Down Payments, Deferred Homes: How LTV Restrictions Reshape Household Consumption

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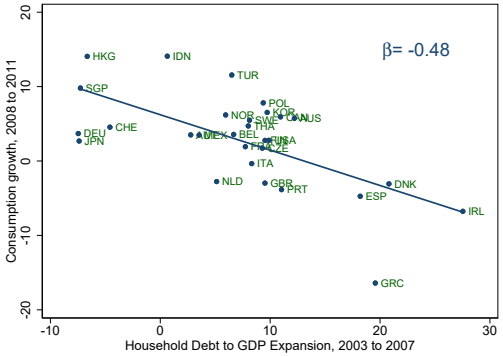
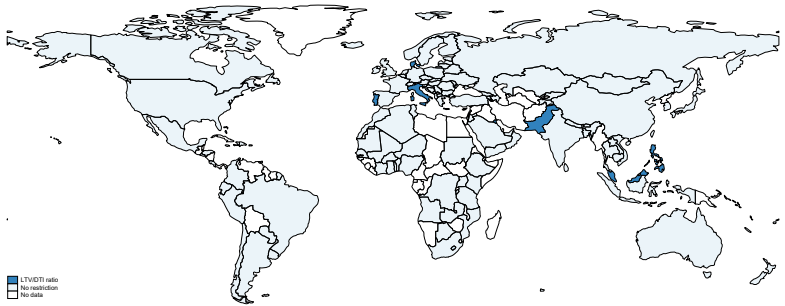
Household Debt and Consumption



Source: **Mian, Sufi, and Verner (QJE, 2017).**

Increase in HH debt before the GFC predicts a decline in consumption during GFC

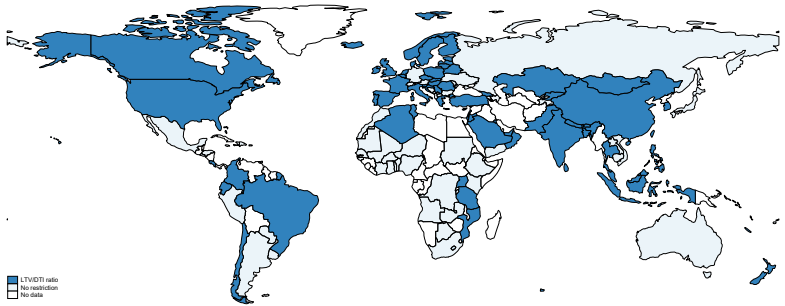
Macroprudential Policies in 2000



Source: **IMF iMaPP Database**

As a result, many countries have implemented borrowing restrictions on HH

Macroprudential Policies in 2021



Source: **IMF iMaPP Database**

As a result, many countries have implemented borrowing restrictions on HH

Borrowing Restrictions Beyond the Housing Market

- **Collateral** and **wealth channels**, via **households who are homeowners**, explain the co-movement between the household debt, housing markets, and consumption
- **Macroprudential Policies** aim to weaken these channels
- **How?** Tighten the borrowing capacity of **households who want to be homeowners**
- **Question: How do households who may want to be homeowners adjust consumption when a macroprudential policy is introduced?**
  $\rightarrow$ Use a loan-to-value ratio restriction introduced in Norway
  $\rightarrow$ Population-wide household consumption, balance sheet, and housing transactions

Findings

- **Renters increase their consumption after the introduction of LTV restriction**
  $\rightarrow$ 3.2 pp increase in the consumption/income ratio
- **Mechanism**: Delayed/discouraged home purchase and savings
- Renters draw on their savings and financial assets and increase uncollateralized debt
- **Homebuyers** change their consumption dynamics around a home purchase
  $\rightarrow$ Homebuyers decrease their consumption before and after a home purchase

Contribution to the Literature

- **Housing markets and consumption**: Collateral and wealth channels
  Campbell&Cocco (2007), Mian et al (2017), Guren et al (2021), Mian&Sufi (2011), Aladangady (2017), DeFusco (2018), Berger et al (2018), Sodini et al (2023), Benmelech et al (2023)
  → **Borrowing constraints affect renters' consumption, implying wider implications**
  → **Changes in consumption dynamics around a home purchase**

