

100

Joint Research Centre

The Macroeconomic Effects of Tax Reform: Evidence from the EU

Wouter van der Wielen





1

4%

NBB, 2019

Disclaimer

The information and views set out in this presentation are those of the authors and do not necessarily reflect the official opinion of the European Commission. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

(4) E (4) E (4)

Table of Contents

1 Introduction

2 Model

- Data
- Methodology
- Estimation Results

3 Real Time Analysis

4 Conclusion

A B F A B F

э

Introduction Impact of fiscal policy

- Vast empirical literature on impact of fiscal shocks
- Tax multipliers found to be larger than spending multipliers:
 - Alesina et al. (2015, 2018), Kataryniuk and Vallés (2018), Ciminelli et al. (2019) for OECD; Hondroyiannis and Papaoikonomou (2015) for EMU
 - Romer and Romer (2010) for US, Cloyne (2013) for UK, Hayo and Uhl (2014) for DE, Gil et al. (2018) for ES
- Multipliers found using structural identification are often smaller, but confirm this (Blanchard and Perotti, 2002; Mountford and Uhlig, 2009)
- Composition of the fiscal adjustment matters (Ilzetzki et al., 2013)
- Impact is conditional on the business cycle (Auerbach and Gorodnichenko, 2012; Mencinger et al., 2017)

イロト イポト イヨト イヨト

3

Introduction Impact of fiscal policy

We **contribute** in the following ways:

- First narrative tax multiplier estimates for full EU panel
- Distinguishing between the impact of anticipated vs. unanticipated reforms (cf. Mertens and Ravn, 2012)
- Cover both tax cuts and hikes (not only deficit reducing measures, e.g. Alesina et al., 2018)
- Novel database: real-time estimates of tax revenue changes

Introduction Real-time Data and Fiscal Policy Analysis

- Used for analysis of data revisions or reactions to the economic cycle (e.g. Barrios and Fargnoli, 2010; Princen et al., 2013)
 - significant role in change in budget balance
 - affect tax elasticity significantly
- To analyse possible bias and errors in fiscal forecasts
 - Strauch, Hallerberg and von Hagen (2004): importance of the form of fiscal governance in explaining forecast accuracy and biases
 - Brück and Stephan (2006) and Pina and Venes (2011): political determinants of the fiscal forecast errors
 - Jonung and Larch (2006): more strategic estimation error to minimize the consequences of the European fiscal framework

- Confirm multipliers from earlier narrative studies
- Medium-term multipliers: -2 for anticipated and -1.7 for unanticipated
- Preannounced changes impact output inversely upon announcement
- Preannounced changes portray larger labour supply responses
- Evidence of asymmetry between tax cuts and hikes in the EU

• • = • • = •

Table of Contents

Introduction

2 Model

- Data
- Methodology
- Estimation Results

3 Real Time Analysis

4 Conclusion

< 3 > < 3 >

Model Narrative Identification

- Member States submit a questionnaire at the same time as the Stability and Convergence Programmes, but with more detail
- Discretionary Tax Measures (DTM) representing at least 0.05 pp of GDP in terms of revenue loss/gain
- Similar to ESCB estimates of the impact of discretionary measures, see Morris et al. (2009), Agnello and Cimadomo (2012) and Attinasi and Klemm (2016)
- Earlier uses of the data:
 - Barrios and Fargnoli (2010), Princen et al. (2013) and Mourre and Princen (2019): cross-country comparison of elasticity of tax revenues with respect to GDP
 - ► Carnot and de Castro (2015): panel regressions of fiscal effort on GDP

Model Narrative Identification



Figure 1: Mean discretionary tax reforms by country and type as a % of GDP_{t-1}

Wouter van der Wielen (EC-JRC)

Model Narrative Identification



Figure 2: Anticipation horizon of observed tax reforms

э

イロト イポト イヨト イヨト

• The output multiplier can be inferred from a regression:

$$\Delta y_{it} = \beta_0 + \beta_1 \Delta y_{it-1} + \beta_2 \Delta T_{it} + \eta_i + \upsilon_{it}$$

Such straightforward interpretation is not without problem

• Romer and Romer (2010) showed that the issues can be overcome by estimating:

$$\Delta y_{it} = \beta_0 + \beta_1 \Delta y_{it-1} + \beta_2 x_{it} + \eta_i + \nu_{it}$$

where x_{it} only entails the revenue impact of exogenous fiscal reforms

• • = • • = •

 We compute the aggregate revenue impact of past and present measures (expressed as percentage of GDP in t − 1):

$$x_{it} = x_{it}^{u} + x_{it}^{a}$$
 with $x_{it}^{a} = \sum_{k=1}^{K} x_{it}^{a,t-k}$

where

- x_{it}^{u} : unforeseen tax revenue changes implemented in year t
- x_{it}^a : sum of tax revenue changes for year t across tax measures introduced in year t-k

