What Do 12 Billion Card Transactions Say About House Prices and Consumption?

Knut Are Aastveit[1], Jesper Böjeryd[2], Magnus H. Guldbrandsen[1], Ragnar E. Juelsrud[3], Kasper Roszbach[1,4]

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[1]**Norges Bank**, [2]**Stockholm University**, [3]**University of Oslo**, [4]**Lund University**

Motivation

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- Largest asset on household balance sheet
- Amplification of business cycle, monetary policy, and aggregate financial risk
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- Wealth effect
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Gap 2: Effect on local economy

- Mapping across spending categories

This Paper

1. **Weekly spending data:**
   - by individual, store type, zip code, and year-week
   - linked with administrative register data for the full Norwegian population

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   \+ Stavanger being most exposed region

   = large response in Stavanger home prices (relative less exposed parts of Norway)

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   $=$ large response in Stavanger home prices (relative less exposed parts of Norway)
3. **Government workers:**
   - $\approx$ 30% of labor force
   - Stable and centrally determined wages $\Rightarrow$ similar income process across Norway

Preview of findings

1. Marginal propensity for expenditure (MPX) ≈ 0.036, but **no broad-based decline in spending**:
   - Vehicle, home improvements, and furnishing expenditures drive the response

2. Findings mostly consistent with the role for collateral constraints and home equity extraction
   - MPX increases in measures of leverage, decreases in liquidity and age
   - Less debt uptake going forward
   - Limited effect for renters

3. **Leakage of spending effect**:
   - local effect at least 20% lower due to imports

Outline

Household-level data on consumption, balance sheets and home prices

Expenditure data (Ahn, Galaasen & Mæhlum 2022)

- All Norwegian residents
- Debit card transactions through BankAxept and bank transfers to businesses
- Aggregation level: person $\times$ week $\times$ zip code $\times$ store type
- What is not covered:
  - Cash payments
  - Credit card (but it is imputed from transfers to financial institutions)
- Covers $\approx$ 80% of card payments in Norway

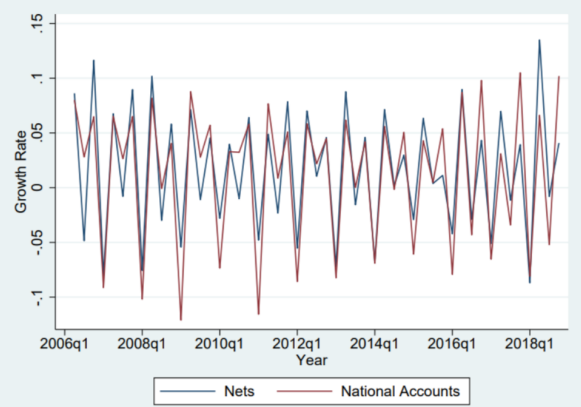
Household registry data

- Detailed income and balance sheet information from Tax Registry
- Demographic and labor market information

Home price data

- Regional home prices from Eiendom Norge

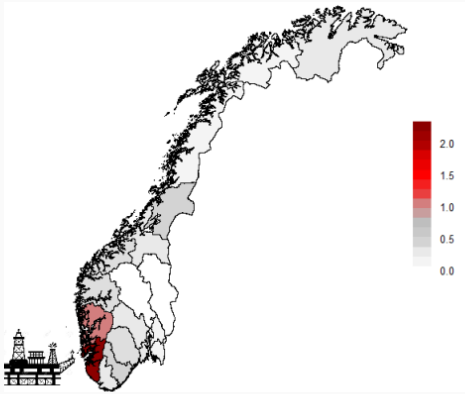
Expenditure data tracks national accounts



Source: Ahn, Galaasen & Mæhlum (2022)

Oil region and oil price

Oil region



Oil price (Brent, USD)

Oil price collapse of 2014 to get variation in housing wealth

Ideal experiment: Random, permanent variation in housing wealth (= random walk)

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Our approximation: Exploit variation in housing wealth induced by **the oil-price collapse of 2014**

