Fiscal Multipliers in the COVID-19 Recession: A Cross-Country Comparison

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Table of contents

Question and Motivation

- How large are fiscal multipliers in *the COVID-19 recession*?
- How are fiscal multipliers in the COVID-19 recession different from those in normal periods?

- The pandemic in 2020: severe recession, fiscal policy was an important tool to combat the recession
- Situation is not so simple
  - Recession, zero lower bound: those may raise effectiveness of fiscal policy
  - High government debt: it may reduce effectiveness of fiscal policy
  - Lockdown style quarantine policy: a new one which potentially affects effectiveness of fiscal policy

- Lockdown policy:
- It restricts face-to-face economic activities
- This can cause a deeper recession (than usual recessions) $->$ It may enhance effectiveness of fiscal policy (e.g. higher MPC)
- However, it can be a natural source to limit stimulus effects of fiscal policy
- Total effects can be mixed (maybe non-linear?)

- What I do:
- Attempting to figure out effectiveness of fiscal policy in the COVID-19 recession and to compare that with the normal one
- Econometrics: time-varying parameter structural VAR with stochastic volatility (TVP-SV-SVAR) model (Primiceri (2005), Cogley and Sargent (2005))
- Data: 14 advanced countries from 2000.Q1 to 2021.Q1
- For each country, I estimate TVP-SV-SVAR and compute multipliers

What's new?

- Aggregate level evidence on fiscal multipliers in the COVID-19 recession
  - Some literature attempt to figure out effectiveness of fiscal policy during the COVID19 recession using micro-level data
  - This paper use aggregate data, which can complement existing literature
- Using a cross-country comparison, I try to investigate a role of quarantine policy in determining fiscal multipliers

Summary of Results

- Size of Multipliers: huge variations across countries and across fiscal instruments
  - I estimate effects of government consumption and net taxes (tax revenue - transfers) separately
- Net taxes: only a few countries have notable stimulus effects (US, CAN, AUS)
- Government spending: seem to be effective in the (very) short-run but not in the longer-run

- Additional stimulus effects (relative to the normal)
  - Several literature claim larger multipliers in recessions than in normal situations
- Ntax: additional stimulus effects are observed in the longer-run, but it is small and uncertain
- GCON: additional stimulus effects are not clear

- Lockdown policy?
- Uncertain, total effects may be non-linear

Econometrics and Data

- I estimate TVP-SV-SVAR for each country (14 advanced countries)
  - USA, AUS, CAN, GBR, KOR, FRA, ESP, ITA, DEU, NLD, FIN, PRT, SWE, CHE
- TVP-SV-SVAR: Primiceri (2005) and Cogley and Sargent (2005)
- Allowing time varying process for both level equations and volatility
- In contrast to other non-linear models (regime switching, threshold VAR...), TVP-SV-SVAR adopts agnostic approach to capture structural changes

- Pros: data driven structural changes, we don't need *ex-ante* restrictions
- Cons: too many parameters to estimate (over-parameterization), sometimes show very wide confidence bands (typically for fiscal policy)

$$A_{0,t}X_t = \sum_{i=1}^{p} A_{i,t}X_{t-i} + \Sigma_t \varepsilon_t \tag{1}$$

$$B_t = \begin{bmatrix} A_{0,t}^{-1}A_{1,t} \\ A_{0,t}^{-1}A_{2,t} \\ \vdots \\ A_{0,t}^{-1}A_{p,t} \end{bmatrix} \tag{2}$$

$$\theta_t = vec(B_t), \theta_t = \theta_{t-1} + \nu_t \tag{3}$$

$$A_{0,t}\Xi_t A_{0,t}' = \Sigma_t \Sigma_t', \eta_t = A_{0,t}^{-1}\Sigma_t \varepsilon_t \tag{4}$$

$$\Sigma_t = \begin{bmatrix} \lambda h_{1,t} & 0 & 0 & 0 \\ 0 & \lambda h_{2,t} & 0 & 0 \\ 0 & 0 & \lambda h_{3,t} & 0 \\ 0 & 0 & 0 & \lambda h_{4,t} \end{bmatrix}, A_{0,t} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ \zeta_{21,t} & 1 & 0 & 0 \\ \zeta_{31,t} & \zeta_{32,t} & 1 & 0 \\ \zeta_{41,t} & \zeta_{42,t} & \zeta_{43,t} & 1 \end{bmatrix} \tag{5}$$

$$\ln h_{j,t} = \ln h_{j,t-1} + \omega_{j,t}, \zeta_{k,t} = \zeta_{k,t-1} + \iota_{k,t} \tag{6}$$

- Bayesian method: 60,000 draw, 50,000 burn-in, keep each 10th draw as posterior
- Using posterior, I can draw impulse responses using sign restrictions (Rubio-Ramirez et al. (2010))

$$x_t = \begin{bmatrix} GCON \\ GDP \\ Lint \\ Ntax \end{bmatrix}$$

- X_t: real government consumption (GCON), real GDP (GDP), long-term interest rate (Lint), real net taxes (Ntax)
- GCON: proxy of government spending (a component of GDP)
- Ntax: (tax income + social benefits) - (transfer payment + subsidy), following Blanchard and Perotti (2002)
- Lint: 10-year governmnet bonds yield, (KOR: 5 year)

- The model includes 2 lags
- GCON, GDP, Ntax are normalzed by the trend GDP (HP-filtered), it is useful to compute multipliers

Data

- Variables for Ntax: department of statistics in each country (e.g. UK ONS)
- GCON, GDP: OECD stat, chained dollar
- Lint: OECD stat, KOR: BOK
- Data covers 2000.Q1 to 2021.Q1 (For cross-country comparison, I use the same length data for each country)

