

# ONLINE APPENDIX

## The Fiscal Response to Revenue Shocks

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## OA.1: The immovable property gains tax in the Canton of Zurich

Figure OA.1.1: The immovable property gains tax schedule in the Canton of Zurich, 1999

Zürcher Steuerbuch Teil I		Nr. 37/600 Grundstückgewinnsteuer Tarif ab 1999	
<b>Tarif für die Grundstückgewinnsteuer</b>		<b>Immovable property gains tax</b>	
<b>A. Steuersätze gemäss § 225 StG</b>		<b>A. Tax rates</b>	
Die Grundstückgewinnsteuer beträgt:		The immovable property gains tax amounts to:	
10% für die ersten	Fr. 4000.-	10 % for the first	CHF 4000.-
15% für die weiteren	Fr. 6000.-	15 % for the next	CHF 6000.-
20% " " "	Fr. 8000.-	...	...
25% " " "	Fr. 12000.-	...	...
30% " " "	Fr. 20000.-	...	...
35% " " "	Fr. 50000.-	...	...
40% für die Gewinnteile über	Fr. 100000.-	40% for profits beyond CHF 100'000.-	
Die gemäss Abs. 1 berechnete Grundstückgewinnsteuer erhöht sich bei einer anrechenbaren Besitzesdauer		As a function of the eligible holding period, the calculated property gains tax increases by	
von weniger als 1 Jahr um 50 Prozent,		50% for periods below 1 year	
von weniger als 2 Jahren um 25 Prozent.		25% for periods below 2 years.	
Die gemäss Abs. 1 berechnete Grundstückgewinnsteuer ermässigt sich bei einer anrechenbaren Besitzesdauer von		As a function of the eligible holding period, the calculated property gains tax decreases by	
vollen 5 Jahren um	5%	5%	for 5 full years
" 6 " "	8%	8%	for 6 full years
" 7 " "	11%	...	...
" 8 " "	14%		
" 9 " "	17%		
" 10 " "	20%		
" 11 " "	23%		
" 12 " "	26%		
" 13 " "	29%		
" 14 " "	32%		
" 15 " "	35%		
" 16 " "	38%		
" 17 " "	41%		
" 18 " "	44%		
" 19 " "	47%	47%	for 19 full years
vollen 20 Jahren und mehr um	50%	50%	for 20 and more full years.
Grundstückgewinne unter Fr. 5000 werden nicht besteuert.		Property gains below CHF 5000.- are exempt.	

Source: Zürcher Steuerbuch (1999), Tarif für Grundstückgewinnsteuer, ZStB-Nummer 225.1, 37/600 (<https://www.zh.ch/de/steuern-finanzen/steuern/treuhaender/steuerbuch/steuerbuch-definition/zstb-225-1.html>, retrieved 30.08.2021)

## OA.2: Immovable property gains tax: transactions and receipts

**Table OA.2.1: Shock years and municipal population size**

Population quartiles	No shock	Any shock (pos. & neg.)	Positive shock	Negative shock	Observations
1	718	384	199	185	1102
2	706	394	205	189	1100
3	711	388	190	198	1099
4	747	353	188	165	1100
Total	2882	1519	782	737	4401

Notes: Absolute numbers of observations per population quantile and state of shock (no shock, positive shock, negative shock).

**Table OA.2.2: Shocks and *IPGT* transactions**

	$\ln(\#\text{Transactions})$
Positive shocks	0.089*** (0.019)
Negative shocks	-0.101*** (0.020)
$\ln(\text{Population})$	0.651*** (0.194)
$\ln(\text{Tax base})$	-0.216** (0.088)
Municipal and year FE	included
No of observations	4348

Notes: OLS estimation. Standard errors are robust to clustering at the municipal level (in parenthesis).

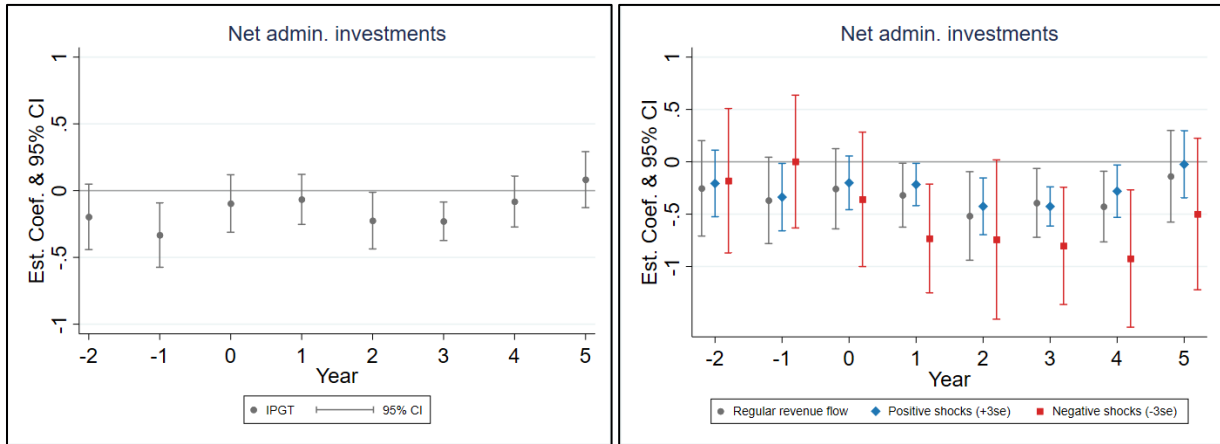
**Table OA.2.3: Correlates of property transactions and IPGT receipts**

