Unequal Expenditure Switching: Evidence from Switzerland

Raphael Auer, Ariel Burstein, Sarah Lein, Jonathan Vogel

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Introduction

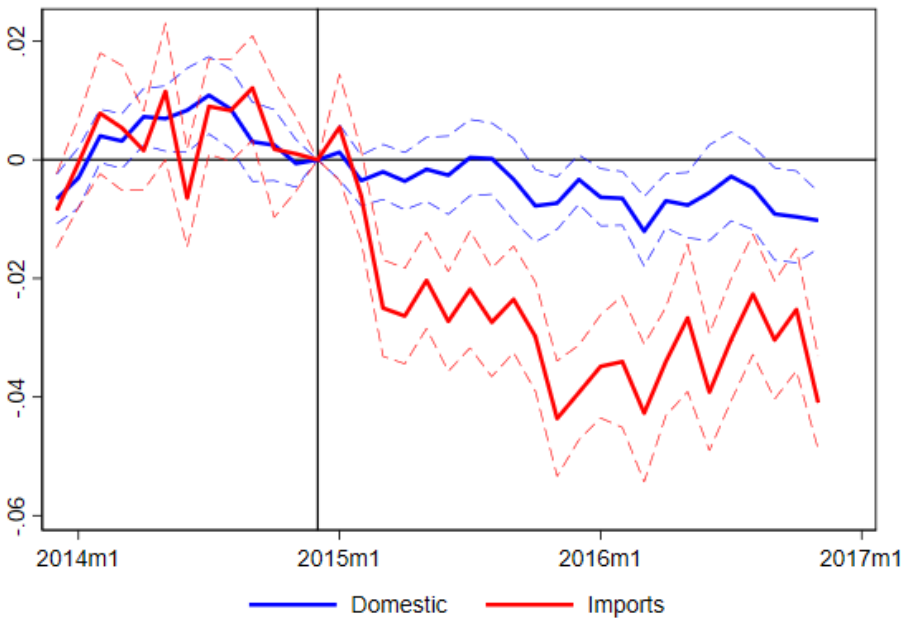
- What are the unequal effects of changes in consumer prices on the cost of living?
- In response to changes in import prices (trade costs, exchange rates)
  - Variation across HHs in initial expenditure shares on imports
  - Differences in how HHs substitute between imports and domestic goods
- This paper:
  - Document unequal expenditure switching using rich Swiss data
  - Show that differences in price elasticities across income distribution contribute significantly to unequal welfare effects of large price changes

Why Switzerland?

- Data: observe imports by household over time for food, beverages, personal care, and household supplies in supermarkets and drugstores
  - + import shares by sector, expenditure shares by income across sector
- January 2015 Swiss Franc appreciation go

Exchange rate

Average log price by month



Outline and overview

- Data description and stylized facts
  - Initial import shares increasing in income
  - Following 2015 appreciation, import shares rise, and rise more among lower income groups... whereas price changes do not differ with income

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  - In general: initial expenditure shares and compensated price elasticities
  - In practice: nested, generalized non-homothetic CES preferences

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  1. Imports shares on groceries by household
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  Difference in elast. of subst. between high & low income HH ≈ 2
- Expenditure-side welfare effects of foreign price shocks
  - Import price $\uparrow$, lower income HH harmed less
  - 20% Δ prices, unequal expenditure switching accounts for 1/2 of differential

Relation to literature

Unequal changes in cost of living due to heterogeneous initial import shares

- Fajgelbaum-Khandelwal 16, Cravino-Levchenko 17, Borusyak-Jaravel 21

In addition to this, we also incorporate...

Evidence that low income households are more price elastic

- Industrial organization: BLP 04...
- Spatial: small differences: Faber-Fally 22 and Argente-Li 21, large: Handbury 21
  - using Hausman instrument, we obtain small differences

We have household-product expenditure panel + exogenous import price shocks

Price sensitivity and income in macro models Kaplan-Menzio 16, Aguiar-Hurst 07, Alessandria-Kaboski 11

Expenditure switching due to income effects Bems-Di Giovanni 16, Coibion et al 15, Michelacci et al 21

Data and Stylized Facts

Data requirements and sources

Data requirements

- HH panel data on price and expenditures by product and date
- Production location

Data sources

- Nielsen homescan: Retail prices, expenditures in supermarket & drugstores
  - 3,300 households in 2013-16, income bin and other characteristics sample

Data requirements and sources

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Data sources

- codecheck.info: country of production for subset of goods (40% of expend.)
  - import share in retail expenditures 26.9% in 2014

Data requirements and sources

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- HH panel data on expenditures and price by product and date
- Data on production location

Data sources

- Swiss Federal Statistical Office
  - import shares by consumption category (common across income groups)
  - and expenditure shares by income group in 2012-2014

  cross-section over 300 consumption categories
  - groceries $\approx$ 17% of aggregate expenditures
  - overall import share 26.1%
- **Import shares are higher among higher income households**
  - rise from 21% for low income to 28% for high income
  - higher income HH have higher budget share on cars

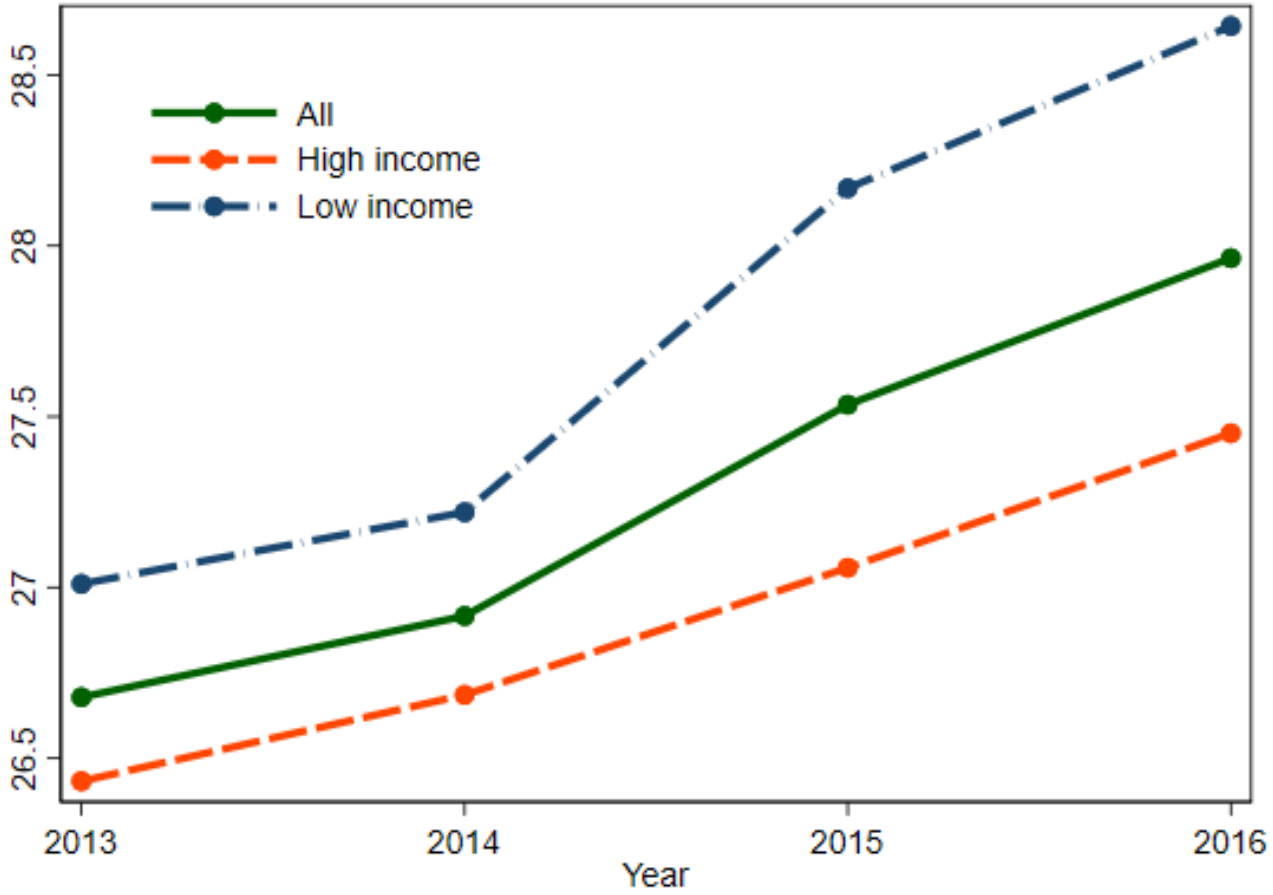
Stylized facts on imports from Nielsen data