- **Macroprudential policies**:
  On the positive side: Mitigate negative externalities (Farhi&Werning (2016), Cerutti et al (2017), Davila&Korinek (2018), Araujo et al (2019), Peydro et al (2024))
  On the negative side: Reducing access to housing, depleting liquidity (Ortalo-Magné and Rady (2006), DeFusco et al (2020), Acharya et al (2022), Carozzi (2020), Tzur-Ilan (2023), Bolliger et al (2025), Tracey&Van Horen (2025), Karlman, Kinnerud, Kragh-Balke (2024), Aastveit et al (2024), van Bekkum et al (2024))
  → **Financial stability implications are not specific to homeowners**
  → **Active consumption adjustment may attenuate liquidity depletion**

Loan-To-Value Restriction & Data

LTV Restriction

- Due to strong growth in house prices and household debt levels, LTV ratio restriction is announced in **Spring 2010** and introduced in Fall 2010.

  $\rightarrow$ LTV cap is at **90%** (later at 85%)

  $\rightarrow$ Covers all loans to the same property

Data

- Consumption, housing transactions, tax filings, individual characteristics
  → Consumption: Debit card transactions, digital invoice, direct remittances. Approximately 80% of the total consumption. 26 COICOP categories
- Sample: 2006-2018, Annual, Household-level
- **3 groups**: Renters, homebuyers, homeowners
  → Renters: Do not have housing wealth, no housing transactions before the restriction
  → Homebuyers: First-time homebuyers
  → Homeowners: Have housing wealth before 2006

Empirical Strategy

Difference-in-Differences Design

$$y_{it} = \beta \, Renter_i \times Post_t + \gamma_1 Renter_i + \gamma_2 Post_t + \epsilon_{it}$$

- y_{it} = Consumption / Income
- $Renter_i$: =1 if HH is a renter until 2010, 0 if HH is already a homeowner prior to 2006
  $\rightarrow$ Renters include HHs that purchase a home after the restriction
- $Post_t$: =1 if year$\geq$2010
- **Identifying assumption**
  1. Without the restriction, the consumption/income difference between renters and homeowners would be the same
     $\rightarrow$ The levels can be different
  2. Homeowners are not affected by the restriction
     $\rightarrow$ The restriction can reduce homeowners' access to credit, or housing wealth

Consumption Reaction of Renters

	Consumption/Income		
	(1)	(2)	(3)
Renter × Post	0.0320***	0.0314***	0.0321***
	(5.52)	(5.27)	(5.79)
Renter	-0.130***	-0.130***	
	(-26.73)	(-25.77)	
Post			
Fixed Effects:			
Year FE		✓	✓
Household FE			✓
Obs.	11304369	11304369	11304369
R^2	0.008	0.010	0.412
Mean(Dependent Var.)	0.675		

Renters increase their consumption after the LTV restriction

▸ Consumption vs Income?

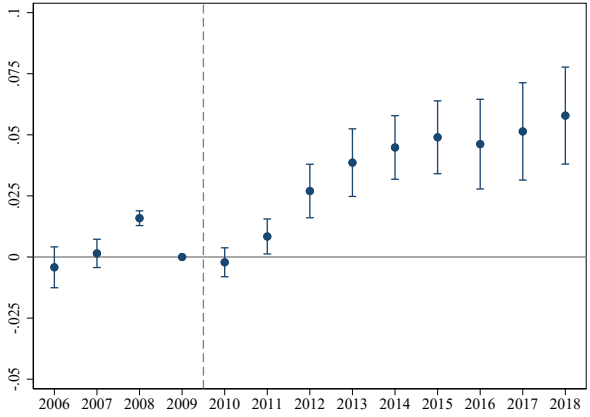
Homeowners as Control

Do homeowners form a good control group for renters?

Possible issues

- Homeowners are different from renters
  → Creates a bias only if the trends are different
  → **Parallel trends** before the restriction?
  → Differences in characteristics start to affect consumption differentially in 2010
- The restriction can limit homeowners' borrowing capacity
  → Suggesting that the consumption difference is due to homeowners' lower consumption
- The effect of homeownership on consumption changes over time
  → Within renter comparison

Dynamics of the Renters' Consumption Reaction



Renters increase their consumption after the LTV restriction

Controlling for Different Characteristics

	Consumption/Income					
	(1)	(2)	(3)	(4)	(5)	(6)
Renter × Post	0.0329***	0.0306***	0.0253***	0.0336***	0.0311***	0.0265***
	(6.44)	(5.51)	(4.44)	(5.86)	(6.17)	(5.79)
Fixed Effects:						
Household FE	✓	✓	✓	✓	✓	✓
Age × Year FE	✓					
Deposit bins × Year FE		✓				
Financial Asset bins × Year FE			✓			
Total wealth bins × Year FE				✓		
Parental wealth bins × Year FE					✓	
Full Interacted FE						✓
Obs.	11304369	11304369	11304369	11304369	11304369	11185919
R^2	0.413	0.413	0.413	0.413	0.412	0.442
Mean(Dependent Var.)	0.675					