	(1)	(2)	(3)	(4)
	IPGT	# Transaction	In- migration	Out- migration
# Transactions	355.8 (1749.7)			
In-migration		3.274*** (0.417)		
Out-migration		-1.837*** (0.324)		
Marriages			0.0775*** (0.0209)	0.0355** (0.0141)
Divorces			0.0578 (0.0370)	0.0239 (0.0287)
Tax base (in 1000 CHF)	67.02*** (16.00)	-0.000123 (0.0000842)	-7.71E-07 (0.00000424)	0.00000186 (0.00000275)
Tax multiplier (%)	11016.5 (7412.7)	0.0608 (0.0968)	0.0421*** (0.0113)	0.0235*** (0.00828)
Net. admin. investm. (in 1000 CHF)	40.45** (19.05)	-0.000337 (0.000249)	-0.00000761 (0.00000704)	5.01E-07 (0.00000596)
Population	271.4** (131.3)	-0.00219 (0.00193)	0.0000226 (0.0000614)	-0.000128** (0.0000594)
Construction activity (CHF/cap)				
... family homes	65.27* (36.86)	0.000738* (0.000424)	0.000567*** (0.0000683)	-0.0000371 (0.0000412)
... multi-fam. homes	66.43** (25.69)	0.00331*** (0.000598)	0.000620*** (0.0000648)	0.00004 (0.0000400)
... services	96.94 (100.1)	0.00321* (0.00190)	0.000191** (0.0000949)	0.0000362 (0.0000566)
... industry	38.75 (49.21)	0.00248** (0.000990)	-0.0000289 (0.0000932)	-0.000128 (0.000105)
... agriculture	-37.01 (32.27)	-0.0012 (0.000775)	0.0000881 (0.0000931)	0.000173 (0.000133)
... roads	395.6 (240.5)	0.00023 (0.00228)	0.000249 (0.000266)	-0.000476** (0.000218)
... public transp.	-36.36 (39.72)	0.000184 (0.000643)	-0.0000128 (0.0000546)	0.0000681* (0.0000358)
... residential	-16.47 (205.9)	-0.00274 (0.00261)	-0.000231 (0.000274)	-0.000248 (0.000182)
Municipal and year FE	included	included	included	included
No of observations	3097	3097	3097	3097
R2	0.235	0.198	0.238	0.0596

Notes: OLS estimation. Standard errors are robust to clustering at the municipal level (in parenthesis)

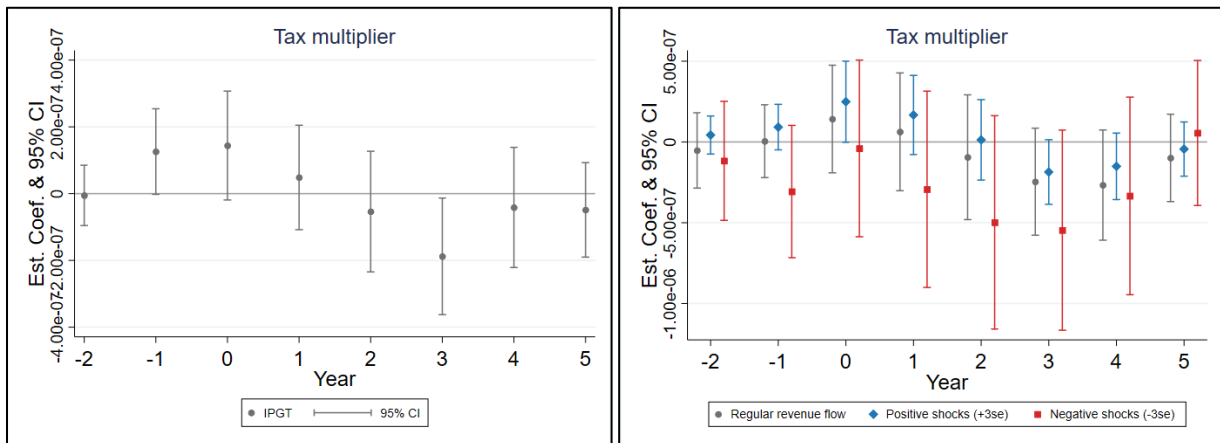
## OA.3: Public policy drivers (main LASSO)

**Figure OA.3.1: Net administrative investments**



Notes: Point estimates and 95% confidence intervals based on the main post-double-selection LASSO specification. Figure on the left uses total *IPGT* variation (no distinction of regular flows and positive or negative shocks), the figure on the right distinguishes regular flows from positive and negative shocks.