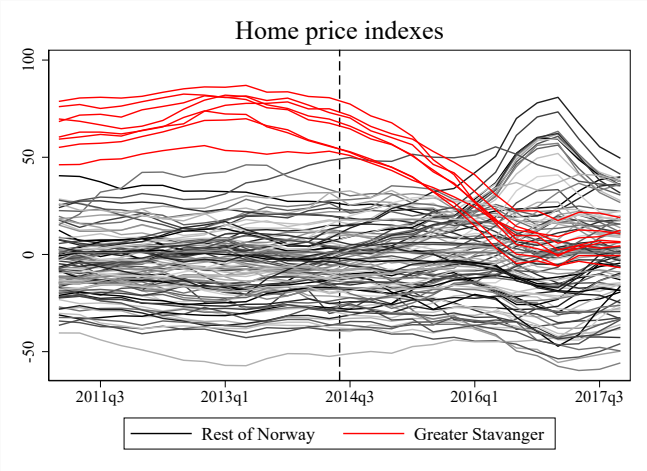
- Regions have differential initial exposure
- Differential development of home prices in 2015–2016

Restrict attention to **government workers**

- Government worker: If $> 50\%$ of adult household members work in gov. sector
- Classification based on 2013 and 2014 (i.e. pre treatment)

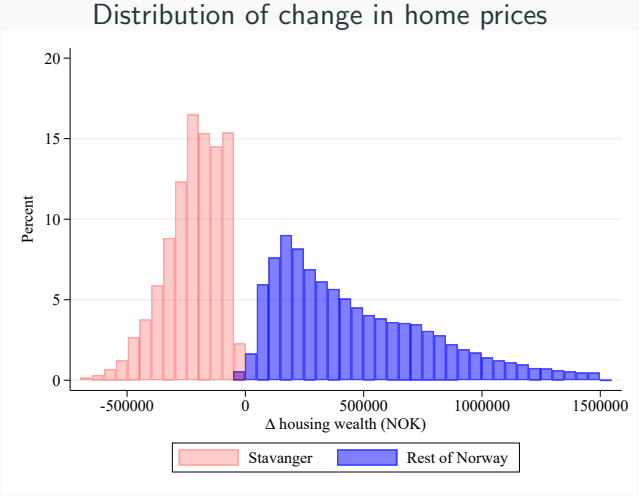
Our empirical design: IV-approach using variation in housing wealth predicted by location Sectoral reallocation Regional reallocation Salience

Large, relative home price decline



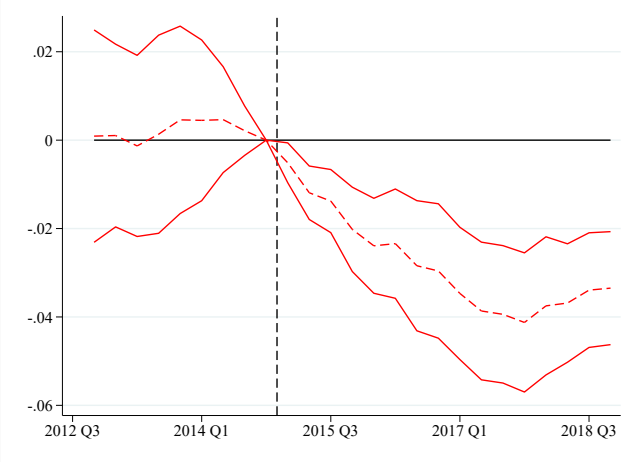
Raw home price indices

Large, relative home price decline



Large relative decline in total spending

Relative log difference in total spending, oil region vs. rest of country



Comparable household groups i

	Oil-region households			Non-oil-region households		
Variable	Mean	Median	SD	Mean	Median	SD
HH head age	46.2	46.0	9.81	47.0	47.0	9.67
HH size	1.85	2.00	0.92	1.88	2.00	0.89
Labor inc.	781,000	680,000	364,000	791,000	705,000	364,000
Capital inc.	12,400	4,050	44,200	11,300	3,700	38,100
Unemp. ins.	1,150	0.00	13,800	2,100	0.00	17,600
Post-tax inc.	618,000	581,000	258,000	627,000	604,000	255,000
Num. households		5,790			111,628	