Go

1. Import share $\uparrow$ following the 2015 CHF appreciation
2. Import shares $\uparrow$ less for higher income HHs following the appreciation
3. Relative import prices $\downarrow$ following 2015 appreciation, neither import nor domestic price changes varied systematically w/ HH income

Heterogeneous import responsiveness

The Evolution of Import Shares by Income



Low income: below median (57K) High income: above median

Heterogeneous import responsiveness

Conditioning on HH effects and additional controls

$$100 \times \frac{X_{hMt}}{X_{hMt} + X_{hDt}} = \mathbb{FE}_t + \mathbb{FE}_h + \sum_{y \neq 2014} \mathbb{I}_{y=t} \left[\beta_t Inc_h + [\zeta_t' K_h] \right] + \varepsilon_{ht}$$

	log(Income)			High income		
	(1)	(2)	(3)	(4)	(5)	(6)
Income 2013	-0.472*	-0.495*	-0.547**	-0.213	-0.228	-0.259
	[0.266]	[0.271]	[0.257]	[0.288]	[0.299]	[0.284]
Income 2015	-0.727**	-0.800***	-0.622**	-0.698**	-0.782**	-0.555*
	[0.272]	[0.290]	[0.284]	[0.293]	[0.310]	[0.293]
Income 2016	-0.953***	-1.069***	-1.006***	-0.383	-0.482	-0.346
	[0.321]	[0.332]	[0.352]	[0.382]	[0.417]	[0.422]
Observations	11630	11630	11630	11630	11630	11630
Controls		X	X		X	X
Control education			X			X

Relative expenditures on imports ↑ relatively less for higher income HHs following appr.

No evidence of a continuation of pre-existing trends

Welfare Impacts of Price Changes

Compensating variation: sufficient statistics

- Preferences of household h over N goods represented by indirect utility $v_h(\mathbf{p}, \mathrm{I}, \zeta)$
- Consider change in prices, income, and tastes between t_0 and t_1

$$v_h(\mathbf{p}_{ht_0}, I_{ht_0}; \zeta_{ht_0}) = v_h(\mathbf{p}_{ht_1}, e^{-CV_h} I_{ht_1}; \zeta_{ht_0})$$

Change in income at t_1 prices to make household ζ_{ht_0} indifferent between what they can buy at t_0 & t_1

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Change in income at t_1 prices to make household ζ_{ht_0} indifferent between what they can buy at t_0 & t_1

- Using Shephard's Lemma, can be expressed as (Hausman 81', Baqaee & Burstein 21')

$$CV_h = \log\left(\frac{\mathrm{I}_{ht_1}}{\mathrm{I}_{ht_0}}\right) - \int_{t_0}^{t_1} \sum_i b_{hi}(\mathbf{p}_{ht}, u_{ht_0}, \zeta_{ht_0}) d\log p_{iht} dt$$

Deflator uses budget shares (given prices) at fixed initial utility and tastes

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Deflator uses budget shares (given prices) at fixed initial utility and tastes

- Requirements (by household):
  1. Changes in prices and income ✓
  2. Budget shares by good in initial period ✓
  3. Hicksian (compensated) price elasticities in initial period
- Do not require income elasticities or taste shocks (given prices & income)
- To measure 3: nested, generalized non-homothetic CES preferences (Fally 2020)

Nested, generalized non-homothetic CES

- Cobb-Douglas across sectors s: grocery goods, non-grocery goods, services

$$b_{hi}(\mathbf{p}_h, u_h, \zeta_h) = \underbrace{\bar{b}_{hs}}_{\text{between sector}} \times \underbrace{\frac{\zeta_{hi} u_h^{\gamma_i} p_{hi}^{1-\eta_s(u_h)}}{\sum_{i' \in \mathcal{I}(s)} \zeta_{hi'} u_h^{\gamma_{i'}} p_{hi'}^{1-\eta_s(u_h)}}}_{\text{within sector}}$$

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- Compensated budget shares (exact hat algebra)

$$b_{hi}(\mathbf{p}_h, u_{ht_0}, \zeta_{ht_0}) = b_{hit_0} \times \frac{\widehat{p}_{hi}^{\,1-\eta_{hst_0}}}{\sum_{i' \in \mathcal{I}(s)} b_{hi'}\, \widehat{p}_{hi'}^{\,1-\eta_{hst_0}}}$$

- Given values of η_{hst_0}, compensated budget shares and CV identical to homothetic model with exogenous taste shifters and elasticities

Nested, generalized non-homothetic CES

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- Given values of η_{hst_0}, compensated budget shares and CV identical to homothetic model with exogenous taste shifters and elasticities
- To a second order:

$$CV_h \approx \underbrace{\log\left(\widehat{I}_h\right) - \mathbb{E}_{b_{ht_0}}\left[\log \widehat{p}\right]}_{\text{First-order effect}} + \underbrace{\frac{1}{2}\sum_s b_{hst_0} \times (\eta_{hst_0} - 1) \times \mathrm{Var}_{b_{ht_0}|s}\left[\log \widehat{p}\right]}_{\text{Expenditure-switching effect}}$$

Estimating differences in compensated price elasticities

Estimating compensated price elasticities

- Differentiate $d \log b_{hit}$, assume:
  1. $\eta_{hst_0} = \bar{\eta}_s + \eta_s \log(I_{ht_0})$
  2. income elasticity can be expressed as $\kappa_i + \kappa_{hs}$

$$d \log b_{hit} = \underbrace{\kappa_i d \log \frac{I_{ht}}{P_{ht}}}_{\text{income effect}} + \underbrace{(1 - \bar{\eta}_s - \eta_s \log(\mathrm{I}_{ht_0}))d \log p_{hit}}_{\text{substitution effect} \times \text{price change}} + \underbrace{\nu_{hit}}_{\text{taste shifter}} + \underbrace{\widetilde{\psi}_{hst}}_{\text{sect shifter}}$$

Estimating compensated price elasticities

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- Two approaches to estimate η_s
  1. import and domestic expenditures by household
  2. product-level expenditures by income group
     - ★ unlike approach 1, approach 2 is valid with entry & exit of products and income-specific import demand shocks

Approach 1: Import and domestic expenditures by HH

Within groceries, two stable homothetic aggregate goods: iMports, Domestic

$$d\log\left(\frac{b_{hMt}}{b_{hDt}}\right) = \alpha + \kappa d\log\left(\frac{I_{ht}}{P_{ht}}\right) - \eta_s \log(I_{ht_0}) d\log\left(\frac{p_{Mt}}{p_{Dt}}\right) + \iota_{ht}$$

- Identification: HH import demand shocks btw 2014-15 $\perp$ initial income

	(1)	(2)	(3)	(4)	(5)	(6)
$\log(I_{ht_0}) d\log(p_{Mt}/p_{Dt})$	2.189***	2.207***	1.838***	1.981***	2.041***	2.172***
	[0.554]	[0.567]	[0.478]	[0.618]	[0.672]	[0.540]
Constant	0.553***	0.557***	0.469***	0.492***	0.516***	0.550***
	[0.129]	[0.132]	[0.110]	[0.144]	[0.157]	[0.126]
Observations	2901	2901	2901	2901	2901	2901
Baseline	X					
No winsorizing		X				
Winsorize 5%			X			
Unweighted				X		
Expenditure weight					X	
No income effects						X

Elasticity of substitution of HH with 2014 income of 60K is 2.4 lower than one with 20K