**Figure OA.3.2: Income and business tax multiplier**

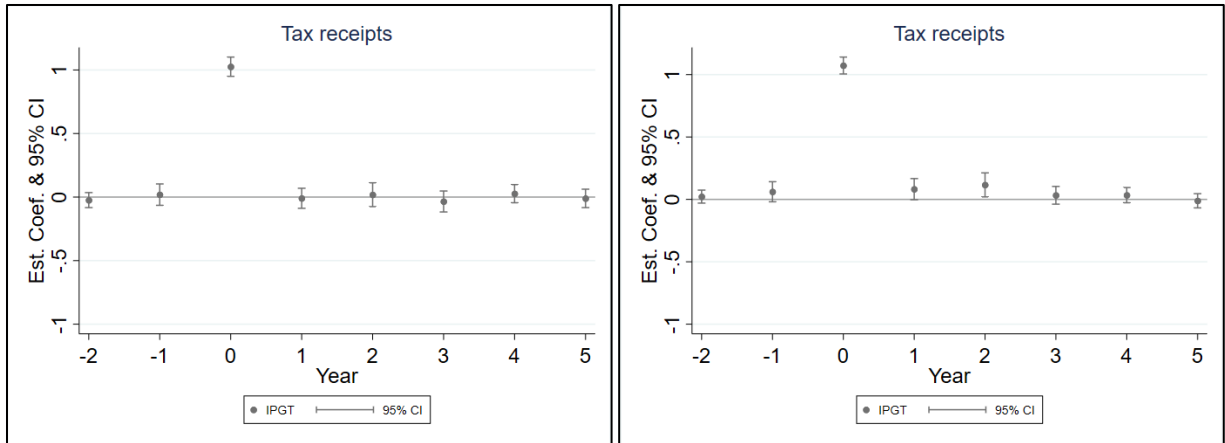


Notes: Point estimates and 95% confidence intervals based on the main post-double-selection LASSO specification. Figure on the left uses total *IPGT* variation (no distinction of regular flows and positive or negative shocks), the figure on the right distinguishes regular flows from positive and negative shocks.

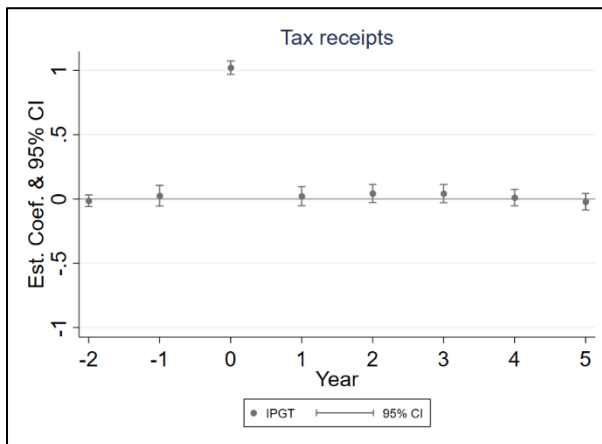
## OA.4: Results from alternative model specifications

Figure OA.4.1: Tax receipts: total *IPGT*

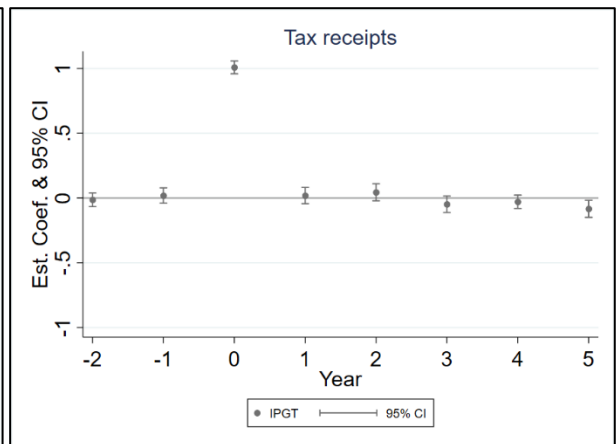
OLS (incl. tax base, pop., tax mult., net. adm. inv.)    Main LASSO



No Trends (LASSO)



No Smoother (LASSO)



No covariate selection on Smoother and shock-year-dummies (LASSO)

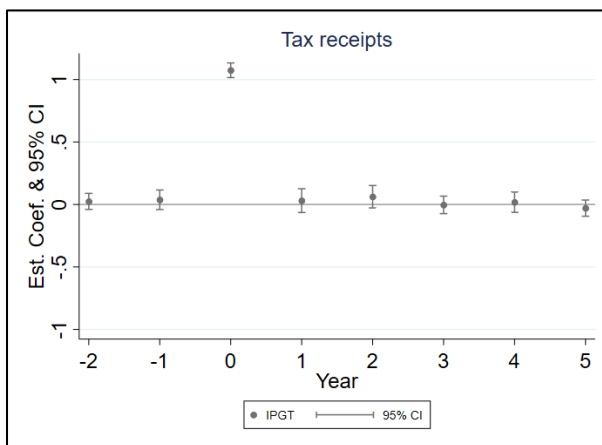
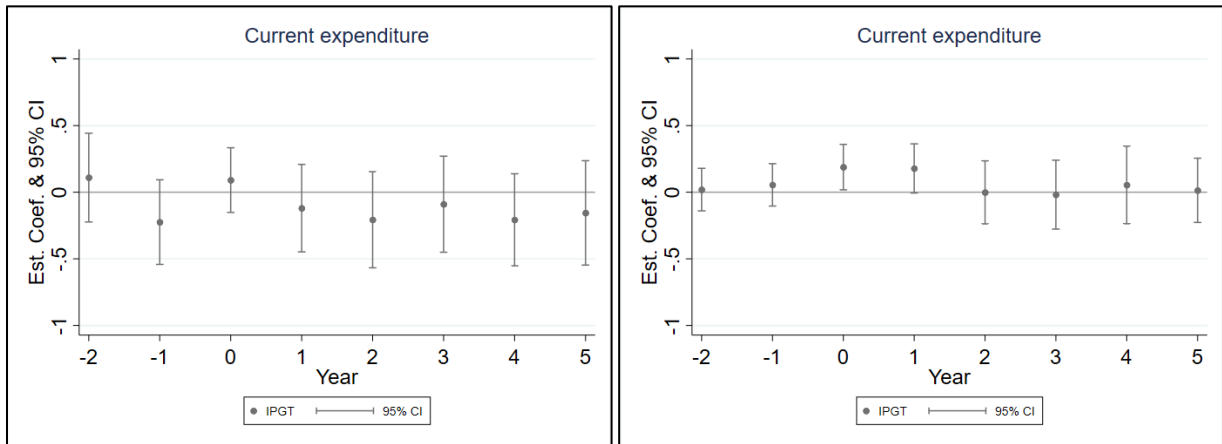
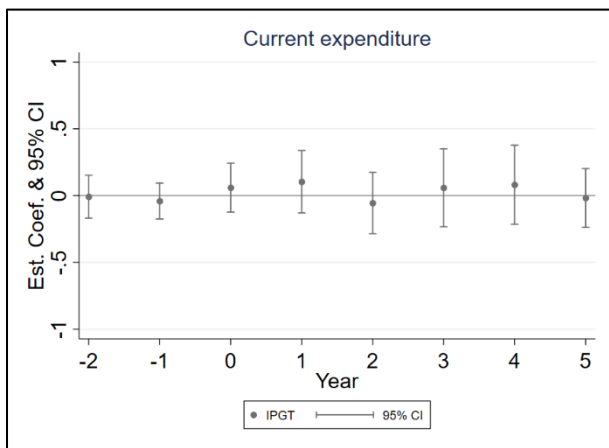