Comparable household groups ii

	Oil-region households			Non-oil-region households		
Variable	Mean	Median	SD	Mean	Median	SD
Debt	1.84 M	1.70 M	1.32 M	1.64 M	1.49 M	1.16 M
Liquid wealth	0.307 M	0.152 M	0.470 M	0.304 M	0.143 M	0.471 M
Housing wealth	3.51 M	3.29 M	1.35 M	2.79 M	2.56 M	1.28 M
LTV	0.54	0.50	0.38	0.61	0.57	0.46
DTI	2.34	2.25	1.64	2.04	1.94	1.67
Num. households		5,790			111,628	

M = million NOK

Comparable household groups iii

	Oil-region households			Non-oil-region households		
Variable	Mean	Median	SD	Mean	Median	SD
Total consumption	415,000	354,000	275,000	410,000	359,000	261,000
Tradables	146,000	114,000	143,000	147,000	119,000	136,000
Non-tradables	159,000	130,000	135,000	151,000	127,000	123,000
Essentials	104,000	93,800	65,400	105,000	95,000	62,300
Non-essentials	180,000	133,000	186,000	174,000	133,000	171,000
Num. households		5,790			111,628	

Outline

Two steps to the analysis

We want for each spending category k:

$$c^k_{i,2014+\Delta t} - c^k_{i,2014} = \beta_{\Delta t}(hw_{i,2014+\Delta t} - hw_{i,2014})$$

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First-stage: Get variation in housing wealth

$$\Delta hw_{i,2014+\Delta t} \equiv \frac{hw_{i,2014+\Delta t} - hw_{i,2014}}{hw_{i,2014}} = \delta \times oil\ region_{i,2014} + \eta_1 X_{i,2014} + \alpha_1 + \varepsilon_{1\,i,\Delta t} \tag{1}$$

Second stage: Estimate consumption response

$$\frac{c^k_{i,2014+\Delta t} - c^k_{i,2014}}{hw_{i,2014}} = \beta_{\Delta t} \widehat{\Delta hw}_{i,2014+\Delta t} + \eta_2 X_{i,2014} + \alpha_2 + \varepsilon_{2\,i,\Delta t} \tag{2}$$

Relevance condition: Location to isolate variation in housing wealth

Results from first-stage regression

Dependent variable: $\frac{\Delta hw}{hw_0}$	(1)	(2)
oil region$_i$	-0.246***	-0.251***
	(0.013)	(0.015)
First Stage F-test (cluster-robust)	344	293
First Stage F-test (Cragg Donald)	38 253	40 220
With additional hh controls	No	Yes
Num. obs.	118 365	118 365

Exclusion restriction

Identification relies on variation in housing wealth predicted by **location**. Exclusion restriction:

$$\text{Cov}(\text{oil region}_{i,2014}, \varepsilon_{2\,i,\Delta t}) = 0$$

Threats to identification

1. Structural differences in spending patterns not captured in $X_{i,2014}$
2. Local labor market outcomes/outside options
3. Home bias in asset portfolios
4. Peer effects

Threats 2. and 3. – No change in labor income or capital income

Static diff-in-diff, oil region vs. rest of country

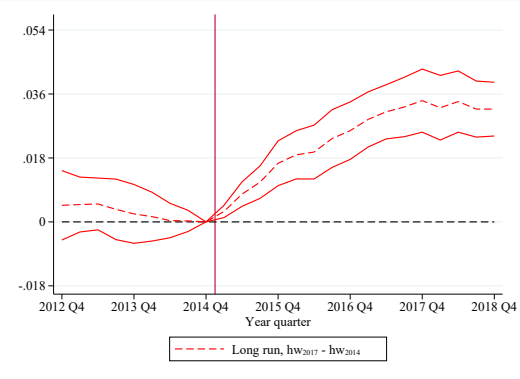
	(1) Log(House Val)	(2) Log(Cons)	(3) Log(Labor Inc)	(4) Capital Inc
Post x Oil region	-0.254***	-0.033***	-0.009	-738
	(0.015)	(0.01)	(0.006)	(527)
R^2	0.989	0.796	0.872	0.322
Household FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Num. obs	820,694	820,549	820,694	820,694

