

Real Effects of Relaxing Financial Constraints for Homeowners: Evidence from Danish Firms

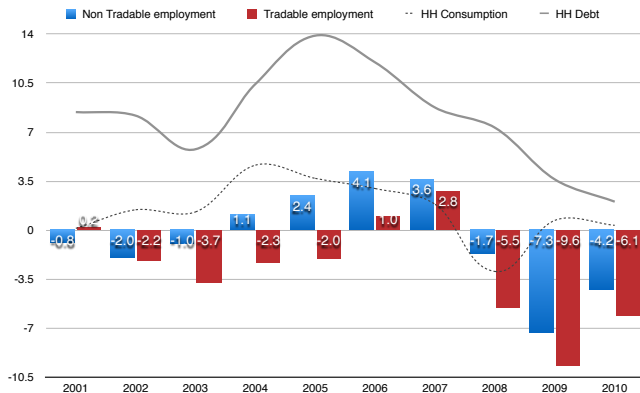
Alessia De Stefani ¹ Julia Moertel ²

¹Danmarks Nationalbank ²University of Edinburgh

Household Finance and Consumption Conference,
December 16 2019

The views expressed in this presentation are those of the authors and do not necessarily coincide with the

Motivation: The Danish economy in boom and bust



Growth Rates, year-on-year. Source: Statistics Denmark

Research question

Does a shift in credit supply **to households** amplify job creation and destruction over the business cycle?

Channel: **consumer demand**

Research question

Does a shift in credit supply **to households** amplify job creation and destruction over the business cycle?

Channel: **consumer demand**

Firms react to changes in spending capacity by changing employment levels and prices (Mian et al., 2014 ECMT; Mian, Sufi and Verner, 2017; Di Maggio and Kermani, 2017 RFS; Stroebele and Vavra, JPE 2019)

Research question

Does a shift in credit supply **to households** amplify job creation and destruction over the business cycle?

Channel: **consumer demand**

Firms react to changes in spending capacity by changing employment levels and prices (Mian et al., 2014 ECMT; Mian, Sufi and Verner, 2017; Di Maggio and Kermani, 2017 RFS; Stroebele and Vavra, JPE 2019)

This paper

- Which jobs are affected by credit-fuelled cycles?
- How do new hires fare once the boom subsides?

Preview of results

We focus on the introduction of interest-only (IO) mortgages in 2003

Preview of results

We focus on the introduction of interest-only (IO) mortgages in 2003

- IO mortgages alter consumption paths: free resources from housing to non-housing expenditure.
- Cumulative expenditure shock of **15 bln DKK** between 2004 and 2010 (1% increase from 2002 consumption);

Preview of results

We focus on the introduction of interest-only (IO) mortgages in 2003

- IO mortgages alter consumption paths: free resources from housing to non-housing expenditure.
- Cumulative expenditure shock of **15 bln DKK** between 2004 and 2010 (1% increase from 2002 consumption);
- Firms respond to increase in demand by hiring more workers. Preliminary estimate: 23000 jobs 2004-2010 (5 to 10% of net job creation in any given year) ;

Preview of results

We focus on the introduction of interest-only (IO) mortgages in 2003

- IO mortgages alter consumption paths: free resources from housing to non-housing expenditure.
- Cumulative expenditure shock of **15 bln DKK** between 2004 and 2010 (1% increase from 2002 consumption);
- Firms respond to increase in demand by hiring more workers. Preliminary estimate: 23000 jobs 2004-2010 (5 to 10% of net job creation in any given year) ;
- Jobs concentrated in **non-tradable** firms, and characterized as **low-skilled positions**;

Preview of results

We focus on the introduction of interest-only (IO) mortgages in 2003

- IO mortgages alter consumption paths: free resources from housing to non-housing expenditure.
- Cumulative expenditure shock of **15 bln DKK** between 2004 and 2010 (1% increase from 2002 consumption);
- Firms respond to increase in demand by hiring more workers. Preliminary estimate: 23000 jobs 2004-2010 (5 to 10% of net job creation in any given year) ;
- Jobs concentrated in **non-tradable** firms, and characterized as **low-skilled positions**;
- Workers employed in these positions face shorter tenure at workplace and a **higher degree of unemployment ex-post**

