

An estimable model of income redistribution in a federation: Musgrave meets Oates

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How does subnational income redistribution work in a federation?
(And does it work?)

Standard view (Musgrave, 1959): Central government should handle redistribution

- fiscally induced migration
- potential for tax competition

Despite this view, we see a lot of decentralization of income tax powers

- tax base sharing in mature federations (Canada, US, CH)
- moves to devolution of income tax (Scotland, Spain)

We take an Oatesian perspective on decentralizing the income tax

Oates (1972) “Decentralization theorem”:

- national policies must be uniform
- local heterogeneity in tastes and technologies
- better to decentralize spending, if local spillovers not too large

We apply the Oatesian perspective to the tax side of the budget:

- differences in state income tax yields tends to favour non-uniform tax policies \implies decentralization
- economic costs of cross-province tax-base shifting – role for federal taxes to correct fiscal externalities

Some key findings from the literature:

- high-income individuals migrate in response to taxes (Kleven et al., 2013, 2014)
- capital income is highly mobile internationally (Johannesen, 2014)
- local taxes shifted onto immobile factors (Feldstein and Wrobel, 1998; Suarez Serrato and Zidar, 2014)
- fiscally induced migration at the subnational level in US (Moretti and Wilson, 2017), Switzerland (Roller and Schmidheiny, 2017), Spain (Agrawal and Foremny, 2017)
- provincial corporate taxes drive profit shifting more than real location decisions (Mintz and Smart, 2004)

How much should we worry about fiscally induced migration, tax competition, heterogeneity?

- 1 Pauly (1973): Even with mobility, redistribution has elements of local public good – favours decentralization
- 2 Wildasin (1991): With full factor price equalization, redistribution is a national public good – requires centralization
- 3 Keen (1998): With shared federal-state taxation, there is an offsetting vertical externality that tends to increase tax rates
- 4 Gordon and Cullen (2012): Federal tax rate can be set to eliminate state tax competition (in a symmetric model with no heterogeneity)

① New empirical results

- estimate elasticity of top taxable income from Canadian data
- tax response from national avoidance – or cross-province shifting?

② New theoretical framework

- what do the elasticities tell us? develop a sufficient statistics approach to optimal taxation in a federation
- can optimal redistribution be achieved in a unitary state? in a decentralized federation?

③ Policy analysis

- simulate effects of alternative fiscal arrangements: Unitary vs. federal state
- should tax rates rise at the top? in which provinces?
- will provinces choose the “right” tax rates?

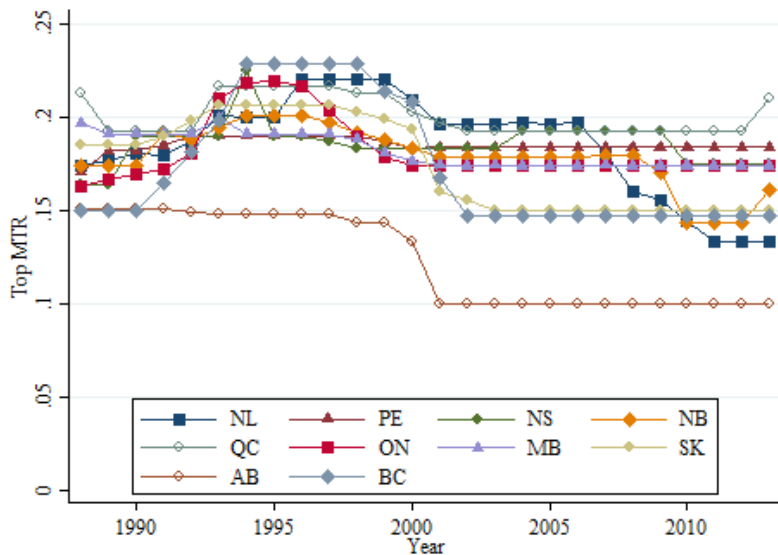
Federal–provincial co-occupancy of PIT base since WWII

- Common base and collection in all provinces except Quebec
- Provincial top marginal rates 10-25%