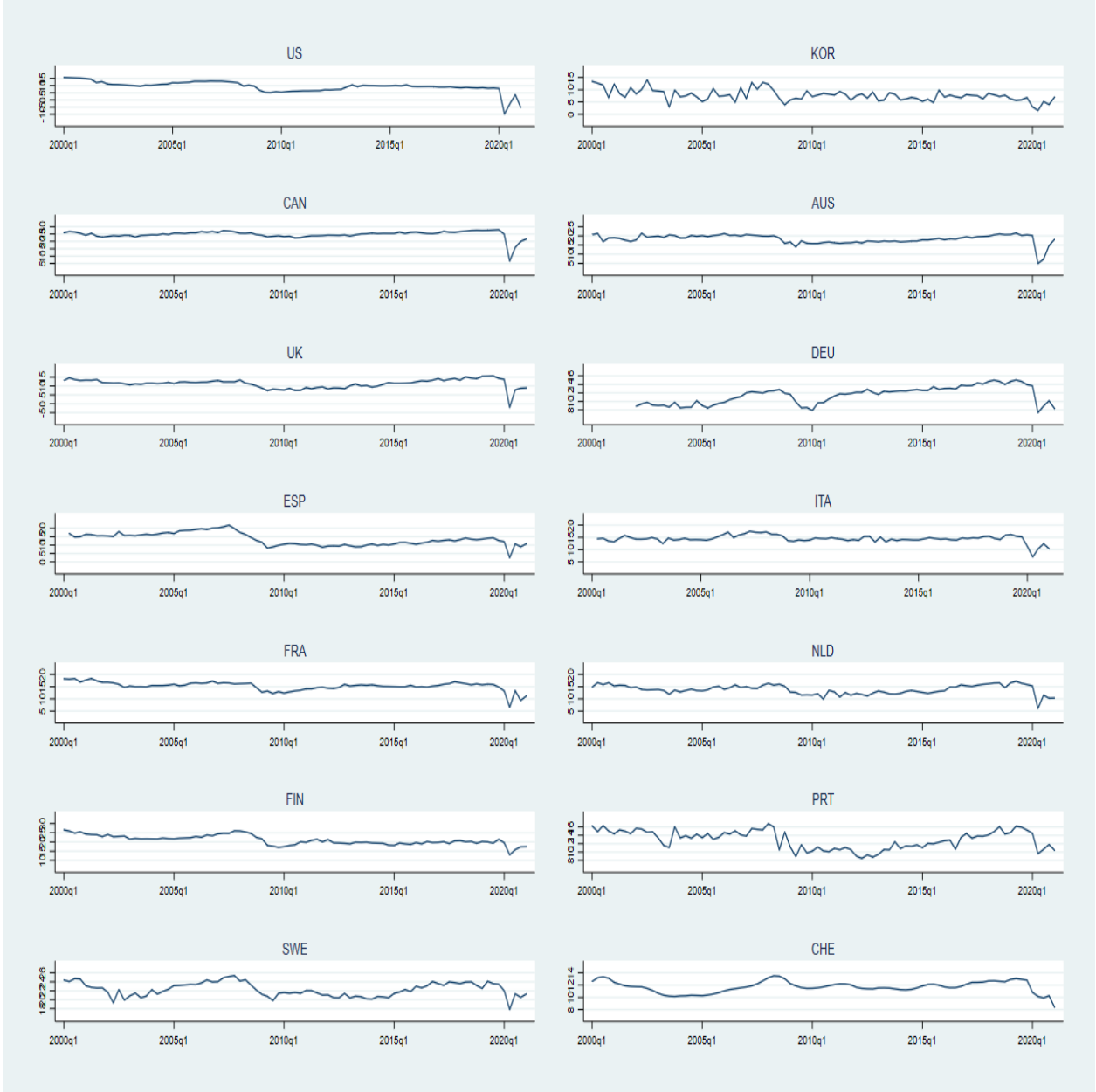


Figure: Ntax to trend GDP

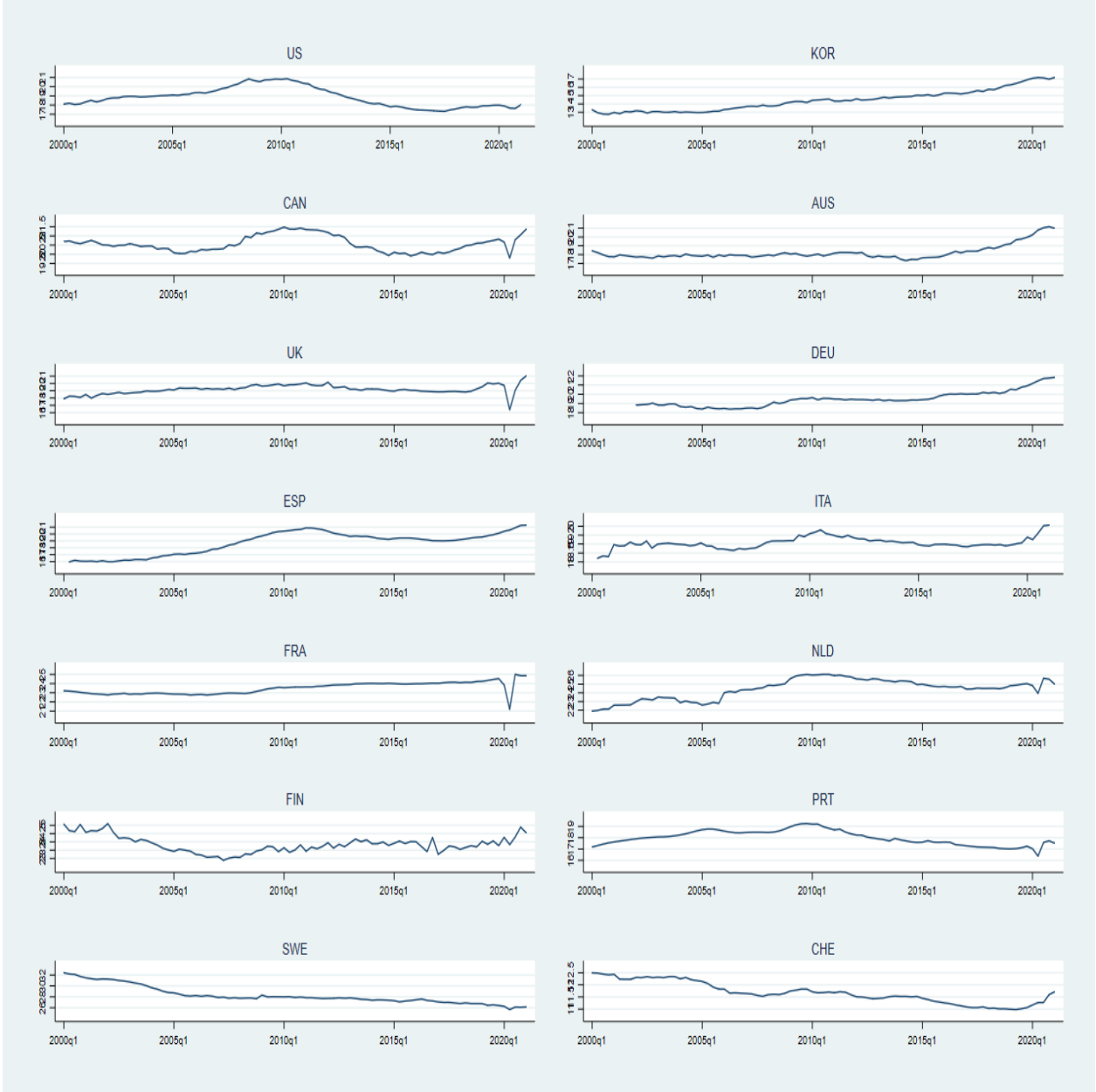


Figure: GCON to trend GDP

- Figures reveal that Ntax played a significant role as a main fiscal instrument, GCON did not
- Onset of the COVID19 recession, GCON decreased (relative to trend GDP) in many countries

Identification

- I adopt sign restrictions in the spirit of Mountford and Uhlig (2009), Cladara and Kamp (2017) and Arias et al. (2018)

	Business cycle shocks	Net tax shocks	Gov't consumption shocks
GCON			+
GDP	+	+	+
Lint			
Ntax	+	-	

- All restrictions are imposed only in a quarter
- No restriction on Lint

- Business cycle shocks and Ntax shocks: as an automatic stabilizer, Ntax is strongly procyclical. This is the main difficulty to identify exogenous shocks of Ntax.
- Idea of Mountford and Uhlig (2009): rule out procyclical movement of Ntax using business cycle shocks

- GCON shock: I assume that an increase in GCON raises GDP contemporaneously (Amendola et al. (2020))
- Several empirical and theoretical works support this assumption.
- Identifying restriction is weak and a minimal set of identifying meaningful fiscal shocks

- Other identifications strategy is hard to exploit in this research setting
- Blanchard and Perotti (2002): elasticity of Ntax shocks are calibrated using external sources.
- But I use 14 advanced countries and it is not easy to calibrate reasonable numbers for each country
- Recursive identification: possible for GCON shock, but not proper for Ntax shocks

- Narrative approach: Recently popular, but narrative variables for GCON are readily available for only limited number of countries (e,g. US and Cananda), also, narrative variables for Ntax are rare.
- Moreover, narrative variable as an IV, it should be tested its relevance, but for TVP-VAR, the method is not well established. (See Paul (2020))

Computing Multiplers

- Cumulative multipliers: popular in related literature

$$CM_{Ntax,h} = \frac{\sum_{i=1}^{h} \Delta GDP_i}{\sum_{i=1}^{h} \Delta Ntax_i} \tag{7}$$

$$CM_{GCON,h} = \frac{\sum_{i=1}^{h} \Delta GDP_i}{\sum_{i=1}^{h} \Delta GCON_i} \tag{8}$$

- Impulse responses measure changes in variables
- Usual logged variables: the equation (7), (8) measure a kind of elasticities.
- transform elasticities to currency unit: a conversion factor (such as the average ratio of GDP to GCON and GDP to Ntax)
- Nonlinear: hard to justify this choice
- Here, I divide GDP and fiscal variables by the common variable (trend GDP), conversion factor is not necessary (Ramey and Zubairy (2018), Gordon and Krenn (2010))

Size of Multipliers

- Multipliers in the COVID-19 recession: 2020.Q1 - 2020.Q4
- Boxplot of each country: it shows the median with the interquartile ranges
- Ntax: negative is good, less than -1 is the best
- GCON: positive is good, larger than 1 is the best