Roadmap

Empirical analysis in two steps

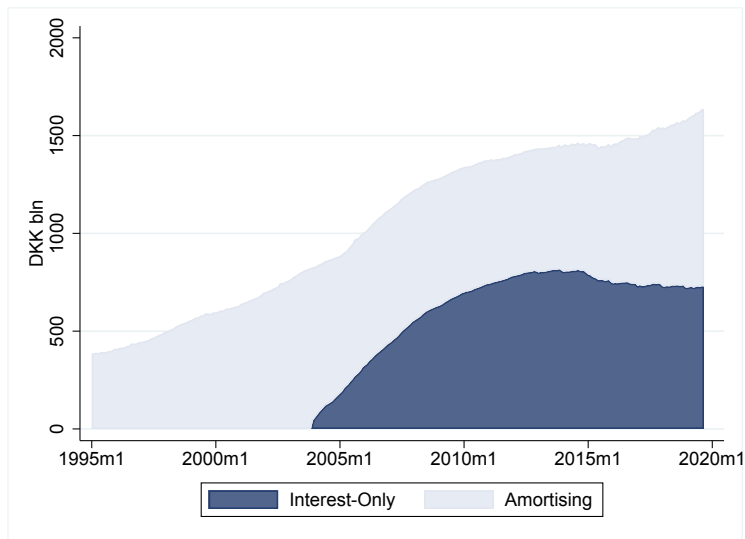
- 1 Effect of exogenous shift in credit availability on household expenditure

Roadmap

Empirical analysis in two steps

- 1 Effect of exogenous shift in credit availability on household expenditure
- 2 Estimate effect of credit-induced expenditure shift on job creation and job characteristics

Introduction of interest-only mortgages in 2003



IO mortgages and Expenditure

IO borrowers avoid repayment of mortgage principal for up to 10 years

IO mortgages and Expenditure

IO borrowers avoid repayment of mortgage principal for up to 10 years

Increase in debt and consumption of **financially constrained households** (Larsen et.al, 2019)

IO mortgages and Expenditure

IO borrowers avoid repayment of mortgage principal for up to 10 years

Increase in debt and consumption of **financially constrained households** (Larsen et.al, 2019)

We don't observe IO uptake before 2009: use liquidity-constraints ex-ante as a proxy

Difference-in-Differences

Compare expenditure changes before/after the reform for households:

- With different levels of liquidity **ex-ante**;
- Similar according to age, income, family composition, wealth, city of residence

Difference-in-Differences

Compare expenditure changes before/after the reform for households:

- With different levels of liquidity **ex-ante**;
- Similar according to age, income, family composition, wealth, city of residence

$$\Delta C_{h,t} = \alpha + \beta_1 D_{h,2002} + \gamma^l X_{h,2002} + \epsilon_{h,t} \quad (1)$$

Difference-in-Differences

Compare expenditure changes before/after the reform for households:

- With different levels of liquidity **ex-ante**;
- Similar according to age, income, family composition, wealth, city of residence

$$\Delta C_{h,t} = \alpha + \beta_1 D_{h,2002} + \gamma^l X_{h,2002} + \epsilon_{h,t} \quad (1)$$

Where

- $\Delta C_{h,t}$ is the change in annual consumption for household h in year t (2004-2010) Imputation

Difference-in-Differences

Compare expenditure changes before/after the reform for households:

- With different levels of liquidity **ex-ante**;
- Similar according to age, income, family composition, wealth, city of residence

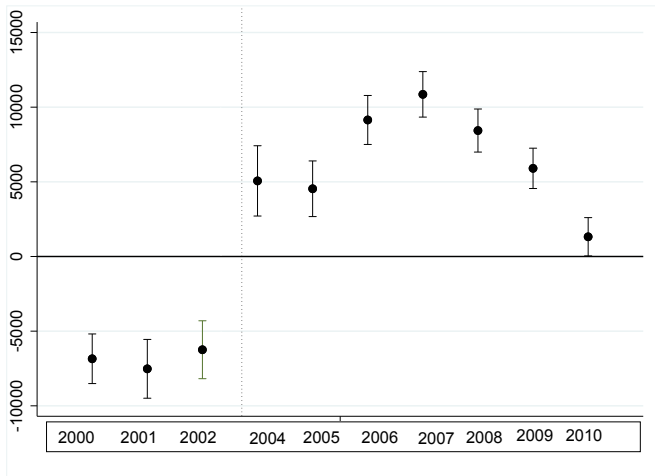
$$\Delta C_{h,t} = \alpha + \beta_1 D_{h,2002} + \gamma' X_{h,2002} + \epsilon_{h,t} \quad (1)$$