Tightening the comparison with granular FEs does not change the results

Homeowners' Borrowing Capacity and Housing Wealth

	Consumption/Income					
	(1) LTV<90%	(2) LTV<75%	(3) LTV<60%	(4) LTV<50%	(5)	(6)
Renter × Post	0.0205***	0.0195***	0.0182***	0.0170***	0.0592***	0.0339***
	(4.50)	(4.58)	(4.82)	(4.91)	(9.51)	(5.98)
Fixed Effects:						
Household FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓		
Housing wealth bins × Year FE					✓	
Municipality × Year FE						✓
Obs.	8,688,858	8,042,192	7,188,687	6,530,123	11304369	11304369
R^2	0.448	0.457	0.468	0.477	0.413	0.416
Mean(Dependent Var.)	0.675					

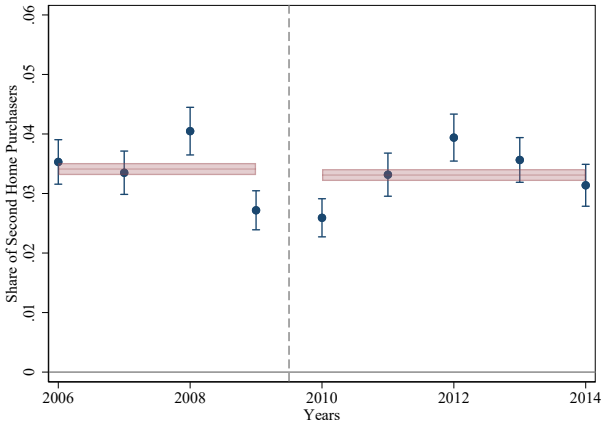
Removing high-LTV homeowners or adding housing controls leaves results unchanged

Macroeconomic Conditions

	Consumption/Income				
	(1)	(2)	(3)	(4)	(5)
Renter × Post	0.0419***	0.0420***	0.0453***	0.0478***	0.0514***
	(6.71)	(6.64)	(6.56)	(7.04)	(6.69)
Renter × Δ GDP growth	-0.00670***	-0.00677***	-0.00902***	-0.00496***	-0.00346***
	(-12.44)	(-11.05)	(-9.05)	(-4.35)	(-4.61)
Renter × Δ Inflation		-0.000122	-0.00223***	-0.00171***	0.000839**
		(-0.46)	(-4.18)	(-3.10)	(2.26)
Renter × Δ Policy rate			0.00378***	0.00000654	-0.00471***
			(4.48)	(0.01)	(-7.72)
Renter × Δ VIX				0.00134***	0.00159***
				(13.64)	(19.86)
Renter × Δ Unemployment rate					-0.0111***
					(-3.49)
Fixed Effects:					
Year FE	✓	✓	✓	✓	✓
Household FE	✓	✓	✓	✓	✓
Obs.	11304369	11304369	11304369	11304369	11304369
R^2	0.412	0.412	0.412	0.412	0.412
Mean(Dependent Var.)	0.675				

Allowing renters to respond differently to macro conditions makes no difference

Second Home Purchases of Homeowners



No significant change in homeowners' second home purchases

Remaining Concerns about Homeowners as Controls

- **Remaining concerns** with homeowners as control:
  $\rightarrow$ Adjustable rate mortgages, house-related consumption, housing wealth, labor market attachment
- **Solution**: Within-renter comparison!
- Some renters are less exposed to the restriction
  $\rightarrow$ They want to remain as renters and never considered a home purchase
  $\rightarrow$ They have enough financial capacity to purchase a home
- How do we detect such renters?
  1. Split the sample into two: homeowners and renters
  2. Use XGBoost to predict the probability of being a homeowner by using 2006 information

  $\rightarrow$ **Intuition**: Renters with high probability have observables suggesting that they are similar to homeowners... but they are not

