Topics on Fiscal Federalism
Lecture 3: Fiscal Federalism in Argentina

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Outline of the lecture

- Subnational public finances in Argentina

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- Specic features of non-tax provincial revenues

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- Vegh and Vuletin (2015): Estimation and econometric results

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- Specic features of non-tax provincial revenues
- Vegh and Vuletin (2015): Estimation and econometric results
- Besfamille et al. (2019): Estimation, conometric results and discussion
- Conclusions

Introduction

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- The country is divided in 23 provinces and the capital city, called the Ciudad Autónoma de Buenos Aires (CABA).

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Subnational public finances in Argentina

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Subnational public finances in Argentina

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- Provinces are the only sub-national units with political representation at the national level, i.e. at the Congress.
- Most important feature of the provincial autonomy.
  - "*Each province shall enact its own constitution under the republican, representative system, in accordance with the principles, declarations, and guarantees of the National Constitution, ensuring its administration of justice, municipal regime, and elementary education.*" National Constitution, Fifth Section.

Subnational public finances in Argentina

Socio-economic heterogeneity

Table 1: Basic geographic and socio-economic statistics of Argentine provinces

Province	(1) Area (Sq. km.)	(2) Population (Hab.)	(3) Density (Hab/Sq. km.)	(4) GPP/GDP	(5) Per capita GPP (2004 AR$)	(6) Poverty index
Buenos Aires	307,751	13,827,203	44.93	35.06%	14,171	13%
CABA	203	2,776,138	13,675.56	25.64%	51,619	7.1%
Catamarca	102,602	334,568	3.26	0.71%	11,868	18.4%
Chaco	99,633	984,446	9.88	0.96%	5,444	27.6%
Chubut	224,686	413,237	1.84	1.69%	22,852	13.4%
Córdoba	165,321	3,066,801	18.55	7.49%	13,642	11.1%
Corrientes	88,199	930,991	10.56	1.03%	6,162	24%
Entre Ríos	78,781	1,158,147	14.70	1.98%	9,545	14.7%
Formosa	72,066	486,559	6.75	0.33%	3,813	28%
Jujuy	53,219	611,888	11.50	0.59%	5,418	26.1%
La Pampa	143,440	299,294	2.09	0.89%	16,587	9.2%
La Rioja	89,680	289,983	3.23	0.72%	13,959	17.4%
Mendoza	148,827	1,579,651	10.61	2.58%	9,124	13.1%
Misiones	29,801	965,522	32.40	1.55%	8,971	23.5%
Neuquén	94,078	474,155	5.04	2.03%	23,886	15.5%
Río Negro	203,013	552,822	2.72	1.40%	14,116	16.1%
Salta	155,488	1,079,051	6.94	1.35%	7,007	27.5%
San Juan	89,651	620,023	6.92	1.00%	9,080	14.3%
San Luis	76,748	367,933	4.79	1.50%	22,810	13%
Santa Cruz	243,943	196,958	0.81	1.06%	29,998	10.1%
Santa Fe	133,007	3,000,701	22.56	7.81%	14,555	11.9%
Santiago del Estero	136,651	804,457	5.89	0.50%	3,488	26.2%
Tierra del Fuego	21,571	101,079	4.69	0.45%	25,124	15.5%
Tucumán	22,524	1,338,523	59.43	1.66%	6,954	20.5%

Sources: (1): Instituto Geográfico Militar. (2),(3) and (6): Censo 2001, Instituto Nacional de Estadísticas y Censos. (4) and (5): Dirección Nacional de Relaciones Económicas con las Provincias.

Subnational public finances in Argentina

Public sector heterogeneity

Table 3: Size of provincial governments (as percent of GPP)

Province	Size	Province	Size	Province	Size
Buenos Aires	6.33	Formosa	53.42	Salta	16.27
CABA	3.09	Jujuy	27.96	San Juan	17.51
Catamarca	25.45	La Pampa	14.70	San Luis	7.39
Chaco	23.98	La Rioja	20.53	Santa Cruz	17.49
Chubut	10.10	Mendoza	13.19	Santa Fe	7.73
Córdoba	8.23	Misiones	12.35	Santiago del Estero	34.89
Corrientes	17.24	Neuquén	17.22	Tucumán	15.43
Entre Ríos	15.20	Río Negro	12.88	Tierra del Fuego	17.19

Source: Dirección Nacional de Relaciones Económicas con las Provincias.

Subnational public finances in Argentina

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- Exclusive competence of provinces: primary and secondary education, municipal organization and local services like police, health and public housing.
- Participation of provincial public expenditures in the consolidated public sector outlays rose from 40 percent at the beginning of the eighties, to an average of 55 percent in 2003.

Subnational public finances in Argentina

Expenditures

Table 4: Public consumption and transfers (as percent of total public expenditures)

Province	Public consumption and transfers	Province	Public consumption and transfers
Buenos Aires	89.2	Mendoza	84.2
CABA	88.0	Misiones	75.3
Catamarca	84.1	Neuquén	72.9
Chaco	81.5	Río Negro	81.2
Chubut	73.0	Salta	83.2
Córdoba	86.7	San Juan	78.2
Corrientes	82.3	San Luis	66.0
Entre Ríos	84.3	Santa Cruz	70.8
Formosa	76.6	Santa Fe	88.1
Jujuy	82.5	Santiago del Estero	78.1
La Pampa	73.0	Tierra del Fuego	76.7
La Rioja	82.5	Tucumán	83.7

Source: Dirección Nacional de Relaciones Económicas con las Provincias.