Where

- $\Delta C_{h,t}$ is the change in annual consumption for household h in year t (2004-2010) Imputation
- $D_{h,2002}$ is a dummy indicating whether the family had liquid **savings < 1.5 months of income** at the end of 2002 (Leth-Petersen, AER 2010) Savings

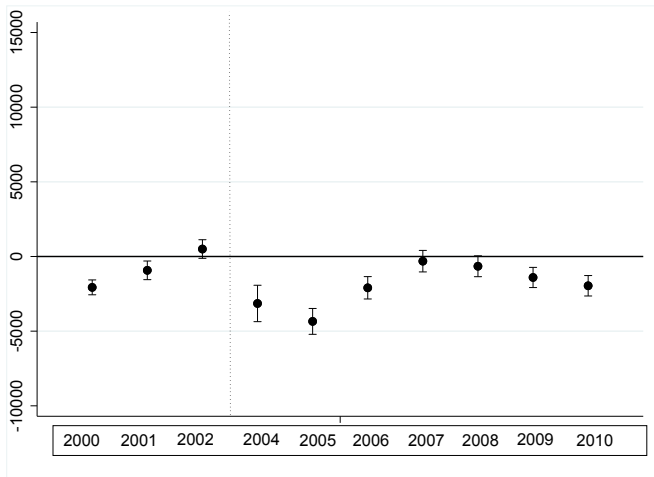
Results: homeowners' consumption

$$\Delta C_{h,t}^H = \alpha + \beta_1 D_{h,2002} + \gamma^l X_{h,2002} + \epsilon_{h,t} \quad (2)$$

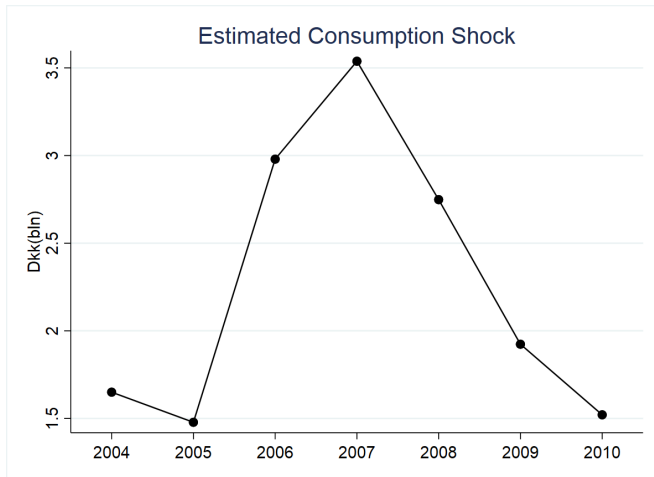


Placebo: renters' consumption

$$\Delta C_{h,t}^R = \alpha + \beta_1 D_{h,2002} + \gamma^l X_{h,2002} + \epsilon_{h,t} \quad (3)$$



Estimated Aggregate Expenditure Shift



Linking households and firms

How to link household consumption to the decisions of firms?

Linking households and firms

How to link household consumption to the decisions of firms?

- Exploit **regional variation**: municipalities with a higher number of liquidity-constrained homeowners should experience relatively larger expenditure shift after 2003;

Linking households and firms

How to link household consumption to the decisions of firms?

- Exploit **regional variation**: municipalities with a higher number of liquidity-constrained homeowners should experience relatively larger expenditure shift after 2003;
- Multiply average consumption effect in each year after the reform by the number of constrained homeowners living in the municipality before the reform

Linking households and firms

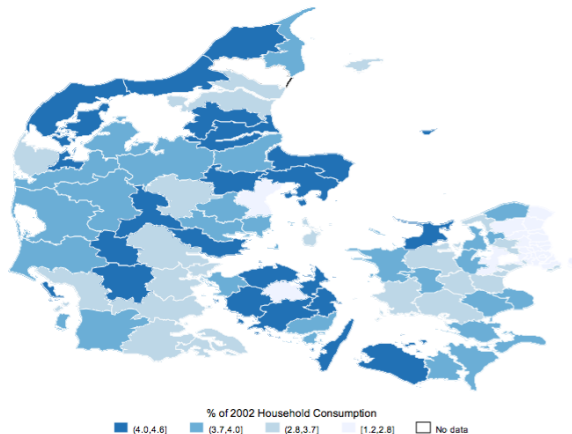
How to link household consumption to the decisions of firms?