Outline

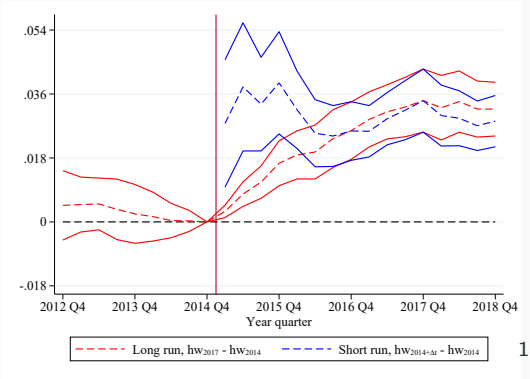
Marginal propensity for expenditure

$$\frac{c^k_{i,2014+\Delta t} - c^k_{i,2014}}{hw_{i,2014}} = \beta_{\Delta t}\, \widehat{\Delta hw}_{i,2014+\Delta t} + \eta_2\, X_{i,2014} + \alpha_2 + \varepsilon_{2\, i,\Delta t}$$

(a) Long-term



(b) Long- and short term

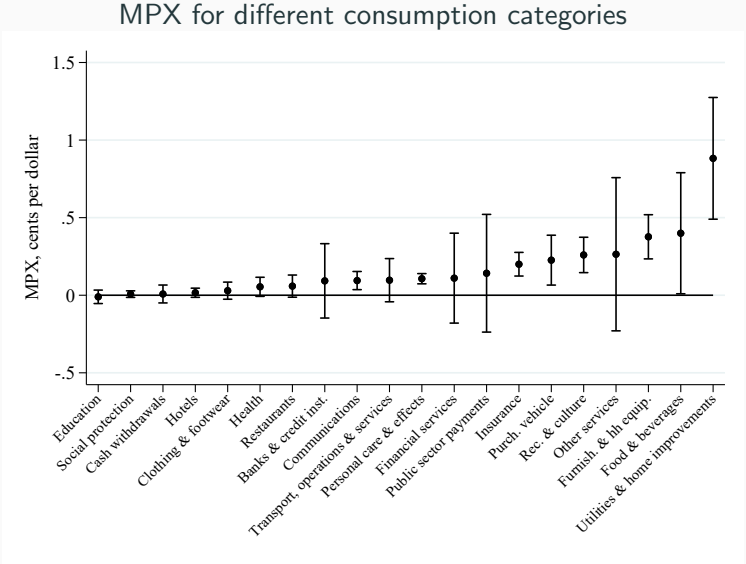


Threat 4. – No major role for peer effects

Comparing consumption response in areas with high vs. low change in unemployment

	$\Delta c/hw_0$	
	High ΔUnempl.	Low ΔUnempl.
$\Delta hw/hw_0$	0.038***	0.030***
	(0.005)	(0.006)
Num. obs	114,347	114,347
Num. clust.	105	105

Effect driven by a few categories



Outline

Why do home prices matter for consumption?

Different views in the literature

Housing as **collateral**

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- Iacoviello (2004), Lustig & Van Nieuwerburgh (2005), Böjeryd et al (2026)
- *Larger* responses for homeowners *close to borrowing constraints*

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Housing as **wealth**

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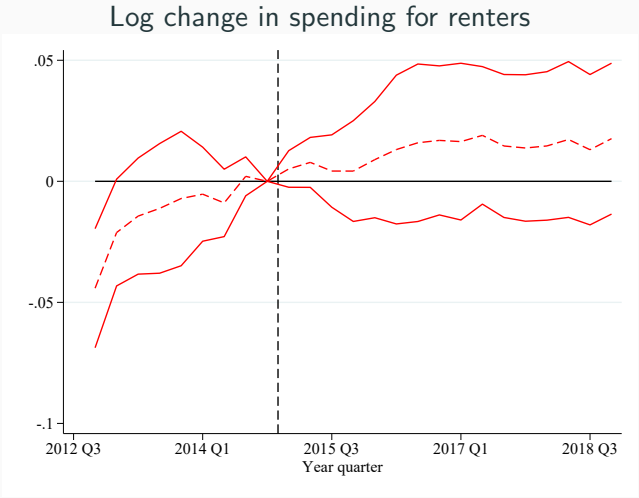
Housing as **wealth**

- Sinai & Souleles (2005), Buiter (2009), Berger et al (2017)
- Sign of wealth effects depend on *expected future net sales* (Fagereng et al 2023)
- Likely *opposite sign* for renters and young households

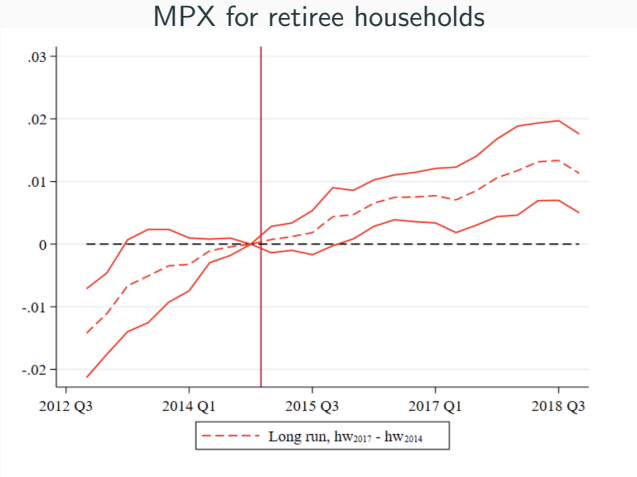
MPX is increasing in leverage and decreasing in liquidity and age

	LTV	DTI	Age	Liquidity
	(1)	(2)	(3)	(4)
MPX, low	0.030***	0.030***	0.041***	0.038***
	(0.005)	(0.005)	(0.004)	(0.006)
MPX, high	0.057***	0.064***	0.028***	0.029***
	(0.009)	(0.009)	(0.006)	(0.006)
Δ MPX	0.028***	0.034***	−0.012**	−0.010
	(0.009)	(0.011)	(0.005)	(0.008)
Cutoff:	90%	4.0	45	200 000
Num. obs.	117 242	117 242	117 242	117 242

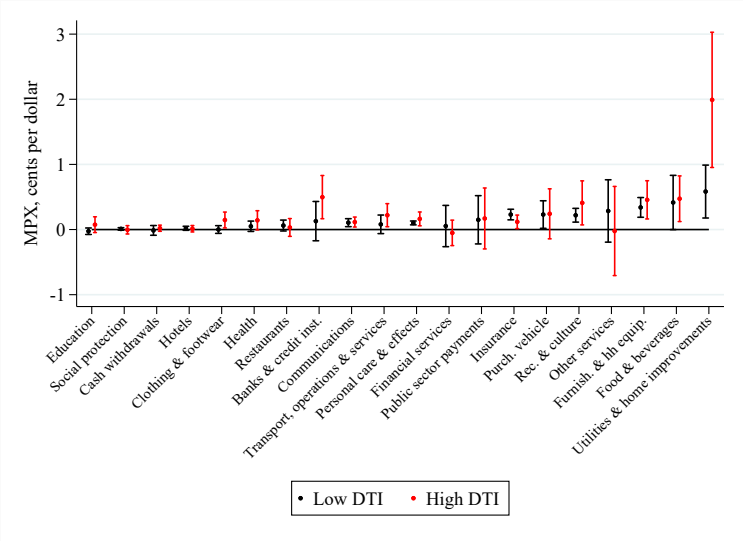
No response of renters ⇒ limited wealth effect



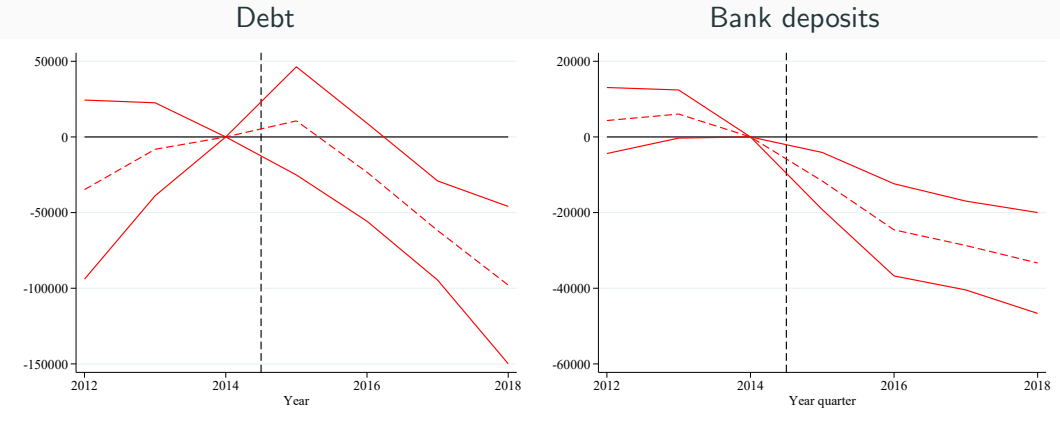
Small response of retirees ⇒ limited wealth effect



Spending on home improvements drives differences



Differential evolution in debt uptake suggest credit channel



Outline

The local MPX

Policy-concern: drop in demand $\Rightarrow$ lower income for other households

- Rationale for macroprudential regulation (Fahri & Werning 2014, Korinek & Simsek 2014)

In practice: not all demand is local (tradables vs. non-tradables)

Need to account for spending response **and** how relevant it is for local output

How much of the "first-round" demand impulse affect local production?

Local first-round effect

For a sector ℓ, the first-round drop in marginal drop in demand is

$$\text{L-MPX}_\ell = \underbrace{m_\ell}_{\text{Share prod. locally}} \times \underbrace{\sum_k \text{MPX}_k \times B_{k\to\ell}}_{\text{Mapping from cons. category to sector}}$$

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- Key input into thinking about *spillovers* to wages etc.

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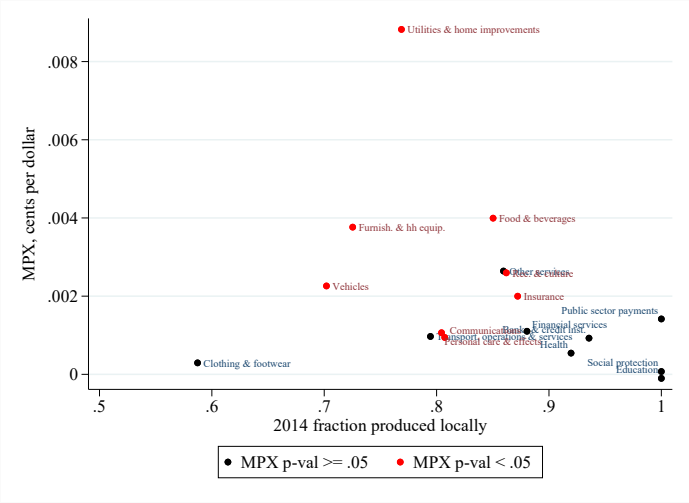
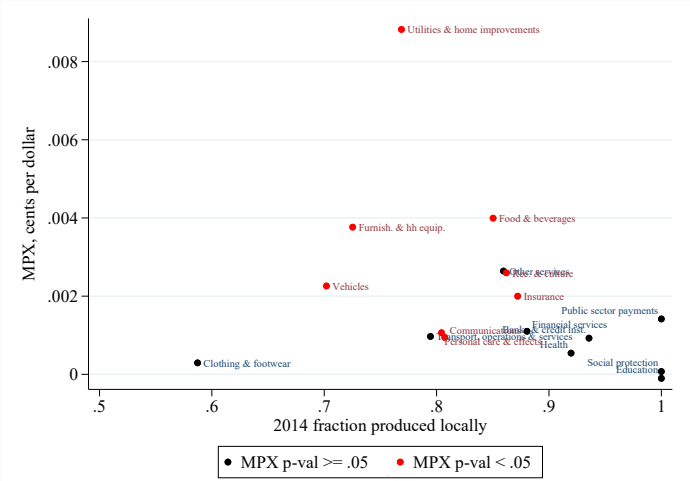
L-MPX captures the impact on local production

- Key input into thinking about *spillovers* to wages etc.
- Caveat: $B_{k \to \ell}$ unweighted many-to-few mapping

Local MPX


Utilities & home improvements
Food & beverages
Furnish. & hh equip.
Other services
Rec. & culture
Vehicles
Insurance
Public sector payments
Financial services
Bank & credit inst.
Communications
Transport. operations & services
Personal care & effects
Health
Clothing & footwear
Social protection
Education
.008
.006
.004
.002
0
MPX, cents per dollar
.5
.6
.7
.8
.9
1
2014 fraction produced locally
MPX p-val >= .05
MPX p-val < .05