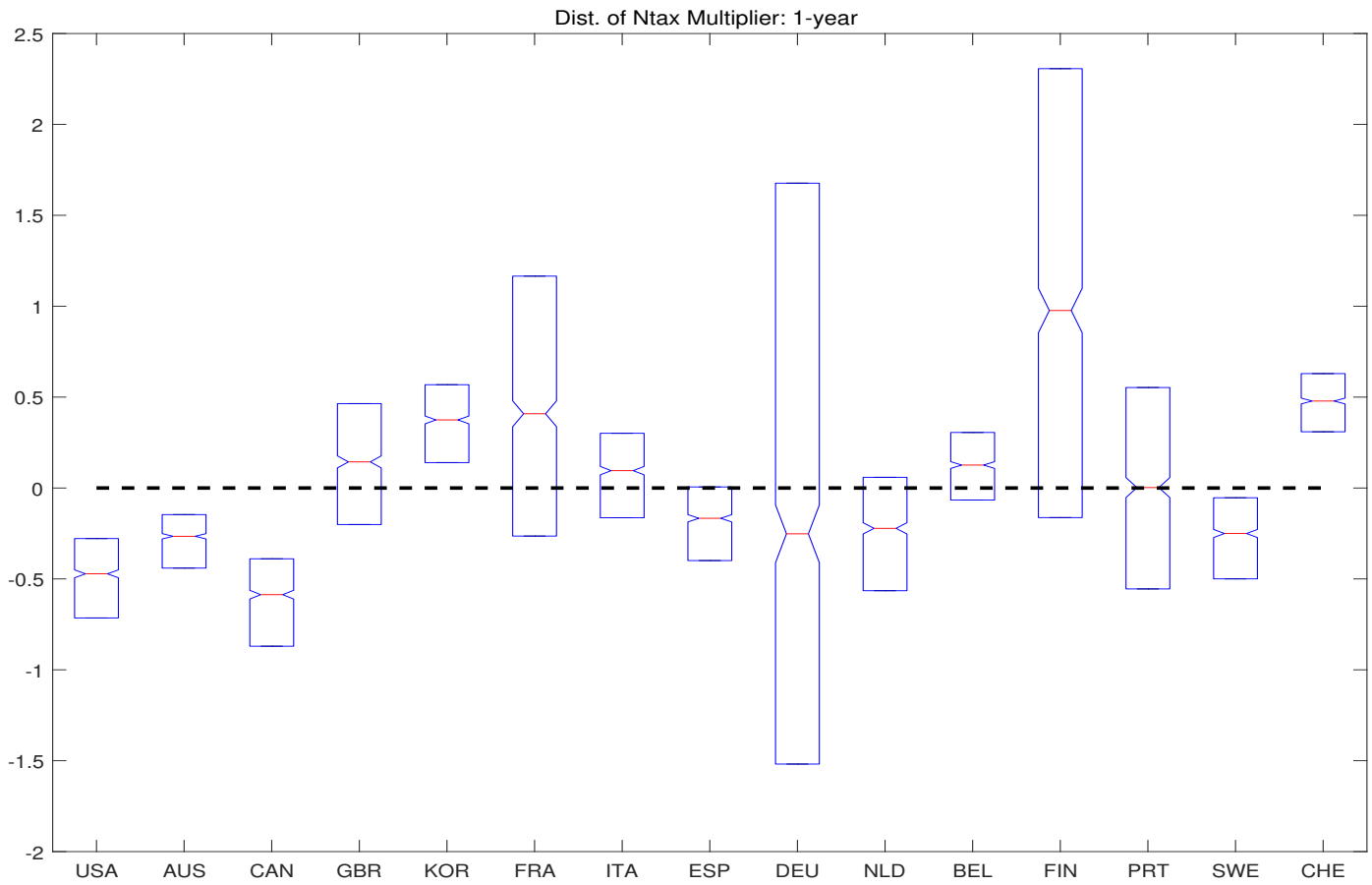


Figure: CM, Ntax: 1-year

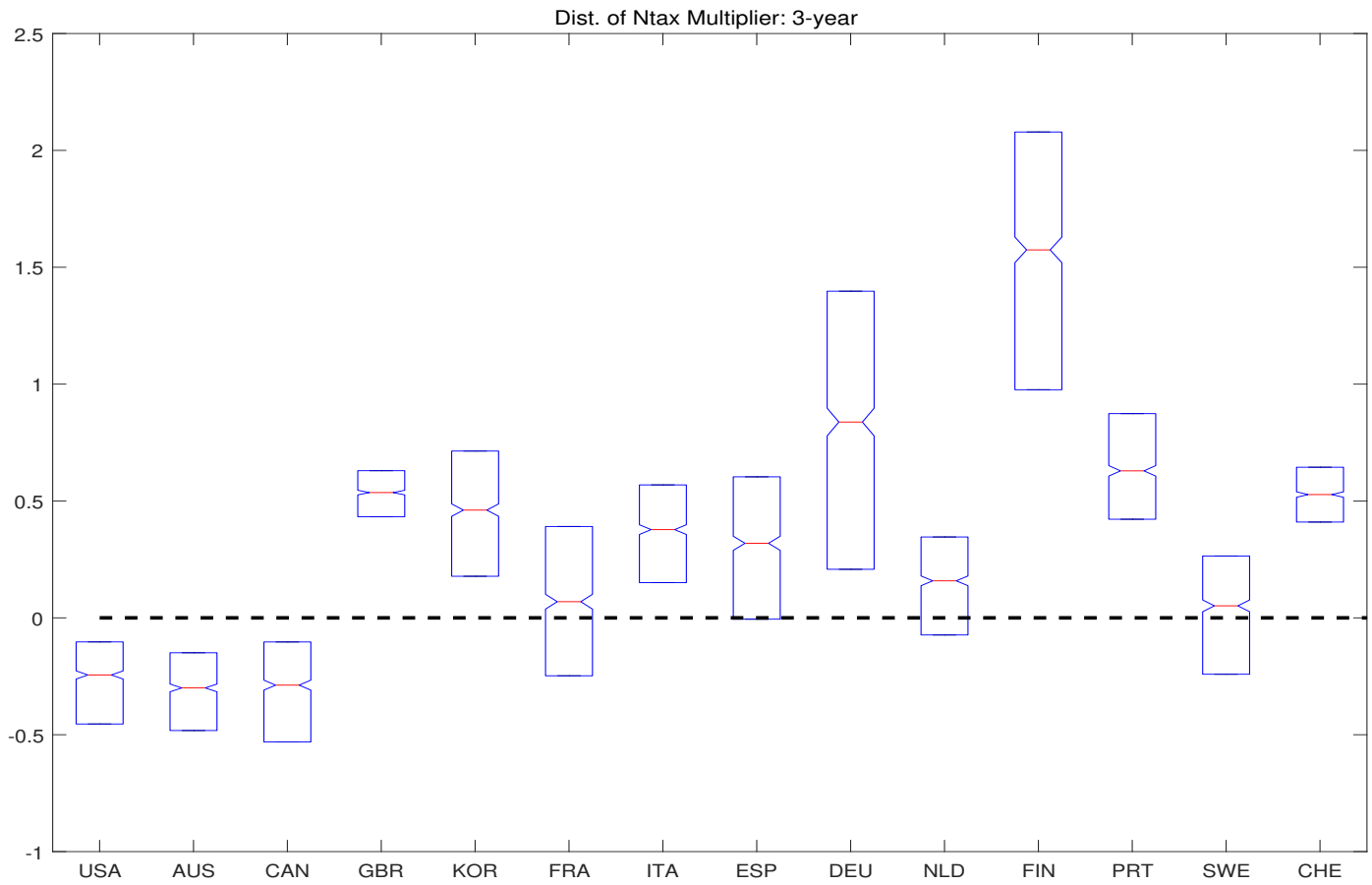


Figure: CM, Ntax: 3-year

- short-run: severe heterogeneity across countries, USA, AUS, CAN, DEU, ESP, NLS, SWE: negative
- longer-run: short-lived and only a few have negative multipliers, USA, AUS, CAN: negative

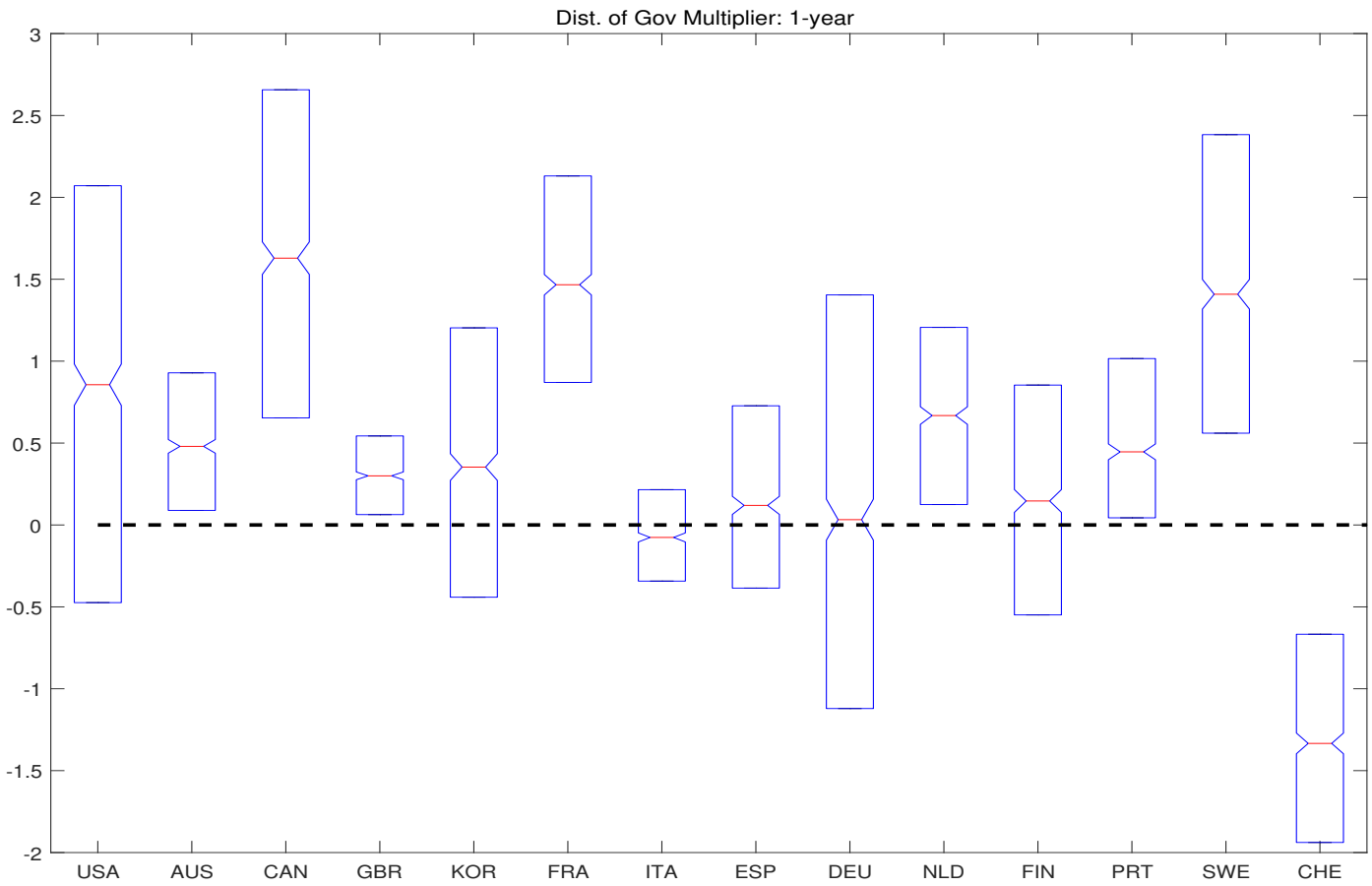


Figure: CM, GCON: 1-year

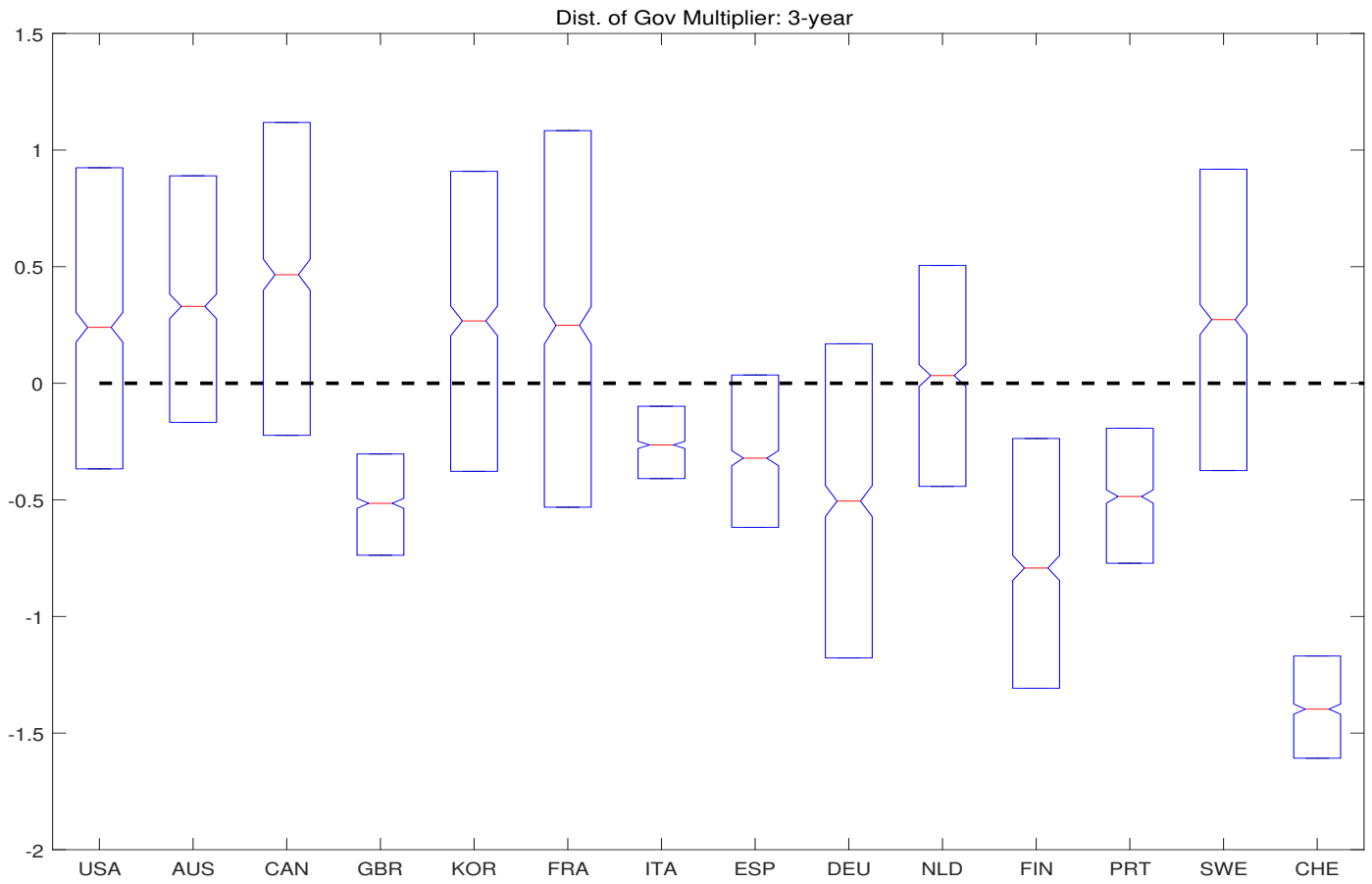


Figure: CM, GCON: 3-year

- short-run: most countries have positive multipliers, severe heterogeneity across countries
- longer-run: half of the countries have positive multipliers