Within Renter Comparison

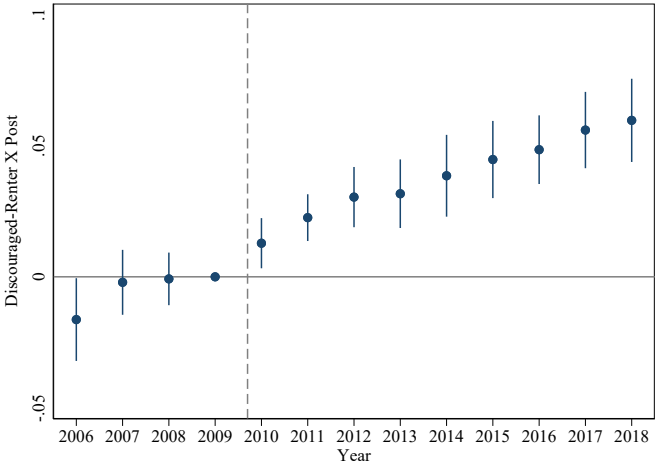
$$y_{it} = \beta \, Discouraged\ Renter_i \times Post_t + \gamma_1 Discouraged\ Renter_i + \gamma_2 Post_t + \epsilon_{it}$$

Treated = Bottom 70% || Control (Always Renters) = Top 30%

	Consumption/Income		
	(1)	(2)	(3)
Disc. Renters × Post	0.042***	0.042***	0.043***
	(0.005)	(0.005)	(0.005)
Disc. Renters	-0.077***	-0.077***	
	(0.005)	(0.005)	
Post	0.027***		
	(0.010)		
Fixed Effects:			
Year FE		✓	✓
Household FE			✓
Obs.	770,032	770,032	770,032
Adj. R^2	0.025	0.028	0.469
Mean(Dependent Var.)	0.58		

Always renters do not drive the effect

Within Renter Comparison



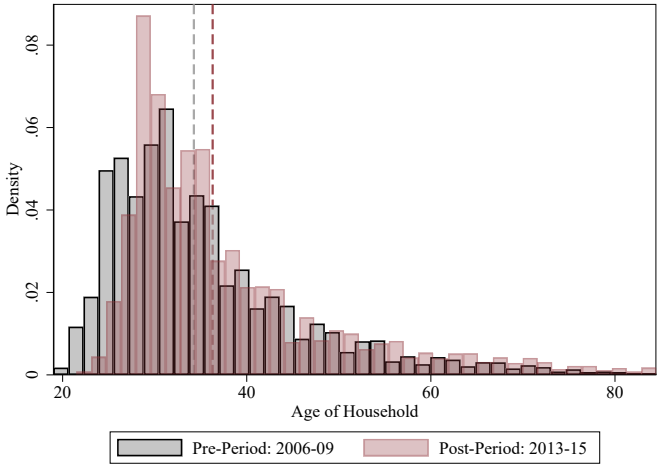
▸ Control vs Treated?

Treated = Bottom 70%, Control = Top 30%

Why do renters increase their consumption?

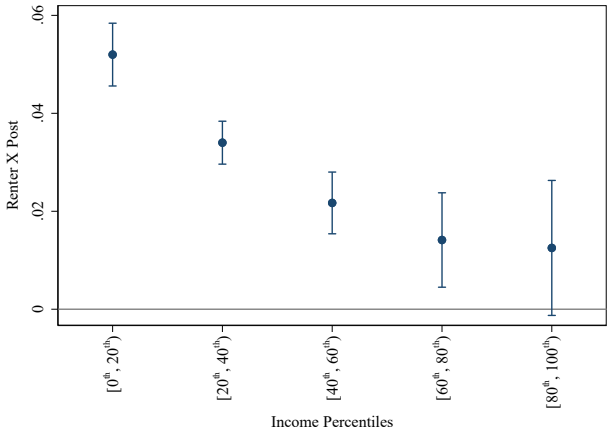
- The aim of the policy is to decrease household leverage by increasing saving rates
  → Yet, we find the opposite effect! Why?
- **Renters may delay their home purchase and SAVINGS** (Karlman et al. (2024))
  → HHs need to reduce their consumption to accumulate savings
  → Leads to deviation in consumption smoothing, which is stronger for low-income HHs
  → The disutility of this deviation can be larger than the benefits of an earlier home purchase
  → Low-income HHs that consider becoming homeowners delay both the home purchase and savings
- **Two predictions**
  1. There must be a delay in home purchases: Age distribution of homebuyers
  2. Income heterogeneity: The effect must be stronger for renters who need to deviate more