イロト 不得 トイヨト イヨト

A panel VARX model:

$$Y_{it} = \sum_{\tau=1}^{T} F_{\tau} Y_{it-\tau} + \sum_{\tau=0}^{T} G_{\tau} X_{it-\tau} + \sum_{\tau=1}^{M} h_{\tau} x_{it+\tau}^{a,t} + \varepsilon_{it}$$

where

- Y_t the vector of endogenous variables at time t
- X_t the vector of exogenous variables at time t
- $x_{it+\tau}^{a,t}$ the sum of anticipated PIT changes known at date t to be implemented at date $t+\tau$
- $F_{\tau}\text{, }G_{\tau}\ \text{ vectors of coefficients for lag }\tau$
- $h_{ au}$ contemporaneous coefficients
- ε_t the vector of white noise innovations

ヨト イヨト

3

Macroeconomic panel covering:

- 28 EU Member States
- Period 1999-2017
- GDP, employment, wages, inflation, primary spending
- PIT, SIC, CIT, VAT, private consumption, interest rate, public debt

Specifications:

- Eurostat sector accounts and EU Labour Force Survey (LFS)
- Fiscal variables refer to the general government sector (ESA 2010)

Exogeneity



Figure 3: F-test tests of narrative fiscal adjustments

Wouter van der Wielen (EC-JRC)

ロト 《聞 と 《臣 と 《臣 と 『臣 』 のへの



Figure 4: Output effect of an unanticipated 1% discretionary shock in tax receipts

東ト

→ ∃ →



Figure 5: Output effect of an anticipated 1% discretionary shock in tax receipts

э

Find multipliers on the high-side, but in line with narrative models

Romer & Romer (2010)	-2.5 to -3	US
Favero & Giavazzi (2012)	-2.5	US
Cloyne (2013)	-2.5	UK
Hayo & Uhl (2014)	-2.4	DE
Mertens & Ravn (2014)	-2.34	US
Hondroyiannis & Papaoikonomou (2015)	-1.59	EMU
Kataryniuk & Vallés (2018)	-1.5	OECD (25)
Ciminelli et al. (2019)	-1.15	OECD (16)
Alesina et al. (2018)	-0.96 to -1.5	OECD (16)
Gil et al. (2018)	-1.3	ES
Mountford & Uhlig (2009)	-1.63	US
Mertens & Ravn (2014)	-1.35	US
Blanchard & Perotti (2002)	-0.72 to -1.32	US

- Preannounced, but not yet implemented, tax hikes give rise to expansions in output, like Mertens and Ravn (2012) for the US
- Anticipated (-2) < unanticipated multiplier (-1.7)? More than anticipated fiscal expansions, surprise stimulus tend to trigger expectations of deficit reversals (Cavallari and Romano, 2017)
- Asymmetries?
 - ▶ Jones et al. (2015) for UK: cut (0) vs. hike -5
 - ▶ Jones et al. (2015) for US: cut 2.5 vs. hike (-1.5)
 - ▶ van der Wielen (2019) EU: cut 1.2 vs. hike -2.6

(4 個) トイヨト イヨト

0.02 0.04 -0.02 -0.01 -0.00 -0.00 -0.02 -0.01 --0.04 --0.02 --0.06 -0.03 -2 10 -3 å -2 10 (a) Contemporaneous (b) Cumulative

SIC, CIT, VAT

A E > A E >

Figure 6: Output effect of an anticipated 1% discretionary shock in PIT

Wouter van der Wielen (EC-JR<u>C)</u>

Table of Contents

Introduction

2 Model

- Data
- Methodology
- Estimation Results

3 Real Time Analysis

4 Conclusion

< 3 > < 3 >

Dynamic Scoring

- **Dynamic Scoring (DS)**: assessing the revenue, behavioural and macroeconomic effects of tax reform proposals (cf. Adam and Bozio, 2009; Barrios et al. 2017)
- Motives:
 - allow an in-depth evaluation of discretionary tax measures, i.e. true impact on national budgets and Member States' economic performance
 - accounting for macroeconomic feedback effects is also crucial for the determination of the cyclically adjusted fiscal balance
- In US: DS is well-established and legally required before significant changes in tax legislation