Changes in Multipliers

- Difference of multipliers: (median of 2020.Q1 - 2020.Q4) - (median of 2015.Q1 - 2017.Q4)
- 2015.Q1 - 2017.Q4 is assumed to be the normal time
- Boxplot of each country: the median with the interquartile ranges
- Ntax: negative means additional stimulus effects
- GCON: positive means additional stimulus effects

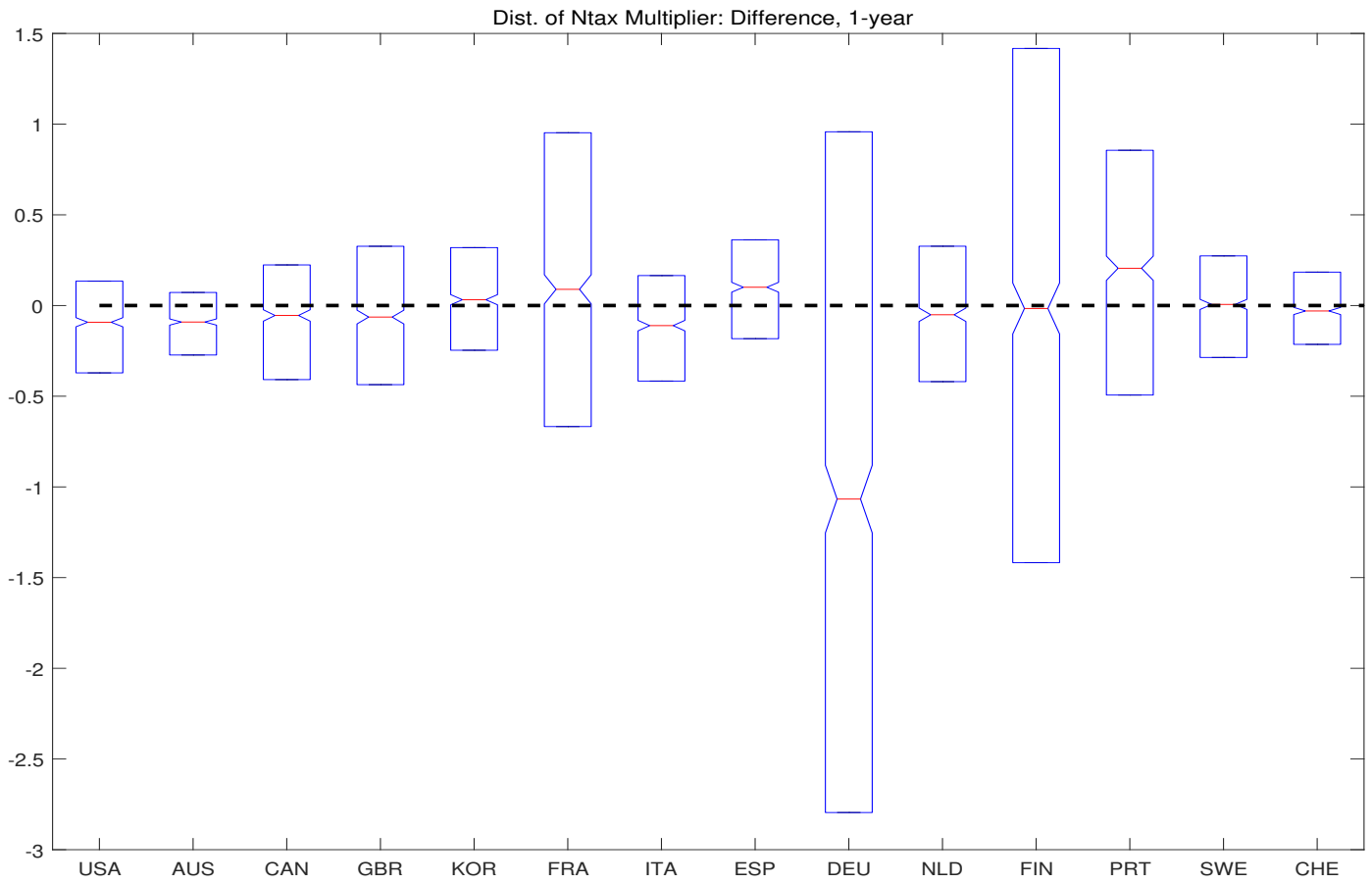


Figure: CM, diff, Ntax: 1-year

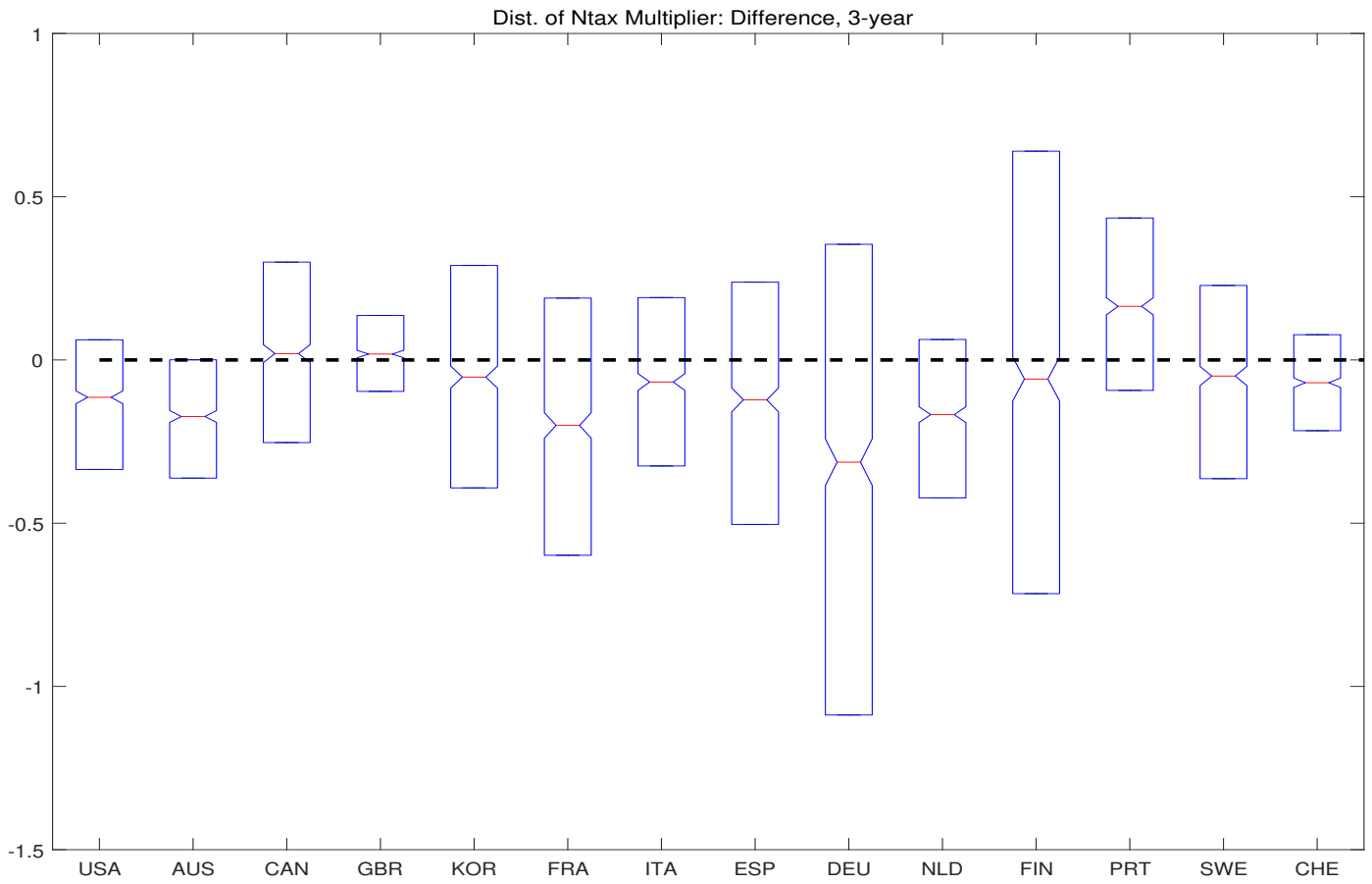


Figure: CM, diff, Ntax: 3-year

- slightly larger stimulus effects (or less crowding-out) of Ntax in the longer-run, but gap is small and uncertain