Approach 2: Product-level expenditures, 50 income groups

$$d \log b_{hit} = \underbrace{\mathbb{FE}_{it}}_{\text{good}} + \underbrace{\mathbb{FE}^{M}_{hst}}_{\text{HH} \times \text{import}} + \underbrace{\kappa_i d \log \left(\frac{I_{ht}}{P_{ht}} \right)}_{\text{income effect}} - \underbrace{\eta_s \log(I_{ht_0}) d \log p_{it}}_{\text{heterog. substitution}} + \iota_{hit}$$

- Endogeneity: if higher income more inelastic then OLS upward bias: ↑ demand shock for higher income ⇒ larger price rise
- Instrument for $\log(I_{ht_0}) d \log p_{it}$ with $\log(I_{ht_0}) \times \mathbb{I}^{M}_{i} \times \text{share}_{it_0}$
  - share_{it_0}: EUR invoicing share of border prices in 2014
  - retail import price change in 2015 increasing in share_{it_0} (Auer et al 2021)
- Exclusion restriction: HH's product-specific demand shock, conditional on
  1. average product-specific demand shock across households
  2. income effects
  3. household-time effects
  4. average import demand shock for HHs in the same income aggregation

  uncorrelated w/ pre-determined invoicing share triple interaction
  - We provide a range of evidence consistent with this exclusion restriction

Approach 2: Baseline Results

$$d \log b_{hit} = \underbrace{\mathbb{FE}_{it}}_{\text{good}} + \underbrace{\mathbb{FE}^{M}_{hst}}_{\text{HH} \times \text{import}} + \underbrace{\kappa_i d \log \left(\frac{I_{ht}}{P_{ht}} \right)}_{\text{income effect}} - \underbrace{\eta_s \log(I_{ht_0}) d \log p_{it}}_{\text{heterog. substitution}} + \iota_{hit}$$

	(1) OLS	(2) RF	(3) 2SLS
$\log(I_{ht_0}) \times d \log p_{it}$	0.018		1.930**
	[0.134]		[0.867]
$\log(I_{ht_0}) \times share_{it_0} \times \mathbb{I}^{M}_{i}$		-0.140**	
		[0.068]	
Observations	95,325	95,325	95,325
K-P F Stat (fist stage)			13.1

Notes: Robust standard errors two-way clustered at the level of income bin and the intersection between import status and the share of imported goods in each border group that is denominated in EUR; observations are weighted by the product of the number of households in each aggregation and the share of expenditures among households within that aggregation on product i; we winsorize changes in log expenditures at the first percentile (both in the right and left tails).

Expected sign of RF + expected bias of OLS (economics + measurement error)

Very similar 2SLS estimate to Approach 1

Robustness: causal interpretation of estimation

	(1)	(2)	(3)	(4)	(5)	(6)
$\log(I_{ht_0}) \times share_{it_0} \times \mathbb{I}_i^M$	-0.140**	-0.004	-0.104			
	[0.068]	[0.066]	[0.082]			
$\log(I_{ht_0}) \times d \log p_{it}$				1.930**	2.191**	2.147**
				[0.867]	[0.871]	[0.870]
Observations	95,325	98,652	78,800	95,325	95,325	95,325
Baseline	X			X		
Outcome period		13-14	15-16			
Additional controls I					X	
Additional controls II						X
K-P F Stat (fist stage)				13.1	15.6	17.1

- Pre-existing trends? No — Column 1-3
- $share_{it_0}$ correlated with some other product characteristic driving the differential patterns of substitution? No — Columns 4-6
  - Control for additional triple interactions in which we replace $share_{it_0}$ w/
    - ★ 2014 import share of each border group — columns 5 and 6
    - ★ 2014 expenditure share on each border group — columns 5 and 6
    - ★ 2014 average price of each individual product — column 6

Robustness: varying baseline choices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\log(I_{ht_0}) \times d \log p_{it}$	1.930**	3.551	2.623**	2.269**	1.971***	1.617*	1.831**
	[0.867]	[2.229]	[1.103]	[1.014]	[0.622]	[0.938]	[0.846]
Observations	95,325	43,559	67,179	82,995	116,930	95,325	95,325
Baseline	X						
Horizon 3m		X					
Horizon 6m			X				
Horizon 9m				X			
Percent change					X		
No income effects						X	
All inv. currencies							X
K-P F Stat (fist stage)	13.1	7.6	8.6	11.4	12.8	12.8	12.7

Results are robust to varying all baseline choices

- Column (6) – no income effects – identifies non-homothetic CES with different elasticities and demand shifters across incomes

Robustness: using imports only

	(1) RF	(2) 2SLS	(3) RF	(4) 2SLS
$\log(I_{ht_0}) \times share_{it_0} \times \mathbb{I}_i^M$	-0.140**		-0.141*	
	[0.068]		[0.068]	
$\log(I_{ht_0}) \times d \log p_{it}$		1.930**		1.933**
		[0.867]		[0.878]
Observations	95,325	95,325	27,128	27,128
Baseline	X	X		
Imports only			X	X
K-P F Stat (fist stage)		13.1		12.8

- $share_{it_0}$ impacts price change for imports substantially more than for domestically produced goods
- Suggests complier group is mostly restricted to the set of imported goods
- Results similar when estimated only on imports

Robustness: incorporating spatial variation

	(1)	(2)	(3)
$\log(I_{ht_0}) \times d \log p_{it}$	1.930**	2.170***	
	[0.867]	[0.663]	
$\log(I_{ht_0}) \times d \log p_{hit}$			1.542***
			[0.572]
Observations	95,325	134,596	134,596
Baseline	X		
Spatial variation: outcome		X	X
Spatial variation: price			X
K-P F Stat (fist stage)	13.1	12.4	18.5

- Further disaggregate HHs into 50 income bins $\times$ nine 1-digit zip codes
- Results similar when incorporating spatial variation

Robustness: incorporating spatial variation

	(1)	(2)	(3)
$\log(I_{ht_0}) \times d \log p_{it}$	1.930**	2.170***	
	[0.867]	[0.663]	
$\log(I_{ht_0}) \times d \log p_{hit}$			1.542***
			[0.572]
Observations	95,325	134,596	134,596
Baseline	X		
Spatial variation: outcome		X	X
Spatial variation: price			X
K-P F Stat (fist stage)	13.1	12.4	18.5

- Further disaggregate HHs into 50 income bins $\times$ nine 1-digit zip codes
- Results similar when incorporating spatial variation

- See paper for details on Hausman-style approach
  - Much smaller differences in elasticities across incomes
  - May be endogenous in Swiss setting (little price variation across space)

Welfare counterfactuals

Baseline

Given focus on expenditure-side, assume ↑ domestic price= ↑ income (as in one factor model)

	% change in import/domestic price				
Annual income	+2.2	+10	+20	+40	+1000
1: 20,000 elasticity 6.6	-0.5	-1.8	-3.2	-4.7	-5.6
2: 60,000 elasticity 4.4	-0.5	-2.2	-4.1	-7.0	-11.1
3: 120,000 elasticity 3.0	-0.6	-2.6	-5.0	-9.1	-22.0
% difference btw CV					
income groups 2 and 1	16%	22%	31%	50%	99%
income groups 3 and 1	31%	41%	57%	95%	295%
Contribution heterogeneous ηs					
income groups 2 and 1	8%	28%	44%	62%	79%
income groups 3 and 1	7%	26%	41%	60%	86%

"Contribution of heterogeneous elasticities" is $1 - (CV_j^{\text{homog}} - CV_1^{\text{homog}})/(CV_j - CV_1)$

- Higher income groups harmed more from import price increase because:
  - (1) higher import share, (2) less elastic

Import price reductions

Annual income	% change in import/domestic price -2.2	-10	-20	-40
1: 20,000 elasticity 6.6	0.5	2.4	5.4	13.2
2: 60,000 elasticity 4.4	0.5	2.6	5.6	12.7
3: 120,000 elasticity 3.0	0.6	2.8	5.8	12.6
% difference btw *CV*				
income groups 2 and 1	13%	9%	4%	-4%
income groups 3 and 1	25%	17%	9%	-4%

- Higher income groups benefit more due to high import share, less from lower price elasticities