- Exploit **regional variation**: municipalities with a higher number of liquidity-constrained homeowners should experience relatively larger expenditure shift after 2003;
- Multiply average consumption effect in each year after the reform by the number of constrained homeowners living in the municipality before the reform

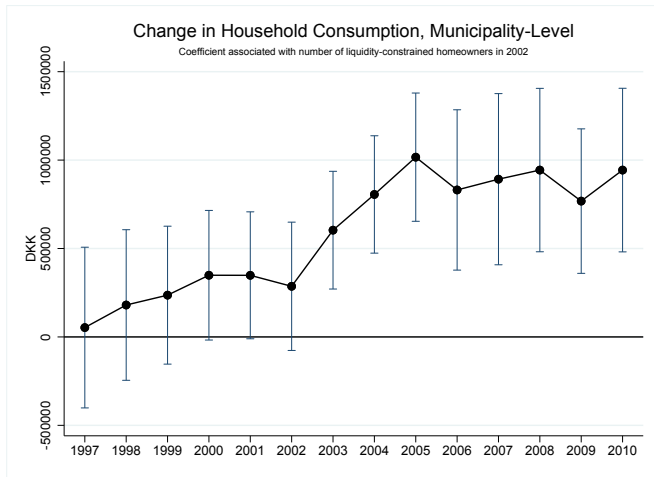
$$C_{mt} = \alpha_{1,t} * N_{2002,m} \quad (4)$$

Example

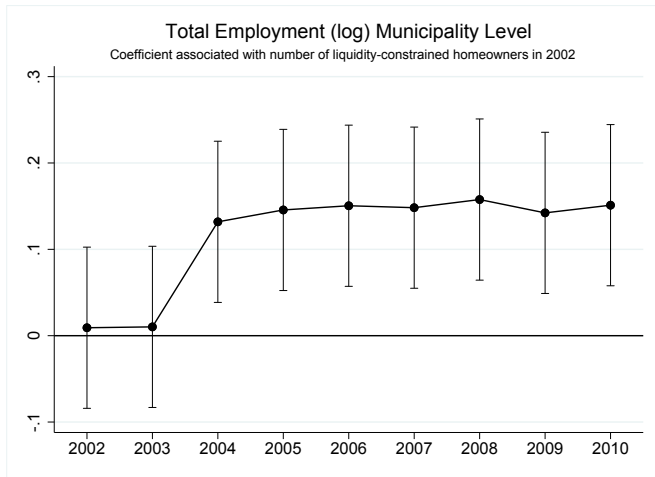
Cumulative consumption shock: 2004–2010



Regional pre-trends:Consumption



Regional pre-trends: Employment



Effects of the reform on employment: model

Panel at the establishment level:

Effects of the reform on employment: model

Panel at the establishment level:

$$Y_{efmt} = \alpha + \beta_1 C_{mt} + \beta_2 X_{f,t-1}^l + \beta_3 \log(HP_{m,t-1}) + \psi_m + \theta_f + \phi_t + \epsilon_{ifmt}$$

Where:

Y_{efmt} is employment in establishment e , located in municipality m and belonging to firm f , in year t

Effects of the reform on employment: model

Panel at the establishment level:

$$Y_{efmt} = \alpha + \beta_1 C_{mt} + \beta_2 X_{f,t-1}^l + \beta_3 \log(HP_{m,t-1}) + \psi_m + \theta_f + \phi_t + \epsilon_{ifmt}$$

Where:

Y_{efmt} is employment in establishment e , located in municipality m and belonging to firm f , in year t

Conditional on:

Effects of the reform on employment: model

Panel at the establishment level:

$$Y_{efmt} = \alpha + \beta_1 C_{mt} + \beta_2 X_{f,t-1}^l + \beta_3 \log(\text{HP}_{m,t-1}) + \psi_m + \theta_f + \phi_t + \epsilon_{ifmt}$$

Where:

Y_{efmt} is employment in establishment e , located in municipality m and belonging to firm f , in year t

Conditional on:

- Firm time-varying characteristics;
- Regional house price developments;
- Firm, municipality and time FE