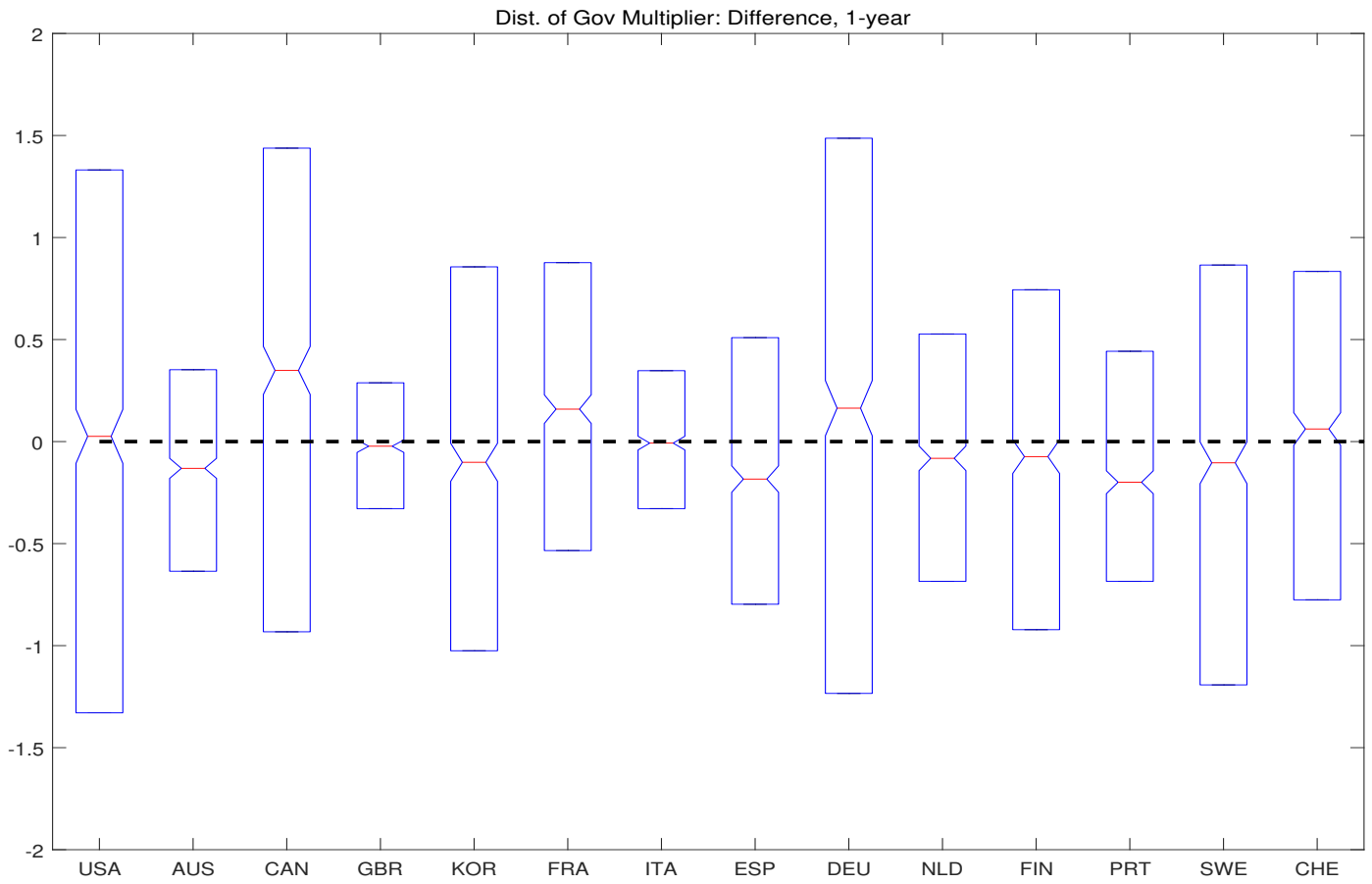


Figure: CM, diff, GCON: 1-year

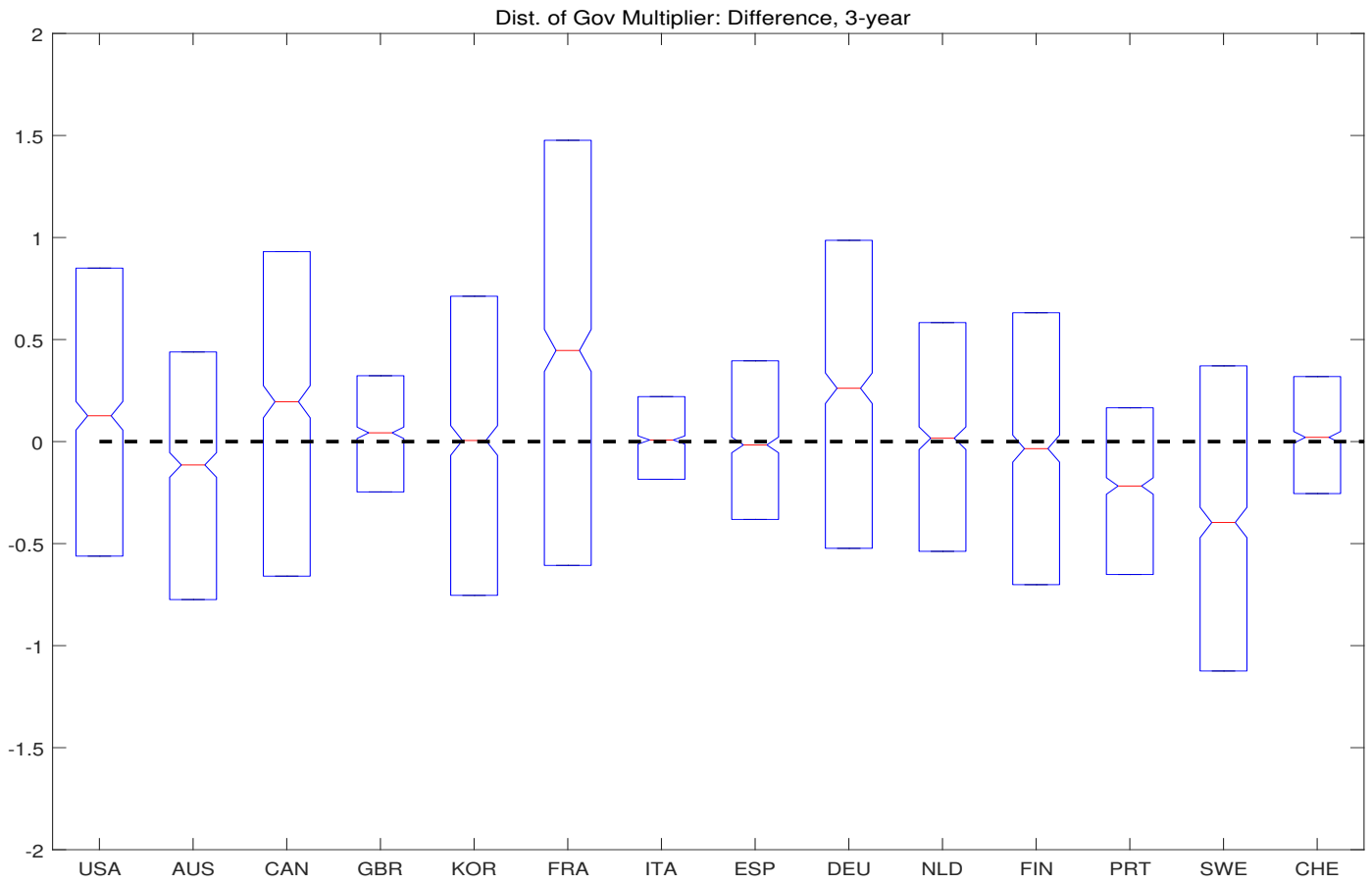


Figure: CM, diff, GCON: 3-year

- no clear evidence on additional stimulus effects of GCON

Lockdown Policy

- Lockdown measure: Hale et al. (2021) stringency index, 0 - 1 scale, 0: no lockdown
- Relation between the difference of Ntax multipliers and the stringency index
  - The differences: it helps removing time-invariant country-fixed effects
  - pre-COVID19: stringency index $= 0$, so I don't need to use the differences of stringency index