Age Distribution of Home Buying Cohorts



Homebuying cohorts get older

Income Heterogeneity



The effect is stronger for households with lower income

Renters' Housing Location

- Renters may become less mobile and prefer to live in more expensive areas
- This can lead to higher consumption

	Relocation dummy	Log(median Muni. Inc.)	Log(Mean Muni. Inc.)
Renter × Post	−0.009***	0.001***	0.001***
	(0.002)	(0.000)	(0.000)
Fixed Effects:			
HH FE	✓	✓	✓
Year FE	✓	✓	✓
Adj. R^2	0.129	0.954	0.956
Obs.	11,097,635	11,097,635	11,097,635

This channel is significant, but economically too small to explain the effect

Consumption Categories

	Durables	Non-durables	Furnishing	Vehicles	Luxury	Clothing	Restaurant	Credit Card	Supermarket
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Renter × Post	-0.000205	0.0134***	0.00172***	-0.00353***	0.00549***	0.000836***	-0.00184***	0.00774***	0.0148***
	(-0.18)	(12.75)	(5.30)	(-14.47)	(4.74)	(4.21)	(-19.44)	(7.53)	(17.38)
Fixed Effects:									
Household FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs.	11304369	11304369	11304369	11304369	11304369	11304369	11304369	11304369	11304369
R^2	0.250	0.664	0.301	0.130	0.457	0.634	0.606	0.414	0.667
Mean(Dependent Var.)	0.155	0.167	0.032	0.030	0.121	0.028	0.016	0.040	0.129

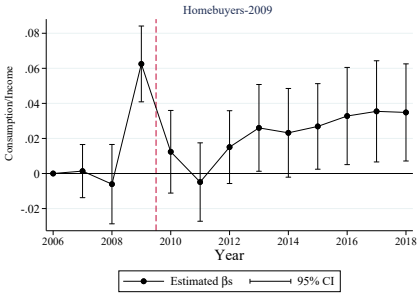
Increases in furniture, non-durables, clothing, supermarket, credit card spending

Renters' balance sheet items

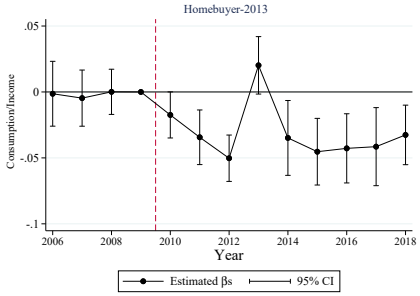
	Debt/Income	Deposits/Income	Fin. Assets/Income	Net Savings/Income
	(1)	(2)	(3)	(4)
Renter × Post	0.275***	-0.132***	-0.218***	-0.486***
	(16.08)	(-12.52)	(-18.35)	(-18.02)
Fixed Effects:				
Year FE	✓	✓	✓	✓
Household FE	✓	✓	✓	✓
Obs.	11304369	11304369	11304369	11304369
R^2	0.725	0.756	0.780	0.789
Mean(Dependent Var.)	1.862	0.870	1.426	-0.438

In line with higher consumption, we find lower savings and higher debt use

Consumption Dynamics around the Home Purchase



Homebuyers-09



Homebuyers-13

- Why? Rebuilding liquidity, cheaper areas, purchasing another home, and habit formation
- Match HB'13 to HB'09 to address the selection problem

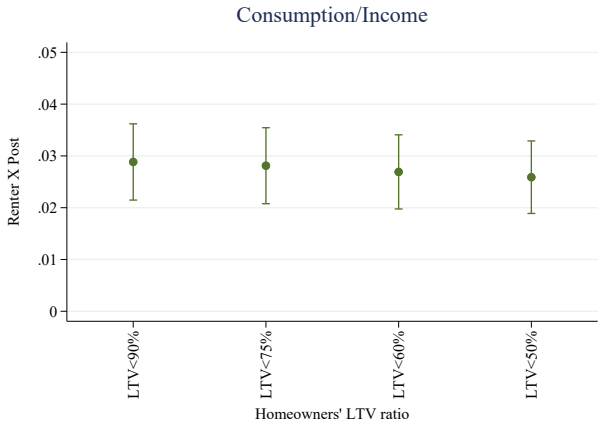
Conclusion

- Renters increase their consumption relative to homeowners when a borrowing constraint is introduced
- Consumption commitments may explain this behavior
- Homebuyers reduce their consumption before and after a home purchase
- The implications of borrowing constraints are wider than previously thought

Thank You!