Elasticity of substitution of high income groups = 1.5

	% change in import/domestic price				
Annual income	+2.2	+10	+20	+40	+1000
1: 20,000 elasticity 5.1	-0.5	-1.9	-3.4	-5.5	-7.6
2: 60,000 elasticity 2.9	-0.5	-2.3	-4.4	-8.1	-19.9
3: 120,000 elasticity 1.5	-0.6	-2.7	-5.3	-10.4	-86.7
% difference btw *CV*					
income groups 2 and 1	16%	22%	30%	48%	163%
income groups 3 and 1	30%	40%	54%	89%	1041%
Contribution heterogeneous ηs					
income groups 2 and 1	8%	28%	44%	62%	87%
income groups 3 and 1	7%	25%	41%	60%	96%

- Differences in CV not very sensitive to elasticities levels, given difference

Homogeneous elasticities within services

Annual income	% change in import/domestic price				
	+2.2	+10	+20	+40	+1000
1: 20,000 elasticity 6.6	-0.5	-1.8	-3.2	-4.7	-5.7
2: 60,000 elasticity 4.4	-0.5	-2.2	-4.1	-7.0	-11.1
3: 120,000 elasticity 3.0	-0.6	-2.6	-4.9	-9.0	-21.4
% difference btw *CV*					
income groups 2 and 1	16%	21%	29%	47%	93%
income groups 3 and 1	30%	39%	54%	89%	275%
Contribution heterogeneous ηs					
income groups 2 and 1	7%	26%	42%	60%	79%
income groups 3 and 1	6%	23%	39%	58%	85%

Conclusions

- Document unequal expenditure switching using rich Swiss data
- Estimate differences in compensated price elasticities across income distribution using panel data on household-product expenditure, heterogeneous impact of exchange rate shock across products
- Show that differences in price elasticities across income distribution contribute significantly to unequal welfare effects of large price changes
- Relevant not only for international price changes, but any shock generating large and heterogeneous price changes

Cross-border shopping: evidence and welfare implications

Unequal spatial effects of foreign price changes

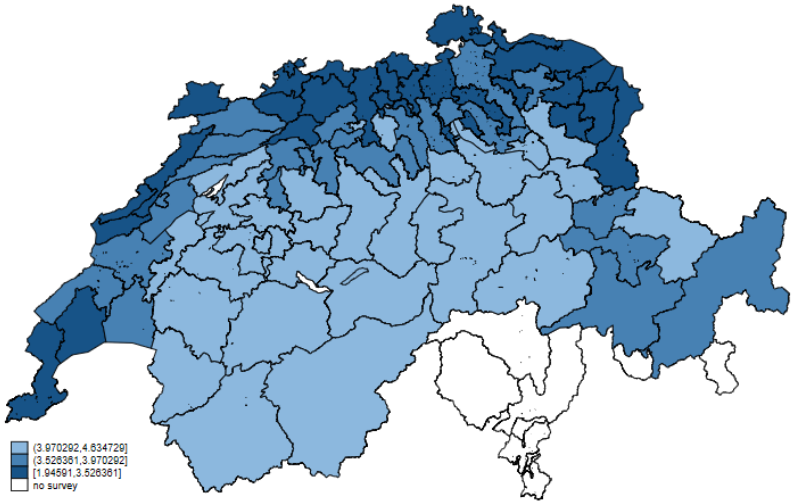
- Households can access foreign goods by crossing the border and shopping abroad, especially those who live nearby
  - salient in countries with large share of population along open international borders and large price gaps, like Switzerland
  - non-commercial cross-border purchases are not recorded in import statistics

- "Cross-border shopping: evidence and welfare implications," BLV (2022)
  - New facts on cross-border shopping in Switzerland
    - ★ For each Nielsen transaction, observe if purchase is in Switz. or abroad
    - ★ 30% of HHs engage in any CB shopping, 75% in regions close to border
  - Model of spatial shopping to quantify heterogeneous...
    - ★ ... effects on cost of living of factual changes in international prices
    - ★ ... welfare benefits from access to cross-border shopping

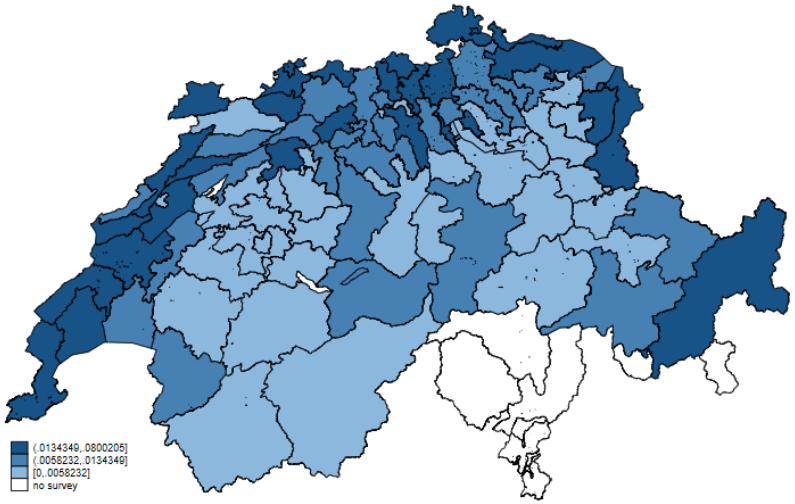
CB shares are higher for HHs closer to foreign retailers