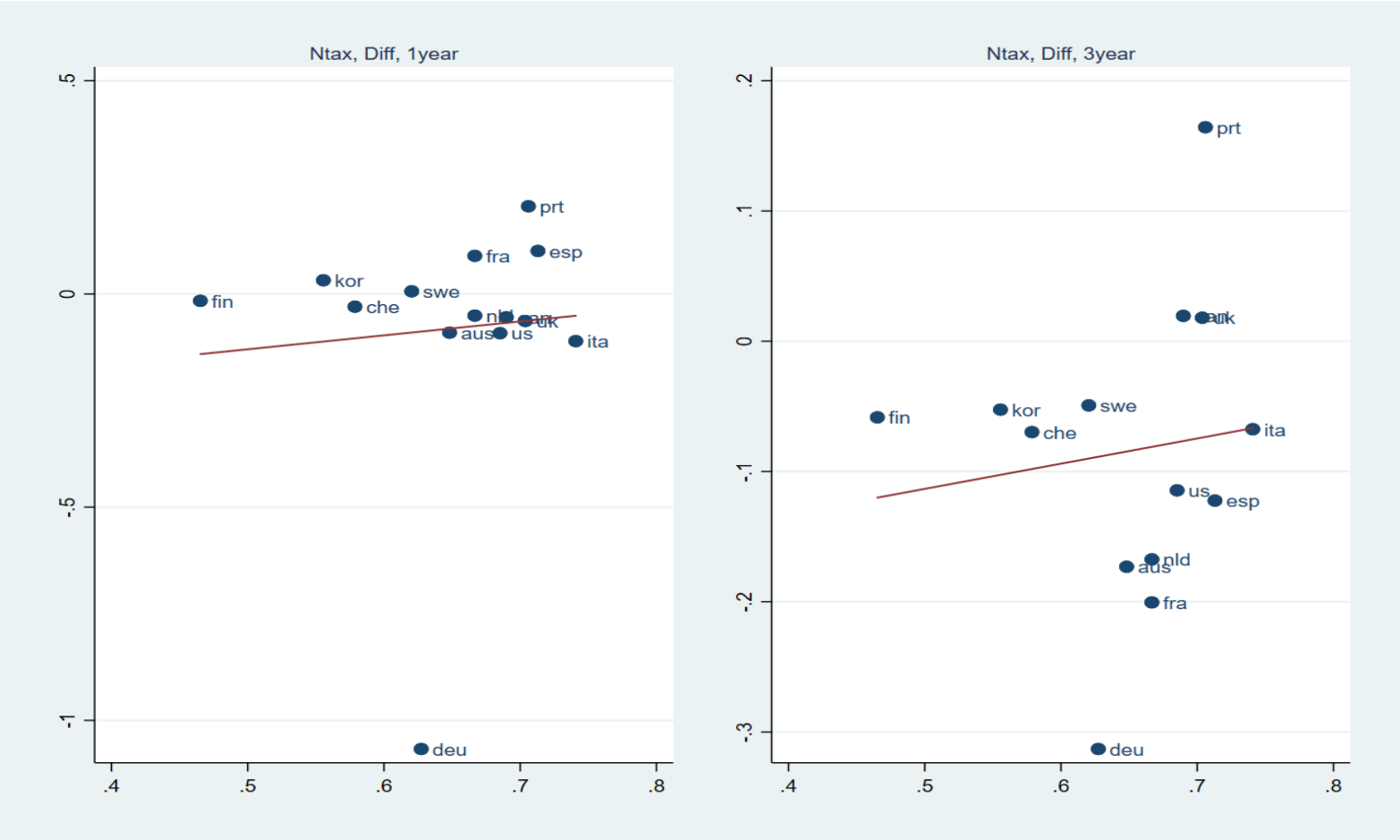


Figure: lockdown and Ntax multiplier, x: lockdown, y: differences

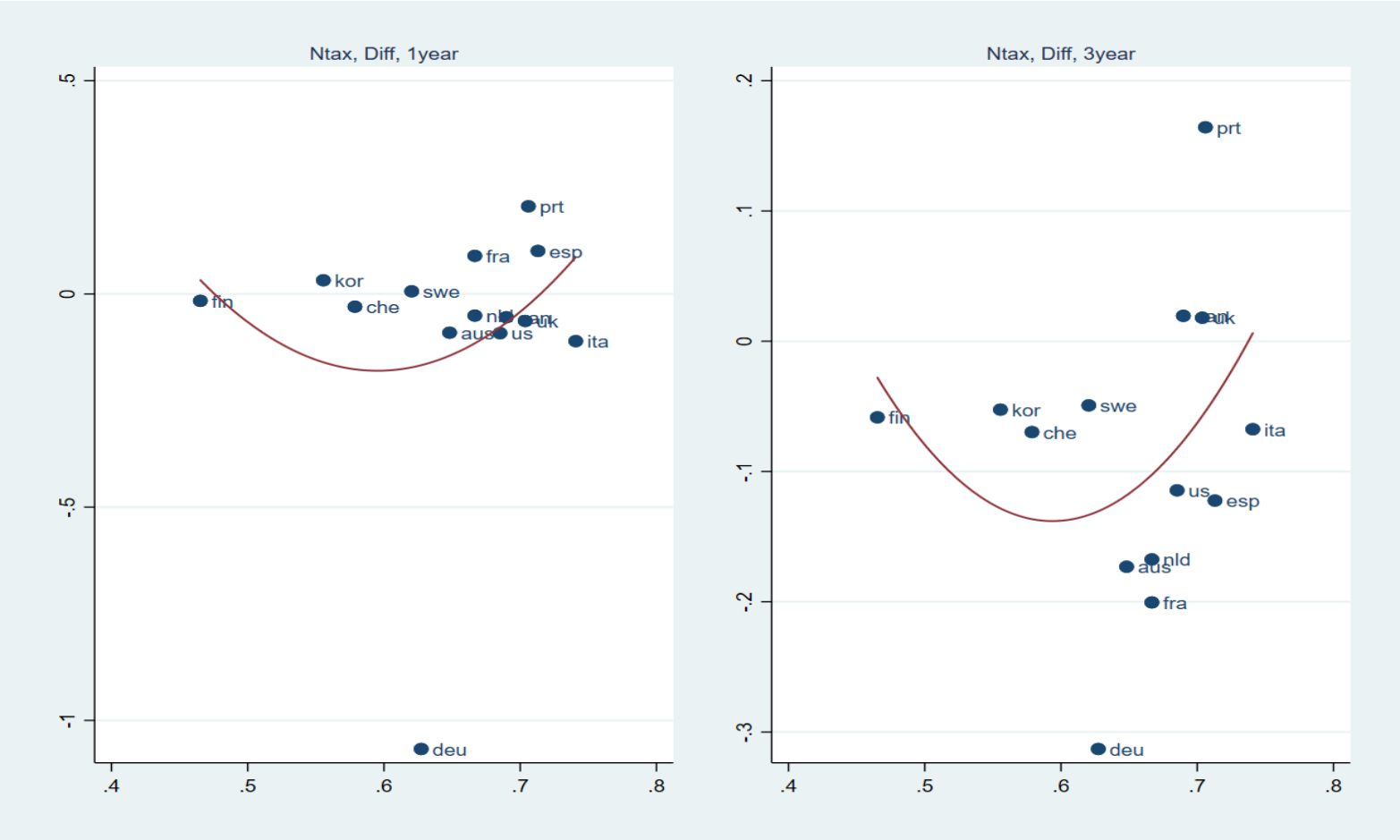


Figure: lockdown and Ntax multiplier, x: lockdown, y: differences

	(1)	(2)
	diff, 3year	diff, 3year
index	0.194	-7.925^{+}
	(0.61)	(-1.68)
$index^2$		6.674^{+}
		(1.66)
cons	-0.210^{+}	2.214^{+}
	(-1.07)	(1.65)
R^2	0.0157	0.152
N	14	14

Note: t-stat in parentheses, $+$: $p<0.32$

- output loss: 1 - $\frac{min[GDP_{2020.Q1}, GDP_{2020.Q2}, GDP_{2020.Q3}, GDP_{2020.Q4}]}{GDP_{2020.Q3}}$
- a proxy of severity of economic downturn in the COVID-19 pandemic, larger number: more severe recession

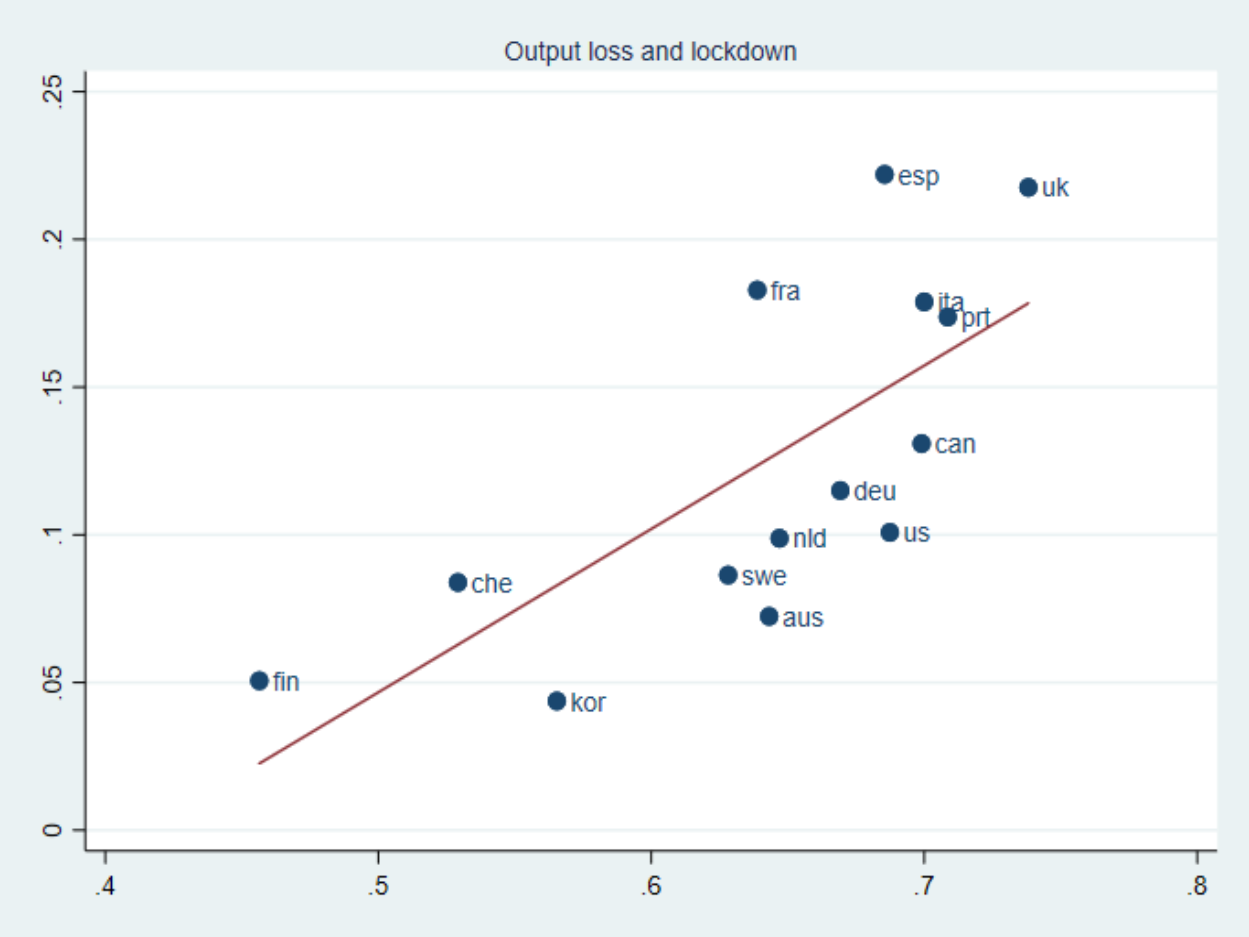


Figure: lockdown and output loss, x: lockdown, y: output loss

- severe lockdown $->$ severe recession

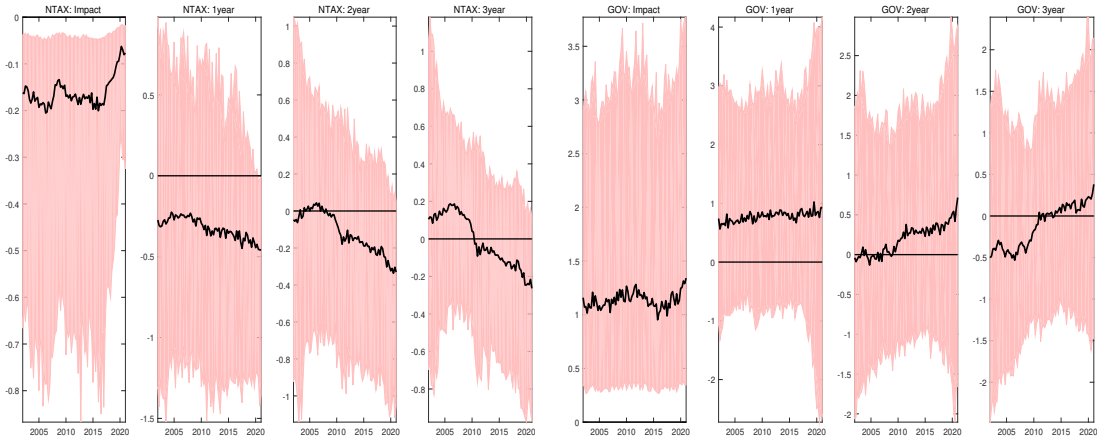
- On the one hand: lockdown $->$ recession $->$ possible additional stimulus through higher MPC or other relevant channels
- On the other hand: lockdown $->$ restrict face-to-face activity $->$ lower stimulus effects

- Low lockdown level : additional stimulus in recessions $>$ restrict face-to-face activity
- High lockdown level : additional stimulus in recessions $<$ restrict face-to-face activity
- This may induce non-linear relation between lockdown and fiscal multiplier
- Still speculative..., more evidence and theoretical works are necessary