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- As a consequence, during 1988-2003, the National Government collected, on average, 77 percent of the total tax revenue of the country, whereas provinces were only in charge of the remaining 22 percent.

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- Provinces' tax collection amounted, on average, to 2.14 percent of their GPP.

Subnational public finances in Argentina

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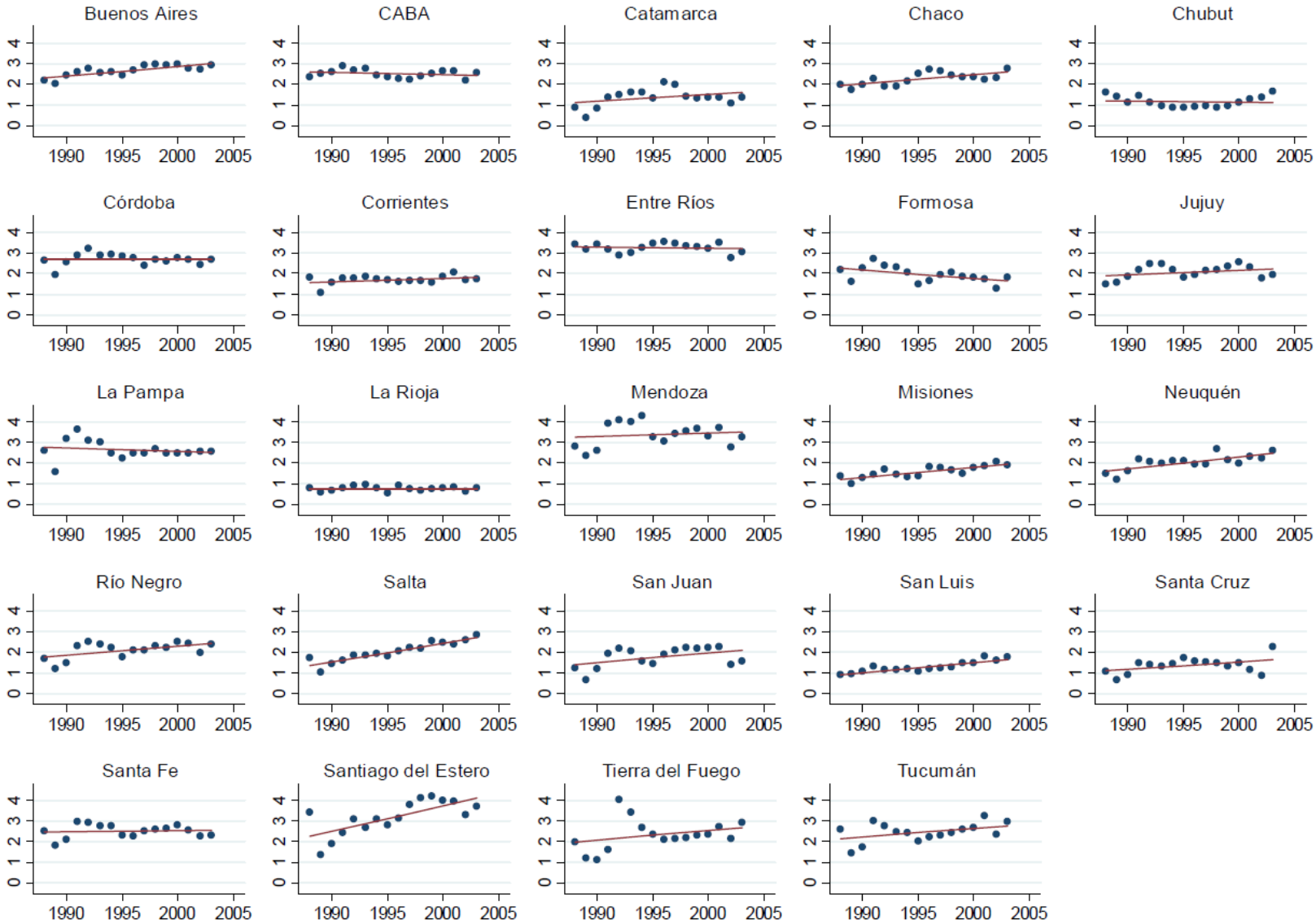

Subnational public finances in Argentina

Revenues

- This gap between expenditures and tax revenues generates an important vertical fiscal imbalance, solved through a system of intergovernmental transfers called *Coparticipación Federal de Impuestos* [Law 23,548 /88], and the possibility for provincial governments to borrow domestically and abroad.

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- For some provinces, a third important source of revenue comes from royalties on private sector exploitation of oil, gas and mineral resources.

Subnational public finances in Argentina

Revenues

Table 5: Revenue composition, by province (as percent of total public income)

Province	Taxes	Cop. transfers	Royalties	Province	Taxes	Cop. transfers	Royalties
Buenos Aires	46.9	44.0	0.0	Mendoza	26.5	48.6	9.3
CABA	83.6	7.8	0.0	Misiones	14.1	72.8	1.0
Catamarca	6.2	84.5	0.2	Neuquén	13.3	30.6	40.1
Chaco	10.8	81.3	0.0	Río Negro	19.2	58.0	10.4
Chubut	12.9	52.0	23.4	Salta	13.5	66.9	5.0
Córdoba	36.1	55.3	0.0	San Juan	11.5	76.8	0.2
Corrientes	10.5	80.9	0.9	San Luis	16.1	70.7	0.0
Entre Ríos	23.6	65.9	0.9	Santa Cruz	8.4	43.1	29.1
Formosa	4.4	86.6	1.2	Santa Fe	34.9	54.1	0.0
Jujuy	8.7	69.6	0.1	Santiago del Estero	9.0	81.7	0.0
La Pampa	18.1	57.8	2.8	Tierra del Fuego	14.9	45.8	19.6
La Rioja	4.1	59.8	0.0	Tucumán	17.3	73.6	0.0

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  - but by 2007 no province had been denied such authorization.

Subnational public finances in Argentina

Debt

Table 6: Per-capita stock of debt, by province (in 2004 AR$)

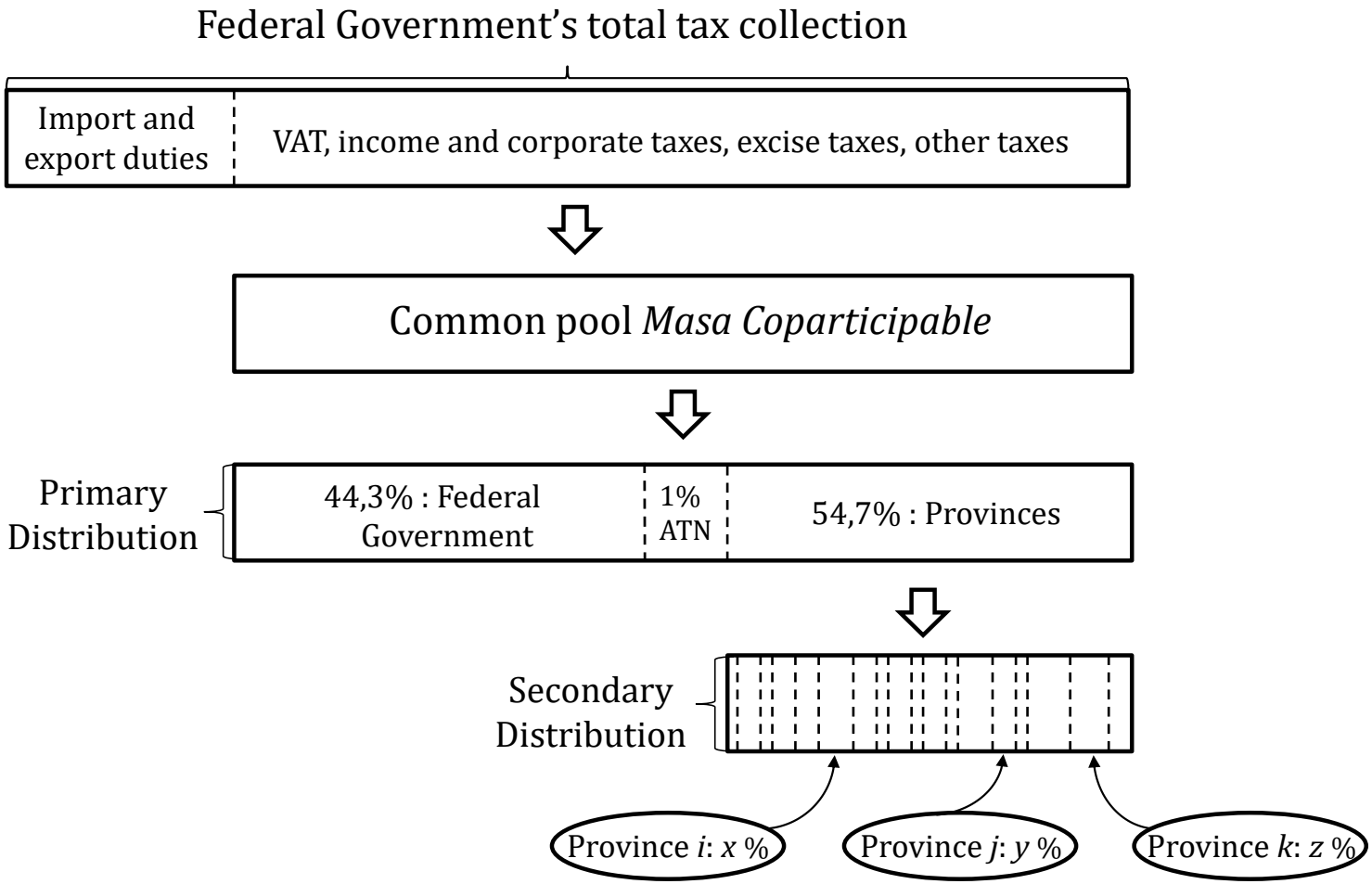
Province	Debt	Coefficient of Variation	Province	Debt	Coefficient of Variation
Buenos Aires	449.63	0.91	Mendoza	865.94	0.33
CABA	817.18	0.28	Misiones	772.53	0.83
Catamarca	764.94	1.47	Neuquén	51.16	31.02
Chaco	888	0.89	Río Negro	811.26	2.07
Chubut	449.52	3.57	Salta	527.27	0.64
Córdoba	25.67	19.4	San Juan	403.66	2.66
Corrientes	851.12	0.34	San Luis	230.67	4.36
Entre Ríos	814.85	0.57	Santa Cruz	712.5	1.48
Formosa	1,556.29	1.06	Santa Fe	166.27	1.51
Jujuy	522.83	2.1	Santiago del Estero	296.96	0.78
La Pampa	260.75	1.73	Tierra del Fuego	241.82	9.47
La Rioja	1,578.6	0.57	Tucumán	664.72	0.6

Source: Dirección Nacional de Relaciones Económicas con las Provincias.

Specic features of non-tax provincial revenues

Coparticipation transfers

- Coparticipation Law 23548/88 defines the process by which taxes collected by the National Government are reallocated to each province



Specic features of non-tax provincial revenues

Coparticipation transfers

- In Section 4 of this law, the provincial coefficients/percents (of the Secondary Distribution) are set as follows

Table 7: Legal shares of the Secondary Distribution

Province	Percent	Province	Percent	Province	Percent
Buenos Aires	19.93	Formosa	3.78	Río Negro	2.62
Catamarca	2.86	Jujuy	2.95	Salta	3.98
Chaco	5.18	La Pampa	1.95	San Juan	3.51
Chubut	1.38	La Rioja	2.15	San Luis	2.37
Córdoba	9.22	Mendoza	4.33	Santa Cruz	1.38
Corrientes	3.86	Misiones	3.43	Santa Fe	9.28
Entre Ríos	5.07	Neuquén	1.54	Santiago del Estero	4.29
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Source: Section 4, Law 23548.

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- These coefficients have been kept fixed during the period.
- Coparticipation transfers are neither closed-ended nor matching.
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- The legal coparticipation coefficients are defined, legally or implicitly, neither upon observable exogenous provincial characteristics nor upon observable outcomes of provincial policies.

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- But, at the end of 1985, this law expired.

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- When the National Congress could finally enact Law 23548 in January 1988, the legal coefficients that appeared there crystallized the shares (of the total amount of transfers) obtained by each province during the previous months.

Specific features of non-tax provincial revenues

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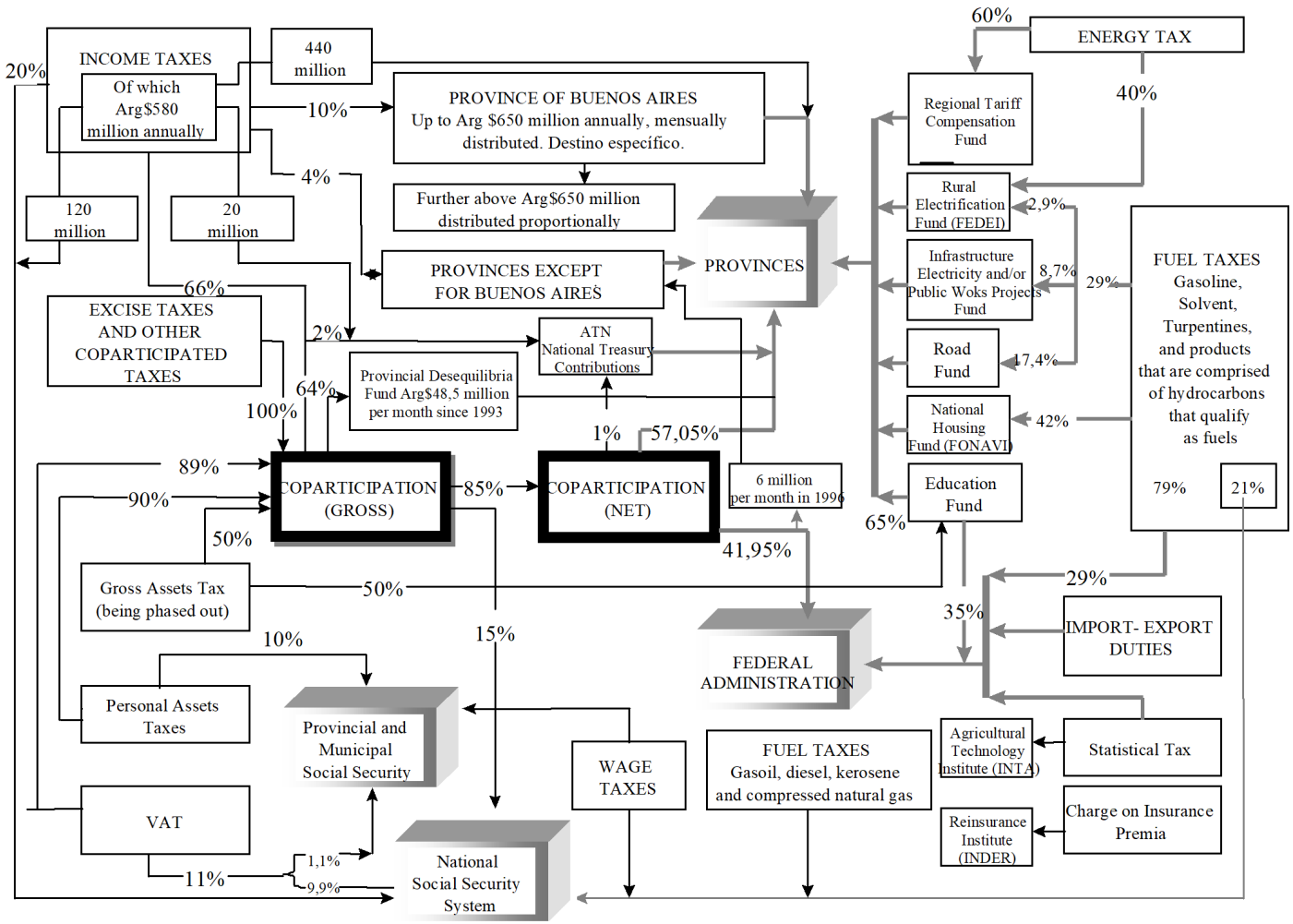
- All this makes the system so complex that it has been called by Richard Bird, the Argentine "fiscal labyrinth".

Specific features of non-tax provincial revenues

The Argentine fiscal labyrinth

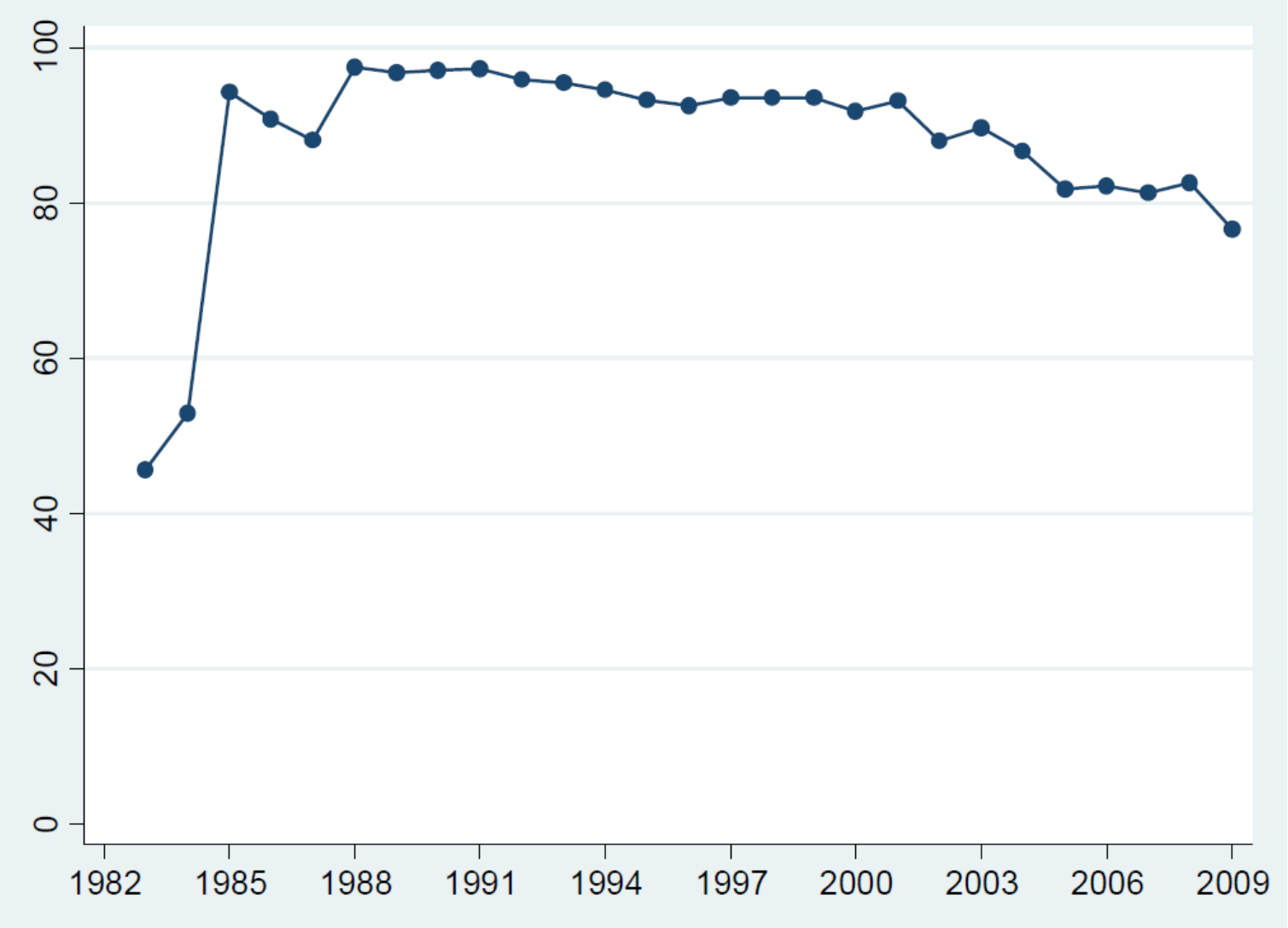


The Argentine Fiscal Labyrinth

Specific features of non-tax provincial revenues

Coparticipation transfers

Total Coparticipation transfers (% of all intergovernmental transfers)



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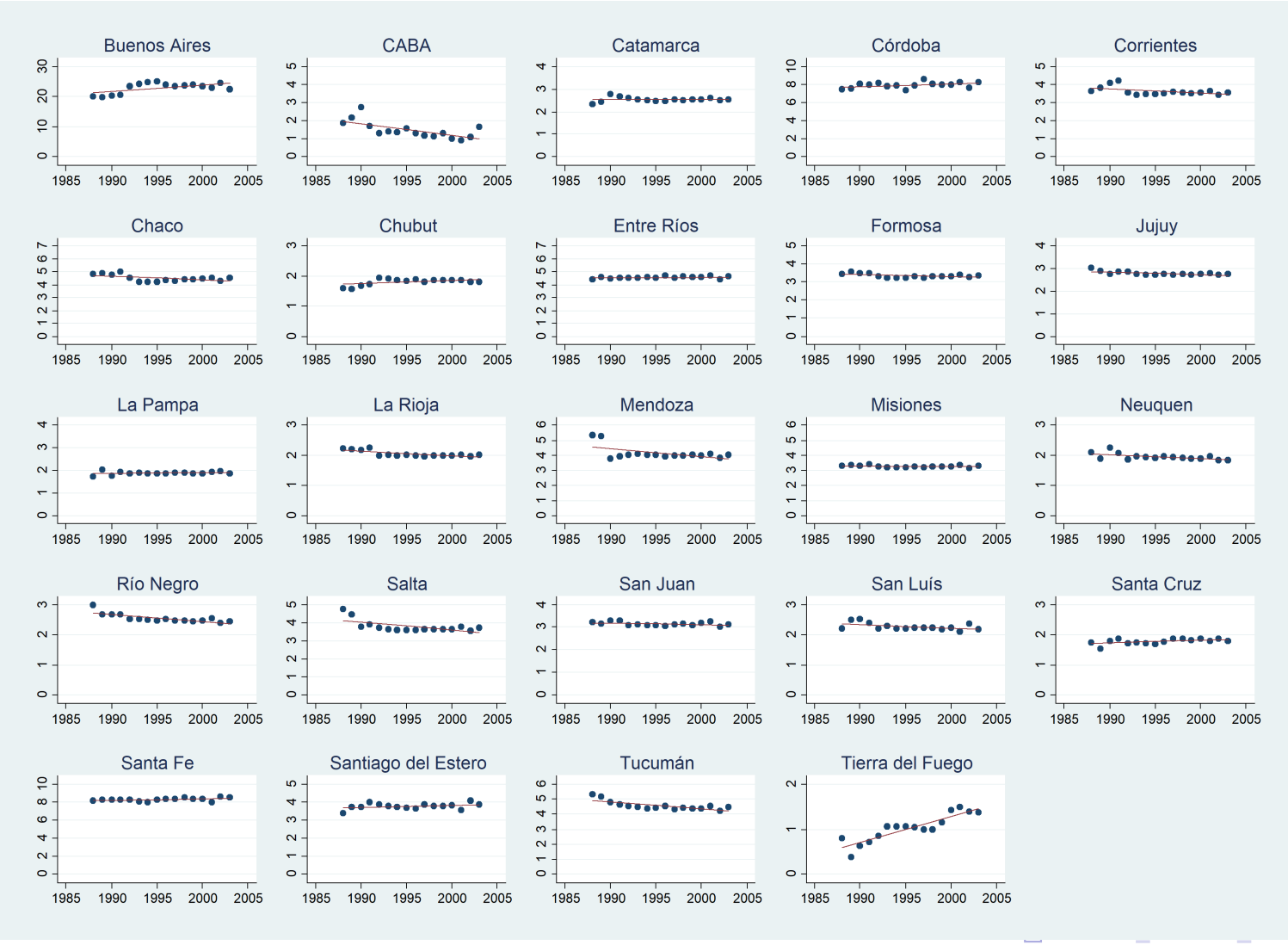
Coparticipation transfers, by province (% of all Coparticipation transfers)



Specific features of non-tax provincial revenues

Hydrocarbon royalties

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- The regime of hydrocarbon royalties was determined by Law 17319/67.
- Under this regime, the National Government set, for all provinces, a uniform rate of 12 percent applied to the value of oil and/or gas computable production, evaluated at domestic prices at the production site.

Specific features of non-tax provincial revenues

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- Chubut, La Pampa, Mendoza, Neuquén, Río Negro, Salta, Santa Cruz and Tierra del Fuego have large hydrocarbon resources and concentrate, on average, more than 95 percent of all natural resources royalties earned in Argentina during 1988-2003.
- As expected, hydrocarbon producer provinces received royalties from oil and gas exploitation, but not exclusively.
  - For example, in 1992, Neuquén earned 13 percent of its royalties from hydroelectricity generation.
- The regime of hydrocarbon royalties was determined by Law 17319/67.
- Under this regime, the National Government set, for all provinces, a uniform rate of 12 percent applied to the value of oil and/or gas computable production, evaluated at domestic prices at the production site.
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- Moreover, the (National) Secretary of Energy was also in charge of auditing whether firms reported accurately their level of production.
- Royalties were collected by the National Government, and then transferred to the provincial governments where oil and/or gas exploitation had originally taken place, according to a pure devolution criterion.

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- But things changed after the 2001-2002 macroeconomic crisis.
  - the currency board was abandoned
  - the state started to intervene in the energy industry.
- Therefore, domestic prices, and thus royalties, began to be disconnected from international prices.

Vegh and Vuletin (2015)

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- As the period is long, there is a real concern for endogeneity in intergovernmental transfers.
- Why? Because during this period of time, there has been different Coparticipation laws in Argentina.
- To deal with this issue, the authors instrumented intergovernmental transfers with an index of over-representation/under-representation at the National Congress: the numbers of deputies/senators per 100.000 inhabitants.

Vegh and Vuletin (2015): main estimation and results

- They estimate the following empirical specification

$$g_{it} = \alpha_0 + \beta_y y_{it} + \beta_f f_{it} + \sum_h \beta_h x_{it}^h + \varepsilon_{it},$$

, and obtain the following results

Table 2
Flypaper effect: basic regressions (1963–2006).

Dependent variable	(1a)	(1b)	(2a)	(2b)
	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage
	Federal transfers	Provincial spending	Federal transfers	Provincial spending
Panel A: primary coefficients				
y (coef. β_y)	−0.007*	0.061***	−0.001	0.063***
	[0.003]	[0.012]	[0.006]	[0.013]
f (coef. β_f)		1.692***		1.696***
		[0.178]		[0.215]
Population	−11.245	16.513	0.815	16.599
	[24.573]	[24.808]	[24.098]	[26.394]
Pop. density	−2.556	−1.749	−2.624	−1.734
	[2.291]	[2.992]	[2.539]	[3.223]
Urban population	14.336***	−13.336*	16.147***	−13.403**
	[3.724]	[7.260]	[3.853]	[6.177]
Governor pre-electoral period	−27.459	−51.448	−57.163	−51.272
	[27.640]	[90.479]	[50.296]	[89.630]
PJ party governor	35.957	−19.207	39.430	−19.394
	[31.265]	[77.163]	[34.023]	[79.519]
Panel B: instruments				
National deputy per capita	96.256***			
	[11.495]			
National senator per capita			182.889***	
			[58.941]	
National deputy per capita × national senator per capita				
Flypaper effect observed				
FP = $\beta_f - \beta_y$		1.6		1.6

Besfamille et al. (2019)

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- All provinces receive Coparticipation transfers, but only some of them earn hydrocarbon royalties.
- We assume that provincial authorities consider both sources of income as exogenous and random, and that they follow different stochastic processes.
- We take the provincial tax collection as a fixed, small fraction of private sector output, which is another exogenously determined random variable.

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- We estimate the following empirical specification of a simultaneous system

$$\begin{cases} \Delta G_{i,t} = \quad cons + \sum_{s=0}^{3} \alpha_s^G \Delta TR_{i,t-s} + \sum_{s=0}^{3} \beta_s^G \Delta R_{i,t-s} + \sum_{s=0}^{3} \gamma_s^G \Delta Y_{i,t-s} + \varrho_i + d_t + \nu_{i,t} \\ \Delta D_{i,t} = \quad cons + \sum_{s=0}^{3} \alpha_s^D \Delta TR_{i,t-s} + \sum_{s=0}^{3} \beta_s^D \Delta R_{i,t-s} + \sum_{s=0}^{3} \gamma_s^D \Delta Y_{i,t-s} + \varrho_i + d_t + \mu_{i,t}. \end{cases} \tag{1}$$

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- As we have to allow for the possibility that $\nu_{i,t}$ and $\mu_{i,t}$ are correlated, we estimate seemingly unrelated regressions (SUR) models.

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  - MAYBE: we consider this possibility later on.

Besfamille et at. (2019)

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- Unobserved shocks affecting both the level of royalties and expenditure decisions could also be relevant.
- To address these concerns, we run the regressions using, as an instrument for provincial royalties, the variable

$$Z_{i,t} \equiv q^{o}_{i,1987} \cdot p^{*}_{t}$$

where $q^{o}_{i,1987}$ is province i's oil production in 1987, and p^{*}_{t} is the international oil price.

Besfamille et at. (2019)

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- The use of p^{*}_{t} as the second component of the instrument deserves some comments.
  - Pindyck (2004) documents that the international oil price determines the international gas price, but not the other way around.
  - As Argentine provinces are small hydrocarbon producers, p^{*}_{t} is clearly orthogonal to provincial characteristics and policies (including fiscal decisions).

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  - Third, royalties seem to be positively related with p^{*}_{t} between 1988 and 2003.
  - Finally, the international oil price can in principle affect both the GPP of hydrocarbon producer provinces or the national GDP (and thus, via the national tax collection, Coparticipation transfers).

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  - Third, royalties seem to be positively related with p^{*}_{t} between 1988 and 2003.
  - Finally, the international oil price can in principle affect both the GPP of hydrocarbon producer provinces or the national GDP (and thus, via the national tax collection, Coparticipation transfers).
    - ★ No causal relationship à la "Dutch Disease".
    - ★ During 1988-2003, changes in the international oil price did not cause, in the sense of Granger, changes neither in the hydrocarbon producer provinces GPP nor in the national GDP.