Figure OA.4.2: Current expenditures: total *IPGT*

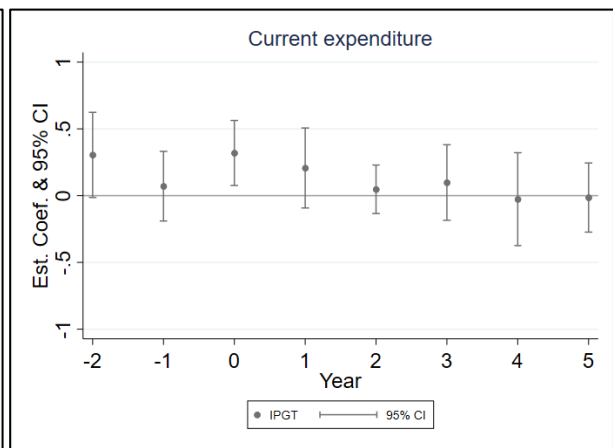
OLS (incl. tax base, pop., tax mult., net. adm. inv.)      Baseline LASSO



No Trends (LASSO)



No Smoother (LASSO)



No covariate selection on Smoother and shock-year-dummies (LASSO)

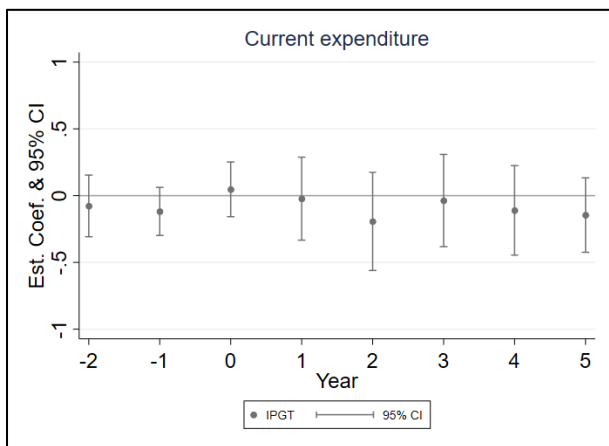
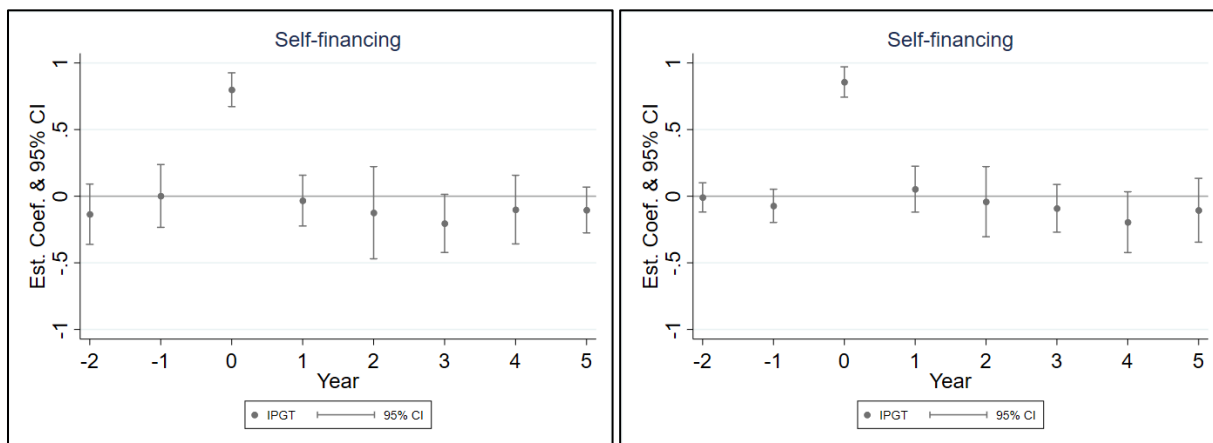
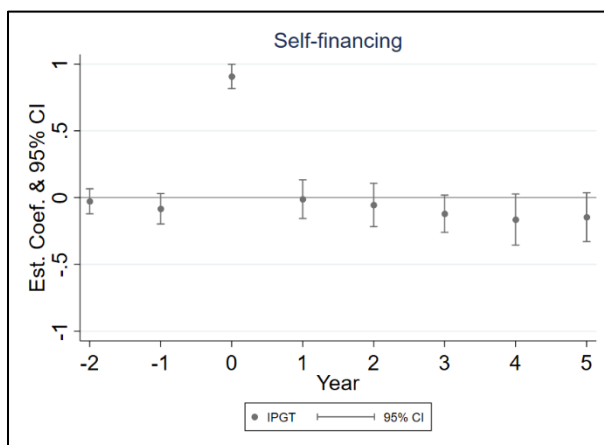


