' \mathbf{X}_{i,t-1} + u_{i,t}^h, \qquad \forall\ i \in g$$

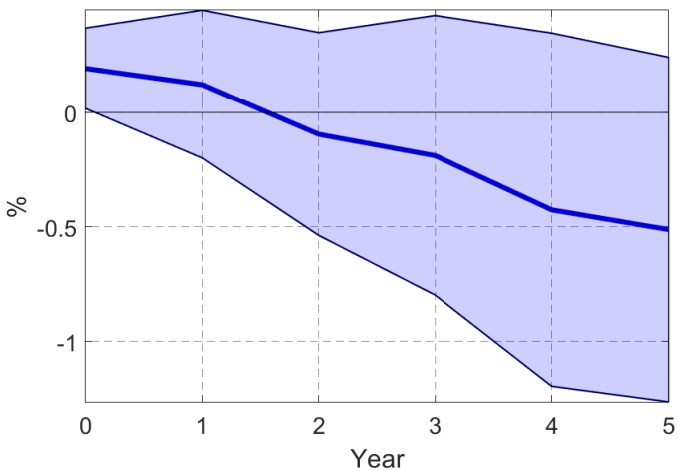
Responses to Monetary Policy in Macro Data



(a) Policy Rate

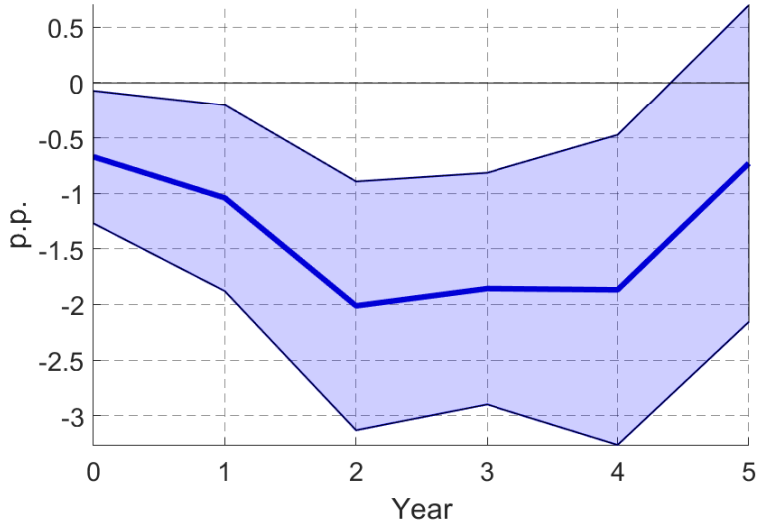


(b) GDP

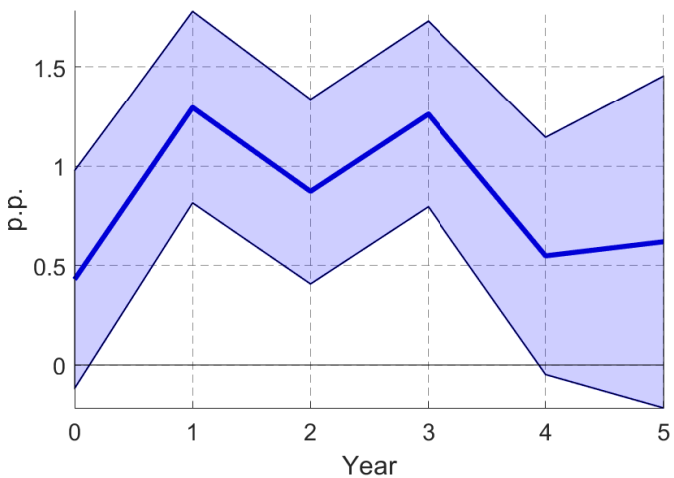


(c) CPI

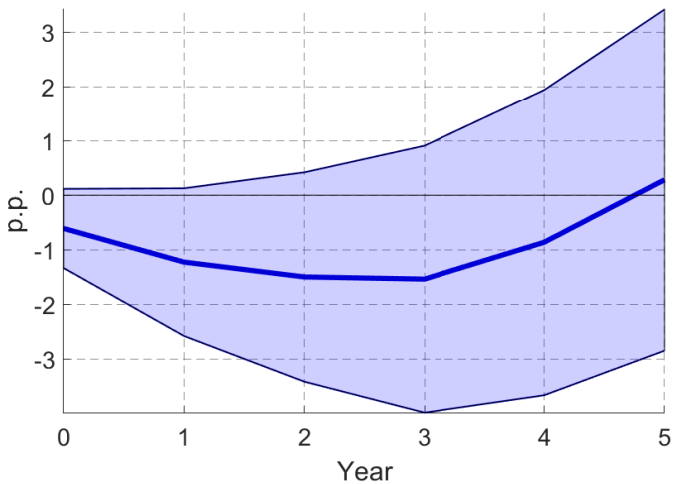
Average DTI Responses to Monetary Policy