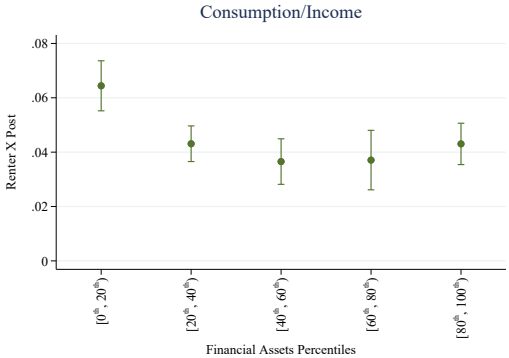
Appendix

Homeowners' access to credit



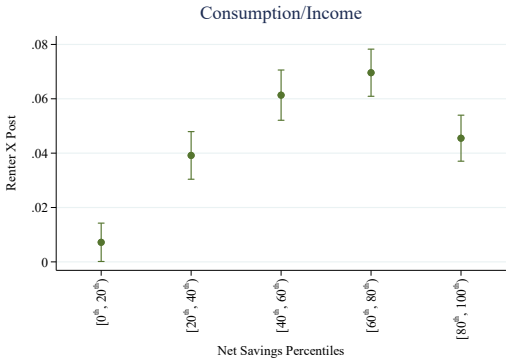
Removing homeowners who are more likely to be constrained by the policy does not change results ▸ Back

Heterogeneity - Assets



Back

Heterogeneity - Savings

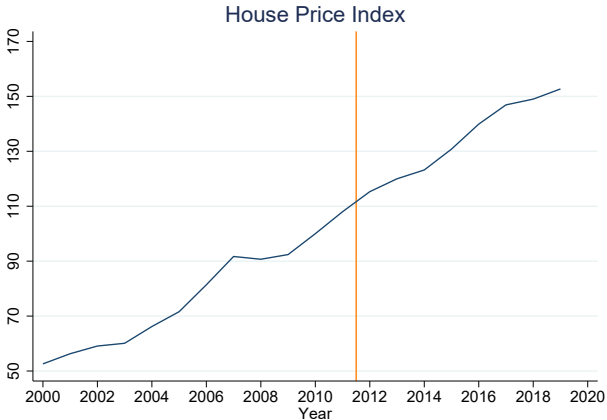


Consumption or Income?

	ln(Income)			ln(Consumption)		
	(1)	(2)	(3)	(4)	(5)	(6)
Renter × Post	0.0289***	0.0295***	0.0147***	0.135***	0.135***	0.108***
	(9.36)	(9.23)	(9.26)	(21.64)	(21.51)	(13.85)
Renter	-0.641***	-0.642***		-0.954***	-0.955***	
	(-87.28)	(-86.55)		(-112.22)	(-112.29)	
Post	0.211***			0.208***		
	(187.87)			(24.33)		
Fixed Effects:						
Year FE		✓	✓		✓	✓
Household FE			✓			✓
Obs.	9,150,918	9,150,918	9,139,463	9,150,918	9,150,918	9,139,463
R^2	0.126	0.138	0.838	0.107	0.112	0.766
Mean(Dependent Var.)	12.981			12.450		