Employment Effects of the Consumption Shock

VARIABLES	(1) log Employment All	(2) log Employment Non Tradables	(3) log Employment Tradables	(4) log Employment All
log Consumption	0.309*** (0.057)	0.432*** (0.057)	0.193*** (0.063)	0.318*** (0.054)
Tradable				0.346** (0.148)
log Cons. x Trad.				-0.028*** (0.010)
log House Price	-0.009 (0.016)	-0.007 (0.019)	0.004 (0.027)	-0.006 (0.016)
log Assets	0.064*** (0.003)	0.056*** (0.003)	0.077*** (0.006)	0.064*** (0.003)
log Investment	0.012*** (0.001)	0.010*** (0.001)	0.013*** (0.002)	0.012*** (0.001)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Observations	367,368	243,845	117,239	367,368
R-squared	0.751	0.780	0.679	0.751

Source: Data from Statistics Denmark, 2004-2010. Notes: Dependent variable is annual number of employees at the establishment level, in logs. Consumption includes the values for municipality and time varying consumption shifts (C_{mt}), in logs. Tradable is a dummy for whether firm is defined as tradable. Tradable firms are those with import-export larger than 70,000 DKK per employee in any given year. House prices are measured at the municipality level and are an average per square meter, in logs. Total assets, Investments are defined at the firm-level and are end-year values based on the tax records, in logs. Standard errors are in parentheses and clustered at the municipality-level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

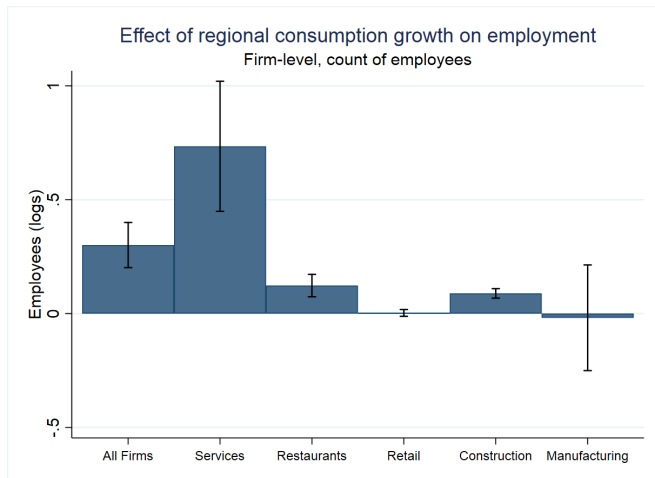
Employment Effects: Controlling for Credit Supply to Firm

VARIABLES	(1)	(2)	(3)	(4)
Sample	Employment All	Employment Non Tradables	Employment Tradables	Employment All
Consumption	0.285*** (0.054)	0.372*** (0.109)	0.207*** (0.055)	0.312*** (0.048)
Consumption x Tradable				-0.056** (0.022)
House Price	0.022 (0.036)	0.073 (0.088)	-0.015 (0.051)	0.020 (0.037)
Firm x Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Observations	132,152	66,165	65,987	132,152
R-squared	0.528	0.536	0.501	0.528

Source: Data from Statistics Denmark, registries FIRE, FIDA, FIRM, 2004-2010. Notes: The dependent variable is the number of employees measured at the level of establishments (workplaces) in any given year, defined as head-count and in a logarithmic scale. Consumption includes the values for municipality and time varying consumption shifts (previously defined as C_{mt}) in a logarithmic scale. Tradable is a dummy that takes value one if a firm is defined as tradable. Tradable firms are defined as those with import-export larger than 70,000 DKK per employee in any given year. House prices are measured at the municipality level and are an average per square meter based on home values estimated through tax records, in a logarithmic scale. Standard errors in parentheses are clustered at the municipality-level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Employment grows in non-tradable sector