• • = • • = •

Dynamic Scoring

Idea of combining micro- and macroeconomic models is not new, but still under development:

- **Behavioural microsimulation** using labour supply models: van Soest (1995), Aaberge and Colombino (2006, 2012, 2013), Blundell and Shephard (2012)
- CGE & microsimulation: Savard (2003), Aaberge et al. (2004), Magnani and Mercenier (2009), El Badaoui and Magnani (2015)
- Parsimonious DGE & microsimulation: Benczur et al (2018), Horvath et al. (2018)
- DSGE & microsimulation: Barrios et al. (2019)
- Heterogeneous agent models (e.g. individuals by decile and micro-imputed tax functions): Diaz-Gimenez and Pijoan-Mas (2006), Lizarazo et al. (2017), Holter et al. (2019)

Dynamic Scoring Microsimulation: EUROMOD

- Static model embedding detailed tax and benefit, and their interaction, systems of the 28 EU Member States
- Uses survey data (based on EU-SILC) to perform tax policy simulations
- Uprates (non-simulated) monetary variables in the data, whenever the policy system does not correspond to the year the data was collected
- Its main outputs are macro-validated against national statistics

Dynamic Scoring Microsimulation: EUROMOD

4		N 🗖 🖬		88 EU 🗠 🕯				💶 💶 🖬 🕯	🖬 🗆 🛲 🗍					
Spai	in AT BE BG CY	CZ DE DK	EE EL ES	FI FR HR I	AD IE IT L	T LU LV MT	NL PL PT	RD SE SI	sk sluk 💡					
	ied													
Policy	Grp/No	ES_2006	ES_2007	E5_2008	E5_2009	65,2010	65,2011	ES_2012	ES_2013	ES_2014	ES_2015	ES_2016	ES_2017	Conment
	setdefault_es	08	00	60	60	60	00	on	on	00	00	60	60	DEF: Set default values
	UAA_es	switch	switch	switch	switch	switch	switch	switch	switch	switch	switch	switch	switch	SWITCH: Uprating Average
	uarate es	00	01	00	50	en	en	an .	05	00	00	60	80	DEP: UPRATING PACTORS
	uprate bands es	an	on	on	on .	en	on	on	an	an	00	cn .	en	DEP: Uprating in bands
	isdel.es	an	on	00	en	en	on	an	an	an	00	60	en	DEP: INCOME CONCEPTS
	idel_es	an	on	on	en .	en	on	an	an	an	on	on	en	DEP: INCOME CONCEPTS
	ConstDef_es	an	on	ce .	en	en	on	on	on l	on	on	on	en	DEP: CONSTANTS
× 0	tudef_es	an	on	on	en	en	on	on	an	an	00	en .	en	DEP: ASSESSMENT UNITS
	yem_es	off	off	off	off	off	off	off	off	off	off	off	off	DEP: Minimum wage (Salario Hinimo Interprofesional)
	neg_es	on	00	60	60		en .	on	on	on	00	60	60	DEF: recode negative self-comborment income to
	orden es	00	00	00	60	60	00	00	00	00		60	60	DEF: Preliminary definitions
	txcft_es	on .		00	60	**	-	-	-		on	60	60	SIC: General regimes full-tin workers (régimen general
	tscpt_es	an			en	en	on	an	on	-	on	cn.	en	SIC General regime: part-ti workers (régimen general trebatadorra a tiermen narr
	tsag_es	an	m	on	en	en	an	an	-	an .		en	en	SIC: Agrarian regime (régin agrario: trabajadores y empleadores)
	base_es	an	an	60	60	en	en	an	an	an	00	60	en	SIC: Self-employment social
														SIC: Agrarian self-employm
• •	tscseag_es	an	an	66	60	en	en	an	an	an	00	en .	en	social insurance contributio (new system, started 01.01
	bunct_es	on	00	60	60	40		on	-		on	60	60	BER Unemployment insurar (Prestación por desempleo) PART-SIMULATED
• •	bunct02_es	n/a	n/a	n/a	n,fa	n,G	toggle	teggle	toggle	toggle	toggle	topple	toggle	BER Unemployment insuran self-employed (Prestaction econémica ceue de actividae trabajadores autócomos): SIPULATED only for new unemployed (via LMA Add-c
••	bunnc_es		on	m	en	en	an	an	an	m	m	m	en	BER Unemployment assista benefit (Subsidio per desem fi Income Guarantee benefi (Renta Activa de Inserción) PART-SIMULATED
• •	bunnt_es	n/a	n/a	n/a	en	on	on	an	on	on	m	en	en	BERL Temporary Unemployn Protection Program (Progra Recualificación Profesional PREPARA y Programa Temp Protección por Desempleo I
	tscun_es	an	an	on	en	en	on	an	on	on	on	on	en	SIC: Unemployed Persons so insurance contributions
	poanc_es	an	on		cn	en	on	on	on		on	on	en	BER Non-contributory old-a pension (Prestaciones no contributivas por jubliación

