Fiscal Reaction Functions: Insights from New Data

Shafik Hebous, Alexander Klemm, and Florian Misch

Evaluating Tax Reforms Conference and Database Launch

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"The views expressed in this presentations are of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management."

Introduction

- Major rate cut in the United States (and some cuts also in other advanced economies)
- How will countries react?
- Will this trigger a race to the bottom?

- Literature on such fiscal reactions suggests: yes countries do react

Introduction, contd.

- Good opportunity to use the new data
  - Any recent changes in relationship?
  - Any additional insights from details of data
    - 1. Announcements of rate changes
    - 2. Control for tax base
    - 3. “Narrative” style approach
    - 4. Competition over bases

Specification

$$t_{it} = \beta \frac{\sum_{k \neq i} t_{kt}}{N-1} + f_i + \varepsilon_{it}$$

- The leave-out average can also be weighted (e.g., inverse distance, GDP)
- Control variable can be added
- Year dummies cannot be added (trend is ok)

Endogeneity

$$t_{it} = \beta \frac{\sum_{k \neq i} t_{kt}}{N-1} + f_i + \varepsilon_{it}$$

- The leave-out average is endogenous
- Solutions from literature:
  - IV: use leave-out averages of exogenous variables as instruments
  - GMM: Arrellano-Bover/Blundell-Bond estimators (i.e., using lagged differences and levels as instruments)
  - Maximum Likelihood (non-linear optimization)

Replication of Standard Results

	(1) FE	(2) IV	(3) GMM	(4) FE	(5) IV	(6) GMM
Tax rate$_{t-1}$				0.85***	0.85***	0.90***
				(0.02)	(0.02)	(0.03)
Leave-out	0.65***	1.09**	0.71***	0.21**	0.36***	0.09
average	(0.23)	(0.44)	(0.26)	(0.09)	(0.12)	(0.09)
ln Real GDP	-0.37	-0.11	-1.51	-1.00**	-0.91**	-0.33
p.c.	(2.83)	(2.71)	(1.54)	(0.36)	(0.37)	(0.30)
Share of old	-0.38	-0.47	0.47*	-0.15*	-0.18**	0.04
people	(0.53)	(0.59)	(0.26)	(0.07)	(0.09)	(0.04)
Spending /	0.17	0.19	0.04	0.08***	0.09***	0.01
GDP	(0.12)	(0.13)	(0.08)	(0.02)	(0.03)	(0.01)
Year	-0.11	0.18	-0.21*	0.10	0.20**	0.01
	(0.19)	(0.32)	(0.12)	(0.07)	(0.09)	(0.05)
Observations	493	493	493	481	481	481
R^2	0.58			0.92		
Countries	20	20	20	20	20	20
AR1 p			0.462			0.0105
AR2 p			0.848			0.975
Hansen p			1			1