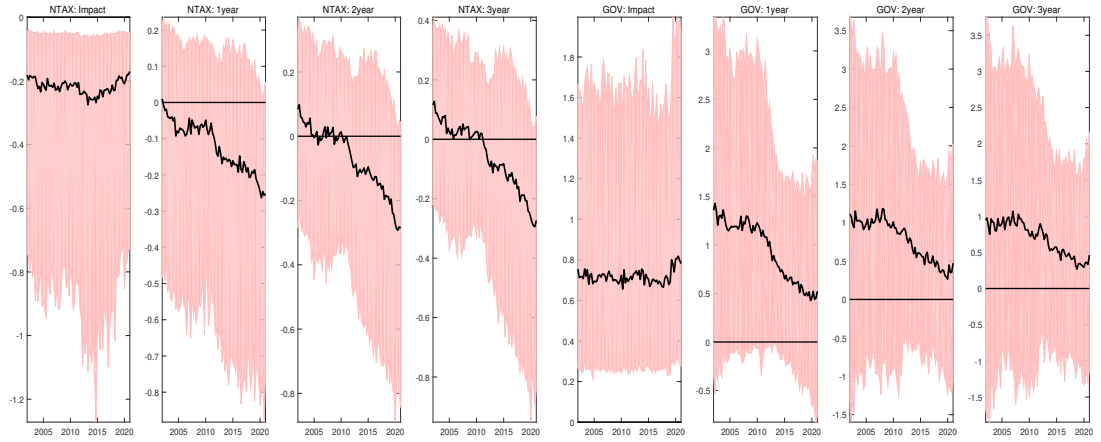
Thank You

Supplement Figures:

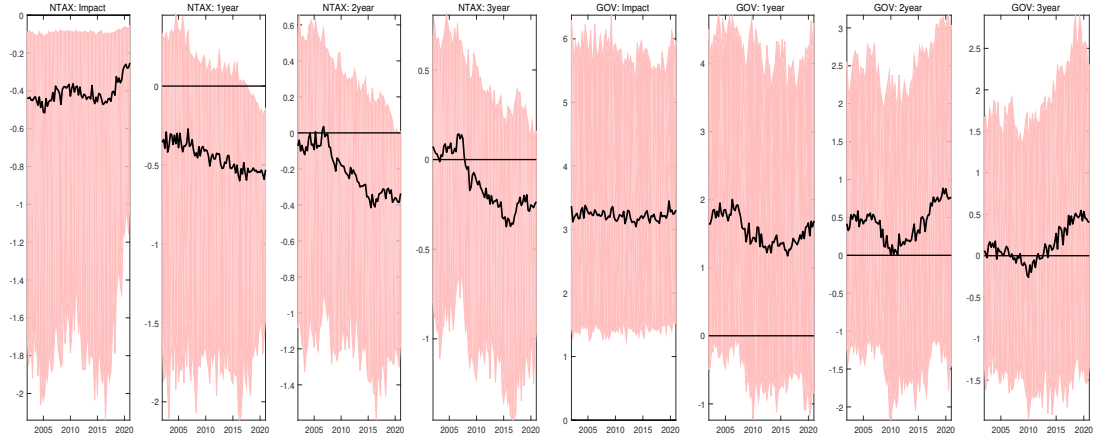
Time series plot of estimated multipliers for selected horizons in each country (the median and 68% bands)



(a) Ntax: US (b) Gcon: US



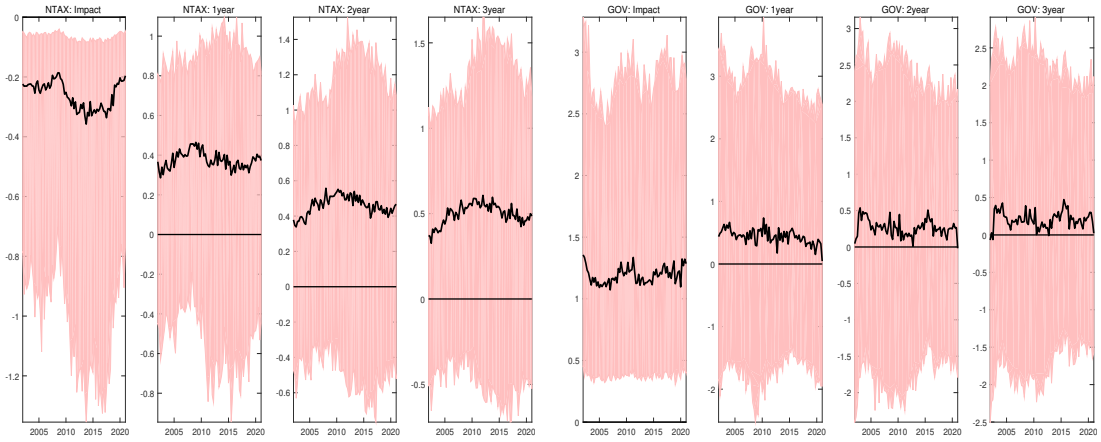
(c) Ntax: AUS (d) Gcon: AUS



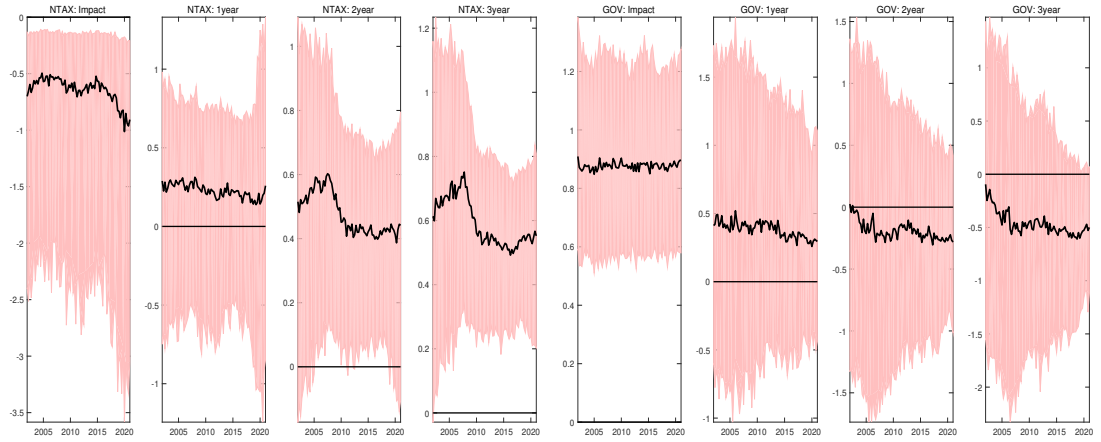
(e) Ntax: CAN (f) Gcon: CAN

Figure 7: Time varying multiplier in each country

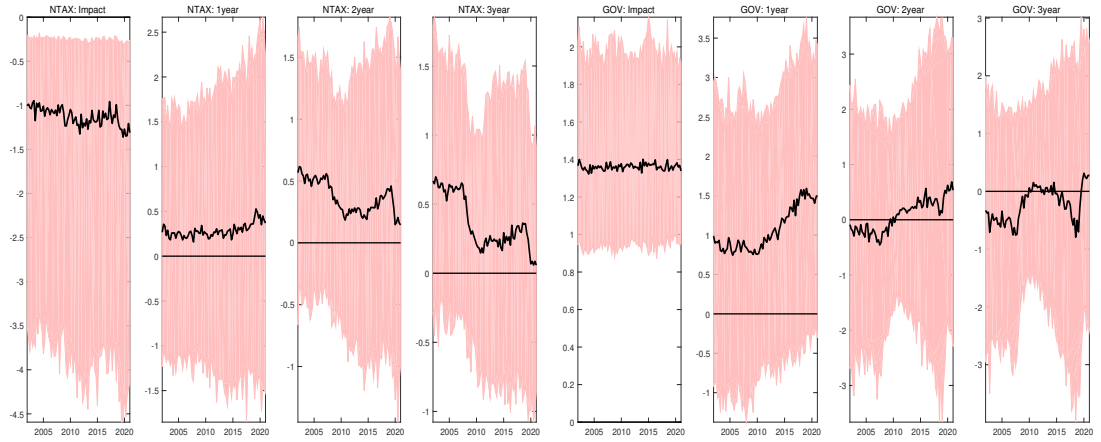
Note:



(a) Ntax: KOR (b) Gcon: KOR



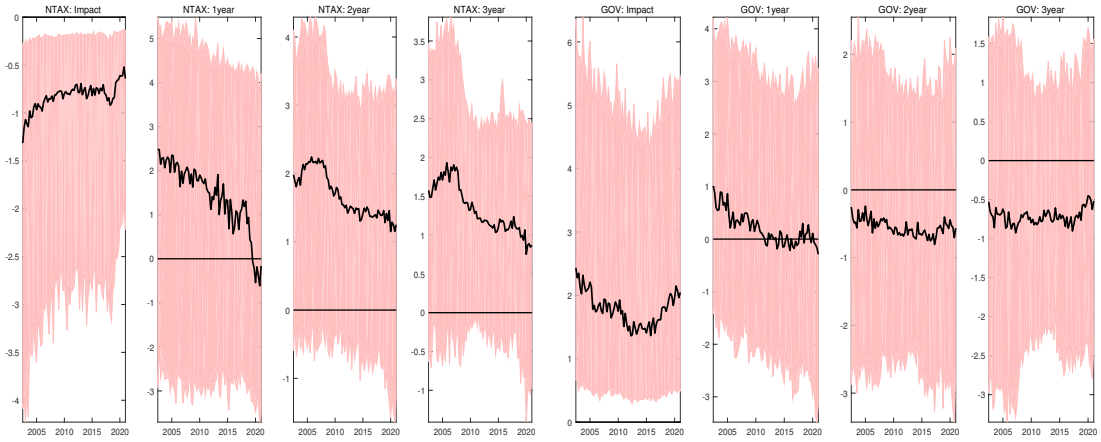
(c) Ntax: GBR (d) Gcon: GBR



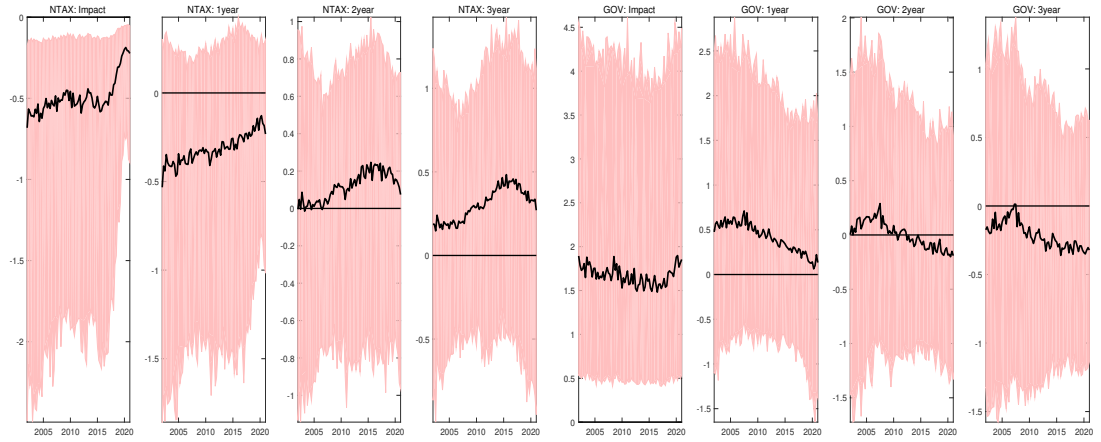
(e) Ntax: FRA (f) Gcon: FRA

Figure 8: Time varying multiplier in each country

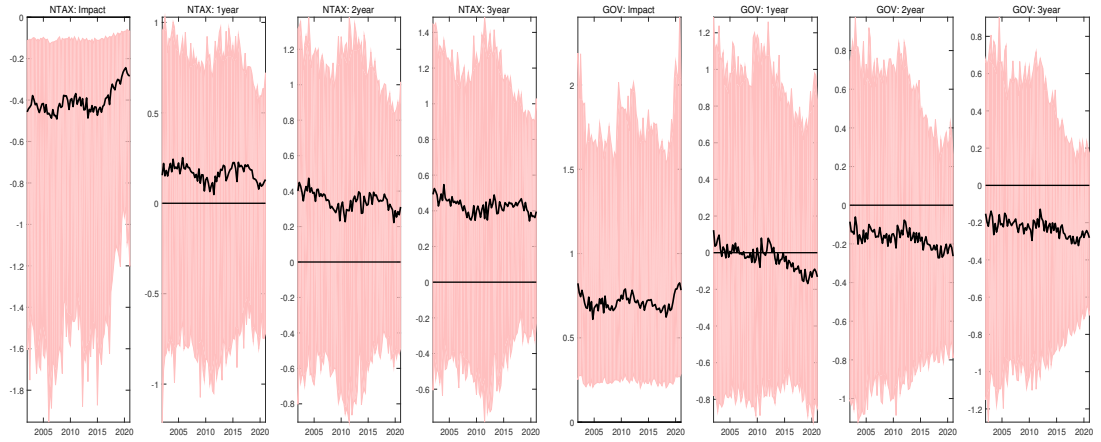
Note:



(a) Ntax: DEU (b) Gcon: DEU



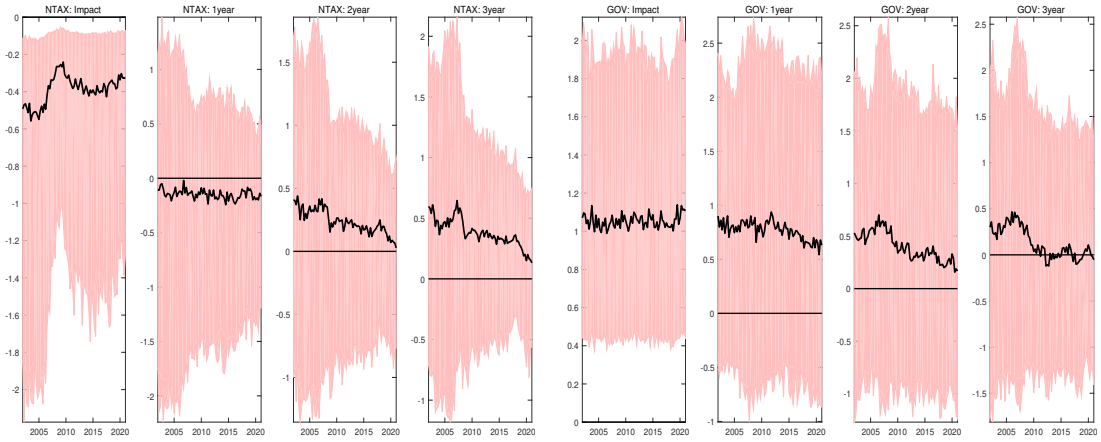
(c) Ntax: ESP (d) Gcon: ESP



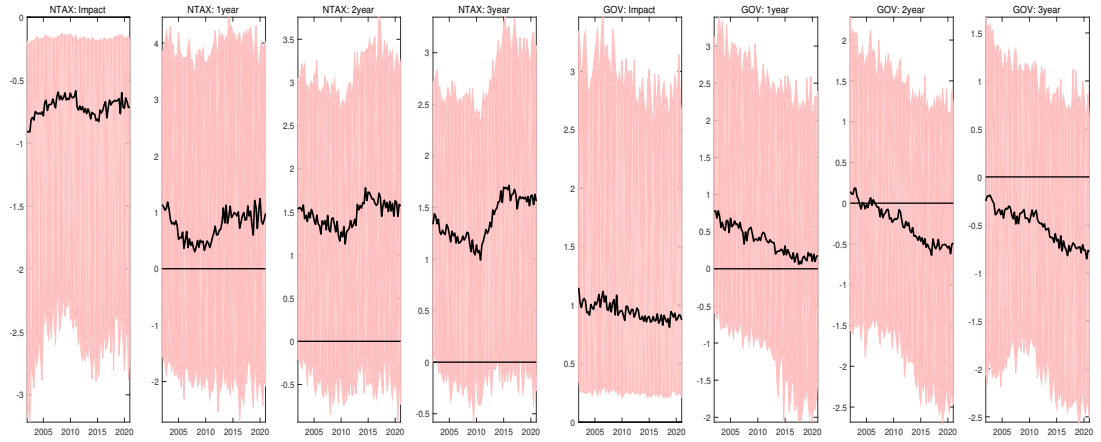
(e) Ntax: ITA (f) Gcon: ITA

Figure 9: Time varying multiplier in each country

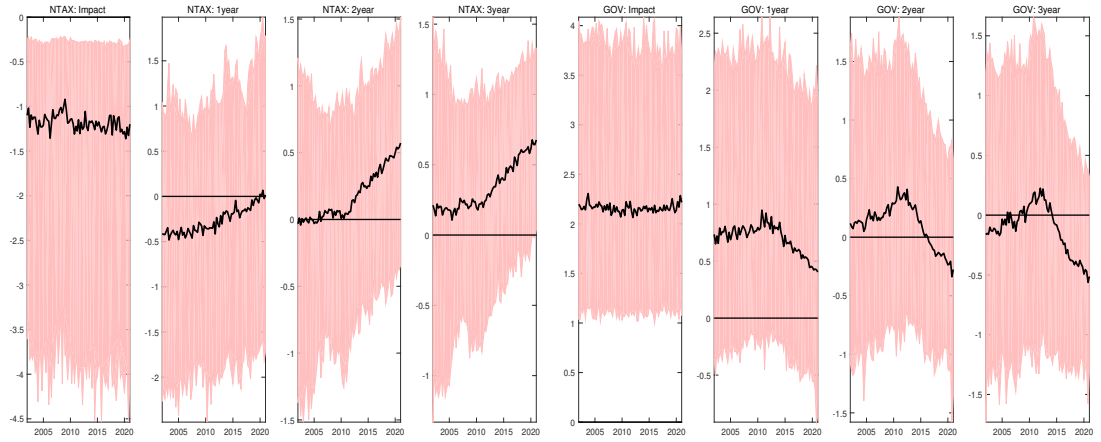
Note:



(a) Ntax: NLD (b) Gcon: NLD



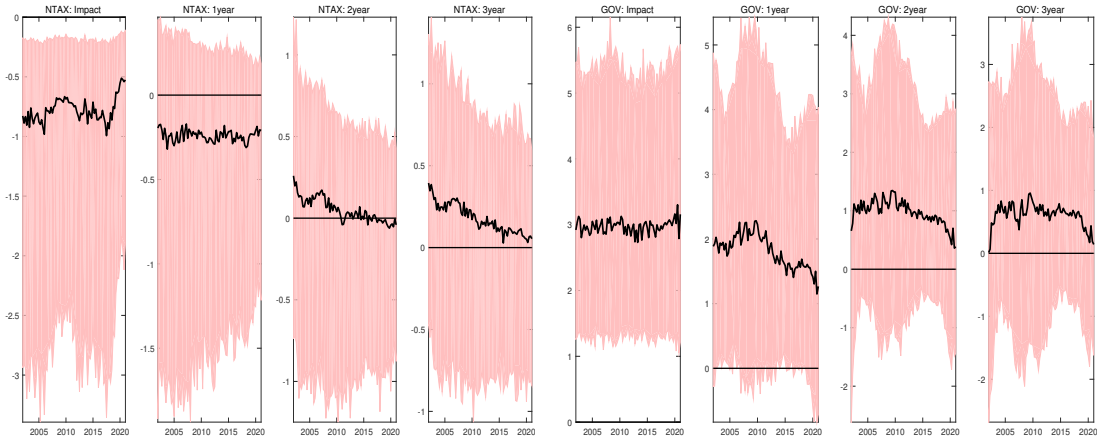
(c) Ntax: FIN (d) Gcon: FIN



(e) Ntax: PRT (f) Gcon: PRT

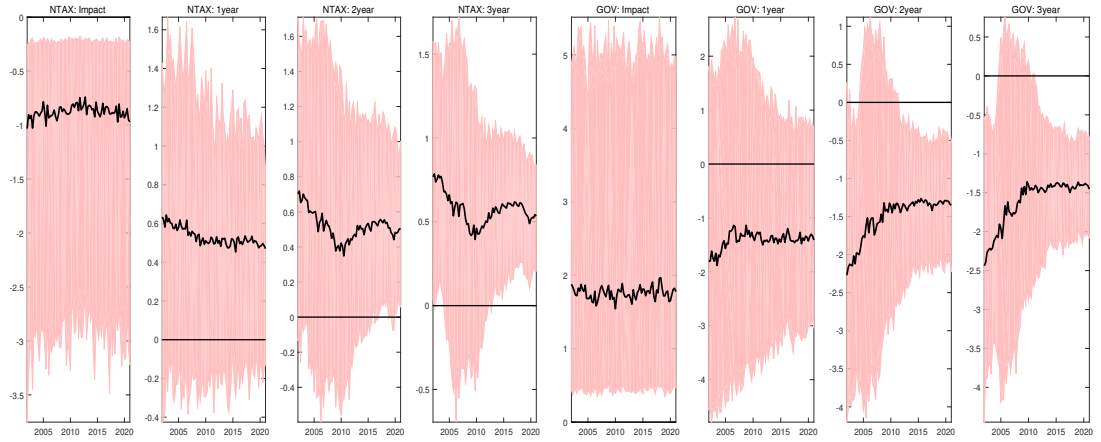
Figure 10: Time varying multiplier in each country

Note:



(a) Ntax: SWE

(b) Gcon: SWE



(c) Ntax: CHE

(d) Gcon: CHE

Figure 11: Time varying multiplier in each country

Note: