Monetary Policy Pass-Through:
Household Consumption and Voluntary Deleveraging

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Motivation

- The most responsive component of real GDP to monetary policy are household consumption and residential investment (Bernanke and Gertler, 1995).

- Households' mortgage debt is the largest component of private debt in the US.
  - Households monthly mortgage payments accounts for about 30 percent of household's disposable income.

- Monetary policy can work through the changes in the monthly mortgage payments of households, assuming that borrowers have higher MPC than lenders.

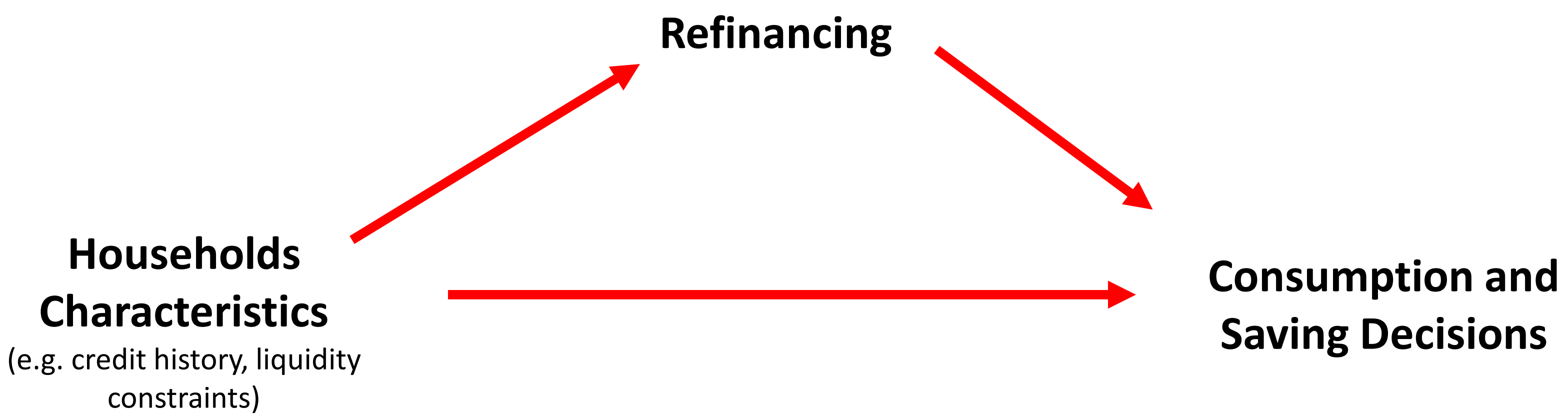
Motivation

If Monetary Policy works through the income channel, effectiveness of monetary policy depends on:

- Households consumption reaction to changes in their monthly mortgage payment.
  - Increase in households precautionary saving motivations (for example due to higher uncertainty) can lower effectiveness of monetary policy.
- Pass-Through of lower interest rates to households.
  - Contractual frictions combined with underwater households can reduce pass-through of monetary policy to households.

Key Identification Challenge

- Decision to refinance as well as opportunity to obtain a mortgage are endogenous.



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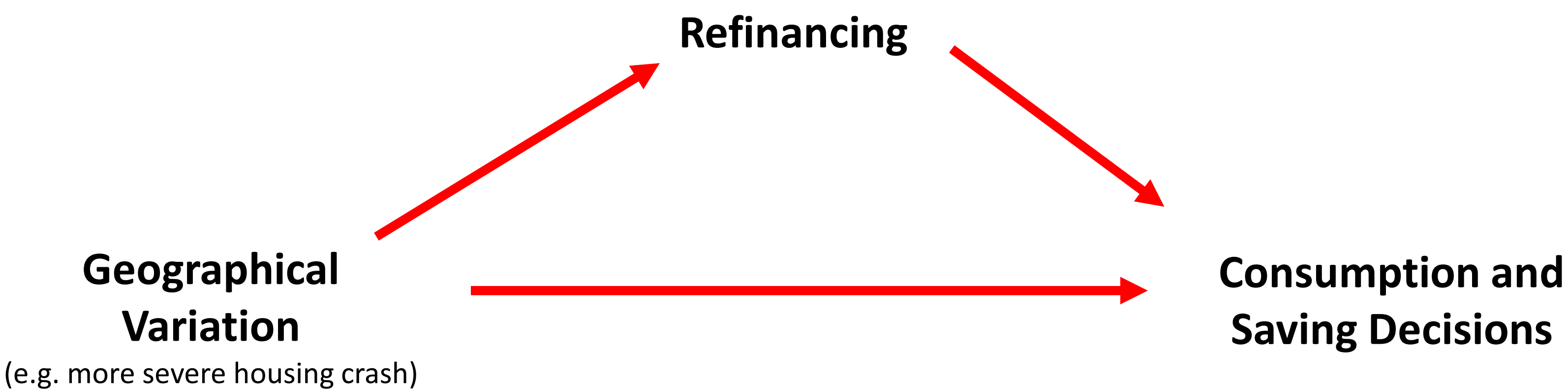


Identification Strategy

- We gathered data on prime, owner-occupied mortgage payments as well as liabilities of households with hybrid ARMs originated between 2005 and 2007.
- These feature a 10-year interest-only period and an automatic interest rate reset after 5 years.
- Reset driven by contract structure (not endogenous)
- By restricting attention only to the households with this type of mortgage, we limit potential concerns about the endogeneity of the choice between FRM and ARM.
- ARMs originated in 2005 were able to take advantage in 2010 of an average reduction of >3% in the interest rate.

Main Results
Household-Level Evidence

1. **Positive Income Shock**: show that at the moment of the interest rate reset, the monthly payment decreases on average by $900 (50%).

2. **Consumption:** households increase their consumption (car purchases and credit card balances) on average by $150-$400 (>40% increase).

3. **Voluntary Deleveraging:** $100-$120 (>100% increase) is allocated to repay their debts faster.

4. **Heterogeneous Effects**:
    1. borrowers with a LTV>120% invest less in deleveraging and their consumption response is almost twice as much as other borrowers.
    2. low-income households tend to consume significantly more and deleverage less than high-income ones

5. **Robust to several sensitivity checks.**

Main Results
Aggregate-Level Evidence

- We have used the sub-sample of hybrid ARMs to limit unobserved heterogeneity and sharpen the identification.
- We then turn to county level data to see if these results might be generalized across a broader sample of households, and to better understand their local general equilibrium implications.