Robust standard errors in parentheses

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

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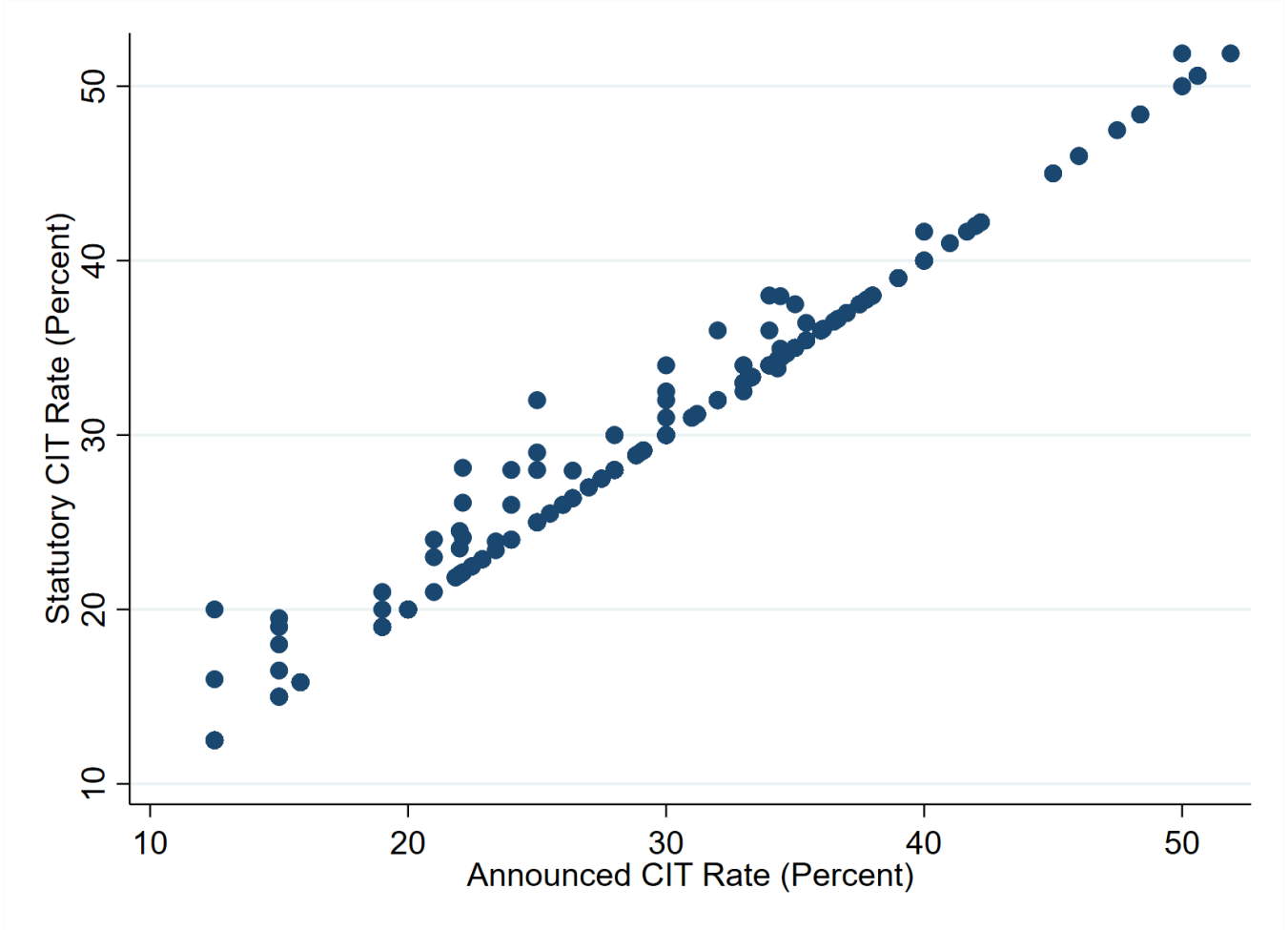
Use of new data #1: Announced Rates

- New database includes announcement dates of tax policies
- Rate changes often pre-announced
- Should countries not react to announced rather than actual rates? If so, existing results are biased.

Announced vs. Statutory CIT Rates



Announced rather than actual tax rates

	(1) FE	(2) IV	(3) GMM	(4) FE	(5) IV	(6) GMM
Announced rate$_{t-1}$				0.82***	0.82***	0.87***
				(0.03)	(0.03)	(0.04)
Leave-out average	0.62**	1.02**	0.67***	0.26**	0.36***	0.13
	(0.23)	(0.43)	(0.24)	(0.10)	(0.12)	(0.09)
Observations	493	493	493	481	481	481
R^2	0.58			0.89		
Countries	20	20	20	20	20	20
AR1 p			0.0227			0.00268
AR2 p			0.536			0.274
Hansen p			1			1

Robust standard errors in parentheses

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

Use of new data #2: tax base

- Countries can react by changing tax base instead or in addition to rate
- Kawano-Slemrod pioneered use of such data (but not in reaction functions)
- Control for own and others' tax bases, distinguishing between broadening and narrowing
- Caveat: Only dummies available, hide differences in size of base changes