Dynamic Scoring Microsimulation: EUROMOD

Spain AT BE BG	CY CZ DE DK	EE EL ES FI FR HR H		4. PL PT RO SE SI SK SL UK					
icy Grp.N	ES_2006	ES_2007 ES_2008	ES_2009 ES_2010	65_2011 65_2012 65_2013	ES_2014	ES_2015	ES_2016	ES_2017	Conment
e setdefault_es	an	on on	en en	on on on	00	00	60	60	DEF: Set default values SWITCH: Uprating Average
0.000	🚽 🗧 tin_	_cons_es	on	TAX: Income Tax - con	stants	SMICH	SWICH	SWICH	Adjustment
uprate bands es	. 6.	DefConst	00	Capital income taxation		00	00	50	DET: Uprating in bands
isdel_es	- JA	Derconsc				on	60	en	DEP: INCOME CONCEPTS
idef_es	→ fx	DefConst	on	on	on	en .	DEP: INCOME CONCEPTS		
ConstDef_es				Tour Order de la constitue et	on	00	en	DEP: CONSTANTS	
tubel_es	- Jx	DefConst	on	Tax Schedule - national		an an	in in	en	DET: Minimum want (Salar
• Yem_es		\$tin_ts_lt1	12450.00#y	limit 1	off	elt	ell	Hinimo Interprofesional)	
e neg_es		Aller 44 (42)	22222 02 1	limite O		00	60	60	self-employment income
prelim_es		sun_ts_tt2	20200.00#y	limit 2		00	60	60	DEF: Preliminary definition
• tscft_es		\$tin_ts_lt3	35200.00#y	limit 3		on	60	60	sit: General regime full-t workers (régimen general trabajadores a tiempo co
tscpt_es		\$tin_ts_lt4	60000.00#y	limit 4	on	on	en	SIC: General regime: part- workers (régimen general trabajadores a tiempo par	
e tscag_es		\$tin_ts_lt5	99999999999	limit 5	on	en	en	SIC: Agrarian regime (rég agraric: trabajadores y empleadores)	
e tsose_es		\$tin_ts_lt6	999999999999	limit 6		an	60	en	SIC Self-employment soci insurance contributions
tscscog_es		\$tin_ts_rt1	0.095	rate 1		on	en	en	53C: Agrarian self-employs social insurance contribut (new system, started 01.0
• bunct_es		\$tin_ts_rt2	0.12	rate 2		60	en	60	BDI: Unemployment insur (Prestación por desemple PART-SIMULATED
		şun_is_ris	0.15	Tate 5			toggle	toggle	BEIL Unemployment insur- self-employed (Prestación económica cese de activió trabajadores autóeomos)
bunct02_es		\$tin_ts_rt4	0.185	rate 4		toggle			
		\$tin_ts_rt5	0.225	0.225 rate 5					unemployed (via LMA Add
• • bunnc_es		\$tin_ts_rt6	0	rate 6		on	m	60	benefit (Subsidio por dese & Income Guarantee bene (Renta Activa de Inserció
		\$tin_ts_rt7	0	rate 7					PART-SIMULATED BER Temporary Unemplo
bunnt_es	→ fx	DefConst	on	Tax Schedule - Andalusia		on	m	en	Protection Program (Prog Recualificación Profesiona PREPARA y Programa TEm
• tsan_es	→ fx	DefConst	on	Tax Schedule - Aragon		m	on	en	SIC: Unemployed Persons insurance contributions
e paanc_es	⊢ fx	DefConst	on	Tax Schedule - Asturias		on	m	on	BER: Non-contributory old pension (Prestaciones no contributivas por jubilació por jubilación parcial)

Dynamic Scoring Steps

The various steps in the dynamic scoring process:

- Establish benchmark by applying EUROMOD tax function of t-1 to macro setting in t-1
- ⁽²⁾ Simulate revenue impact of the PIT reform by applying year t tax function to t-1 setting and subtracting the baseline
- Use the macroeconomic response functions to estimate the impact on wages, employment and prices
- **Over the set of the s**