Retail



Characteristics of new matches

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	
	Age _{i,t}	Exp _{i,t}	Uni _{i,t}	High _{i,t}	Interm _{i,t}	Low _{i,t}	
	Years			Head count			
log Consumption	-0.821*** (0.086)	-1.115*** (0.064)	-0.005*** (0.001)	0.071 (0.058)	0.216** (0.088)	0.693*** (0.228)	
Age _{i,2002}	0.298*** (0.014)						
Exp _{i,2002}		0.374*** (0.018)					
Uni _{i,2002}			0.291*** (0.032)				
High _{i,2002}				0.257*** (0.024)			Source: Data
Interm _{i,2002}					0.280*** (0.046)		
Low _{i,2002}						0.312*** (0.062)	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	205,772	205,710	202,887	146,582	146,582	146,582	
R-squared	0.552	0.554	0.512	0.559	0.368	0.407	

from Statistics Denmark, 2002-2011. Notes: The dependent variables in cols 1-3 are measured as yearly averages for each establishment of the following characteristics of new hires: age (years); experience (years); university degrees (head count). Cols 3-6 measures the number of new matches classified as requiring high, intermediate or low skills, respectively. Standard errors in parentheses are clustered at the municipality-level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Tenure and Unemployment Ex-Post

VARIABLES	(1)	(2)
	Tenure _{i,t} Years (ex-post)	Unemp _{i,t} % Year (ex post)
log Consumption	-0.026*** (0.003)	0.0466*** (0.0116)
Tenure _{i,2002}	0.131*** (0.008)	
Unemp _{i,2002}		0.820*** (0.014)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Municipality FE	Yes	Yes
Controls	Yes	Yes
Observations	276,441	154,444
R-squared	0.916	0.576

Source: Data from Statistics Denmark, 2002-2011. Notes: Cols 1 & 2 measure yearly averages for each establishment of two forward-looking measures: length of tenure (years) for new hires and average yearly share in unemployment for new hires in the future (percent). Standard errors in parentheses are clustered at the municipality-level. ***

$p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Conclusions

- 1 IO reform creates expenditure and jobs, concentrated in non-tradable firms/sectors;
- 2 The new jobs are mostly classified as low-skilled positions;
- 3 New hires experience earlier separations and a higher degree of unemployment ex-post;

Conclusions

- 1 IO reform creates expenditure and jobs, concentrated in non-tradable firms/sectors;
 - 2 The new jobs are mostly classified as low-skilled positions;
 - 3 New hires experience earlier separations and a higher degree of unemployment ex-post;
- By feeding into NT sector, credit-fuelled consumption booms create jobs that are particularly subject to business cycle fluctuations (low-skilled positions)
 - Volatility of employment for low skilled workers hired in this episode is amplified vis-a-vis baseline; possibly, a function of lower matching quality

Consumption imputation

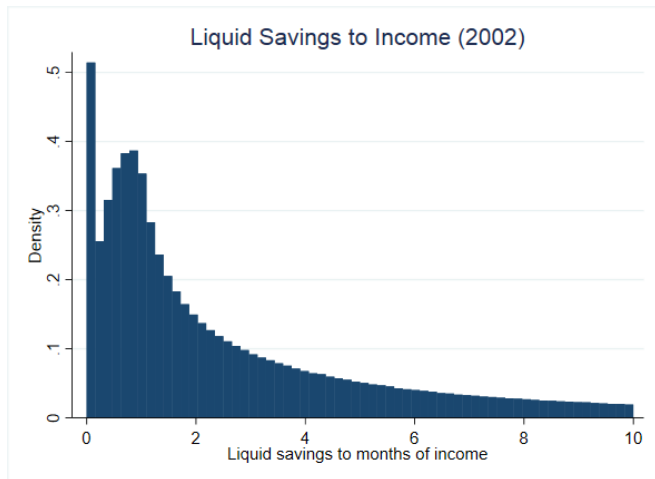
Consumption is **imputed** from Danish administrative wealth and income registries. Follow methodology in Browning and Leth-Petersen (EJ, 2003), Leth-Petersen (AER, 2010), Jensen and Johannesen (AER, 2017) among others

$$\text{Consumption}_{h,t} = \text{DisposableIncome}_{h,t} - (\text{NetWealth}_{h,t} - \text{NetWealth}_{h,t-1}) \quad (5)$$

- Disposable income is income minus all taxes;
- Net wealth is the difference between assets and debts at the end of the year;
- Assets are bank deposits, stocks, bonds, pension savings and housing;
- Debts are mortgage and non-mortgage loans;
- Passive housing revaluation is excluded;
- Passive increase in stock/bond/pension proxied by stock/bond market indices.