Figure OA.4.3: Current balance (self-financing): total *IPGT*

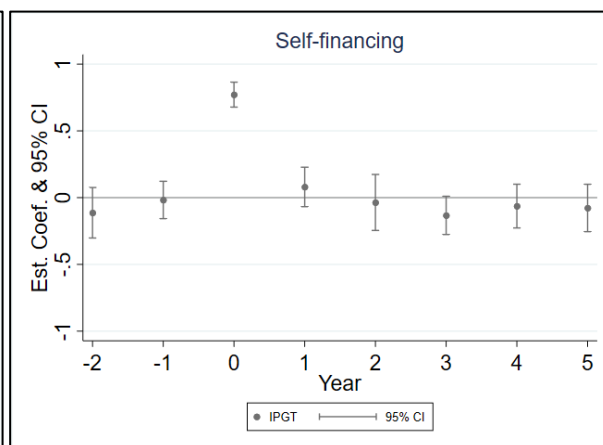
OLS (incl. tax base, pop., tax mult., net. adm. inv.)    Baseline LASSO



No Trends (LASSO)



No Smoother (LASSO)



No covariate selection on Smoother and shock-year-dummies (LASSO)

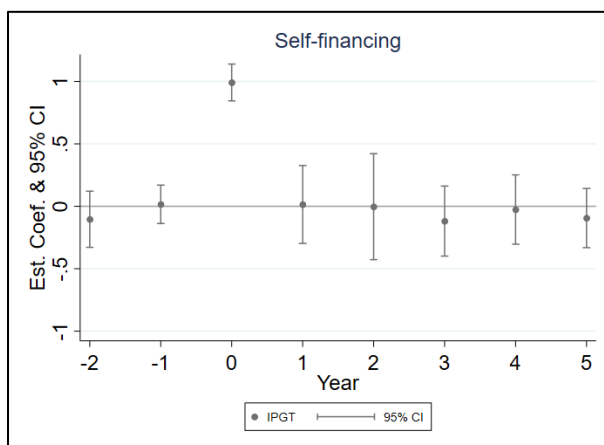
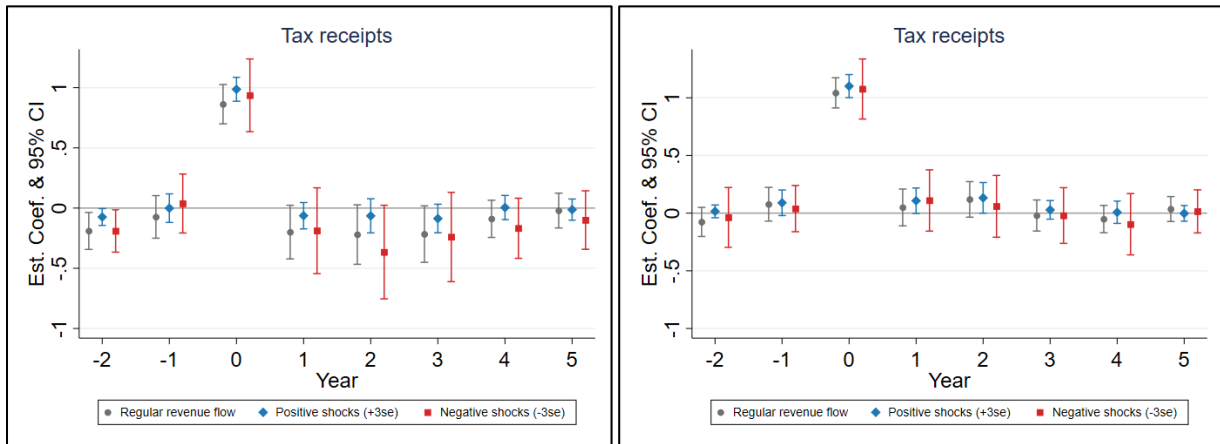


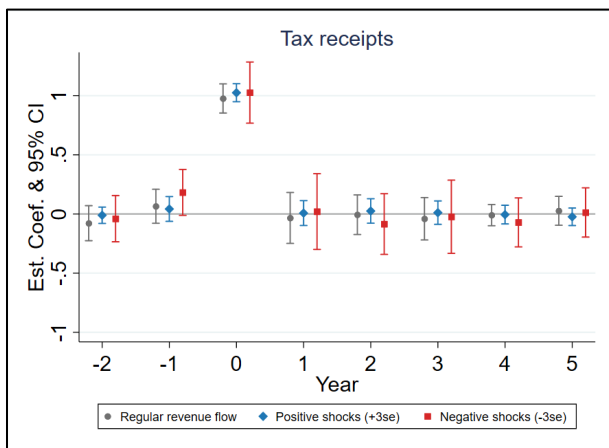


Figure OA.4.4: Tax receipts: shocks

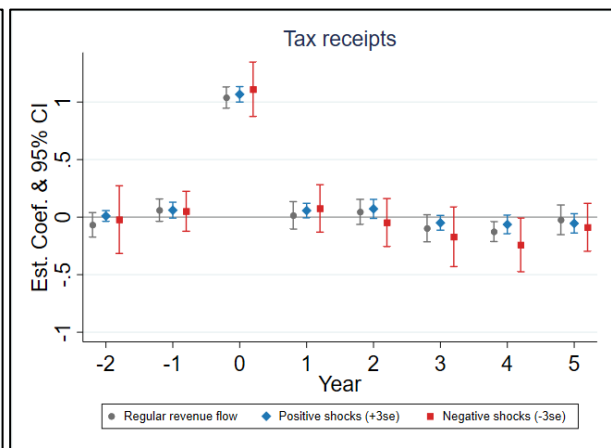
OLS (incl. tax base, pop., tax mult., net. adm. inv.)      Baseline LASSO



No Trends (LASSO)



No Smoother (LASSO)



No covariate selection on Smoother and shock-year-dummies (LASSO)

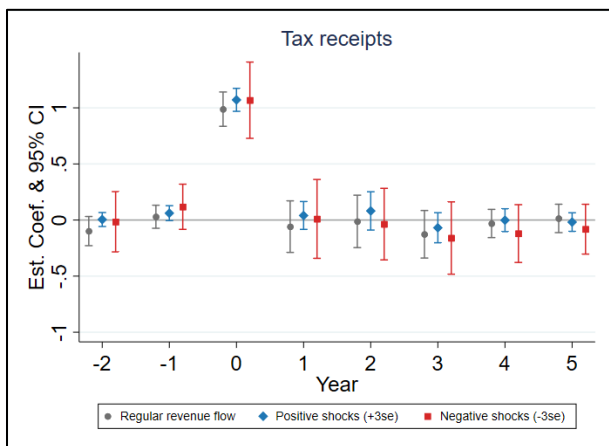
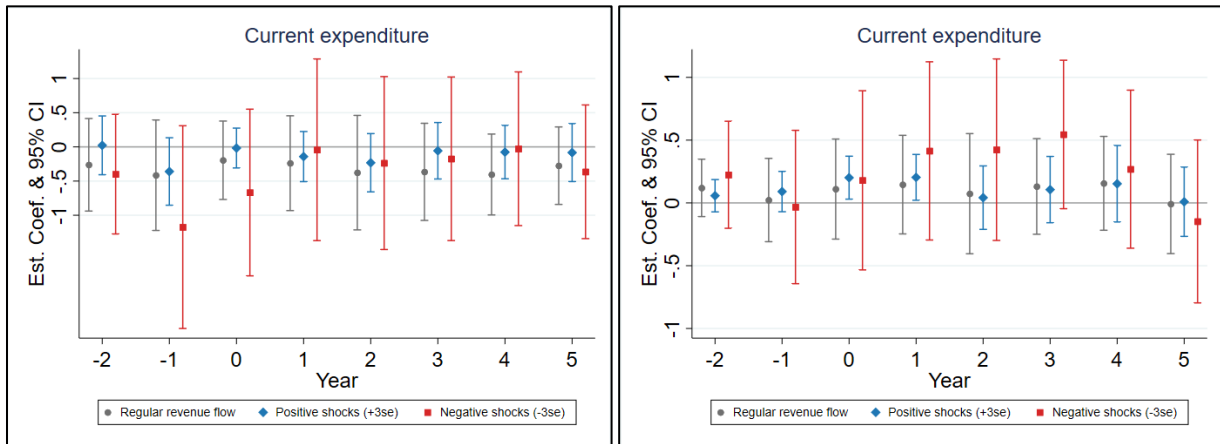


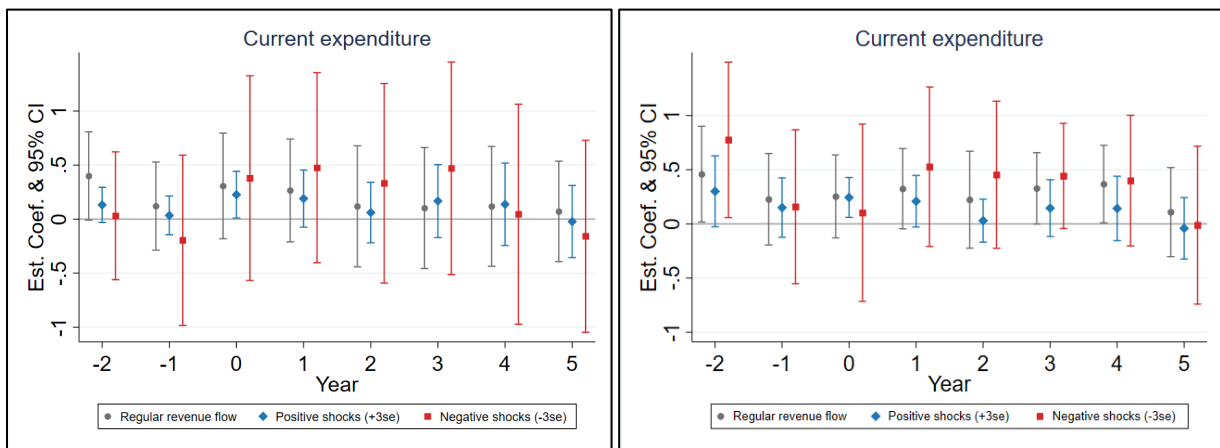
Figure OA.4.5: Current expenditures: shocks