-8,000 2008 2012 2015 2016

Figure 7: Real time comparison of the revenue impact of Spain's PIT reforms



Dynamic Scoring Spanish PIT Reform





・ 同 ト ・ ヨ ト ・ ヨ ト

Table of Contents

Introduction

2 Model

- Data
- Methodology
- Estimation Results

3 Real Time Analysis

4 Conclusion

(B)

Conclusion

- Using a unique real-time database, we estimate detailed fiscal multipliers for EU MSs
- Preannounced measures impact output inversely upon announcement and portray larger employment responses
- Find suggestive evidence of asymmetry between tax cuts and hikes in the EU
- Next: an integrated framework for first comparative analysis of PIT reforms using real-time data

References

- van der Wielen, W. (2019). **The Macroeconomic Effects of Tax Reform: Evidence from the EU.** JRC Working Papers on Taxation and Structural Reforms (no. 2019/4).
- Barrios, S., Reut, A., Riscado, S., and van der Wielen, W. (*Forthcoming*). **Dynamic Scoring of Tax Reforms in Real Time.** JRC Working Papers on Taxation and Structural Reforms.

Stay in touch



EU Science Hub: ec.europa.eu/jrc



Twitter: @EU_ScienceHub



Facebook: EU Science Hub - Joint Research Centre



LinkedIn: Joint Research Centre



YouTube: EU Science Hub





18 N



Figure 8: Weak exogeneity tests (Alesina et al., 2018) of narrative fiscal adjustments



★ ∃ >

∃ ⊳



Figure 9: Probit tests of narrative fiscal adjustments





Figure 10: Granger causality test of narrative fiscal adjustments

▶ 《圖》 《필》 《필》 · 트 · · 이익()



3

イロト イポト イヨト イヨト

Table 1: Exogeneity tests of narrative fiscal adjustments

		Public Spending	GDP	Employ- ment	Wages	Inflation	Full
Full	F-test	0.951	0.963	0.991	1.000	0.938	1.000
	Alesina et al.	0.233	0.522	0.620	0.936	0.378	n.a.
	Ordered probit	0.000	0.004	0.001	0.002	0.006	0.000
Gen. 1	F-test	0.996	0.675	0.993	1.000	1.000	0.997
	Alesina et al.	0.788	0.634	0.943	0.933	0.979	n.a.
	Ordered probit	0.373	0.187	0.132	0.410	0.335	0.285
Gen. 2	F-test	1.000	0.994	0.991	0.438	0.705	1.000
	Alesina et al.	0.408	0.651	0.853	0.668	0.360	n.a.
	Ordered probit	0.006	0.013	0.003	0.010	0.043	0.002

Note: The table shows the p-values for the respective tests. The dependent variable is the narrative indicator of exogenous tax measures.



P + 4 = + 4 = +



Figure 11: Cumul. labour market adjustments for an anticipated 1% PIT shock



→ Ξ →

∃ ⊳



Figure 12: Cumul. labour market adjustments for an unanticipated 1% PIT shock





Figure 13: Output effect of an anticipated 1% discretionary shock

・ < 昂 > く 臣 > く 臣 > 、 臣 - の へ ()





Figure 14: Output effect of an unanticipated 1% discretionary shock

<□> <@> < E> < E> E の





Figure 15: Cumul. labour market adjustments for an unanticipated 1% shock

NBB, 2019



イロト イポト イヨト イヨト



Figure 16: Cumul. labour market adjustments for an anticipated 1% shock

NBB, 2019



A B M A B M

- To make our estimate comparable to the **ex post** observed change in PIT, it has to be adjusted for the revenue impact of:
 - trend growth with respect to the previous year, i.e. not the result of discretionary measures
 - other measures taken but not included in the EUROMOD simulation
- In particular, our earlier simulation has

$$E''[T_t] = E'[T_t] + \frac{\varepsilon T}{\bar{Y}} \left[\left(\hat{Y}_{EC} - \hat{Y}_{VAR} \right) + \left(\bar{Y} - Y_{t-1} \right) \right]$$

Spanish PIT Reform

Appendix



∢ Go Ba<u>ck</u>

- 4 同 6 4 日 6 4 日 6

3

Figure 17: Adjustment of 2016 Spanish estimates

Wouter van der Wielen (EC-JRC)

3,000

Spanish PIT Reform

Appendix



Figure 18: Real time forecasts of Spain's PIT reforms vs. realized PIT changes

4%