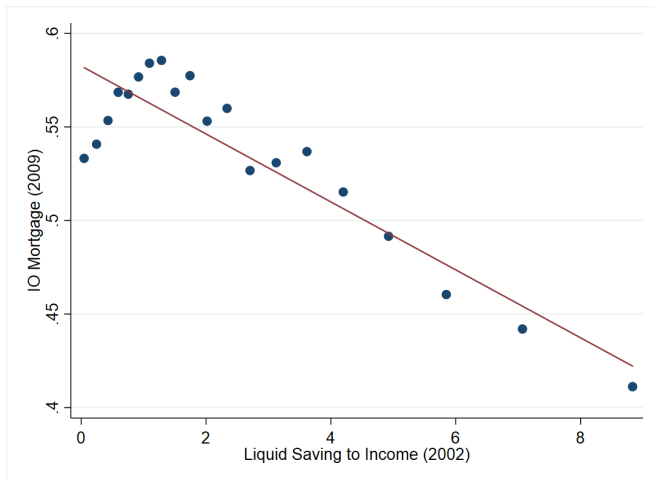
[back](#)

Distribution of Savings in 2002



[back](#)

IO Ownership in 2009 and Savings in 2002



[back](#)

Table: Homeowners' income changes [back](#)

VARIABLES	(1) ΔI_{00}	(2) ΔI_{01}	(3) ΔI_{02}	(4) ΔI_{04}	(5) ΔI_{05}	(6) ΔI_{06}
Constrained ₂₀₀₂	-4.3*** (0.34)	-5.6*** (0.34)	-4.9*** (0.32)	1.9*** (0.41)	2.0*** (0.40)	0.76* (0.41)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Family Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99,465	99,471	99,472	99,491	99,487	99,455
R-squared	0.137	0.139	0.169	0.060	0.112	0.182

VARIABLES	(7) ΔI_{07}	(8) ΔI_{08}	(9) ΔI_{09}	(10) ΔI_{10}
Constrained ₂₀₀₂	-1.3*** (0.42)	-0.9*** (0.45)	-4.0*** (0.45)	-4.9*** (0.49)
Municipality FE	Yes	Yes	Yes	Yes
Family Controls	Yes	Yes	Yes	Yes
Observations	99,421	99,387	99,347	99,305
R-squared	0.294	0.336	0.407	0.441

Source: Registry data, Danish population, 1996-2010. Notes: Results include only a balanced panel of households that were recorded as homeowners for tax purposes in the year 2002 and never moved or changed tenure status through the sample period. Coefficients to be interpreted in thousands of Danish Kronas. The dependent variable is the within-household change in the moving average of disposable income for each given year from before and after the reform. Household level controls include the house value in 2002 (logs); annual household income (logs); age of the household head (defined as the person with the highest income); number of family members and number of children in 2002. standard errors in parentheses are robust to heteroskedasticity.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table: Homeowners' mortgages [back](#)

VARIABLES	(1) ΔM_{2000}	(2) ΔM_{2001}	(3) ΔM_{2002}	(4) ΔM_{2004}	(5) ΔM_{2005}	(6) ΔM_{2006}
Constrained ₂₀₀₂	50.6*** (1.44)	46.8*** (1.47)	32.2*** (1.48)	54.6*** (1.57)	62.5*** (1.70)	80.5*** (1.88)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Family Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99,465	99,471	99,472	99,491	99,487	99,455
R-squared	0.114	0.093	0.089	0.036	0.072	0.106

VARIABLES	(7) ΔM_{2007}	(8) ΔM_{2008}	(9) ΔM_{2009}	(10) ΔM_{2010}
Constrained ₂₀₀₂	98.4*** (2.07)	114.9*** (2.25)	131.8*** (2.44)	149.1*** (2.60)
Municipality FE	Yes	Yes	Yes	Yes
Family Controls	Yes	Yes	Yes	Yes
Observations	99,421	99,387	99,347	99,305
R-squared	0.130	0.147	0.163	0.179

Source: Registry data, Danish population, 1996-2010. Notes: Results include only a balanced panel of households that were recorded as homeowners for tax purposes in the year 2002 and never moved or changed tenure status through the sample period. Coefficients to be interpreted in thousands of Danish Kronas. The dependent variable is the within-household change in the moving average of mortgages for each given year from before and after the reform. Household level controls include the house value in 2002 (logs); annual household income (logs); age of the household head (defined as the person with the highest income); number of family members and number of children in 2002. standard errors in parentheses are robust to heteroskedasticity.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table: House Prices [back](#)