1. **MP Pass-Through:** counties with a higher fraction of ARMs display a more significant reduction in the average mortgage rate and in their average monthly payments. (10-15 bps)
2. **Stimulus**: significant consumption response in counties with a higher share of ARMs in 2006 (2.5-3% increase in car sales in that county.).
3. **Voluntary Deleveraging:** more significant deleverage in counties with more AMRs (1.5% decline in mortgage balances)

To be clear, even if the exclusion restriction is satisfied, we cannot use these elasticities to calculate the aggregate effect of changes in interest rates on households consumption and deleveraging decisions.

Related Literature

- Monetary Policy and Households
  - Keys, Piskorski, Seru and Yao (2014), Auclert (2014), Eberly and Krishnamurthy (2014)

- Identification strategy
  - Fuster and Willen (2012) and Tracy and Wright (2012)

- Income shcoks, Consumption and heterogeneous MPC
  - Souleles et al. (2006), Parker et al. (2013), Agarwal et al. (2007), Agarwal and Qian (2013), Romer and Romer (2014), Carrol et al. (2014)

- Financial Crisis, Consumption and Deleveraging
  - Guerrieri and Lorenzoni (2011), Eggertsson and Krugman (2012), Mian and Sufi (2011, 2015a,b)

- Balance sheet Channel of Monetary Policy ("Allocation of Credit")
  - Krishnamurthy and Vissing-Jorgensen (2013), Walsh (2014)

Outline

- Research Design
- Data and Summary Statistics
- Main Results:
  - Consumption Response
  - Deleveraging
  - Robustness Checks
  - Heterogeneous Effects
- (Aggregate Evidence)

Research Design

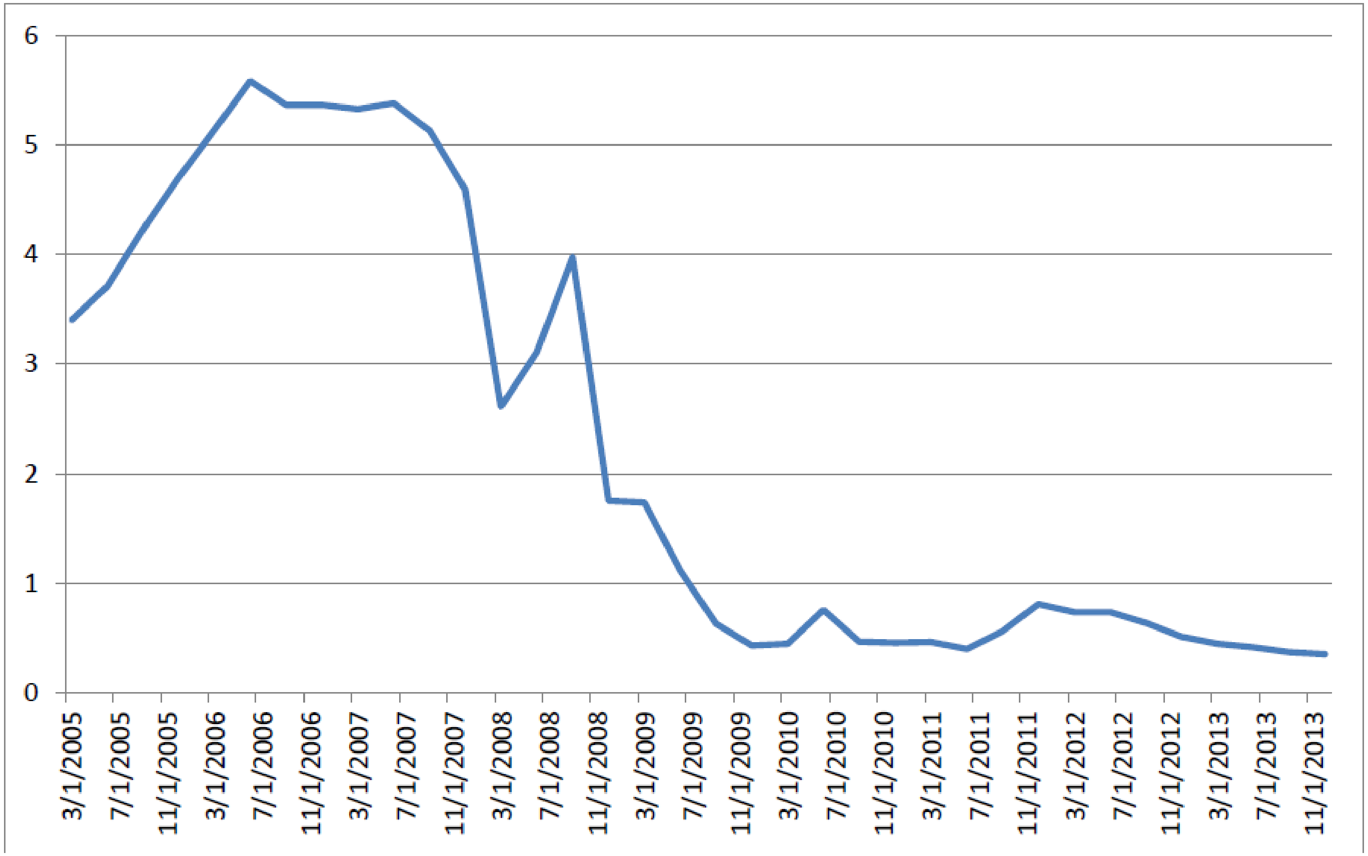
Research Design

- We consider mortgages originated between 2005 and 2007 featuring
  - Fixed interest rate for the first 5 years;
  - Interest-only payment for the first 10 years;
  - Automatic adjustment of the interest rate 5 years after origination.

➡ The monthly payment reduction is a feature of the contract and not an endogenous choice of the borrower.

- We exploit the *timing* of the change in the interest rate and the automatic reset for these ARMs as a positive income/cash-flow shock for households holding these mortgages.