Controlling for tax base

	(1) FE	(2) IV	(3) GMM	(4) FE	(5) IV	(6) GMM
Announced rate$_{t-1}$				0.83***	0.82***	0.90***
				(0.03)	(0.03)	(0.02)
Leave-out average	0.67***	1.11***	0.29	0.25**	0.34***	0.09
	(0.23)	(0.41)	(0.22)	(0.10)	(0.11)	(0.10)
Base narrowing	0.53**	0.55**	-0.16	0.38***	0.38***	0.22**
	(0.20)	(0.21)	(0.20)	(0.10)	(0.10)	(0.09)
Base broadening	-0.38	-0.36	-0.49	-0.68	-0.68	-0.76*
	(0.30)	(0.27)	(0.34)	(0.45)	(0.45)	(0.46)
LOA base narrowing	-1.43**	-1.32**	-0.55	0.52	0.52	0.82**
	(0.59)	(0.63)	(0.79)	(0.39)	(0.40)	(0.38)
LOA base broadening	1.43	2.36***	0.87	0.48	0.65	0.05
	(1.00)	(0.84)	(1.23)	(0.99)	(0.99)	(0.99)
	493	493	493	481	481	481
	0.59			0.90		
	20	20	20	20	20	20
			0.0993			0.00108
			0.733			0.342
			1			1

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Use of new data #3: “narrative”-style approach

- Not all tax rate changes are reaction to rates elsewhere
- Tax increases arguably exogenous (given global downward trend)
- Temporary tax cuts or increases: in this case both changes are exogenous
- Can use these exogenous changes as instrument for leave-out average

Exogenous tax changes as instrument

	(1) cit_rate	(2) cit_rate	(3) cit_rate	(4) cit_rate
Tax rate$_{t-1}$		0.83***		0.83***
		(0.03)		(0.04)
Leave-out	1.04*	1.00***	1.37**	0.96***
average	(0.58)	(0.28)	(0.58)	(0.36)
Base			0.53**	0.38***
narrowing			(0.21)	(0.10)
Base			-0.38	-0.66
broadening			(0.33)	(0.47)
LOA base			-1.10*	0.65*
narrowing			(0.64)	(0.35)
LOA base			2.73***	1.79*
broadening			(0.90)	(1.05)
	493	481	493	481
	20	20	20	20

Robust standard errors in parentheses

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

Use of new data #4: Base reactions

- How does one country react to changes in the tax base of other countries?
- Dummy for investment-related measures to narrow or broaden the base: preliminary findings
- Have not found significant results for (i) all base changes or (ii) R&D-related base changes (too few observations).

Use of new data #4: Base reactions

	(1)	(2)	(3)	
	Univariate Probit	Univariate Probit	Bivariate Probit (system)	
Dependent Variable	Base Inv. Narrowing	Base Inv. broadening	Base Inv. Narrowing	Base Inv. broadening
LOA base narrowing dummy	-0.29	-3.17*	-0.29	-3.06*
	(1.16)	(1.72)	(1.16)	(1.69)
LOA base broadening dummy	-3.90*	-1.87	-3.76*	-1.84
	(2.00)	(2.73)	(1.97)	(2.72)
Announced tax rate	-0.01	-0.00	-0.01	-0.00
	(0.01)	(0.02)	(0.01)	(0.02)
LOA announced tax rate	-0.16*	-0.23*	-0.15*	-0.22*
	(0.08)	(0.12)	(0.08)	(0.12)
ln Real GDP p.c.	-0.01	-0.24	-0.00	-0.23
	(0.17)	(0.22)	(0.17)	(0.22)
Share of old people	0.03	0.03	0.03	0.04
	(0.31)	(0.44)	(0.31)	(0.44)
year	-0.14**	-0.19**	-0.14**	-0.18**
	(0.06)	(0.09)	(0.06)	(0.09)
Observations	536	536	536	536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusions

- New data confirm fiscal reactions
- Using implemented rather than announced rates does not appear to have biased results much.
- Base narrowing and rate cuts are complements
- “Narrative” style instrument works, too
- Tentative evidence of reaction to base changes

Extensions

- More countries
  - Strengthen GMM results
  - Reduce sample selection bias
- More detailed analysis of tax base reactions
  - e.g., technology incentives
  - Ideally would want quantification of measures

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