Import shares of purchases within Switzerland are not

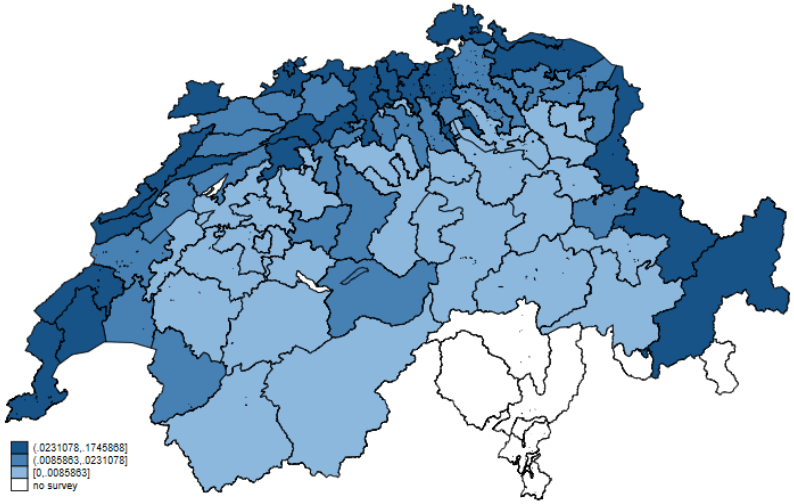
Drive time to closest foreign retailer



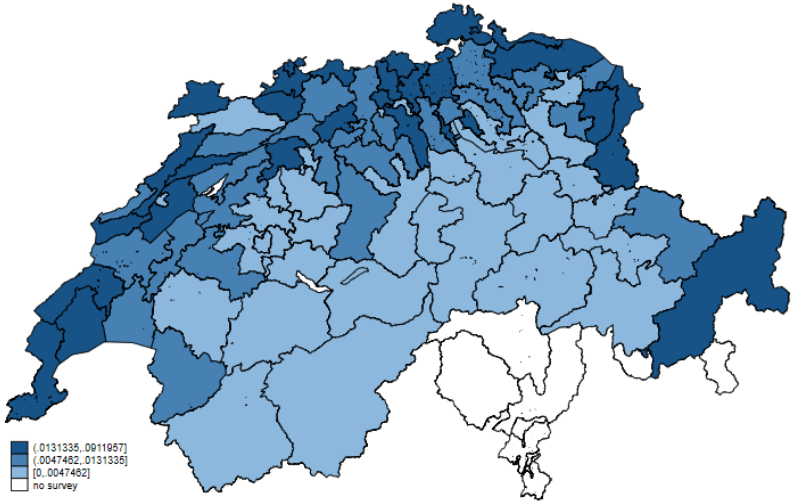
Expenditure share



Trip share



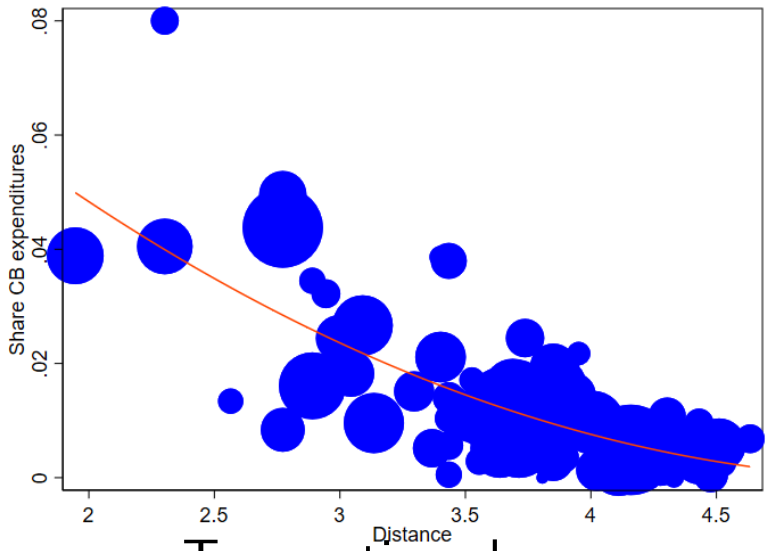
Transaction share



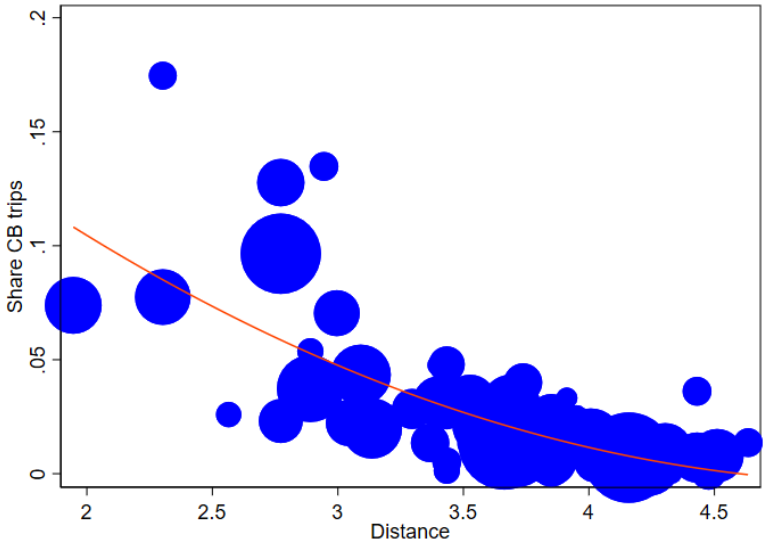
CB shares are higher for HHs closer to foreign retailers

Table

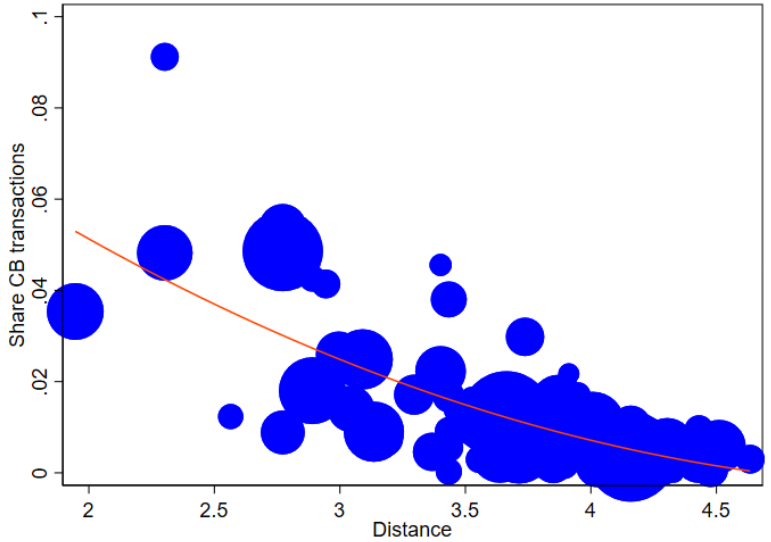
Expenditure share



Trip share



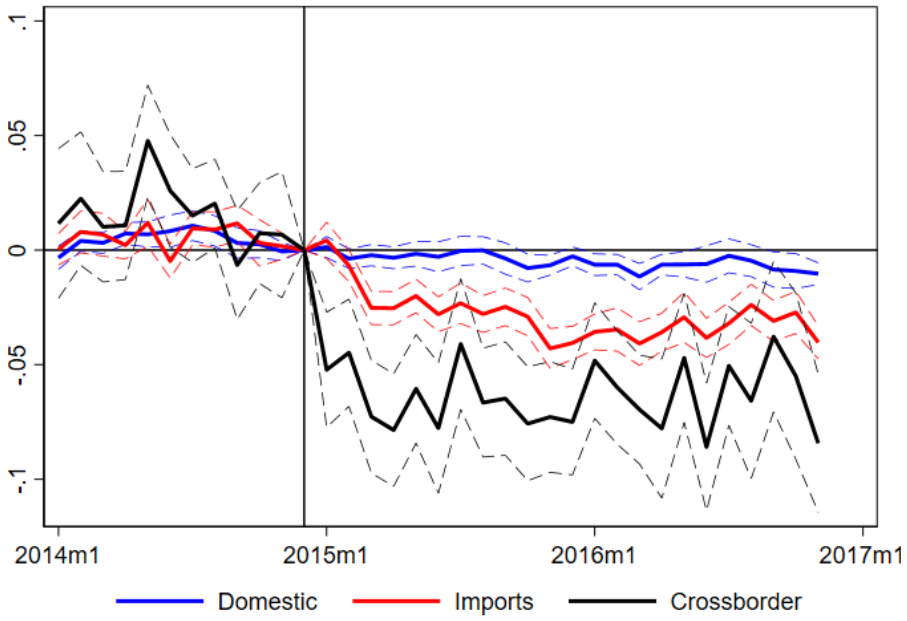
Transaction share



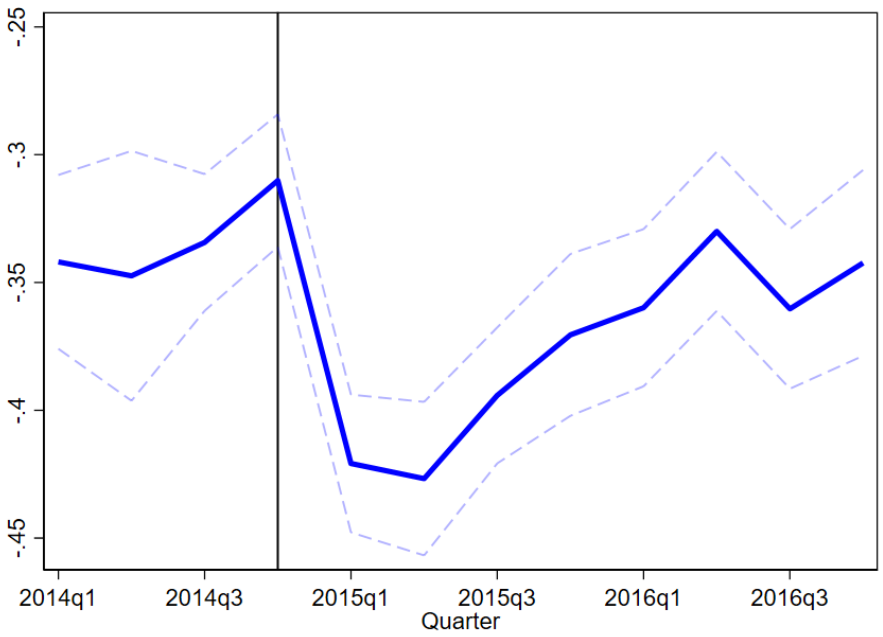
Prices are lower across the border from Switzerland

CB prices fell in 2015 relative to goods purchased in Switzerland

Price changes



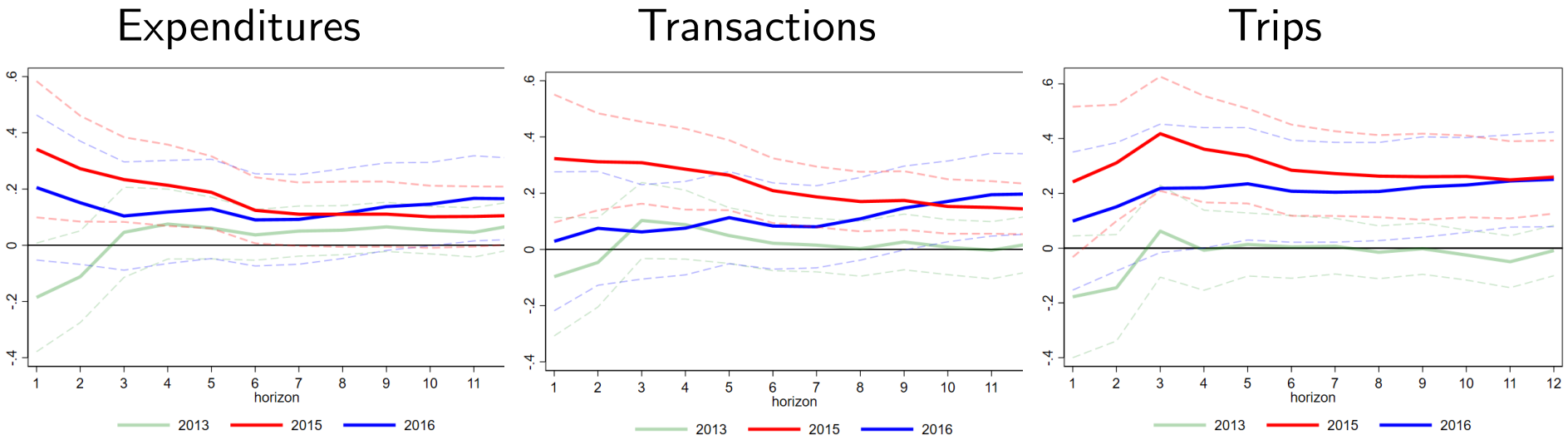
CB price gap for identical goods



CB shares increased following the 2015 CHF appreciation

No heterogeneity with income or space

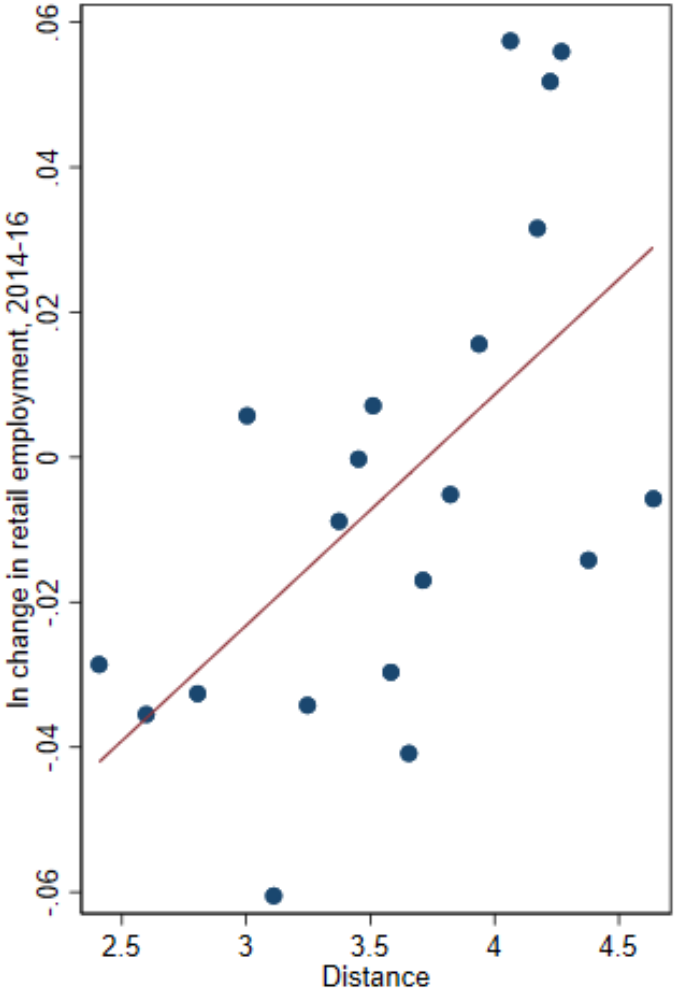
Figure: Changes in CB shares compared to 2014

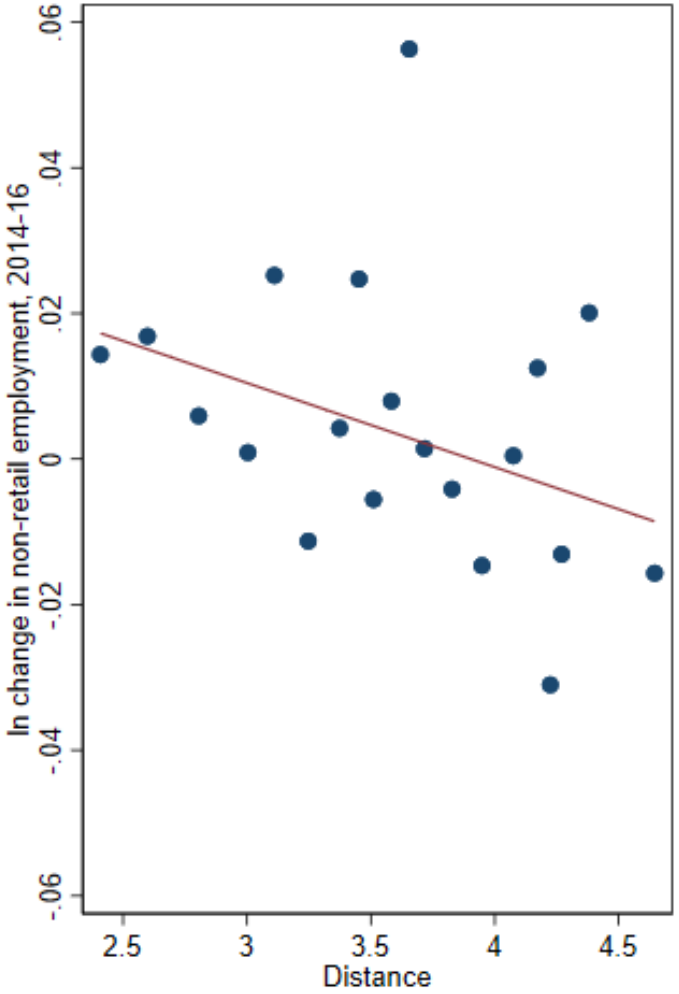


$$100 \times \frac{X_{hft}}{X_{hft} + X_{hdt}} = \alpha + \mathbb{FE}_h + \sum_{y \neq 2014} \beta_y \mathbb{I}_{y=t} + \varepsilon_{ht}$$

Retail employment fell in 2015 in regions near border

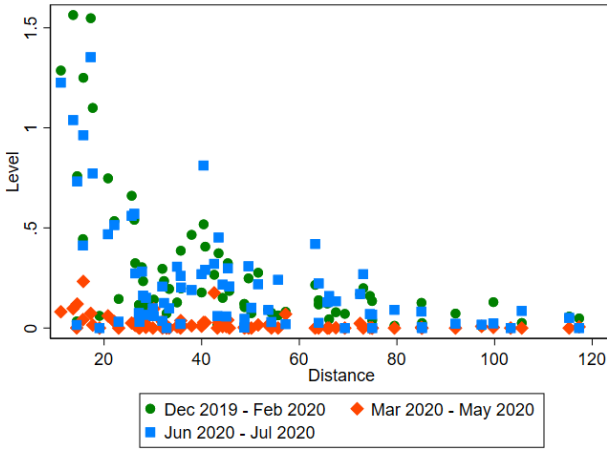
Binscatter across 4-digit zips of 2014-16 log changes in retail, non-retail employment



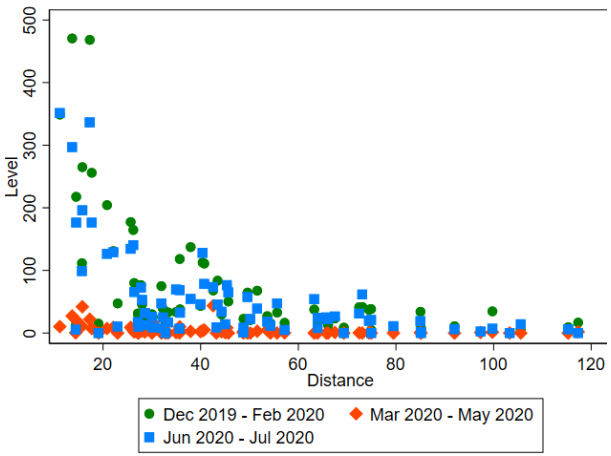


CB shares fell to ≈ 0 during 2020 border closure

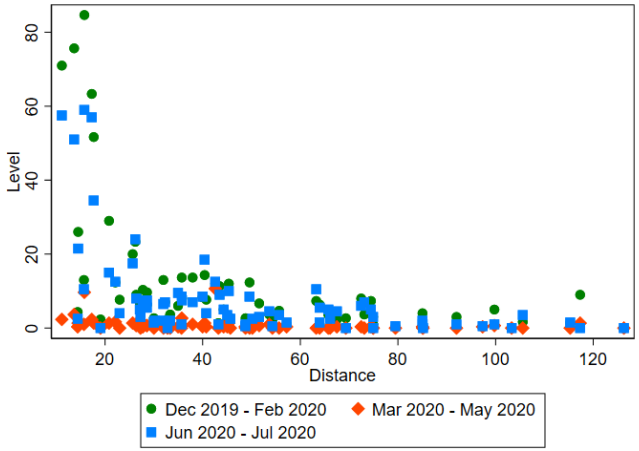
CB Expenditures



CB Transactions



CB Trips

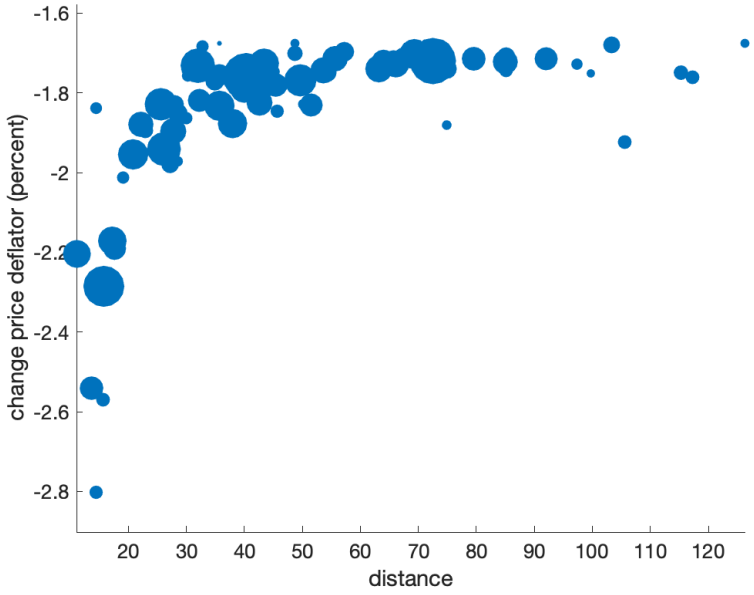


Simple model of CB shopping

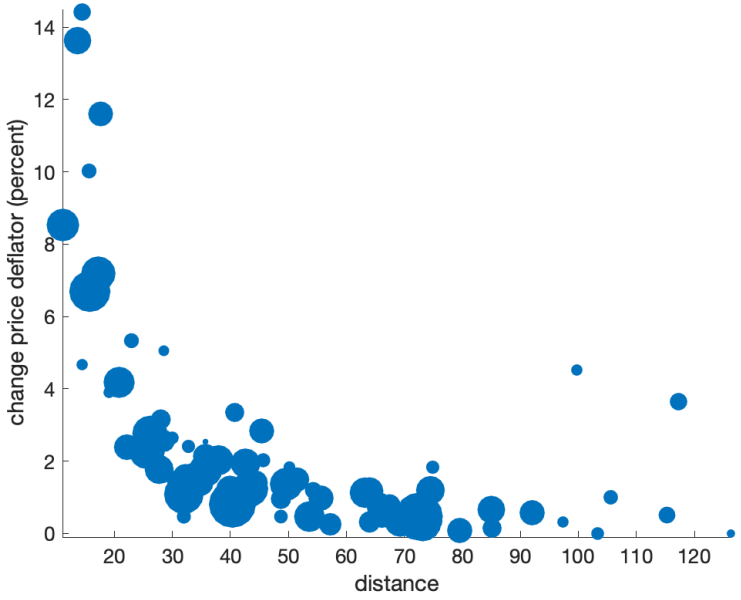
- Continuum of shopping trips within each time period
- Each trip, choose shopping location
  - pecuniary and non-pecuniary costs and benefits
  - systematic (common across trips) and idiosyncratic (Fréchet with dispersion θ)
- If shop in Switzerland, purchase homothetic composite of m and d
- Requirements (by household):
  1. initial share of expenditures on cross-border shopping
     - given non-pecuniary costs (not measured in expenditures), must use trip share
  2. elasticity of CB shopping share to retail prices
     - $\theta = 1.24$ using Δ HH CB trip share

Change in price deflator across space

2015 Appreciation



2020 border closure



Conclusions

Using the 2015 CHF appreciation as a case study, we document how

- households allocate expenditures across goods produced domestically and abroad, and goods sold within or across the border
- these choices respond to relative price swings
- these patterns differ across households

Measure sufficient statistics to quantify heterogeneous welfare implications of factual or counterfactual international price changes on costs of living

- Two channels that complement heterogeneity in initial import shares
  1. high income households are less price sensitive to import price changes
  2. those living close to border are more exposed to international price shocks
- Both channels contribute significantly to unequal effects on cost of living due to large changes in foreign prices

Appendix

January 2015 Swiss Franc Appreciation

- Sept. 6, 2011: After sharp appreciation of the Swiss franc (CHF), Swiss National Bank (SNB) introduced a min. exchange rate of 1.20 CHF per EUR
- Late 2014, early 2015: Foreign developments (e.g., anticipation of large QE program in the euro area) raised perceived cost of sustaining CHF policy
- Jan. 15, 2015: SNB unexpectedly abandons minimum exchange rate
  - $\Rightarrow$ Large and sudden appreciation of the CHF
- Appreciation episode is unique in a number of ways
  1. Followed a period of exchange rate stability
     - EUR/CHF fluctuated in range of 1.2-1.25 while minimum rate was in place...
     - ... and 1.2-1.22 in the last six months before January 15, 2015
  2. Exchange rate movement was large in magnitude
     - EUR/CHF appreciated more than 20% on day of policy change
     - 14.0% and 10.6% by the end of Mar. and Dec. 2015
  3. Appreciation occurred against the backdrop of a stable Swiss economy
     - reflected a policy response to foreign events

back

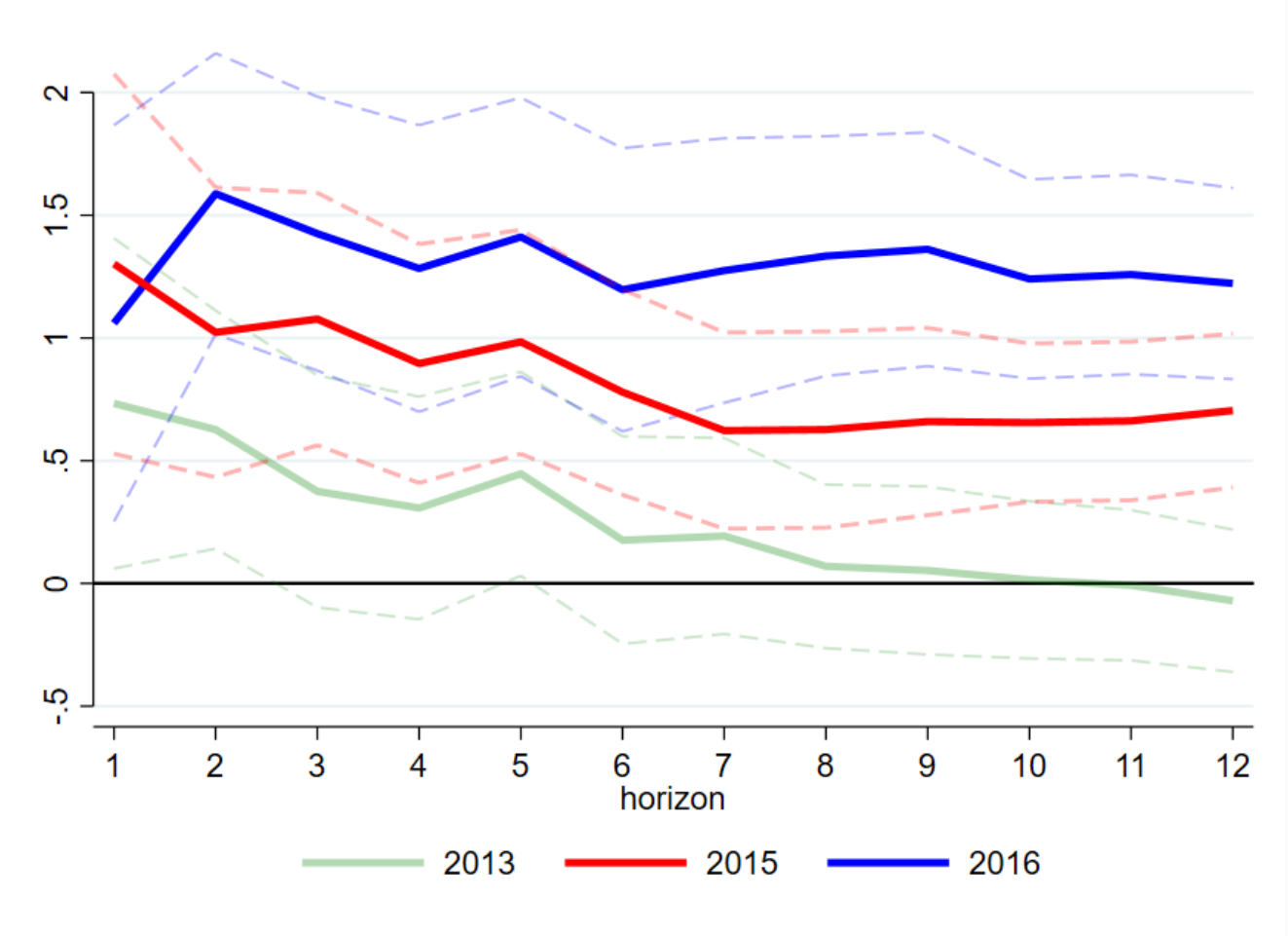
Characteristics in 2014

Income bin	0-35k	35-50k	50-70k	70-90k	90-110k	110-160k	>160k	Total
Median income	15,069	45,410	55,566	76,005	96,569	128,035	257,259	
No. of households	398	554	733	739	391	458	29	3,302
Avg household size	1.7	2.1	2.5	2.9	3.1	3.2	3.8	2.6
Share with kids	7	8	13	17	20	20	24	14
Share elderly HH	22	21	13	9	5	3	0	12
Share higher education	12	15	17	24	33	53	45	17
Median expenditure	735	935	1,043	1,252	1,246	1,292	1,617	1,270

Back

Average import responsiveness

$$100 \times \frac{X_{hMt}}{X_{hMt} + X_{hDt}} = \alpha + \mathbb{FE}_h + \sum_{y \neq 2014} \beta_t \mathbb{I}_{y=t} + \varepsilon_{ht}$$

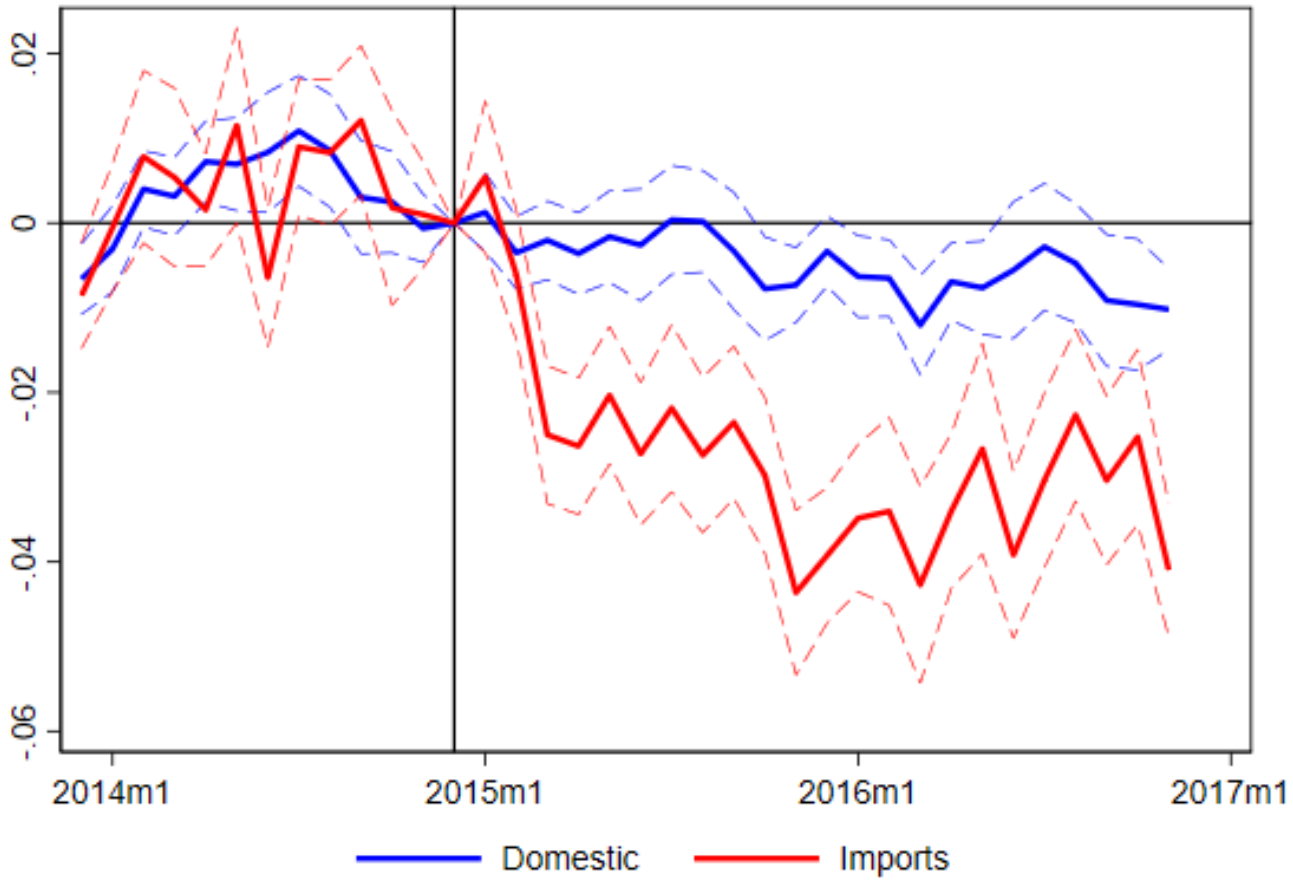


back

Import prices

$$\log p_{im} = \alpha + \mathbb{FE}_i + \sum_{m' \neq \text{Dec 2014}} \mathbb{I}_{m'=m}\beta_m + \varepsilon_{em}$$

where i indexes EANs and m indexes the month



back

Import prices

$$\log p_{ihq} = \alpha + \alpha_{ih} + \alpha_q + \sum_{y \neq 2014Q4} \mathbb{I}_{y=q} \beta_q \log(Income_h) + \varepsilon_{ihq}$$

where p_{ihq} is the level of the price of product i in quarter q paid by income group h (of which there are 50)

back