An Example (1)



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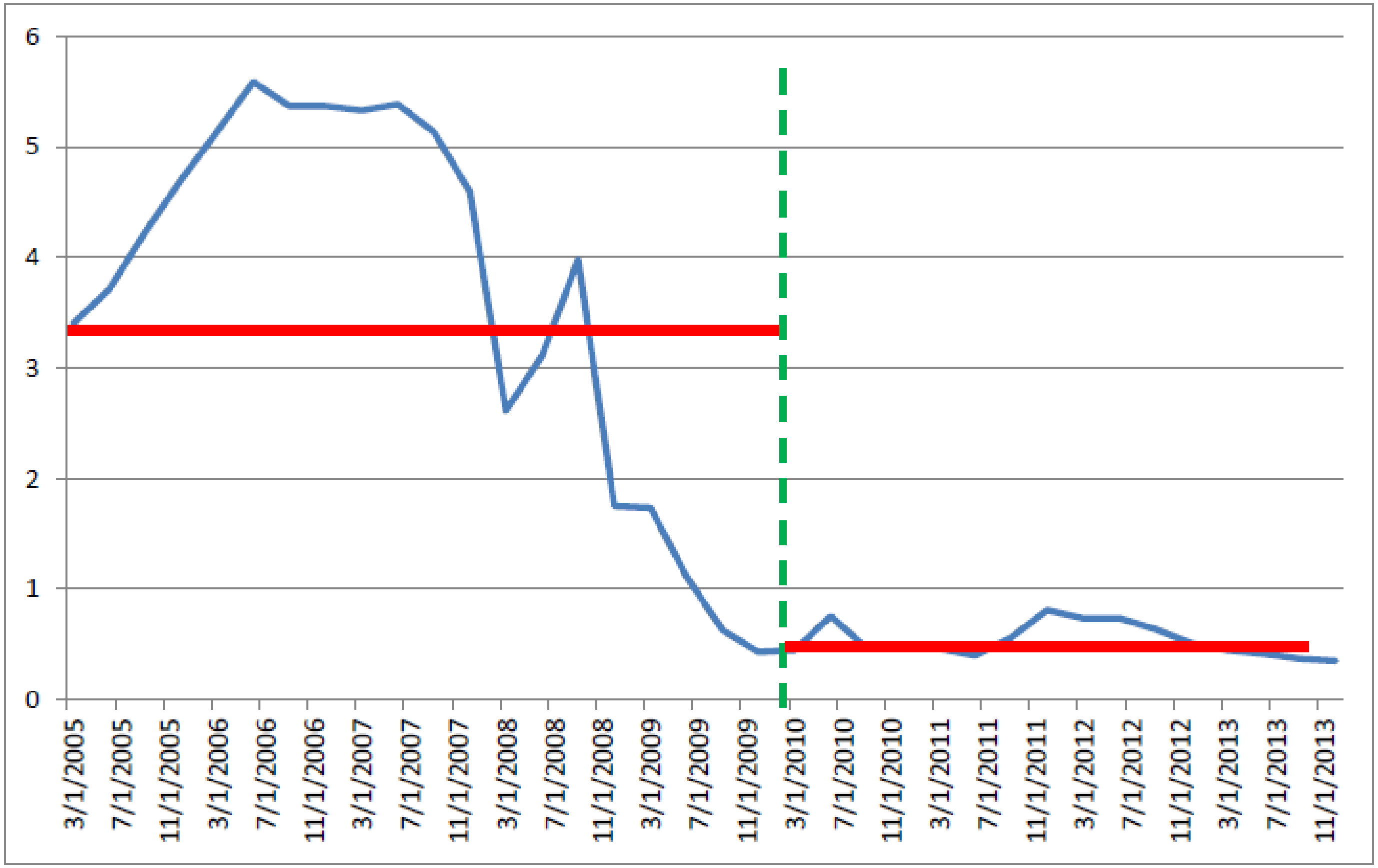
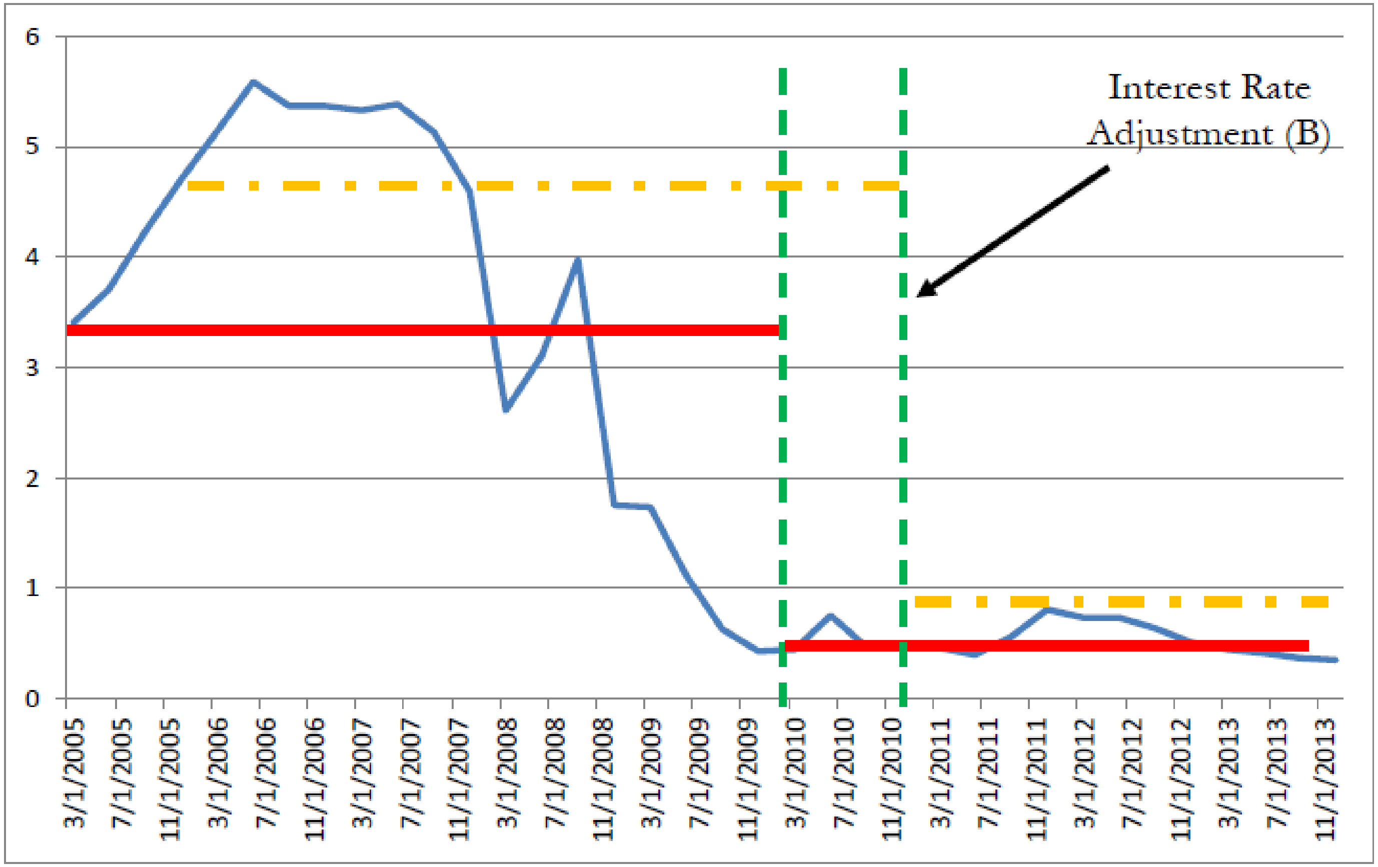
An Example (2)



Interest Rate Adjustment (A)

An Example (3)



Interest Rate
Adjustment (A)

Research Design

- Borrower (A) is "treated" by the reduction in the monthly payments (due to the interest rate reset at lower level);
- Borrower (B) serves as "control", he/she will be treated at a later date.
- (A) and (B) have bought a house/ refinanced with the *same* type of mortgage, but at different points in time.

Possible Concerns

$$y_{i,t(g,\tau)} = \sum_{\theta=-4}^{\theta=8} \beta_\theta 1\{\tau = \theta\} + \lambda_i + \eta_{g,t} + \Gamma X_{i,t} + \varepsilon_{i,t}$$

- Differences across households
- Differences across cohorts of originations
- Differences in treatment intensity
- Unobserved county-level heterogeneity

Data (Household Level)

- We take advantage of two main sources of information, one on the characteristics of the mortgages and one on households' balance sheets.
- Data on mortgage loans originated every month from 2005 to 2013 through Blackbox Logic.
  - Information on the mortgages and the borrowers at origination, such as the loan type, the initial interest rate, the initial FICO score and the amount of the loan, with monthly updates about the status of each mortgage, the monthly payments, the current balance and other important information.
- These loans are then matched with credit bureau reports from Equifax.
  - Detailed information on households' balance sheets: the monthly information on all the loans that a borrower has, such as credit cards, auto loans, mortgages, and home equity line of credit, but also on current FICO score.

We only consider households for whom their mortgage is not in foreclosure nor is repaid or refinanced.

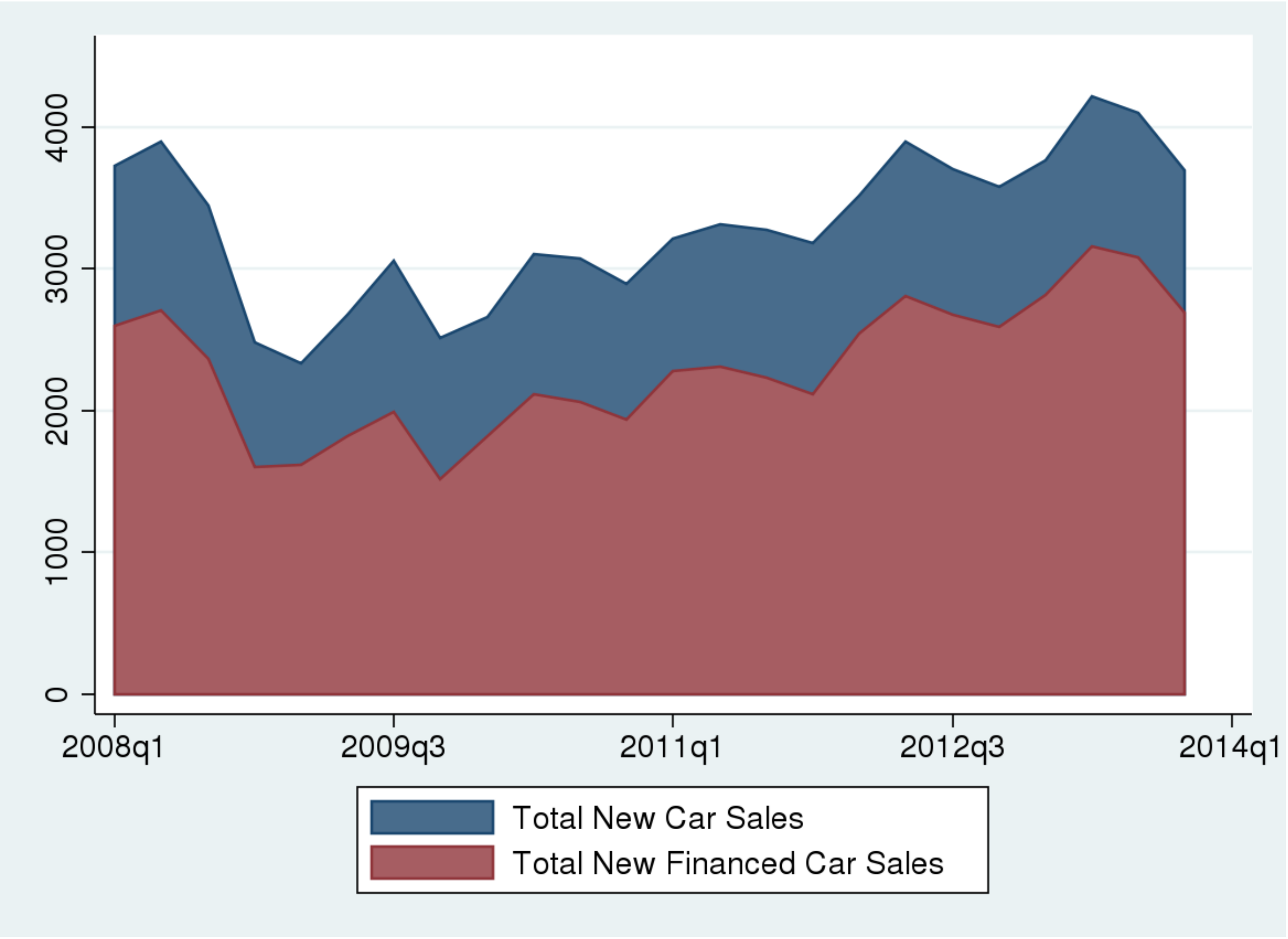
Measures of Consumption and Deleveraging

- We observe the change in the monthly mortgage payments.
- Main measure of consumption: auto sales.
  - Additional measures: balance of the borrowers' credit cards issued by both stores (e.g. Best Buy card, Macy's card, etc.) and banks (e.g. Chase, BoA, etc…).
- Main measure of deleveraging: we observe the borrowers' mortgage payments each month.
  - Additional measures: payment to Equity Loans and HELOC.