VARIABLES	(1) Delta HP 2005	(2) Delta HP 2006	(3) Delta HP 2007	(4) Delta HP 2008	(5) Delta HP 2009	(6) Delta HP 2010
Constrained ₂₀₀₂	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.000)
Observations	99,393	99,425	99,416	99,457	99,427	99,406
R-squared	0.201	0.143	0.147	0.168	0.107	0.151

Cross-Sectional Reform Intensity

$$C_{mt} = \alpha_{1,t} * N_{2002,m} \quad (6)$$

→ $\alpha_{1,t}$ measures the avg. effect of the reform on constrained homeowners which we estimated in the DiD setup, for each **year** t after the reform (2004-2010)

Cross-Sectional Reform Intensity

$$C_{mt} = \alpha_{1,t} * N_{2002,m} \quad (6)$$

→ $\alpha_{1,t}$ measures the avg. effect of the reform on constrained homeowners which we estimated in the DiD setup, for each **year** t after the reform (2004-2010)

→ $N_{2002,m}$ defines the number of constrained homeowners (hh) in 2002 in each **municipality** m

Cross-Sectional Reform Intensity

$$C_{mt} = \alpha_{1,t} * N_{2002,m} \quad (6)$$

→ $\alpha_{1,t}$ measures the avg. effect of the reform on constrained homeowners which we estimated in the DiD setup, for each **year** t after the reform (2004-2010)

→ $N_{2002,m}$ defines the number of constrained homeowners (hh) in 2002 in each **municipality** m

- $\alpha_{1,2004} = 5.1$, or 5,100 DKK

Copenhagen: $N_{2002,m} = 12,100$

→ $C_{CPH,04} = 5,100 * 12,100 = 62$ mln DKK (10 mln USD)

Roskilde: $N_{2002,Ros} = 3,596$

→ $C_{Ros,04} = 5,100 * 3,596 = 18$ mln DKK (3 mln USD)

Table: Employment effects: retail sector

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Sector	Empl. Motors	Empl. Food	Empl. Technology	Empl. Household	Empl. Clothes	Empl. Recreation
Consumption (log)	0.050*** (0.014)	-0.063*** (0.013)	-0.028 (0.038)	0.023 (0.019)	0.140** (0.065)	0.305** (0.117)
Constant	0.087 (0.720)	2.527*** (0.644)	1.290 (1.421)	2.046** (0.861)	-1.481** (0.668)	-3.864*** (1.334)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,623	22,384	3,007	9,473	16,729	6,036
R-squared	0.811	0.668	0.661	0.767	0.591	0.697

Source: Data from Statistics Denmark, registries FIRE, FIDA, FIRM, 2004-2010. Notes: The dependent variable is the number of employees measured at the level of establishments (workplaces) in any given year, defined as head-count, in a logarithmic scale and per indicated sector. Consumption includes the values for municipality and time varying consumption shifts (previously defined as C_{mt}) in a logarithmic scale. Tradable is a dummy that takes value one if a firm is defined as tradable. Tradable firms are defined as those with import-export larger than 70,000 DKK per employee in any given year. House prices are measured at the municipality level and are an average per square meter based on home values estimated through tax records, in a logarithmic scale. Standard errors in parentheses are clustered at the municipality-level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ [back](#)

Table: Average effects of the reform on employment excluding real estate and construction sector

VARIABLES	(1) Employment All	(2) Employment Non-tradables	(3) Employment Tradables	(4) Employment All
Consumption	0.267*** (0.048)	0.323*** (0.099)	0.200*** (0.052)	0.299*** (0.044)
Tradable x Consumption				-0.063*** (0.021)
Firm x Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Observations	118,663	54,878	63,785	118,663
R-squared	0.528	0.537	0.504	0.528

Source: Data from Statistics Denmark, 2004-2010. Notes: The dependent variable is the number of employees measured at the level of establishments (workplaces) in any given year, defined as head-count and in a logarithmic scale. Consumption includes the values for municipality and time varying consumption shifts (previously defined as C_{mt}) in a logarithmic scale. Tradable is a dummy that takes value one if a firm is defined as tradable. Tradable firms are defined as those with import-export larger than 70,000 DKK per employee in any given year. Real estate and construction sector (NACE2 codes 41,42,43,68,71,81) excluded. Standard errors in parentheses are clustered at the municipality-level, in a logarithmic scale. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[back](#)