Local MPX



Local MPX $\equiv \sum_\ell$ L-MPX$_\ell \approx$ 80% of headline MPX

Outline

Summary and conclusions

Quasi-natural experiment and high quality consumption data to estimate the expenditure response to changes in housing wealth

- MPX out of housing wealth ≈ 0.036, but substantial variation between expenditure categories
- No broad decline across categories

Evidence supports dominant role of housing as collateral to obtain credit, as opposed to wealth effects

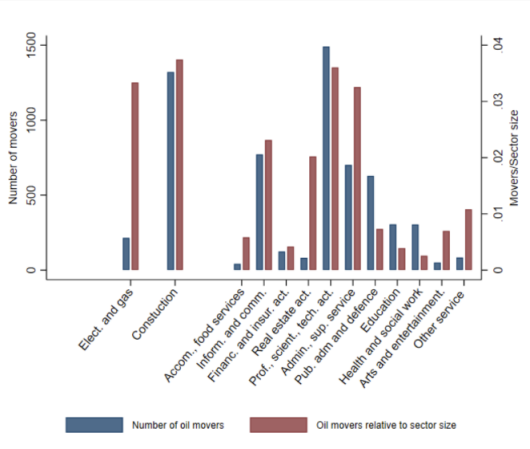
- MPX increasing in leverage, decreasing in liquidity and age

Rule out alternative explanations, e.g., peer effects, income expectations

The end

Oil shock and reallocation of workers: Sectors

Back



Source: Lorentzen (2022)

Oil shock and reallocation of workers: Regions

Back

Rogaland har blitt et fraflyttingsfylke

Oljekrisen får flere til å flytte fra Rogaland. I tredje kvartal flyttet rekordmange 3086 personer til andre steder i landet der jobbmulighetene er bedre.

Bare Nordland hadde mer innenlands utflytting enn Rogaland i fjor. Her er Bryne på Jæren for noen år siden.
FOTO: HANSEN, ALF ØVE / NTB SCANPIX

Øystein Ellingsen
Journalist

Rolv Christian Topdahl
Journalist

Publisert 2. des. 2016 kl. 08:44
Oppdatert 2. des. 2016 kl. 08:45

Artikkelen er flere år gammel.

Oil shock and reallocation of workers: Regions

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Bare Nordland hadde mer innenlands utflytting enn Rogal
FOTO: HANSEN, ALF ØVE / NTB SCANPIX

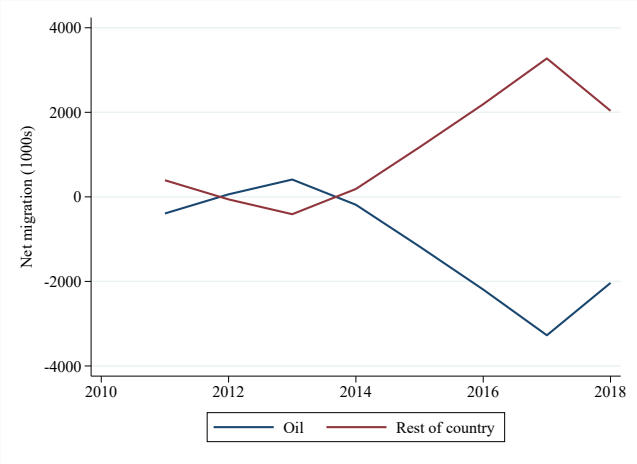
Oljefylket blir fraflyttet for første gang på 16 år

Ved opptelling ved utgangen av 2016 «manglet» 1200 rogalendinger, viser tall fra Statistisk Sentralbyrå (SSB). - Hold hodet kaldt, sier sjeføkonom.

Publisert: 24. april 2017

Oil shock and reallocation of workers: Regions

Back



Data filtration

Back

Two steps

1. Clean consumption data:
   - Remove transactions related to home purchase
   - Remove large transactions ($>$ 5 mill for vehicle consumption, $>$ 500,000 for other categories)
2. Sample filtration:
   - Initial sample (government workers): 281,000
   - Self employed income (as share of total income) $<$ 5%: 261,000
   - Observed in consumption data pre and post: 260,000
   - Remove bottom 0.5 and top 99.5 of the distribution of total wealth and consumption: 257,000
   - Restrict attention to homeowners: 206,000

Large, relative home price decline

Back