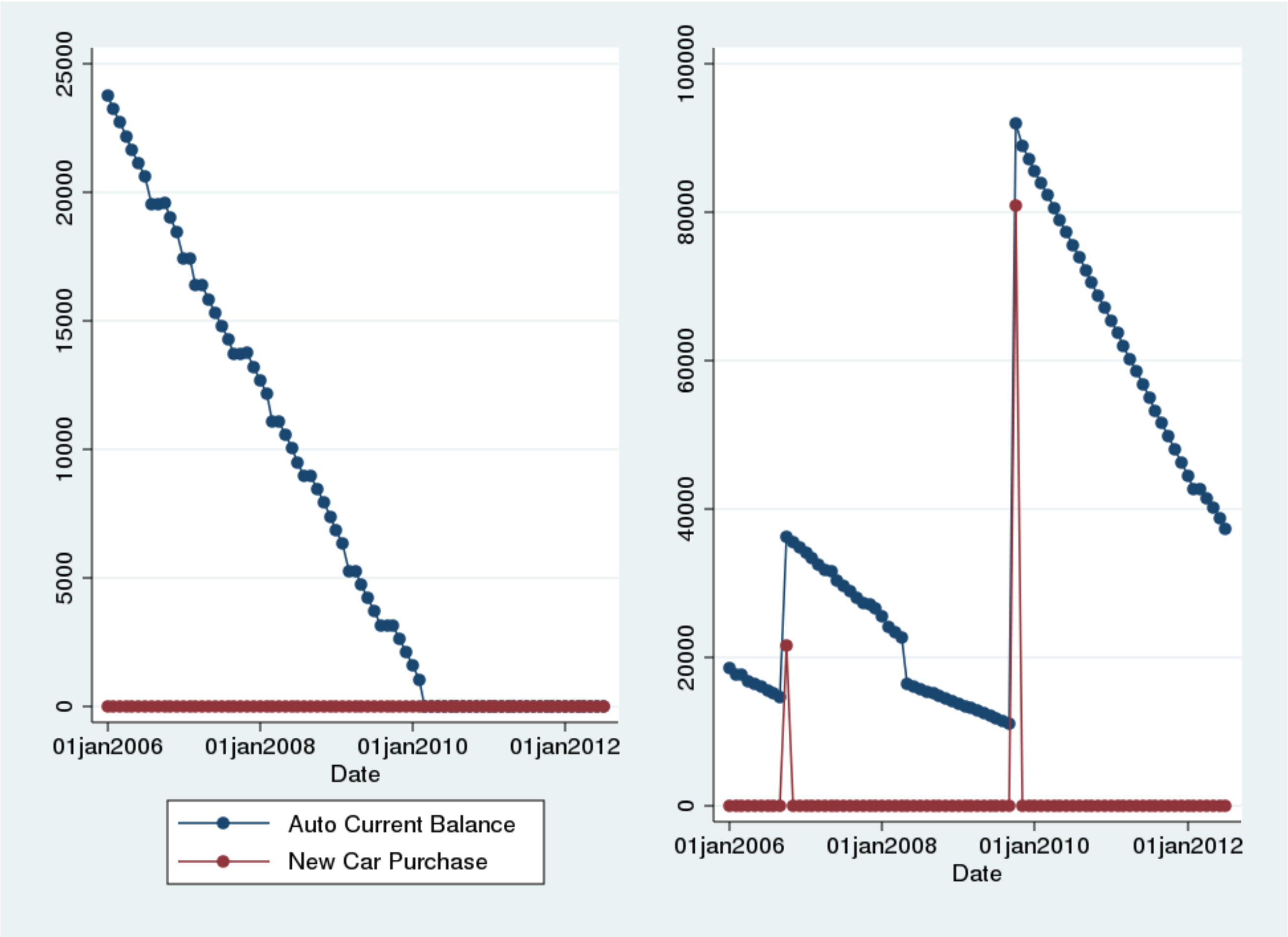
These measures <u>underestimate</u> the increase in consumption, cannot capture purchases made by cash, check or other means not recorded in Equifax.

At the same time, we cannot observe the decision of the households to save part of the reduction in the monthly payment in their checking or saving accounts.

Finance Car Sales



Auto Sales Measure



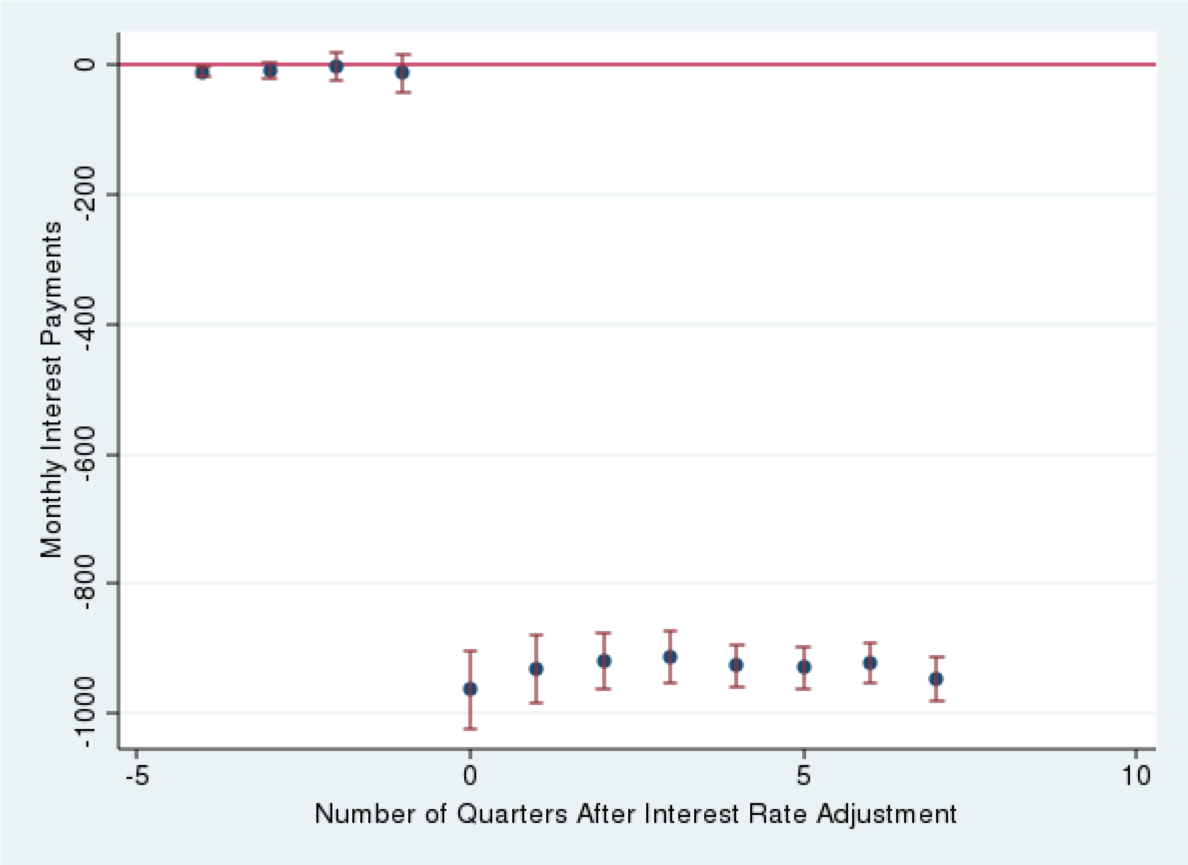
Mortgage Characteristics

	Our Sample	All Mortgages 2005-2008	FRMs	**ARMs**
FICO	**736.2**	703.76	705.16	687.97
Balance	**357,949**	239,043	196,125	312,466
Loan-to-Value Ratio	77.11	74.53	74.23	76.06
Interest Rate	6.449	6.27	6.30	6.06
Average Monthly Payment	1,921	1,654	1,485	1,765
Interest Rate After Adjustment	3.096			
Monthly Payment After Adjustment	915.8			

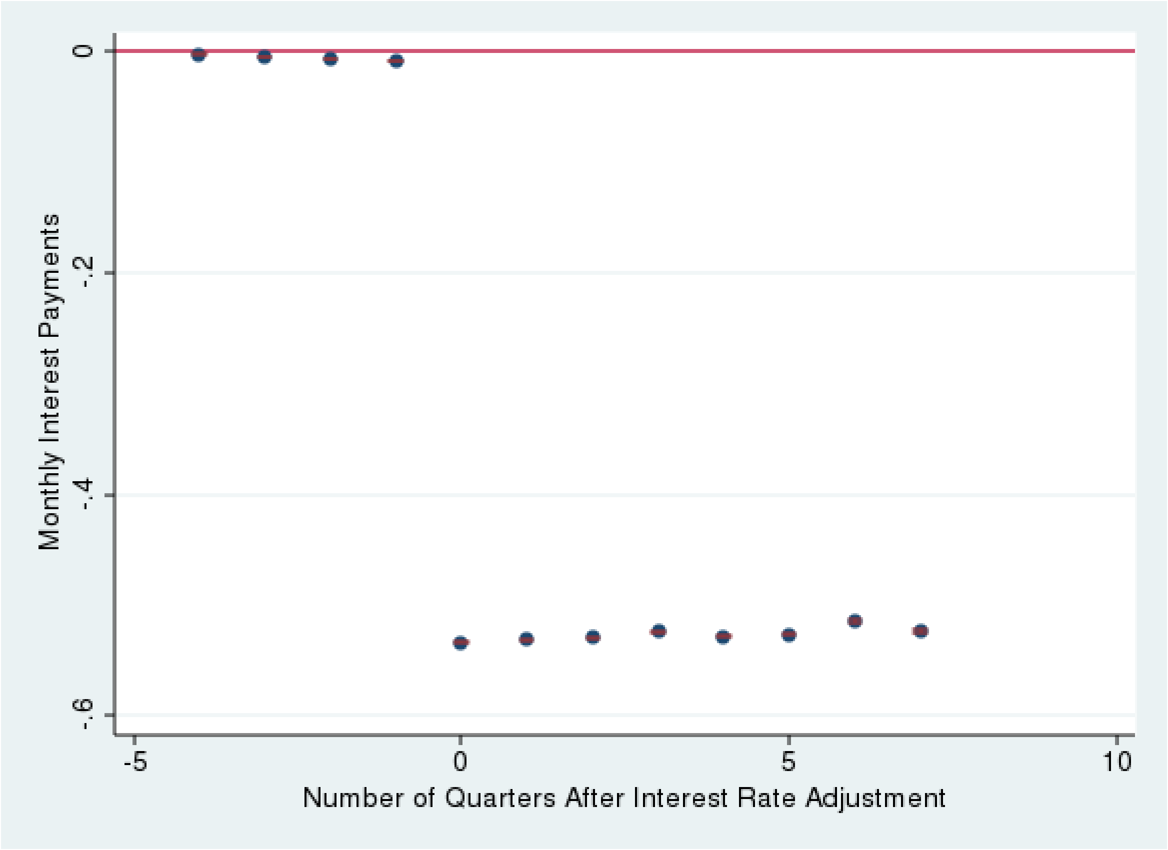
Main Results

1. *The cash flow shock*
2. *The consumption response*
3. *Voluntary Deleveraging*

Reduction in Monthly Payments



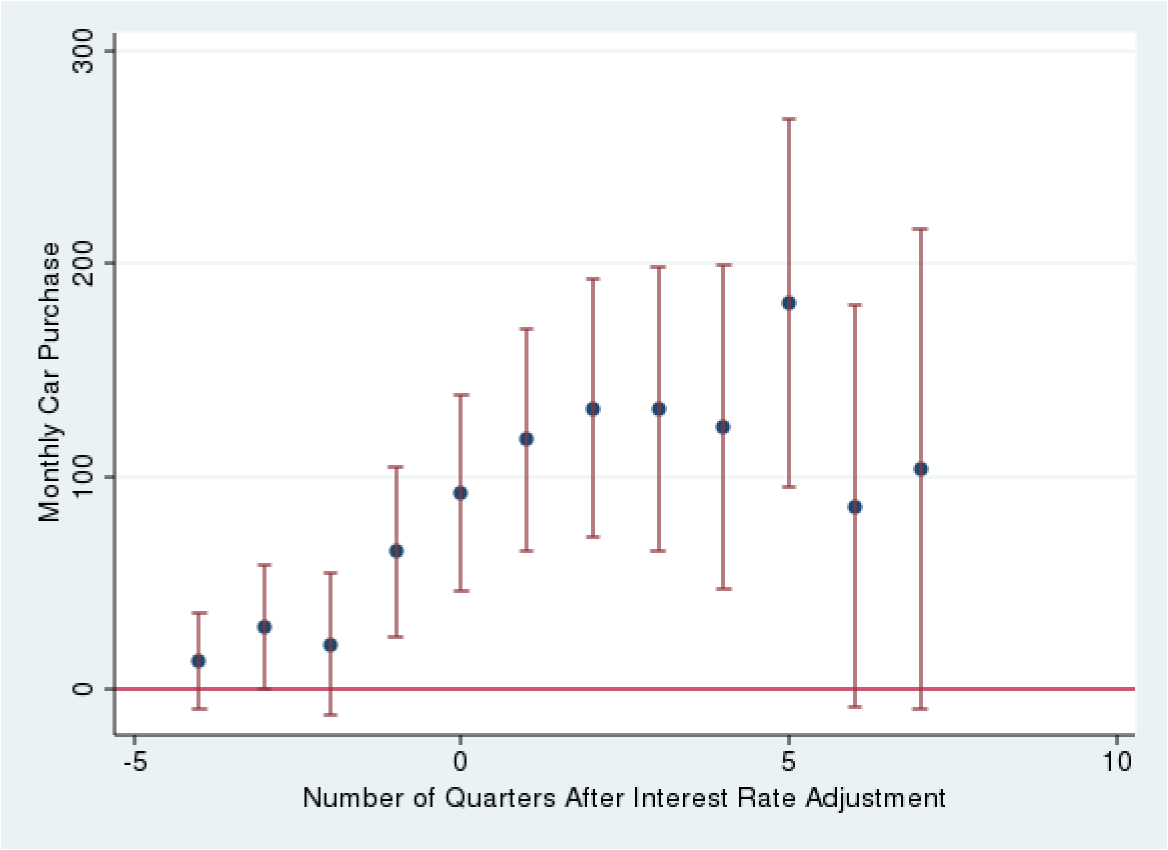
Reduction in Monthly Payments



Main Results

1. *The cash flow shock*
2. *<u>The consumption response</u>*
3. *Voluntary Deleveraging*

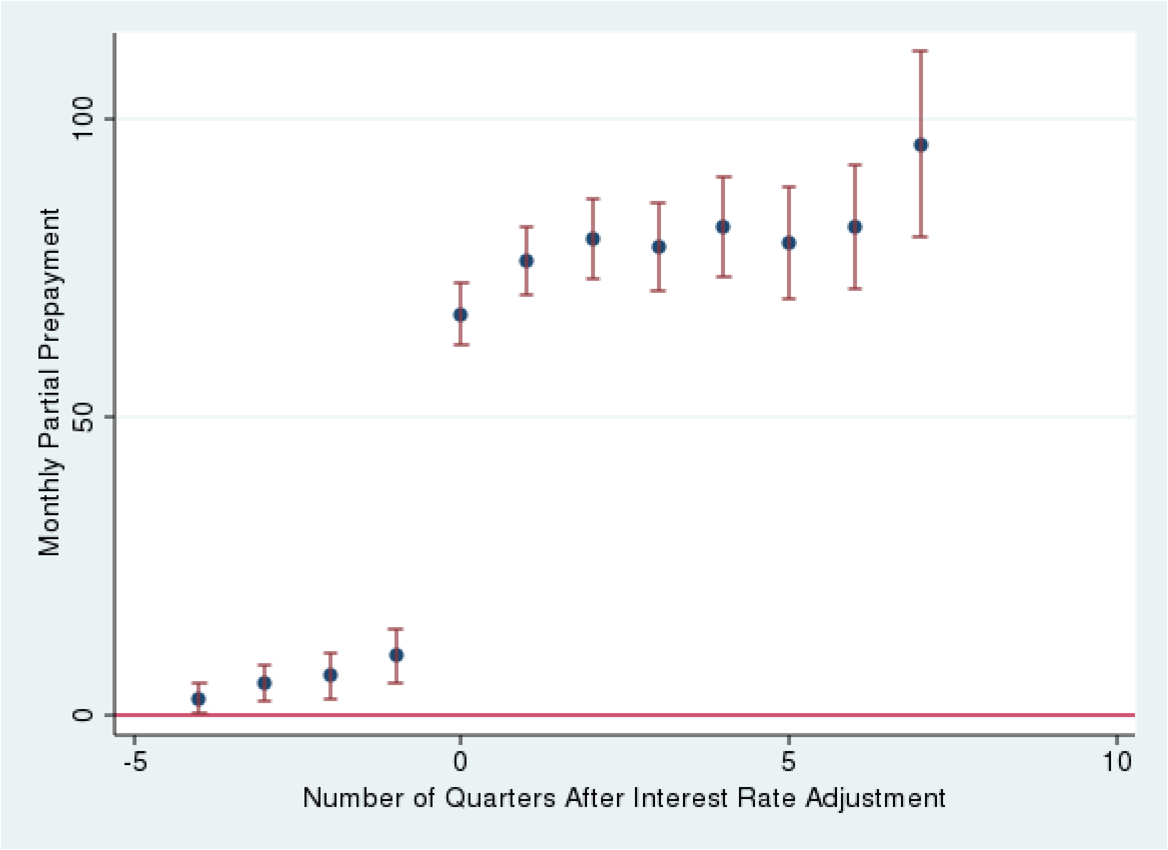
Car Purchase



Main Results

1. *The cash flow shock*
2. *The consumption response*
3. *Voluntary Deleveraging*