OLS (incl. tax base, pop., tax mult., net. adm. inv.)      Baseline LASSO



No Trends (LASSO)

No Smoother (LASSO)



No covariate selection on smoother and shock-year-dummies (LASSO)

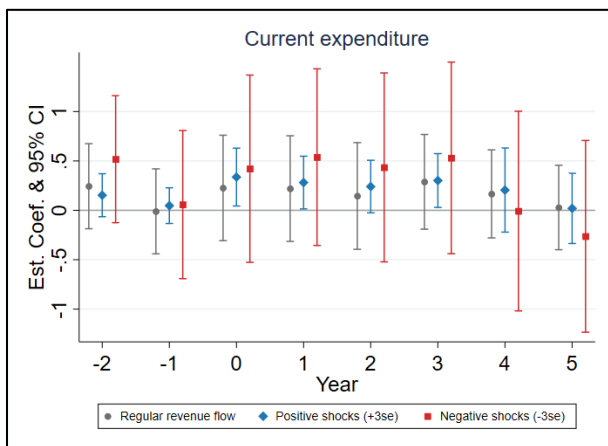
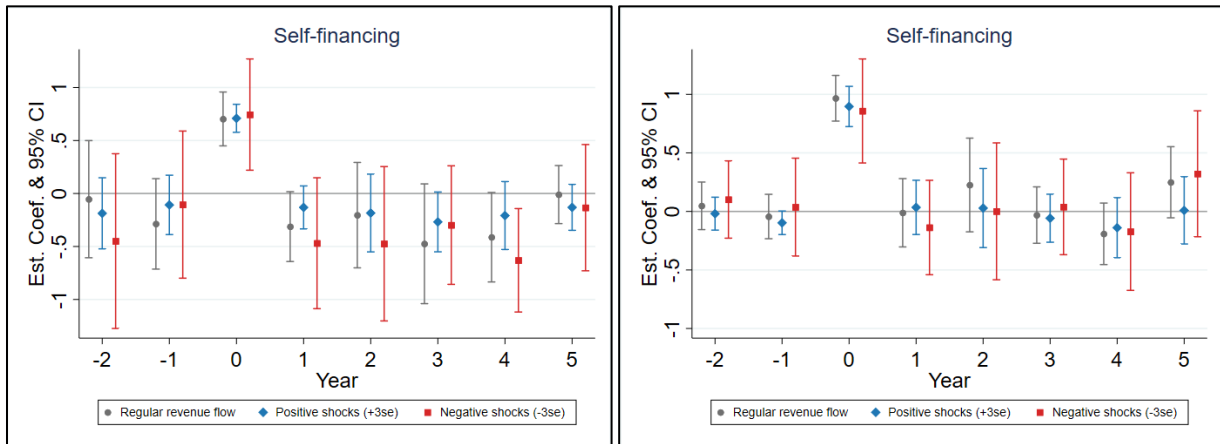
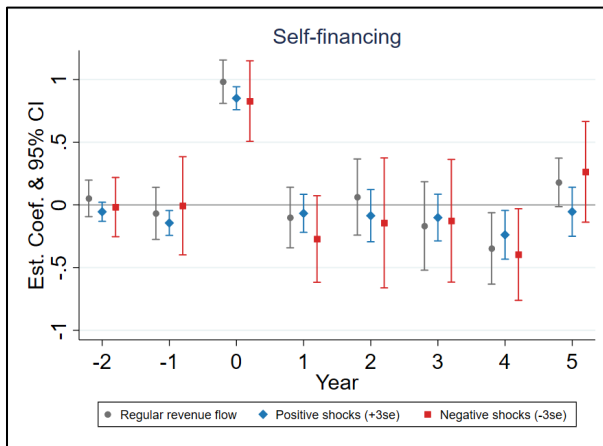


Figure OA.4.6: Current balance (self-financing): shocks

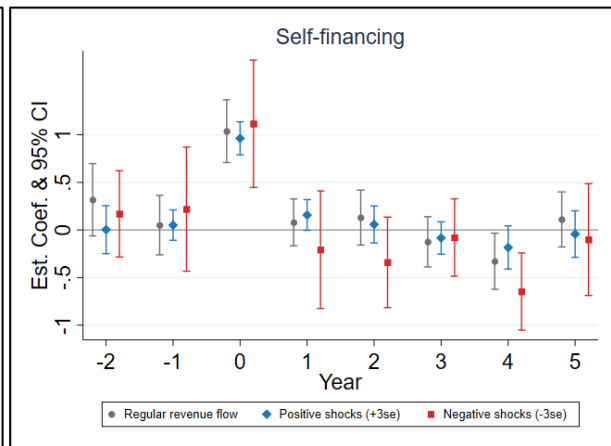
OLS (incl. tax base, pop., tax mult., net. adm. inv.)    Baseline LASSO