(a) DTI

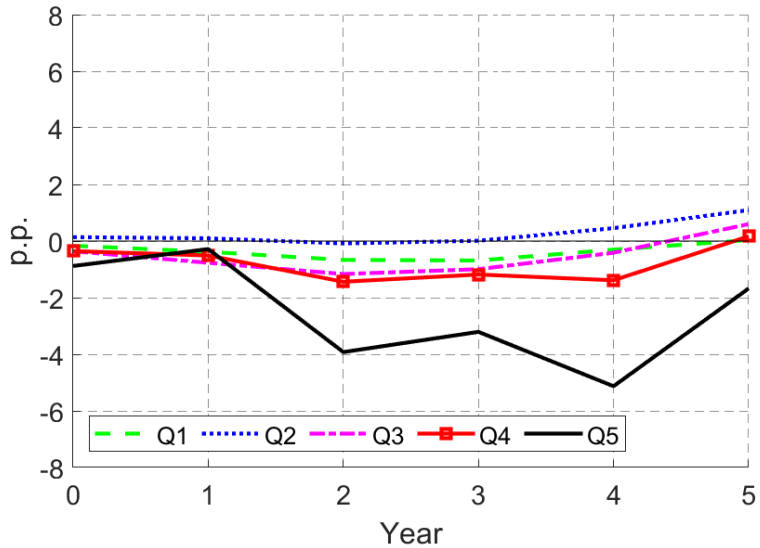


(b) Fisher Effects

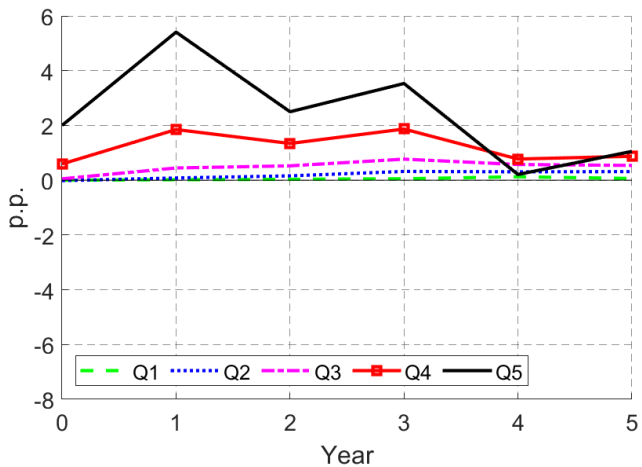


(c) Primary Deficit

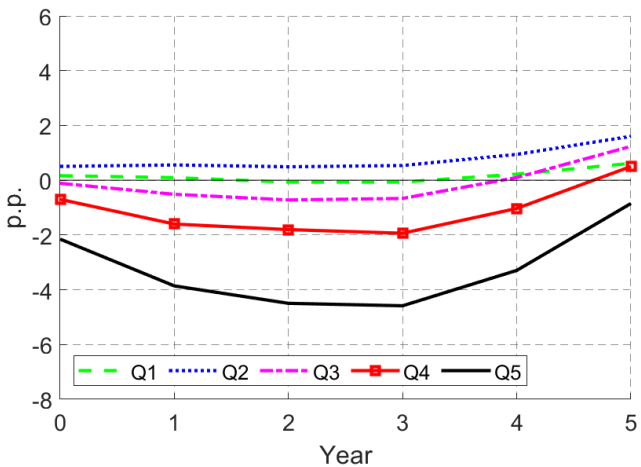
Responses to Monetary Policy by DTI Quintiles



(a) DTI



(b) Fisher Effects



(c) Primary Deficit

Behavior or Cash Flow Effects?

- "Primary deficits" are total household expenditures on debt service
  - -(*Repayment* + *interest*)
- If households mechanically follow amortization schedules:
  - Primary deficit responses partly reflect mechanical cash flow effects

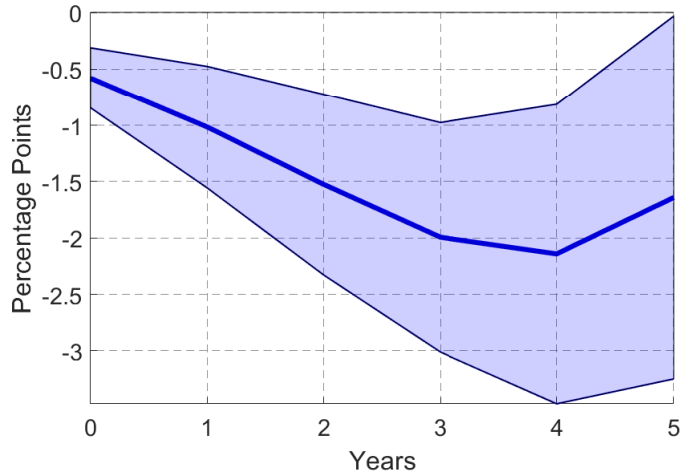
Decomposition to isolate behavior from cash flow effects:

$$b_{t+1} = \frac{B^n_{t+1}}{Y^n_t - iB^n_t}$$

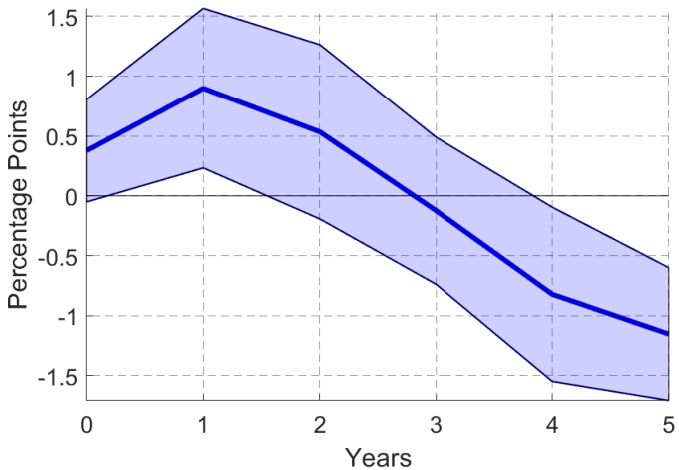
- iB^n_t are the directly observed interest expenditures in year t

$$\Delta b_{t+1} \approx b_t \left(\frac{B^n_{t+1} - B^n_t}{B^n_t} - \frac{Y^n_t - Y^n_{t-1}}{Y^n_{t-1} - iB^n_{t-1}} + \frac{iB^n_t - iB^n_{t-1}}{Y^n_{t-1} - iB^n_{t-1}} \right)$$

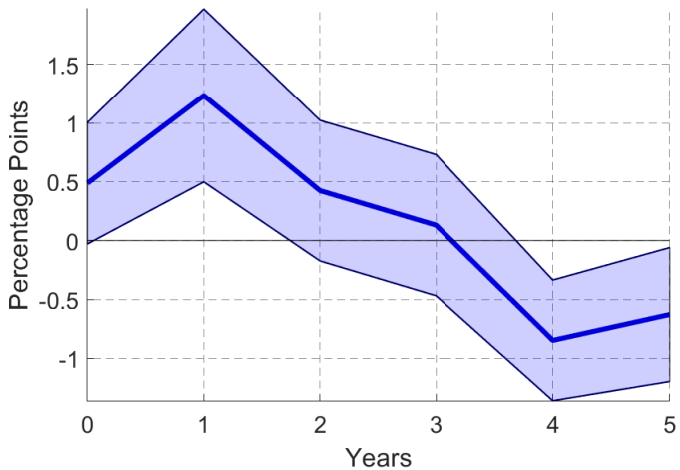
Isolating Behavior From Cash Flow Effects



(a) Nominal Debt

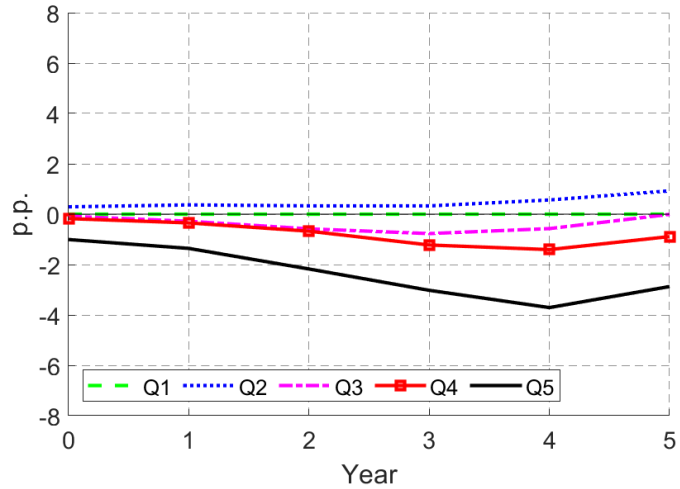


(b) Income excl. Interest Expenses

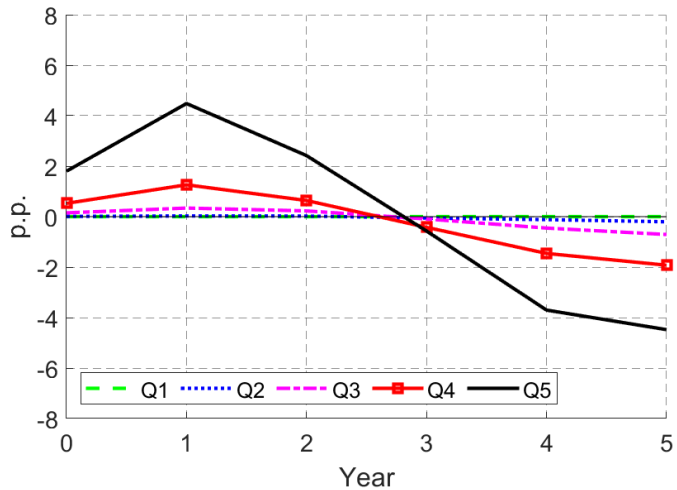


(c) Interest Expenses

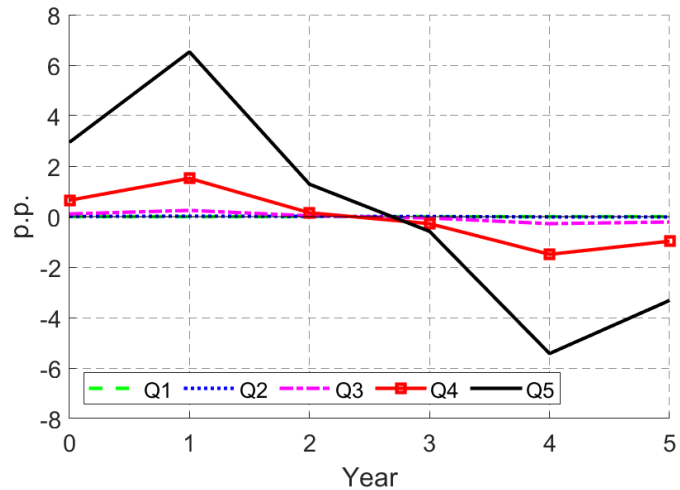
Behavior and Cash Flow Effects - by DTI Quintiles



(a) Nominal Debt

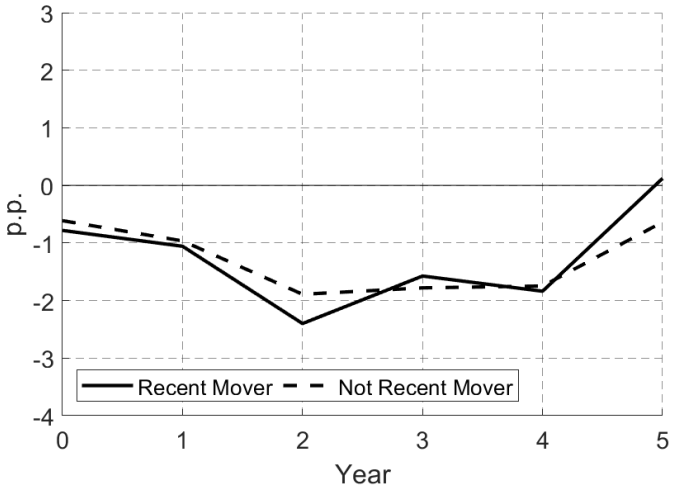


(b) Income excl. Interest Exp.

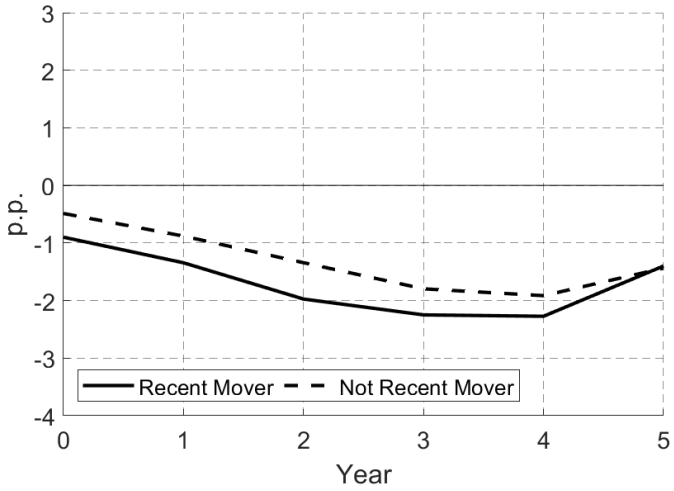


(c) Interest Expenses

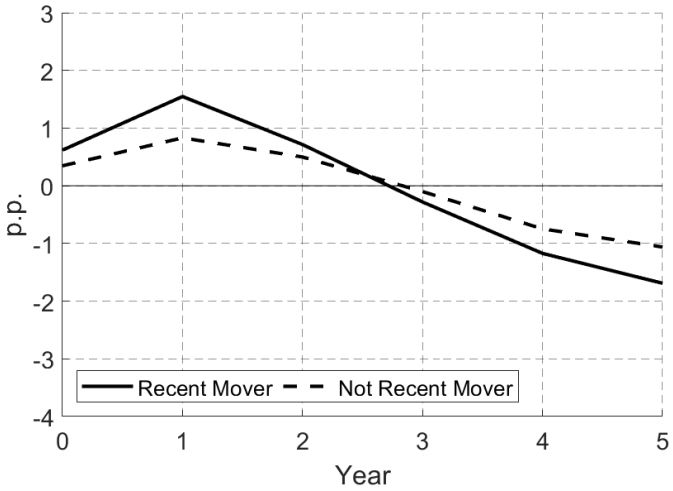
Same Pattern even among Recent Movers



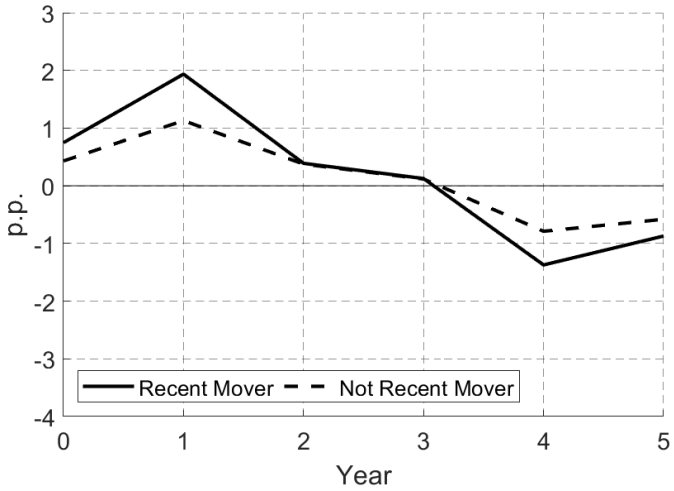
(a) DTI



(b) Debt



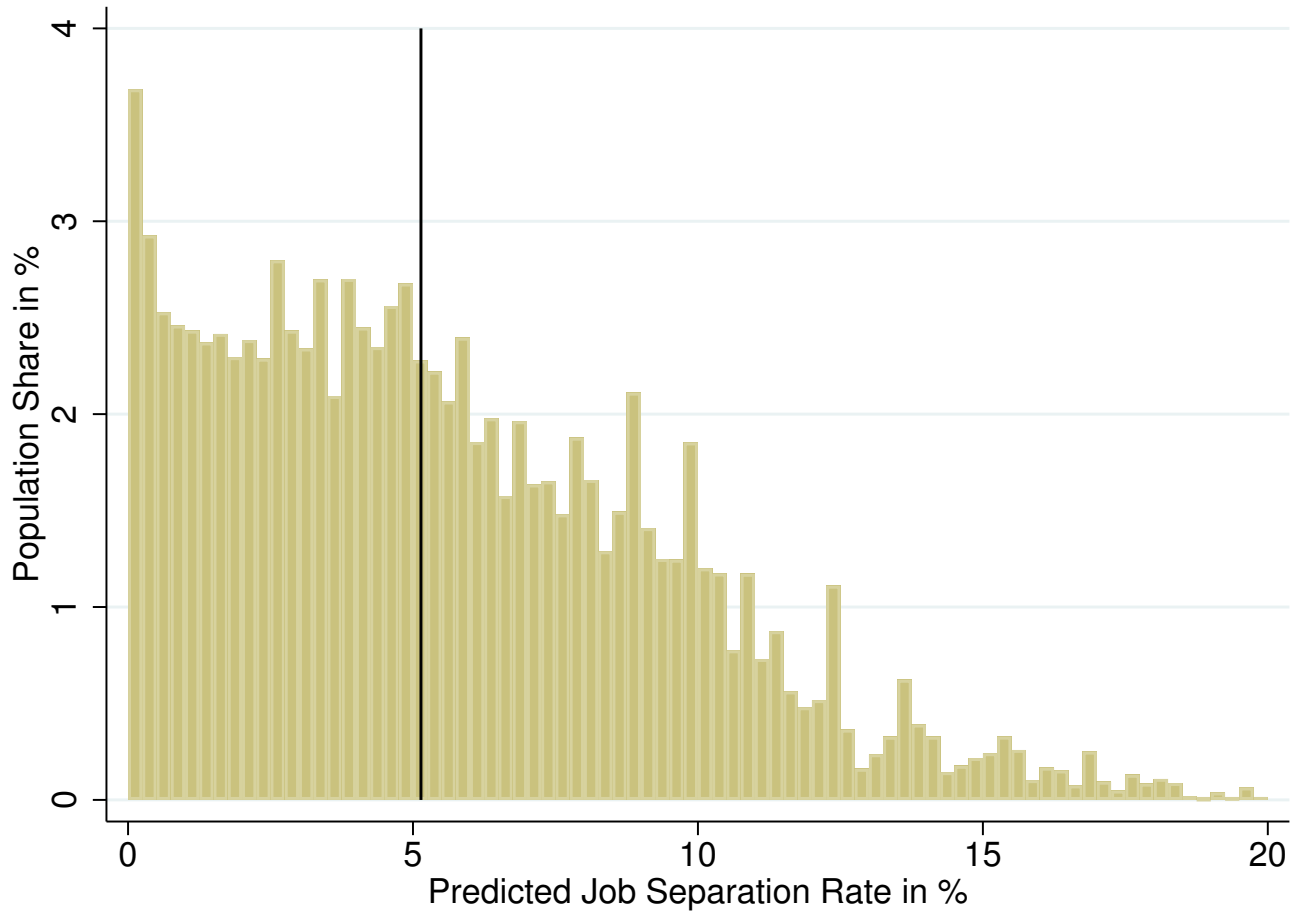
(c) Income excl. Interest Exp.



(d) Interest Expenses

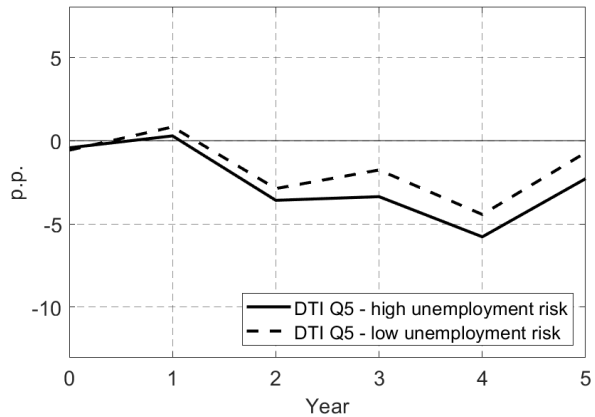
Split by Job Loss Probability

- Probit regression for unemployment in $t+1$ on industry and tenure in t.

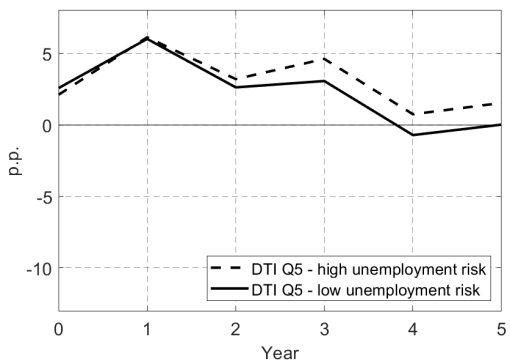


Responses to MP-shocks by DTI and Job Loss Probability

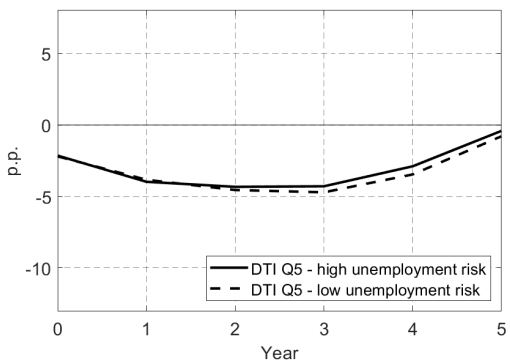
- Financial stability concerns - how does MP affect the most financially vulnerable households?



(a) DTI



(b) Fisher Effects



(c) Primary Deficit

Conclusion

Decomposition of DTI growth

- Aggregate: Primary deficits dominate
- Heterogeneity: Fisher effects important for the highly leveraged

MP shocks and DTI

- Main channel is primary deficits
  - ... even among the highly leveraged and recent movers
  - ... also among the most "vulnerable"
- Upshot: Behavior, not mechanics

Monetary policy implications

- Interest hikes reduce debt burden $\approx$ conventional logic
  - ... but the effects are moderate
  - ... still likely that inflation reduces DTI among leveraged households

Calculating Components of Debt Dynamics

Key accounting identity:

$$\underbrace{\Delta b_{h,t+1}}_{\text{Change in Leverage}} \approx \underbrace{d_{h,t}}_{\text{Primary Deficit}} + \underbrace{(i_{h,t} - g_{h,t} - \pi_t) b_{h,t}}_{\text{Fisher Effects}}$$

- **Debt-to-income, $b_{h,t}$:**

$$b_{h,t} = \frac{Debt_{h,t-1}}{Income_{h,t-1}}$$

- **Change DTI, $\Delta b_{h,t}$:**

$$\Delta b_{h,t} = b_{h,t+1} - b_{h,t}$$

- **Inflation, π_t:**

$$\pi_t = \frac{CPI_t}{CPI_{t-1}} - 1$$

- **Interest rates, $i_{h,t}$:**

$$i_{h,t} = \begin{cases} \frac{InterestExpenses_{h,t}}{Debt_{h,t}}, & \text{if } Debt_{h,t} > 0 \\ \bar{i}_t, & \text{if } Debt_{i,t} = 0 \end{cases}$$

- **Income growth, $g_{h,t}$:**

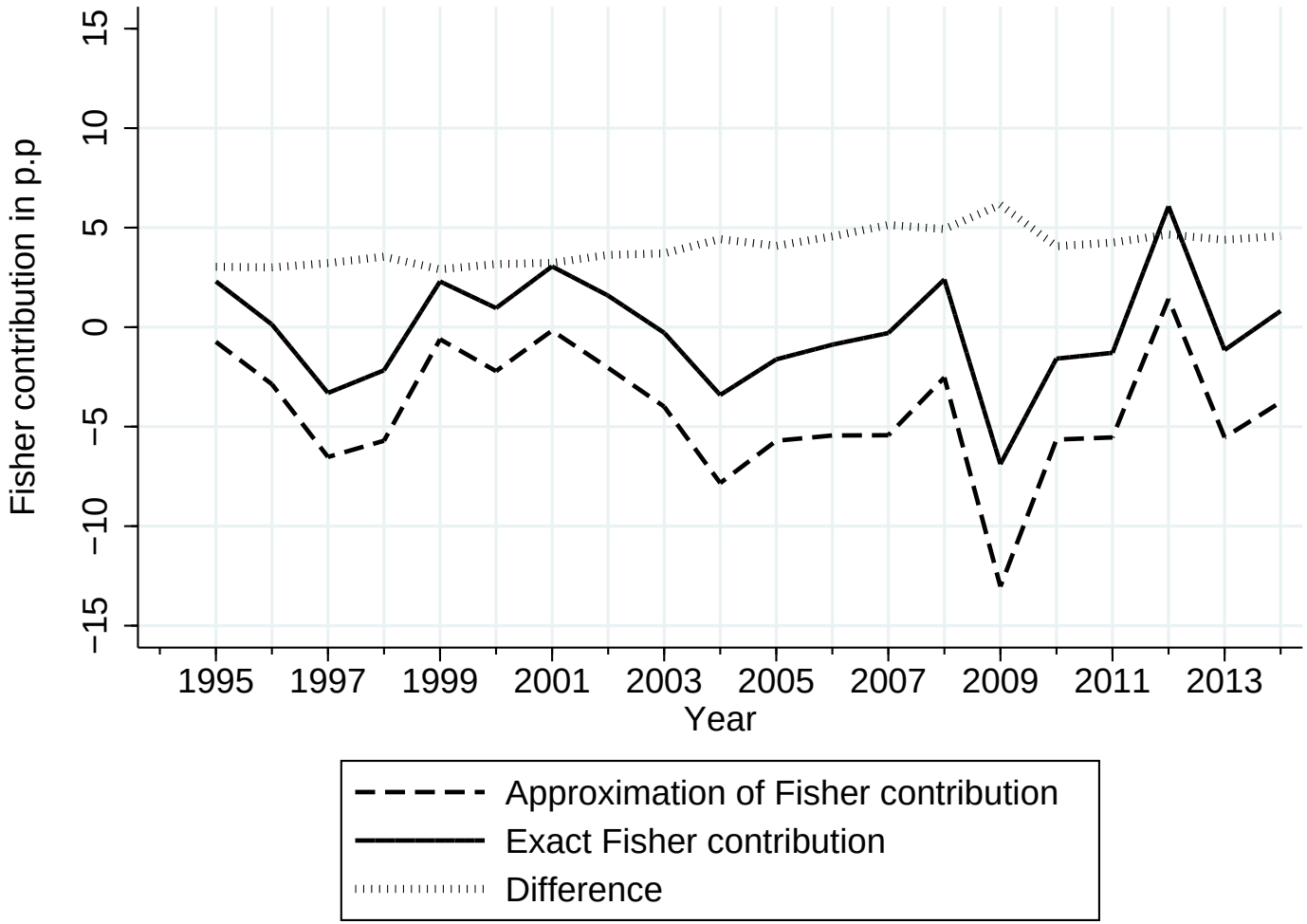
$$g_{h,t} = \frac{Income_{h,t}}{Income_{h,t-1}} - 1$$

- **Primary deficit, $d_{i,t}$:**

$$d_{h,t} = b_{h,t+1} - \frac{1 + i_{h,t}}{1 + \pi_t} \frac{1}{1 + g_{h,t}} b_{h,t}$$

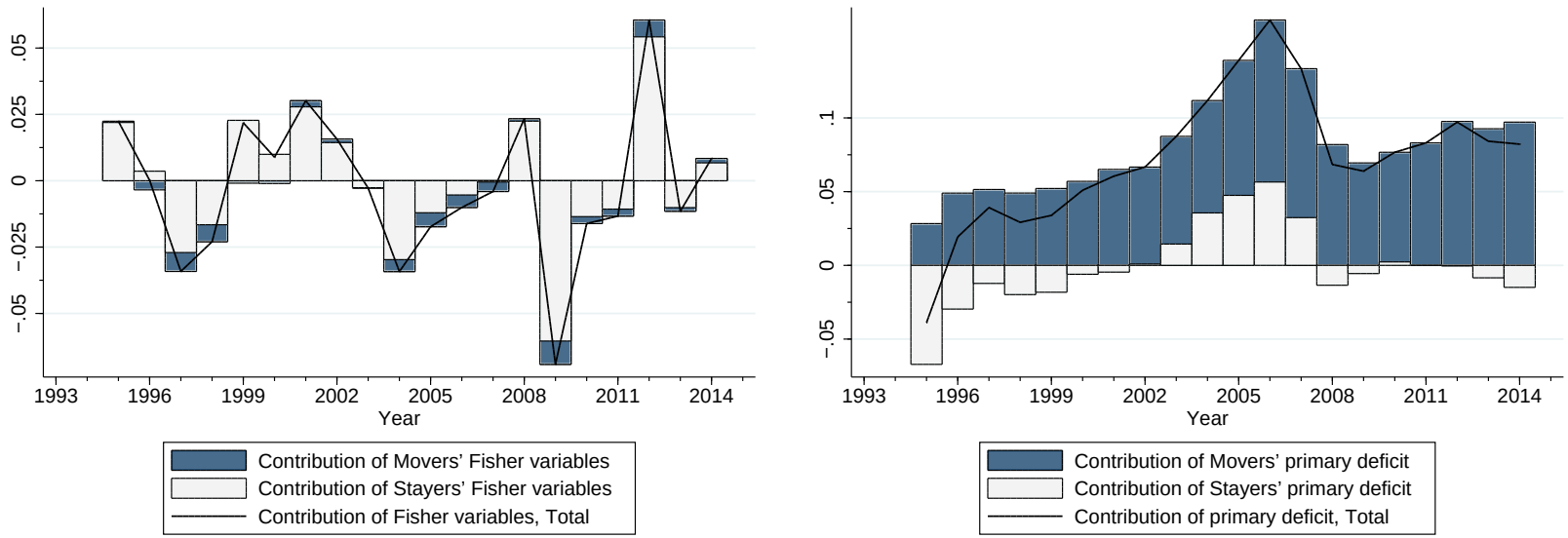
Approximation Error

Figure: Exact versus approximate Fisher effects.



Accounting - Movers vs Stayers

Figure: Fisher effects and primary deficits for movers and stayers

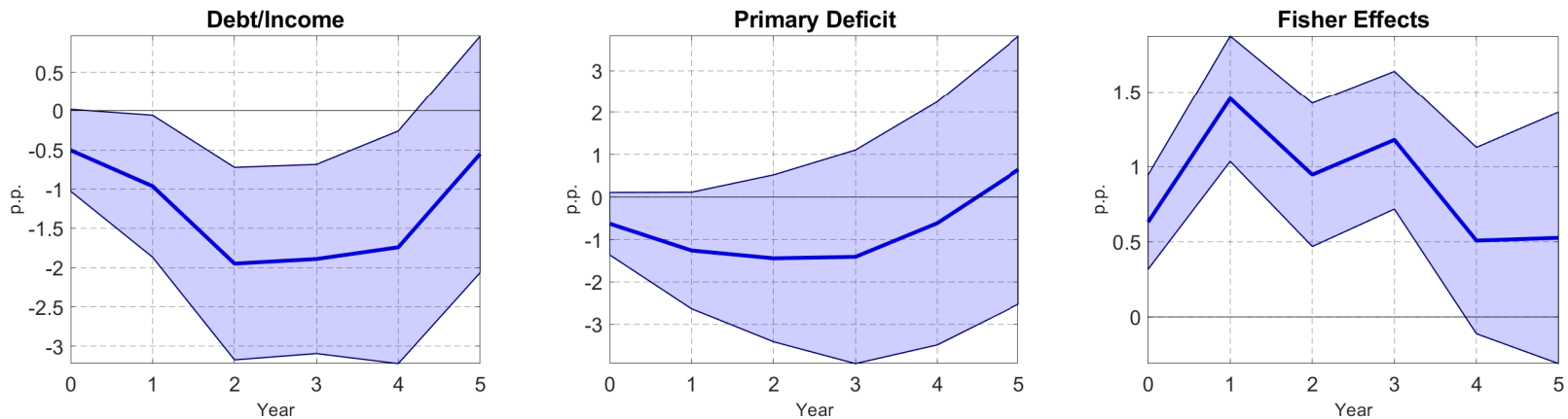


(a) Fisher effects

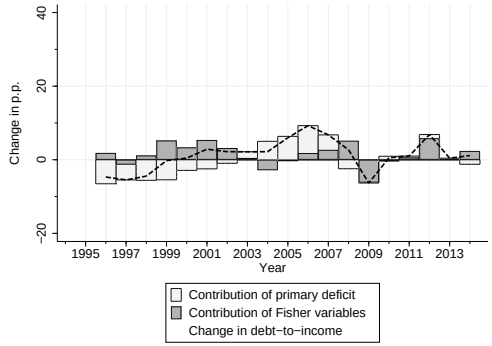
(b) Primary deficits

Average MP-Shock Effects without post-2008 Period

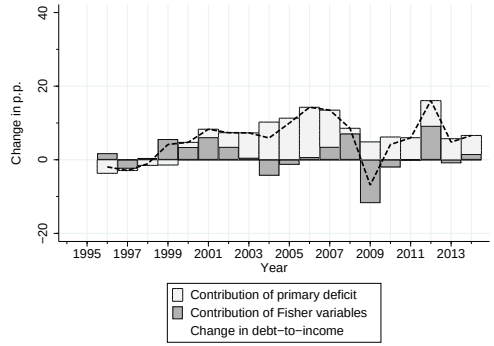
Figure: Average debt-to-income responses to monetary policy. Robustness to dropping years after 2008.



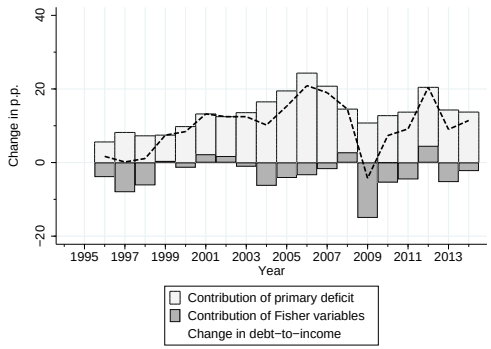
Accounting - Primary Deficits vs Fisher Effects by U-Risk



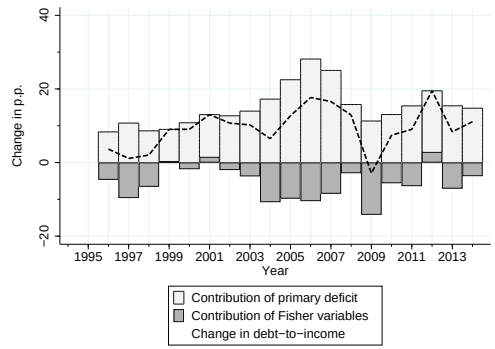
(a) Quintile 1



(b) Quintile 2



(c) Quintile 4



(d) Quintile 5

Accounting - Decomposition of DTI Growth by U-Risk