Further decentralization through 2000 “Tax on Income” reform:

- Provinces can levy tax on income – not just surtax on federal tax \implies flexibility on progressivity
- In 2001 Alberta introduced 10% flat-rate tax – 4 to 11 points below top rate of other provinces (Fig. 1)
- Concern about “internal tax haven”: cross province shifting through
 - moving tax residency to Alberta
 - shifting capital income through Alberta family trusts (Fig. 2)

Provincial top income tax rates, 1988-2013



Consider an Alberta trust even if you don't live there

Saturday, June 21, 2003

TIM CESTNICK

Alberta taxpayers

It's no secret that the top marginal tax rate in Alberta is lower than any other province or territory. Take a look at the table to see the difference in top tax rates in Alberta, Ontario, British Columbia, and Manitoba.

Wouldn't it be nice if you could add an Alberta taxpayer to the family to share your tax burden? Where the amount of taxable income is high enough, an Alberta trust may make sense. The spread between the tax rates in Alberta and the other provinces can be pure tax savings to you.

Alberta trusts

The key to taking advantage of Alberta tax rates, short of moving to Alberta, is to establish a trust that is resident in Alberta. You can then transfer certain income-producing assets to this trust. Since the trust will be resident in Alberta, income earned in the trust will be taxed at Alberta tax rates. It's important to note that, for the trust to be resident in Alberta, a majority of the trustees must reside in Alberta (a lawyer, accountant, friend, associate, or trust company could do the job), and the management and control over the trust assets must be exercised in Alberta.

We base our analysis on a standard approach in the literature: regressing the share of income on tax rates

$$\log y_{it} = \alpha_i + \delta_t - e_u \tau_{it} + e_s \bar{\tau}_{-it} + x'_{it} \beta + \epsilon_{it}$$

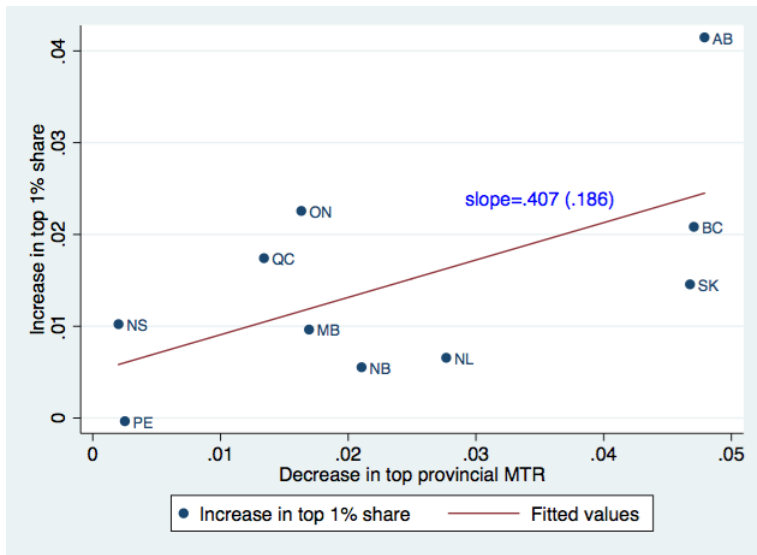
Here we augment the standard specification by including separate own and neighbour average tax terms.

- data are from CANSIM high earner database, 1988-2013
- diff-in-diff specification: province and year fixed effects

Identification through differential response to 2000 TONI reform

- tax rates fell more in resource provinces with other revenues
- compare resource provs to non-resource provs
- use $\text{TONI} \times \text{RESOURCE}$ to form an IV strategy

Own tax effects: Simple difference in difference



Results: Ordinary least squares estimates

VARIABLES	(1) Log 1% share	(2) Log 1% share	(3) Log 1% share
Own tax rate	-2.31** [0.93]	-2.18*** [0.43]	-2.18*** [0.42]
Neighbor tax rate			0.08 [0.92]
Log total income		0.93*** [0.09]	0.93*** [0.09]
RES*Energy price		-0.12*** [0.02]	-0.11*** [0.02]
Observations	250	250	250
R-squared	0.25	0.61	0.61
Number of prov	10	10	10
Avoidance Elasticity	1.21	1.14	1.10
Shifting Elasticity			0.04

All specifications include year and province fixed effects. Robust standard errors clustered by province. We use a t distribution with 9 degrees of freedom. Three asterisks for 1% significance; two asterisks for 5%; one asterisk for 10%.

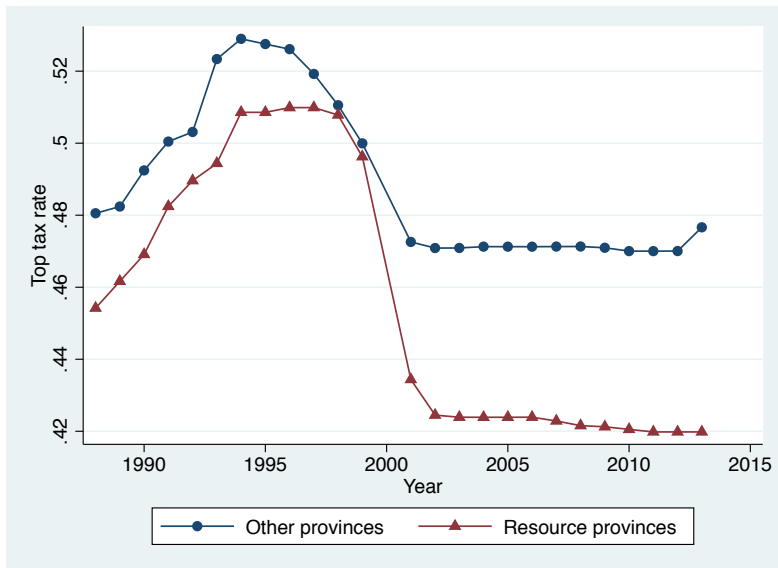
Tax rates may be endogenous

- omitted variables, measurement error, reverse causality?
- spatial correlation: neighbour tax rate may capture own tax effects

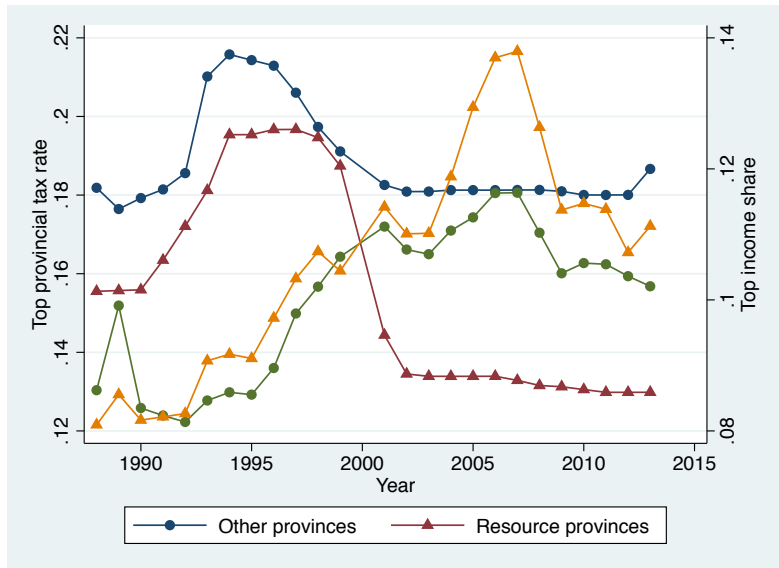
We construct instruments for own and neighbour tax rates from:

- 2000 decentralization reform: tax rates fell more in resource provinces with fiscal room (distance-weighted average of $\text{RESOURCE}_i \times \text{POST2000}_t$)
 - control for direct effects of resource booms with $\text{RESOURCE}_i \times \text{ENERGY PRICE}_t$
- political variation: dummy for provincial governments controlled by social democratic party (NDP_{it})

Top tax rates and incomes: Resource vs other provinces



Top tax rates and incomes: Resource vs other provinces



Results: Instrumental variables estimates

VARIABLES	(1) Log 1% share	(2) Log 1% share	(3) Log 1% share
Own tax rate	-2.32** [0.78]	-2.26*** [0.41]	-2.41*** [0.44]
Neighbor tax rate			1.70 [0.94]
Log total income	0.93*** [0.09]	0.93*** [0.09]	0.92*** [0.10]
RES*Energy price	-0.12*** [0.02]	-0.12*** [0.02]	-0.11*** [0.02]
R-squared	0.61	0.61	0.59
Instruments	RES*POST	RES*POST	RES*POST
	-	NDP	NDP
First stage F: Own tax rate	30.45	39.52	39.52
Neighbor tax rate	-	-	135.11
Avoidance Elasticity	1.21	1.18	0.37
Shifting Elasticity			0.89

All specifications include year and province fixed effects. Robust standard errors clustered by province. We use a t distribution with 9 degrees of freedom. Three asterisks for 1% significance; two asterisks for 5%; one asterisk for 10%.

New evidence on elasticity of taxable income using top income share data and top tax rates in Canadian provinces, 1988-2014

- tax bases respond to unilateral tax rate increases – and also to cross-province tax differentials following the 2000 TONI reform
- further evidence show that response is limited to top one percent of taxpayers – and is larger in top 0.1 percent
- estimated total elasticity of provincial taxable income is large
- about 70% of total elasticity is due to cross-province shifting

Cross-province elasticity of tax base implies a horizontal fiscal externality – and potential for tax competition

- are the estimated elasticities consistent with the high rates of provincial taxation observed in Canada?
- are provincial policies consistent with national welfare maximization?
- could we do better under alternative fiscal arrangements – e.g. unitary taxation?

We develop a simple model to relate estimated elasticities to optimal tax policies and federal fiscal arrangements

Top income taxation in a federation: A model

Tax on incomes above threshold k_i in state $i = 1, \dots, J$:

state tax rate	t_i
federal tax rate	T (uniform)
combined tax rate	$\tau_i = t_i + T$

Top bracket taxable income function:

$$y_i(\tau_1, \dots, \tau_J) = y_i(\tau_i, \tau_i - \bar{\tau}) \quad (1)$$

where average tax rate is

$$\bar{\tau}(\tau_1, \dots, \tau_J) = \sum_j \omega_j(\tau_1, \dots, \tau_J) \tau_j \quad (2)$$

and ω_j is income share in state j .

Tax avoidance and tax shifting

We decompose the usual taxable income semi-elasticity into:

- national avoidance:

$$e_a = - \left. \frac{\partial \log y_i}{\partial \tau_i} \right|_{\tau_i - \bar{\tau} \text{ fixed}} = - \frac{y_{i1}}{y_i}$$

- cross-state shifting:

$$e_s = \left. \frac{\partial \log y_i}{\partial \bar{\tau}} \right|_{\tau_i \text{ fixed}} = - \frac{y_{i2}}{y_i}$$

The (semi-)elasticity of taxable income usually estimated in the literature is for a unilateral tax increase in one state:

$$e_u = - \left. \frac{\partial \log y_i}{\partial \tau_i} \right|_{\bar{\tau} \text{ fixed}} = e_a + e_s$$

State and national objectives

Social welfare here is tax revenues – i.e. welfare weight on rich taxpayers is negligibly small.

State government revenues:

$$R_i(\tau_1, \dots, \tau_J, T) = (\tau_i - T)[y_i(\tau_i, \tau_i - \bar{\tau}) - k_i] \quad i = 1, \dots, J$$

State and federal revenues add up to national revenues:

$$R^N(\tau_1, \dots, \tau_J) = \sum_j \tau_j [y_j(\tau_j, \tau_j - \bar{\tau}) - k_j]$$

State tax rate is set to maximize state revenues – but federal tax rate-setting reflects national revenue objective.

Consider Stackelberg tax-setting game – feds commit to T then states choose rates simultaneously.

Nash equilibrium state tax rates satisfy

$$\hat{\tau}_i - T = \frac{\theta_i}{e_a + (1 - \omega_i)e_s}$$

where

$$\theta_i = \frac{y_i - k_i}{y_i}$$

and ω_i is state's share of national tax base. Notes:

- θ_i is inverse Pareto parameter measuring inequality
 - “mechanical” effect of tax increase, cf. optimal tax literature
- denominator is tax base semi-elasticity *from state perspective*

Horizontal and vertical fiscal externalities

Marginal revenue of a tax increase differs from state and national perspectives, due to avoidance and shifting effects.

We can show this difference is

$$\frac{\partial R^N / \partial \tau_i - \partial R / \partial \tau_i}{y_i} = e_s \underbrace{\sum_{j \neq i} \omega_j (\tau_j - T)}_{\text{horizontal externality}} + \underbrace{(-e_a T)}_{\text{vertical externality}} \quad (3)$$

Notes:

- first term: revenue increase in other states due to shifting
- second term: federal revenue decrease due to avoidance

From state perspective, yield of tax (and optimal tax) may be *higher or lower* than from national perspective.

Nationally optimal redistribution

Nash equilibrium tax rates are not optimal in general, due to horizontal and vertical externalities.

We can show that these tax rates are nationally optimal:

$$\tau_i^* = \frac{\theta_i}{e_a} - \frac{\theta_i - \bar{\theta}}{e_a + e_s} \frac{e_s}{e_a} \quad i = 1, \dots, J$$

This is also an inverse elasticity rule:

- first term would be optimal for a single state, no shifting
- second term shrinks tax differentials to reduce impact of cross-state shifting

Optimal tax system is non-uniform, when states are heterogeneous.

Comparing fiscal arrangements

I. Unitary national taxation

Given the horizontal externality, we know that full decentralization is not nationally optimal.

So should we go “full Musgrave” – i.e. uniform federal taxation?

We can show the optimal unitary tax rate is

$$\tau^U = \frac{\bar{\theta}}{e_a}$$

where $\bar{\theta}$ is weighted-average Pareto parameter θ_i . Note:

- Compared to national optimum, revenue loss due to rates too low (high) in states with high (low) θ .

So

\implies *unitary taxation is never optimal with differences in state tax yields*

Comparing fiscal arrangements

II. Optimal federalism

Now consider fiscal federalism – shared tax base occupancy

- offsetting vertical and horizontal externalities
- federal tax rate T must be uniform – the Oatesian constraint
- set T to max national revenues given equilibrium state taxes

Is the national optimum implementable?

Comparing fiscal arrangements

II. Optimal federalism

Is the national optimum implementable? Yes, approximately.

Comparing equilibrium and optimal tax rates

$$\hat{\tau}_i - T = \frac{\theta_i}{e_a + (1 - \omega_i)e_s}$$

$$\tau_i^* = \frac{\theta_i}{e_a} - \frac{\theta_i - \bar{\theta}}{e_a + e_s} \frac{e_s}{e_a}$$

We can show that, if

$$\frac{T}{\bar{\theta}/e_a} = \frac{e_s}{e_a + e_s}$$

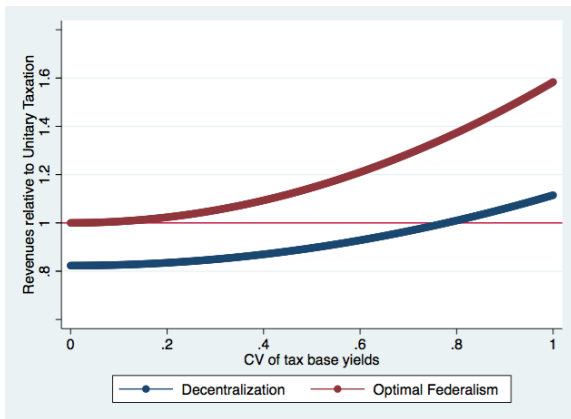
then $\hat{\tau}_i \rightarrow \tau_i^*$ as $\omega_i \rightarrow 0$.

\implies *fiscal federalism is optimal, at least asymptotically as number of states grows large*

- 1 ETI and federal welfare: (e_a, e_s, θ_i) are sufficient statistics for welfare, optimal tax rates
- 2 Optimal tax assignment in a federation
 - Musgravian dichotomy does not hold
 - unitary taxation is suboptimal with tax yields differences
 - shared taxation can decentralize the national optimum
 - optimal “vertical fiscal gap”: federal share of taxation should equal share of shifting elasticity in total ETI

Implications for federalism: Simulations

Using estimated elasticities, simulate revenues from the three federal arrangements – as a function of tax-yield heterogeneity



- Full decentralization only better with high heterogeneity
- Optimal federalism is always at least as good as unitary taxation

Federal tax reform: Simulations for Canada

Using estimated elasticities, we simulate the effect of a new top bracket on incomes over \$250,000 for each province independently

- new top rate 5 percentage points higher than in 2010 data

To illustrate the federal dimension, we compute components of simulated marginal revenues from

$$\frac{\partial R^N / \partial \tau_i}{y_i} = \underbrace{\frac{\partial R / \partial \tau_i}{y_i}}_{\text{own province}} + \underbrace{(-e_a T)}_{\text{federal}} + \underbrace{e_s \sum_{j \neq i} \omega_j (\tau_j - T)}_{\text{other provinces}}$$

Results

- provincial rate increases cause revenue losses borne by feds
- this is nearly optimal
 - negative vertical externality nearly offsets base shifting positive horizontal externality

Simulated effect of a new top bracket at \$250,000

Marginal revenue from increasing MTR 5 pts.
on taxable incomes over \$250,000
Effect on:

Province	Mean Income over \$250,000	Provincial MTR	Own province	Federal	Cross province	Total
			(dollars per top taxpayer)			
Newfoundland	\$421,443	13.3%	761	-4,278	5,850	2,333
PEI	\$383,538	18.4%	-1,130	-3,893	5,337	314
Nova Scotia	\$450,065	19.2%	795	-4,568	6,184	2,411
New Brunswick	\$419,414	14.3%	559	-4,257	5,812	2,114
Quebec	\$467,970	24.0%	1,781	-3,931	5,186	3,037
Ontario	\$559,529	17.4%	8,092	-5,679	3,977	6,390
Manitoba	\$479,261	17.4%	1,994	-4,865	6,550	3,680
Saskatchewan	\$466,127	15.0%	1,965	-4,731	6,394	3,628
Alberta	\$538,920	10.0%	5,983	-5,470	6,576	7,090
British Columbia	\$560,068	14.7%	5,783	-5,685	6,839	6,937
National Average	\$533,832	15.8%	6,079	-5,333	5,202	5,947

Note: Based on 2010 taxable income data and estimated elasticities.

- ① For most provinces, a strong case to raise top tax rates, based on standard welfare criteria.
- ② Own tax base losses are large – but mostly absorbed by federal revenues
 - Federal tax subsidizes provincial tax rates increases
 - Perceived marginal excess burden of provinces is *smaller* than national MEB.
 - Decentralization does not discourage redistribution.
- ③ Considerable heterogeneity among provinces in marginal revenues, due to differences in inequality of top incomes.
 - Heterogeneity tends to reduce the gains to coordinated, national tax increases, while strengthening the case for decentralization.
 - An Oatesian argument for provincial redistribution

We extend the ETI “sufficient statistics” literature to a federal context.

- decompose the ETI into its cross-border shifting and pure avoidance components

Our estimates indicate cross-province shifting is large. There is however scope for subnational redistribution because:

- large differences in inequality across provinces
- large vertical fiscal externalities through shared tax base;

Our model suggests an optimal theory of the vertical fiscal gap – depends on degree of cross-state shifting and extent of heterogeneity.