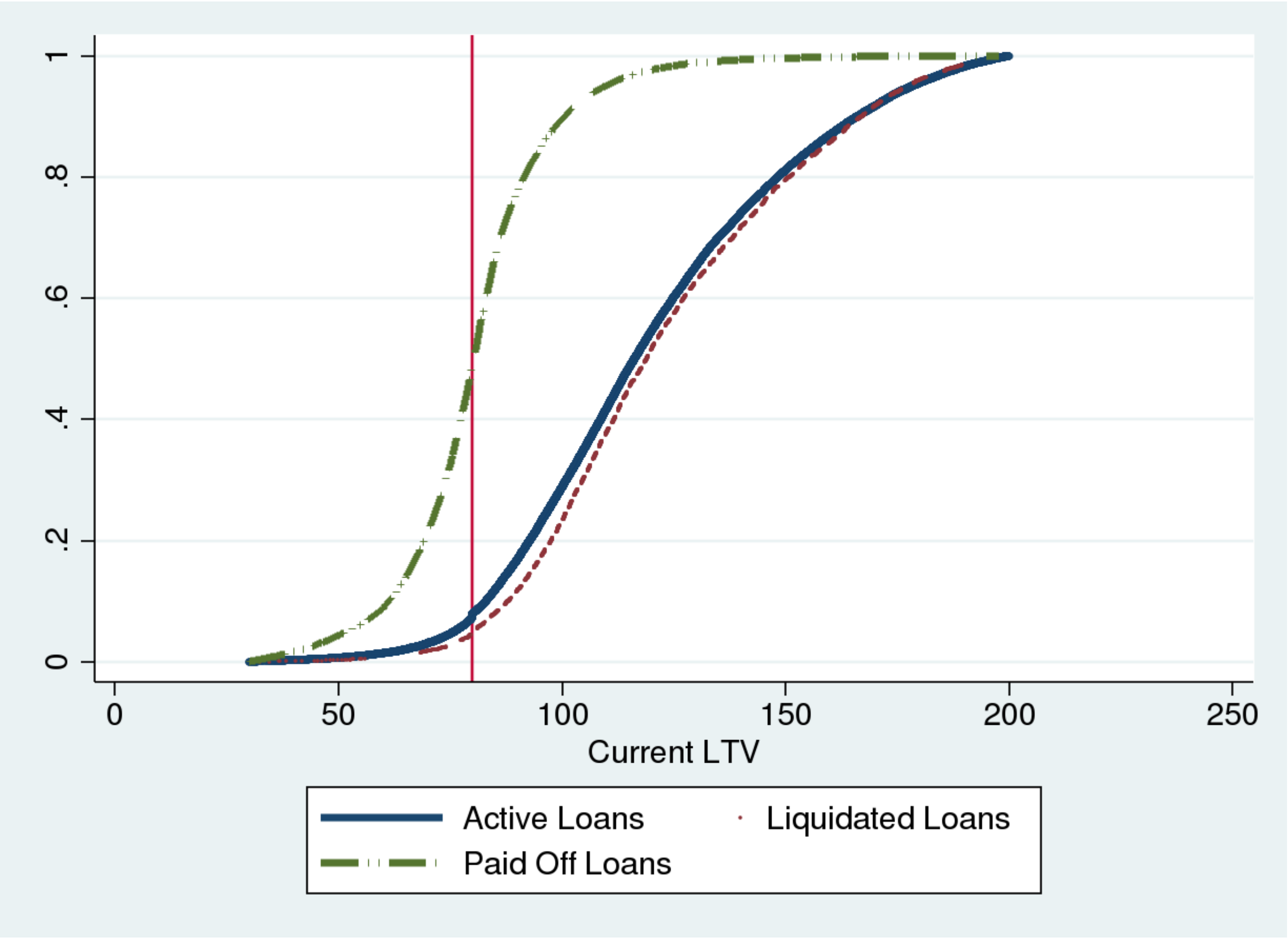
Deleveraging



Further Evidence/Robustness Checks

1. *Attrition*
2. *Difference-in-Differences Results*
3. *Alternative Consumption and Deleveraging Measures*

Attrition and Current LTV



5-Year and 10-Year ARMs

- One potential concern is that there might be a mortgage-specific trend that could affect our results.
- Since the <u>age of the mortgage</u> is collinear with the time dummies, we could not control for it, which might be correlated with the household's consumption or prepayment behavior.
- For instance, households might be more inclined to purchase a new car twelve months after they bought a house, or they might have a greater incentive to prepay their mortgage once they have built enough equity in it. Then there might be heterogeneity among households with mortgages of different vintages.
- In order to correct for this possibility, we consider as control group the mortgages that have the interest rate reset 10 years after origination, i.e. 10-year ARMs.

5-year vs 10-year ARMs

	Interest Payment	Car Purchase	Prepayment
Four Quarters Before	-10.75***	40.11*	8.442**
	(3.135)	(21.58)	(3.206)
Three Quarters Before	-19.75***	26.13	6.935
	(4.852)	(31.32)	(4.462)
Two Quarters Before	-23.72***	48.57	12.12***
	(5.342)	(34.26)	(4.511)
One Quarter Before	-20.74***	99.45***	10.61**
	(7.376)	(33.88)	(4.931)
One Quarter After	-922.3***	146.7***	66.26***
	(43.58)	(46.24)	(6.329)
Two Quarters After	-848.7***	162.3***	75.30***
	(33.86)	(46.17)	(6.956)
Three Quarters After	-793.6***	187.3***	71.74***
	(33.06)	(42.69)	(7.501)
Four Quarters After	-750.6***	186.1***	67.25***
	(33.88)	(60.19)	(8.844)
Two Years After	-713.5***	137.7*	62.21***
	(34.58)	(80.01)	(9.658)

Alternative Measures of Consumption

	Store Credit Cards	Bank Credit Cards
Four Quarters Before	1.170	19.34
	(2.649)	(26.00)
Three Quarters Before	3.174	19.09
	(3.194)	(31.94)
Two Quarters Before	0.451	46.02
	(3.760)	(44.86)
One Quarter Before	10.01**	87.69
	(4.324)	(54.99)
One Quarter After	14.25***	129.0**
	(4.926)	(61.27)
Two Quarters After	15.32***	125.3*
	(5.564)	(71.48)
Three Quarters After	15.22**	140.4
	(6.191)	(89.33)
Four Quarters After	20.87***	275.6***
	(6.919)	(98.48)
Two Years After	27.85***	330.0**
	(7.877)	(123.4)
Observations	1,158,492	289,562
R-squared	0.060	0.365

Heterogeneous Responses across Households

Heterogeneity across Income Groups

Low Income vs. High Income Households

	Interest Payment	Car Purchase	Prepayment
One Year Before	-0.005***	0.03**	0.00
	(0.0005)	(0.01)	(0.001)
One Year After	-0.54***	0.07***	0.04***
	(0.0008)	(0.02)	(0.002)
Two Years After	-0.54***	0.14***	0.04***
	(0.001)	(0.03)	(0.003)
One Year Before X Household Group	0.004***	-0.04***	0.002
	(0.0006)	(0.01)	(0.002)
One Year After X Household Group	0.03***	-0.05***	0.01***
	(0.0008)	(0.02)	(0.002)
Two Years After X Household Group	0.03***	-0.12***	0.002
	(0.001)	(0.03)	(0.003)

Heterogeneity across LTV Groups

Low LTV vs. High LTV Households

	Interest Payment	Car Purchase	Prepayment
One Year Before	0.001**	-0.008	0.001
	(0.0006)	(0.01)	(0.001)
One Year After	-0.52***	0.03*	0.04***
	(0.001)	(0.02)	(0.002)
Two Years After	-0.52***	0.01	0.04***
	(0.001)	(0.03)	(0.003)
One Year Before X Household Group	-0.01***	0.03**	0.0004
	(0.001)	(0.01)	(0.002)
One Year After X Household Group	-0.04***	0.05**	-0.008***
	(0.001)	(0.02)	(0.003)
Two Years After X Household Group	-0.04***	0.11***	-0.0006
	(0.002)	(0.03)	(0.004)

Mini Conclusion

- We show that households' consumption responds significantly to changes in their monthly payment, as opposed to aggregate interest rates, but attenuated by voluntary deleveraging.
  - This highlight the importance of *debt contracts* in determining the effectiveness of monetary policy.
- Underwater and low-income households exhibit a higher marginal propensity to consume and less deleveraging.
  - From the aggregate demand point of view it really matters who receives the money. *(Allocation of credit)*