How Does Monetary Policy Affect Household Indebtedness?

Andreas Fagereng
BI Norwegian Business School

Magnus A. H. Gulbrandsen
Norges Bank*

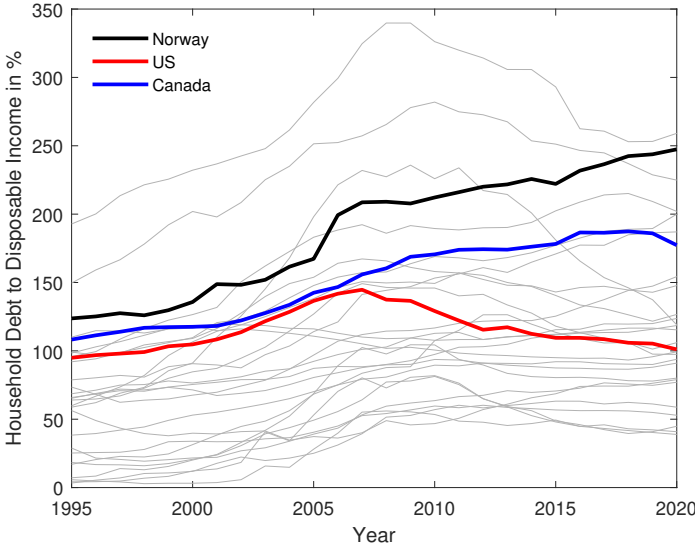
Martin B. Holm
University of Oslo

Gisle J. Natvik
BI Norwegian Business School

Bank of Canada, Nov 3, 2022

*The views expressed are those of the authors and do not represent the views of Norges Bank.

Debt-to-Income (OECD)



Motivation

- Household indebtedness high on policy agendas
  - Concerns for “instability” if many households are highly leveraged
  - Calls for central banks to internalize effects of MP on indebtedness

- Debates on indebtedness typically center on primary deficits
  - Potentially misleading due to mechanical effects:

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

What We Do

Use micro data covering the universe of Norwegian adults from 1993-2015 to

1. Decompose evolution of debt-to-income into primary deficits and Fisher effects

$$\Delta b_{i,t} \approx d_{i,t} + (r_{i,t} - g_{i,t})\, b_{i,t-1}$$
$$\Delta b_{i,t} \approx d_{i,t} + (i_{i,t} - \pi_{t+1} - g_{i,t})\, b_{i,t-1}$$

2. Estimate how monetary policy affects the debt-to-income ratio among different households

Main Findings

1. Descriptive accounting exercise over 1993-2015:

- **Aggregate:** DTI mainly driven by primary deficits ($\approx 70\%$)
- **Heterogeneity:** Fisher effects matter for households with high DTI (young, high g)

2. Monetary policy shocks - if $i \uparrow$ 1 ppt:

- **Aggregate:** DTI $\downarrow$ by $1-3$ ppt

  Primary deficits response dominates Fisher effects

  Debt repayment

- **Heterogeneity:** similar results across distributions

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...

Outline

Data

- Norwegian population tax record data with supplements
  - Panel, 1993–2015
  - ≈ 3.3M persons per year
- Tax records include (third party reported)
  - Income, assets, liabilities, household characteristics
- Variable definitions:
  - Debt = all debt incl. mortgages
  - Income = disposable income
- Sample selection:
  - Above 24 years
  - Drop very high debt or income (top 0.5%), DTI > 10, some very large annual changes in DTI (top/bottom 1%), income/implied spending below social security minimum

Institutional Setting

- **Household debt:**
  - Primarily mortgages with adjustable rate contracts ($\approx 90\%$ of outstanding debt)
  - Macroprudential policies since 2010
    - LTV requirements (2010)
    - Stress test of debt-service ability (2012)
    - DTI requirements (2017)

- **Monetary policy:**
  - Flexible inflation targeting since 2001 (de facto 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
Real income growth g in %	3.85	2.81	2.35	3.25	4.29	6.47
Interest rate i in %	5.21	5.34	4.86	5.35	5.21	5.20
Inflation π in %	2.01					
Predicted job separation rate, %	5.60	5.66	5.37	5.40	5.47	5.95
Observations	30 mill					

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
Real income growth g in %	3.85	2.81	2.35	3.25	4.29	6.47
Interest rate i in %	5.21	5.34	4.86	5.35	5.21	5.20
Inflation π in %	2.01					
Predicted job separation rate, %	5.60	5.66	5.37	5.40	5.47	5.95
Observations	30 mill					

Outline

Accounting Framework

- Law-of-motion for real debt:

$$B_t = D_t + (1 + r_t)B_{t-1}$$

- Define $b_t = \frac{B_t}{Y_t}$ and $d_t = \frac{D_t}{Y_t}$, then

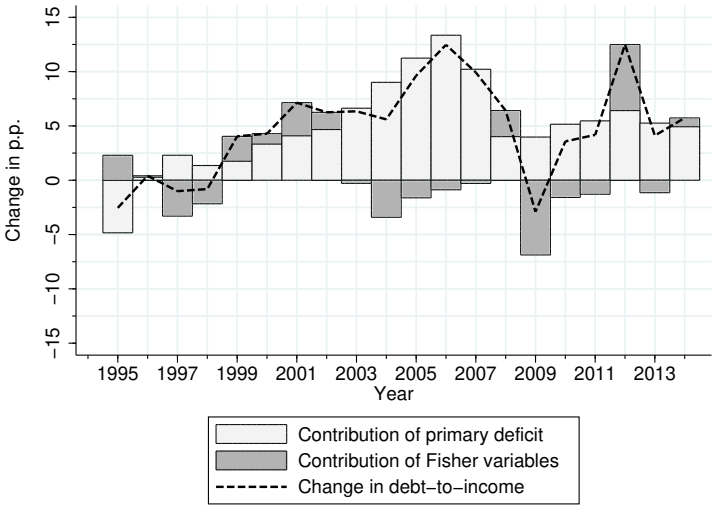
$$b_t = d_t + \frac{1 + r_t}{1 + g_t} b_{t-1}$$

where g_t is real income growth

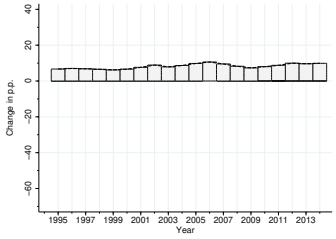
- Linearize:

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

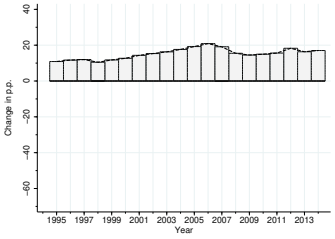
Fisher Effects and Primary Deficit over Time



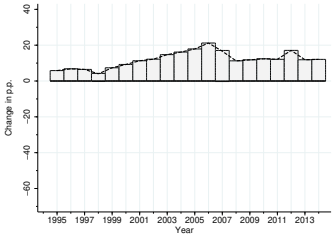
Decomposition by DTI level



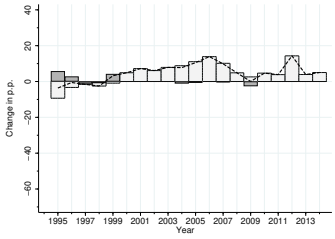
(a) Quintile 1



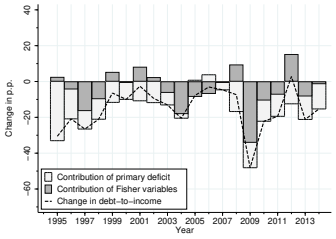
(b) Quintile 2



(c) Quintile 3

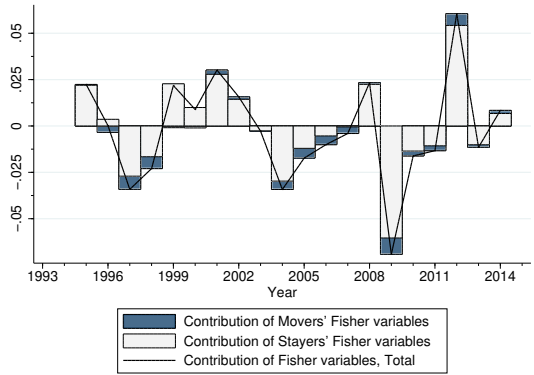


(d) Quintile 4

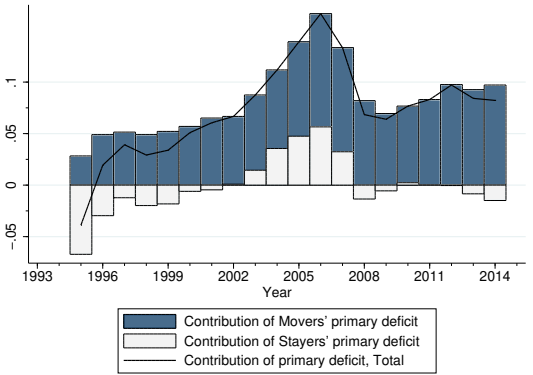


(e) Quintile 5

Movers vs. Stayers



(a) Fisher Effects



(b) Primary Deficits

Accounting - Summary

- Aggregate DTI movements mainly driven by primary deficits
- ... but Fisher effects are important among indebted households

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

Outline

Monetary Policy Responses

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

How do interest rate changes affect DTI?

1. $i_t \uparrow \Rightarrow$ primary deficits $\downarrow$ (intertemporal substitution)
2. $i_t \uparrow \Rightarrow i_t \uparrow, \pi_{t+1} \downarrow, g_t \downarrow$ (Fisher effects $\uparrow$)

- Monetary policy shocks from Holm, Paul and Tischbirek (2021)

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

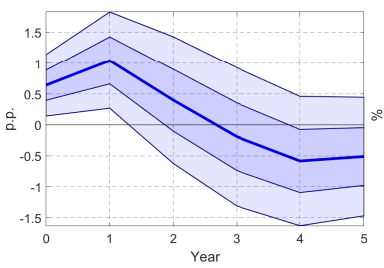
$$\text{Debt-to-income: } y_{i,t+h} - y_{i,t-1} = \delta_i^h + \beta^h \cdot \epsilon_t^{MP} + \gamma' \mathbf{X}_{i,t-1} + u_{i,t}^h$$

$$\text{Fisher, primary deficits: } \sum_{j=0}^{h} y_{i,t+j} = \delta_i^h + \beta^h \cdot \epsilon_t^{MP} + \gamma' \mathbf{X}_{i,t-1} + u_{i,t}^h$$

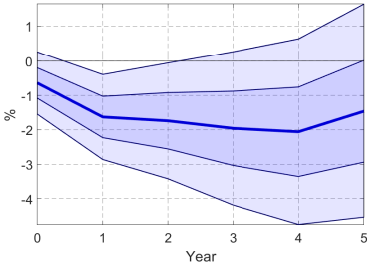
- **Within-group estimation:** For household i in group g

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

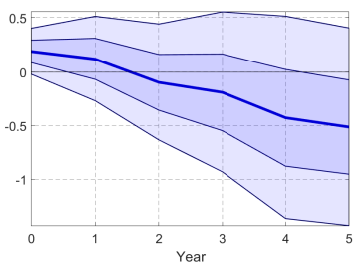
Responses to Monetary Policy in Macro Data



(a) Policy Rate



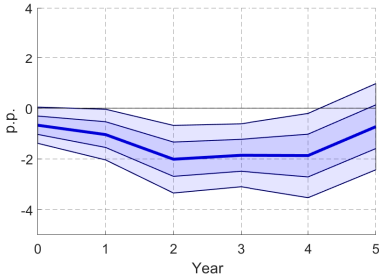
(b) GDP



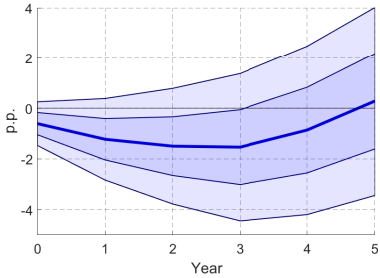
(c) CPI

Average DTI Responses to Monetary Policy

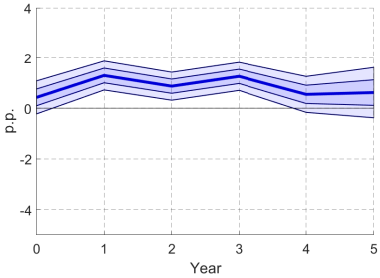
▸ Debt vs. Income



(a) Debt-to-income



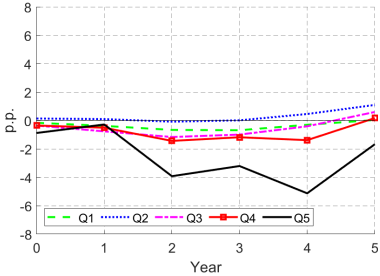
(b) Primary Deficit



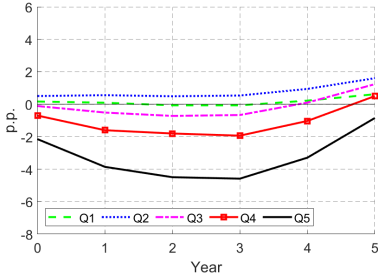
(c) Fisher Effects

Responses to Monetary Policy by DTI Quintiles

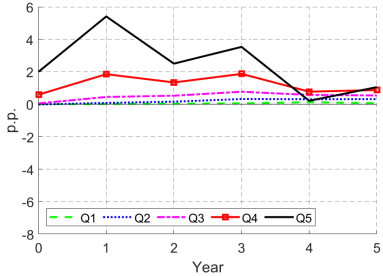
▸ Debt vs. Income



(a) Debt-to-income

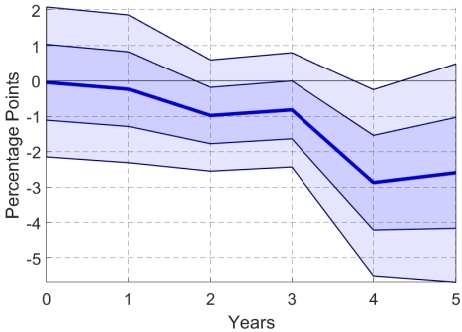


(b) Primary Deficit

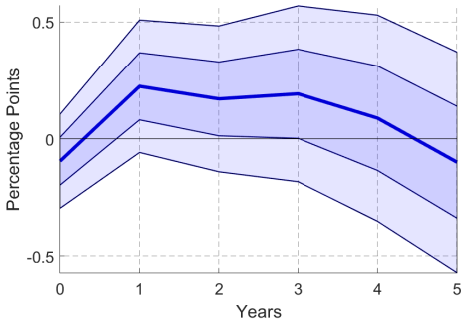


(c) Fisher Effects

Other Measures of Household Indebtedness?



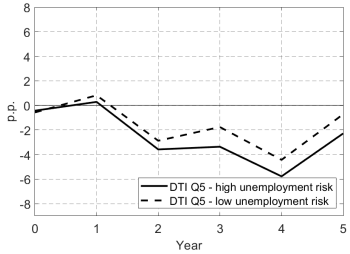
(a) Net debt-to-disposable income



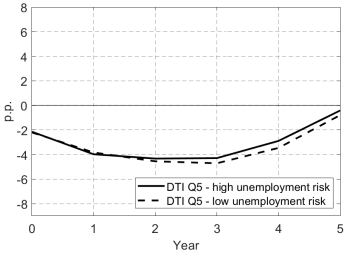
(b) Loan-to-housing wealth

Responses to Monetary Policy by Job Loss Probability

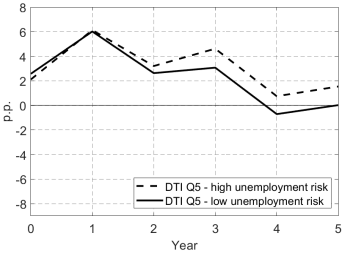
- How does MP affect the most financially vulnerable households?
  - A measure: high debt + risk of income loss
- Split households by above versus below median job separation risk
  - Probit regression: $unemployment_{t+1}$ on $industry_t$ and $tenure_t$



(a) DTI



(b) Primary Deficit



(c) Fisher Effects

Behavior or Cash Flow Effects?

- "Primary deficits" are total spending on debt service costs
  - $-$ (*Repayment/amortization* + *interest*)

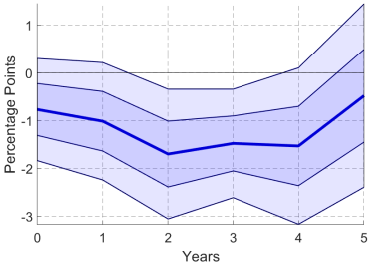
Decomposition to isolate behavior from cash flow effects:

$$b_t = \frac{B_t}{Y_t - i_t B_{t-1}}$$

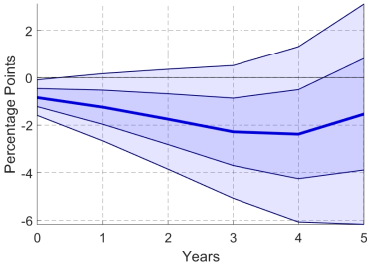
- $i_t B_{t-1}$ are the directly observed nominal interest expenditures in year t

$$b_{t+h} - b_{t-1} \approx b_{t-1} \left(\frac{B_{t+h} - B_{t-1}}{B_{t-1}} - \frac{Y_{t+h} - Y_{t-1}}{Y_{t-1} - i_{t-1} B_{t-2}} + \frac{i_{t+h} B_{t+h-1} - i_{t-1} B_{t-2}}{Y_{t-1} - i_{t-1} B_{t-2}} \right)$$

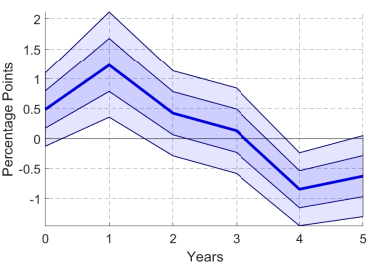
Behavior or Cash Flow Effects?



(a) DTI

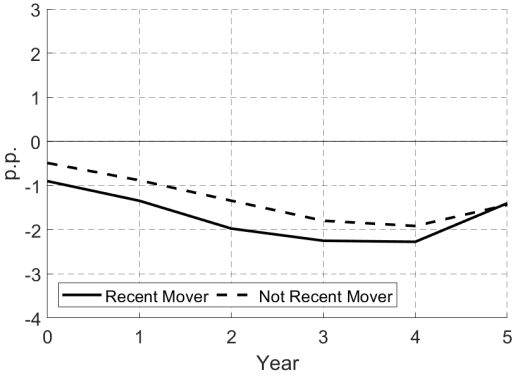


(b) Nominal Debt

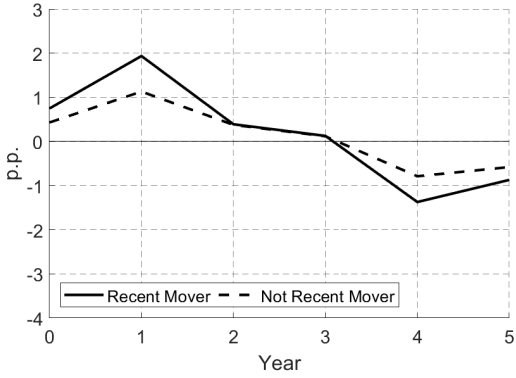


(c) Interest Expenses

Same Pattern Among Recent Movers



(a) Debt



(b) Interest Expenses

Conclusion

Decomposition of DTI growth

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

Monetary Policy and Indebtedness

- Interest hikes reduce debt burden $\approx$ conventional logic
  - ... even among the highly leveraged and recent movers
  - ... also among the most “vulnerable”
  - ... but the effects are moderate

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 851891).

Decomposition

Back

Because

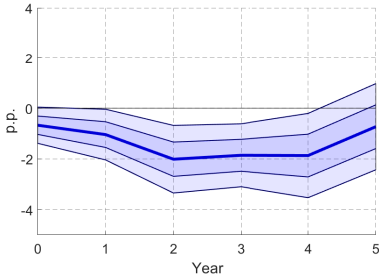
$$b_t - b_{t-1} \approx d_t + (i_t - \pi_{t+1} - g_t)b_{t-1}$$

we have that

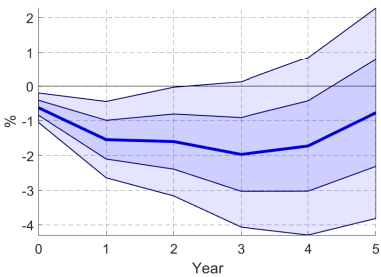
$$b_{t+h} - b_{t-1} \approx \sum_{j=0}^{h} d_{t+j} + \sum_{j=0}^{h} (i_{t+j} - \pi_{t+1+j} - g_{t+j})b_{t-1+j}$$

Average DTI Responses to Monetary Policy

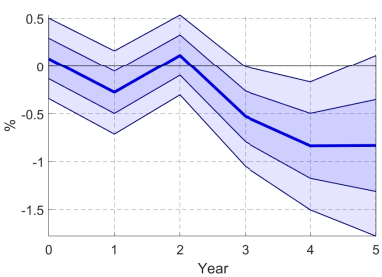
Back



(a) Debt-to-income



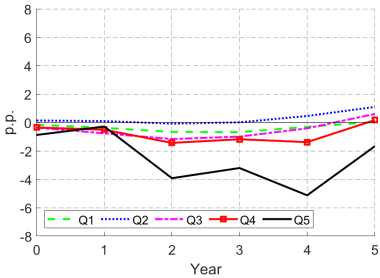
(b) Debt



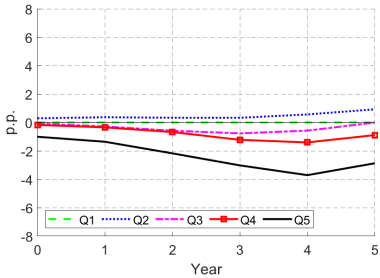
(c) Income

Responses to Monetary Policy by DTI Quintiles

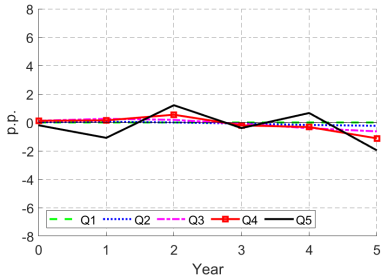
Back



(a) Debt-to-income



(b) Debt



(c) Income

Split by Job Loss Probability

Back