Back

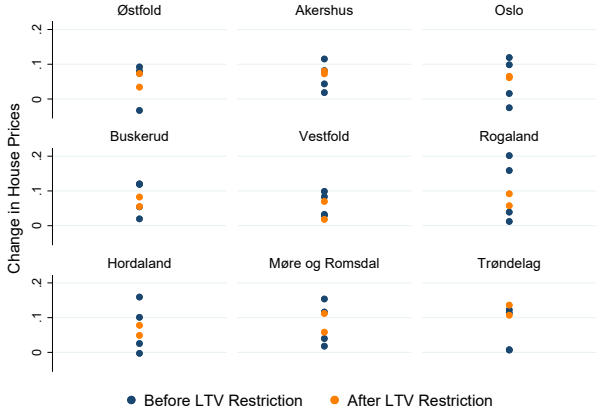
House Prices



The aggregate house price index does not suggest a big effect

back

House Prices



The regional house price growth rates are similar to the previous ones

Stock Market Participation - Norway

Table 1: Summary statistics

	Mean	Std. dev	P10	Median	P90	P99
Demographics						
Age (in years)	48.87	18.00	26	47	74	90
Male	0.51	0.50	0	1	1	1
Single	0.36	0.48	0	0	1	1
College degree	0.35	0.48	0	0	1	1
Income and wealth ($'000s)						
Total income	41.06	63.20	17.63	36.51	64.45	135.22
Financial wealth	74.27	1,695.97	0.47	12.53	123.51	774.35
Financial wealth in public equity	7.44	233.43	0	0	9.52	132.23
Non-financial wealth	199.96	308.21	0	154.35	471.92	1,115.31
Gross wealth	271.59	1,745.58	1.11	182.81	570.79	1,640.21
Net wealth	180.88	1,724.07	-38.78	67.23	463.62	1,424.09
Participation and wealth shares						
Invest in stock market	0.25	0.43	0	0	1	1
Hold mutual funds	0.21	0.41	0	0	1	1
Hold listed stocks	0.08	0.27	0	0	0	1
Cond. risky share (of gross wealth)	0.09	0.17	0.00	0.02	0.26	0.87
Cond. risky share (of fin. wealth)	0.28	0.28	0.01	0.18	0.74	0.98
Observations	4.13m					

Notes. This table provides summary statistics using data from 2016. The first block gives summary statistics for demographic characteristics. *Single* is a binary variable equal to 1 if the individual is neither married nor cohabiting, and zero otherwise. The second block information on income and wealth measured in USD (in thousands) based on an exchange rate of $1=8.62 NOK at the end of 2016. *Total income* is income from all sources. *Public equity* is measured as the sum of holdings in equity mutual funds and listed stocks. The third block gives summary statistics on stock market (i.e., public equity) participation and the share of wealth invested in public equity conditional on holding a nonzero amount of such wealth.

Source: Galaasen & Raja, 2024

Descriptive statistics

	Renters (N = 60,340)	Homebuyers–Pre (N = 13,720)	Homebuyers–Post (N = 13,747)
Total consumption	130,198	180,655	208,937
Food consumption	27,012	30,022	41,862
Furniture consumption	4,703	10,407	10,321
Restaurant consumption	2,632	3,880	7,708
Income	246,466	282,921	334,791
Deposits	136,412	136,167	134,571
Household age	50.82	34.43	34.79
Financial assets	175,631	189,213	285,785
Debt (gjeld)	123,346	283,529	511,194
Immigrant (share)	0.119	0.101	0.132
Parental wealth (bin)	8.851	7.055	6.749
Parental wealth 2009	219,557	318,173	351,553
Household size	1.292	1.588	1.657
Child (share)	0.138	0.252	0.250
Loan-to-value (LTV)	.	0.974	0.727
House price	.	1,539,787	2,452,764
Housing wealth	4.524	36.748	267,551

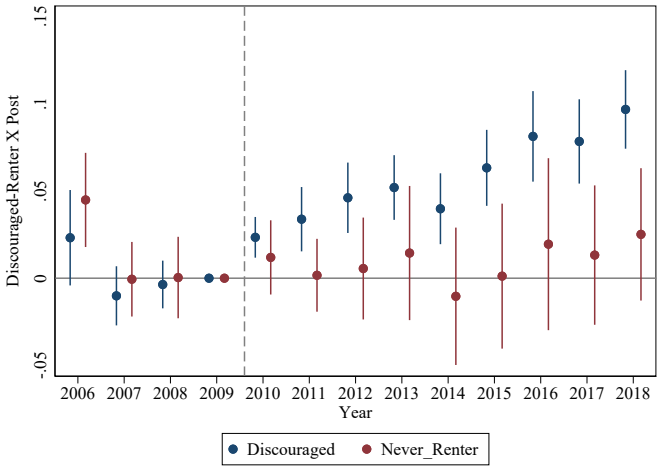
Descriptive statistics - Within Renter

Variable	Always Renters (N = 18,102)	Discouraged Renters (N = 42,238)
Total consumption	169,377	113,407
Food consumption	35,051	23,568
Furniture consumption	6,487	3,938
Restaurant consumption	2,958	2,492
Income	293,092	226,485
Deposits	266,240	80,772
Household age	59.96	46.91
Financial assets	374,343	90,468
Debt (gjeld)	210,431	86,023
Immigrant (share)	0.113	0.120
Parental wealth bin (2009)	9.567	8.544
Parental wealth (2009)	225,730	217,998
Household size	1.493	1.205
Child (share)	0.128	0.143

Policy rate

Source: Norges Bank

Within Renter Control and Treated



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Homebuyers

Empirical Strategy-Homebuyers

- Challenge in homebuyer analysis: Home purchase affects consumption
  - → Aim is to estimate the restriction's effect in addition to the home purchase effect
  - → Compare homebuyers in 2013 ($HB'13$) to homebuyers in 2009 ($HB'09$)
  - → Due to home purchases in different years, use homeowners to control for time effects
  - → Model the home purchase effect explicitly

$$
\begin{aligned}
y_{it} = & \beta_1 \, HB'13 \times Prepurchase + \beta_2 \, HB'13 \times Purchase + \beta_3 \, HB'13 \times Postpurchase \\
& \gamma_1 HB \times Prepurchase + \gamma_2 HB \times Purchase + \gamma_3 HB \times Postpurchase \\
& \alpha_1 HB'13 + \alpha_2 HB + \alpha_3 Prepurchase + \alpha_4 Purchase + \alpha_5 Postpurchase + \epsilon_{it}
\end{aligned}
$$

- **Identifying assumption**
  1. Without the restriction, the difference between $HB'13$ and $HB'09$ would be the same
     → Time effects are differenced out by using homeowners
  2. The restriction should not change the homebuyer characteristics

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Consumption Dynamics around the Home Purchase

	Consumption/Income		
	(1)	(2)	(3)
HB'13 × Prepurchase	0.0237**	-0.0238*	-0.0206*
	(1.97)	(-1.91)	(-1.79)
HB'13 × Purchase	-0.0176	-0.0302**	-0.0272**
	(-1.43)	(-2.49)	(-2.13)
HB'13 × Postpurchase	-0.0186	-0.0563***	-0.0475***
	(-1.49)	(-4.68)	(-4.35)
Prepurchase	-0.0493***	0.00571	0.00368
	(-3.88)	(0.56)	(0.39)
Purchase	0.0312*	0.0708***	0.0695***
	(1.82)	(5.29)	(5.58)
Postpurchase	-0.0137	0.0402***	0.0361***
	(-0.65)	(2.92)	(3.34)
HB'09	-0.0509***	-0.0997***	
	(-4.58)	(-13.63)	
HB'13	-0.0297**	0.00969	
	(-2.18)	(0.83)	
Fixed Effects:			
Year FE		✓	✓
Household FE			✓
Obs.	7,240,872	7,240,872	7,233,040
R^2	0.000	0.002	0.416
Mean(Dependent Var.)	0.671		

HB'13 have lower consumption before and after the home purchase

Homebuyers-Matching

	HB'13	HB'09		HB'09-Matched	
	Mean	Mean	Diff.	Mean	Diff.
Consumption	147.77	150.93	3.17	151.47	3.70
Income	255.14	245.74	-9.40*	255.10	-0.04
Consumption/Income	0.63	0.64	0.01	0.63	0.00
Deposits	111.61	107.89	-3.72	115.06	3.44
Financial Assets	148.62	144.03	-4.59	153.28	4.66
Debt	192.55	177.99	-14.55	186.11	-6.44
Net Savings	-43.93	-33.97	9.96	-32.83	11.10
Age	32.93	32.63	-0.30	33.12	0.19
# of Adults	1.31	1.38	0.06***	1.34	0.03
# of Children	0.19	0.19	0.01	0.19	0.01
Observations	4826			3103	

Matching reduces the differences

Homebuyers-Matching

Matched Sample	Consumption/Income		
	(1)	(2)	(3)
HB'13 × Prepurchase	0.00774	-0.0400***	-0.0363**
	(0.52)	(-2.59)	(-2.48)
HB'13 × Purchase	-0.0286*	-0.0413**	-0.0363**
	(-1.74)	(-2.59)	(-2.26)
HB'13 × Postpurchase	-0.0302*	-0.0679***	-0.0606***
	(-1.77)	(-4.20)	(-4.31)
Prepurchase	-0.0321**	0.0229*	0.0205
	(-1.98)	(1.66)	(1.59)
Purchase	0.0441**	0.0836***	0.0805***
	(2.10)	(4.98)	(5.52)
Postpurchase	0.000459	0.0543***	0.0519***
	(0.02)	(3.03)	(3.97)
HB	-0.0740***	-0.123***	
	(-4.86)	(-11.17)	
HB'13	-0.00897	0.0304*	
	(-0.49)	(1.87)	
Fixed Effects:			
Year FE		✓	✓
Household FE			✓
Obs.	7,220,875	7,220,875	7,213,047
R^2	0.000	0.002	0.417
Mean(Dependent Var.)	0.672		

The decline in consumption gets larger