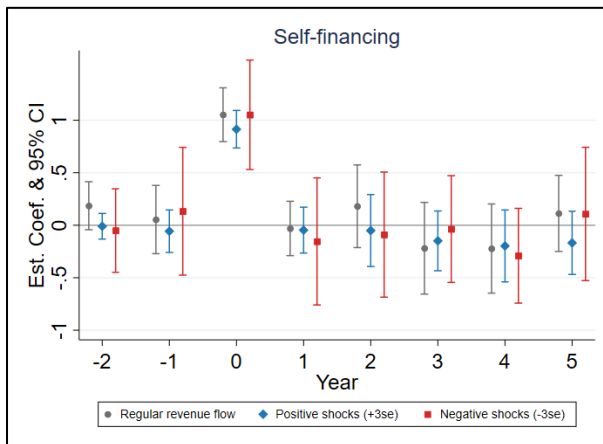
No Trends (LASSO)



No smoother (LASSO)



No covariate selection on smoother and shock-year-dummies (LASSO)



## OA.5: LASSO covariate selection

**Table OA.5.1: Covariate pool**

Parliament	Share 1-person households
Fiscal referendum	Share 2-person households
Election year	Share 3-person households
Election in 1 year	Share 4-person households
Election in 2 years	Share 5-person households
Election in 3 years	Share 6+-person households
Seat in executive	Medical doctors per 1000 pop
Share of male in the executive	Agricultural area (ha)
Share leftwing in executive (SP, Green, Alternative)	Share agricultural employment
At least one left-wing seat	Share part-time agricultural employment
Member share not affiliated to main parties in executive	Hotel beds per 1000 pop
Female mayor	Share gastro employment
One party holds majority in local council	Building volume (1000 m3)
Unified municipality ("Einheitsgemeinde")	Share residential building volume
Post Leukerbad	Share service building volume
Unassigned grants	Share infrastructure volume
Compensations to public authorities	Share industry volume
Revenue shares and contributions unassigned	Share agricultural volume
Reimbursements from public authorities	Share secondary building volume
Net admin investment	Tax capacity (CHF)
Loans and financial interests	Tax capacity (CHF/cap)
Investment contributions	Total equalization transfers (CHF)
Repayment of loans and financial interests	Total equalization transfers (CHF/cap)
Repayment of investment contributions	Net total transfers
Investment contributions	Tax multiplier (%)
Population	Taxable income natural persons (1000 CHF)
Share 0-14 years	Taxable wealth natural persons (1000 CHF)
Share 15-19 years	Taxable profits legal persons (1000 CHF)
Share 20-39 years	Taxable equity legal persons (1000 CHF)
Share 40-64 years	Tax receipts of natural persons (CHF/cap)
Share 65+	Tax receipts of legal persons (CHF/cap)
Share foreigners	Fees water (CHF/cap)
Share females (%)	Fees waste water (CHF/cap)
Population density (Pop/km2)	Fees waste (CHF/cap)
Birth per 1000 pop	Share of empty buildings
Nationalizations per 1000 pop	Share of new buildings (last 5 years)
Kindergarten per 1000 pop	Share of single homes
Primary school per 1000 pop	Share of 1 bedroom
Middle school per 1000 pop	Share of 2 bedrooms
Vocational school per 1000 pop	Share of 3 bedrooms
Share catholic	Share of 4 bedrooms
Share protestant	Share of 5 bedrooms
Share other religion	Share of 6+ bedrooms
Dentists per 1000 pop	Rural municipality
Pharmacies per 1000 pop	

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Note: Covariates enter the covariate pool with 5 lags and 2 leads. Linear and quadratic time trends not reported.

**Table OA.5.2: LASSO selected covariates**

**IPGT Shocks (specifications of Figures 2, 3 & 5)**

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Tax receipts	Compensations to public authorities, Building volume (1000 m3), Tax receipts of natural persons (CHF/cap), Population, Birth per 1000 pop, Fiscal referendum, Net total transfers, Parliament, Primary school per 1000 pop, Share 0-14 years, Share 1-person household, Share 2-person household, Share 3-person household, Share 4-person household, Share 40-64 years, Share 65+, Share females (%), Share of new buildings (last 5 years), Tax capacity (CHF), Tax capacity (CHF/cap), Tax multiplier (%), Taxable income natural persons (1000 CHF), Taxable wealth natural persons (1000 CHF), Total equalization transfers (CHF/cap), Unassigned grants
Current expenditures	Compensations to public authorities, Net admin investment, Share of 3 bedrooms, Building volume (1000 m3), Birth per 1000 pop, Fiscal referendum, Net total transfers, Parliament, Primary school per 1000 pop, Share 0-14 years, Share 1-person household, Share 2-person household, Share 3-person household, Share 4-person household, Share 40-64 years, Share 65+, Share females (%), Share of new buildings (last 5 years), Tax capacity (CHF), Tax capacity (CHF/cap), Tax multiplier (%), Taxable income natural persons (1000 CHF), Taxable wealth natural persons (1000 CHF), Total equalization transfers (CHF/cap), Unassigned grants
Self-financing	Birth per 1000 pop, Fiscal referendum, Net total transfers, Parliament, Primary school per 1000 pop, Share 0-14 years, Share 1-person household, Share 2-person household, Share 3-person household, Share 4-person household, Share 40-64 years, Share 65+, Share females (%), Share of new buildings (last 5 years), Tax receipts of legal persons (CHF/cap), Tax capacity (CHF), Tax capacity (CHF/cap), Tax multiplier (%), Taxable income natural persons (1000 CHF), Taxable wealth natural persons (1000 CHF), Total equalization transfers (CHF/cap), Unassigned grants

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Note: LASSO specifications include 5 lags and 2 leads for causal variables and covariate pool. Covariates have been selected in various lag and lead structures. This information is omitted from this table. LASSO-selected linear and quadratic time trends not reported.