Besfamille et at. (2019): Econometric results

Table 9: Basic estimations

	(A) SUR (1988-2009)		(B) SUR (1988-2003)		(C) 3SLS	
Variables	$\Delta G_{i,t}$	$\Delta D_{i,t}$	$\Delta G_{i,t}$	$\Delta D_{i,t}$	$\Delta G_{i,t}$	$\Delta D_{i,t}$
$\Delta TR_{i,t}$	1.081^{***} (0.098)	-0.136 (0.1)	0.31^{***} (0.109)	-0.426^{***} (0.133)	0.317^{***} (0.111)	-0.432^{***} (0.135)
$\Delta TR_{i,t-1}$	0.237^{***} (0.099)	0.257^{**} (0.102)	0.136 (0.096)	0.064 (0.117)	0.142 (0.098)	0.06 (0.119)
$\Delta TR_{i,t-2}$	0.265^{***} (0.095)	0.051 (0.98)	0.282^{**} (0.118)	-0.349^{**} (0.144)	0.289^{**} (0.120)	-0.354^{**} (0.146)
$\Delta TR_{i,t-3}$	-0.026 (0.083)	0.246^{***} (0.085)	-0.056 (0.093)	-0.06 (0.113)	-0.046 (0.096)	-0.067 (0.117)
$\Delta R_{i,t}$	-0.042 (0.073)	-0.553^{***} (0.074)	-0.282^{***} (0.099)	-0.717^{***} (0.121)	-0.232 (0.163)	-0.752^{***} (0.199)
$\Delta R_{i,t-1}$	-0.171^{*} (0.095)	-0.649^{***} (0.097)	0.207^{**} (0.104)	-0.328^{***} (0.127)	0.204^{*} (0.105)	-0.326^{***} (0.127)
$\Delta R_{i,t-2}$	0.185^{*} (0.097)	-0.319^{***} (0.1)	-0.386^{***} (0.126)	-0.385^{**} (0.154)	-0.379^{***} (0.128)	-0.39^{**} (0.156)
$\Delta R_{i,t-3}$	0.492^{***} (0.089)	0.571^{***} (0.091)	0.296^{***} (0.094)	0.491^{***} (0.114)	0.286^{***} (0.097)	0.498^{***} (0.118)
$\Delta Y_{i,t}$	0.013^{*} (0.008)	-0.018^{**} (0.008)	-0.018^{**} (0.007)	-0.016^{*} (0.009)	-0.018^{**} (0.008)	-0.017^{*} (0.009)
$\Delta Y_{i,t-1}$	0.026^{***} (0.007)	0.017^{**} (0.007)	0.016^{**} (0.007)	0.009 (0.008)	0.016^{**} (0.007)	0.009 (0.008)
$\Delta Y_{i,t-2}$	-0.012^{*} (0.007)	-0.0 (0.007)	-0.019^{***} (0.007)	-0.017^{**} (0.008)	-0.018^{***} (0.007)	-0.017^{**} (0.008)
$\Delta Y_{i,t-3}$	-0.014^{*} (0.007)	-0.005 (0.007)	-0.001 (0.007)	-0.028^{***} (0.008)	-0.001 (0.007)	-0.028^{***} (0.008)
Observations	432	432	288	288	288	288
R^2	0.709	0.504	0.537	0.561	0.536	0.561
AIC[a]					-360.61	

Table 10: First stage of 3SLS

Variables	$\Delta R_{i,t}$
$Z_{i,t}$	0.657^{***} (0.055)
$\Delta TR_{i,t}$	-0.147^{***} (0.056)
$\Delta TR_{i,t-1}$	-0.078 (0.049)
$\Delta TR_{i,t-2}$	-0.062 (0.061)
$\Delta TR_{i,t-3}$	-0.223^{***} (0.047)
$\Delta R_{i,t-1}$	0.125^{**} (0.054)
$\Delta R_{i,t-2}$	-0.316^{***} (0.075)
$\Delta R_{i,t-3}$	-0.082 (0.053)
$\Delta Y_{i,t}$	0.003 (0.004)
$\Delta Y_{i,t-1}$	-0.001 (0.004)
$\Delta Y_{i,t-2}$	-0.004 (0.003)
$\Delta Y_{i,t-3}$	-0.002 (0.004)
Observations	288
R^2	0.583
F^b	140.9
Cragg-Donald[c]	140.9

Besfamille et at. (2019): Robustness checks I

Different dynamic specifications of (1)

Table 11: 3SLS specification with different number of lags

	(A)		(B)		(C)	
Variables	$\Delta G_{i,t}$	$\Delta D_{i,t}$	$\Delta G_{i,t}$	$\Delta D_{i,t}$	$\Delta G_{i,t}$	$\Delta D_{i,t}$
$\Delta TR_{i,t}$	0.637^{***} (0.133)	-0.057 (0.13)	0.342^{***} (0.098)	-0.091 (0.116)	0.262^{***} (0.101)	-0.23^{*} (0.122)
$\Delta TR_{i,t-1}$			0.370^{***} (0.075)	-0.038 (0.09)	0.137 (0.098)	-0.088 (0.117)
$\Delta TR_{i,t-2}$					-0.114 (0.088)	-0.295^{***} (0.105)
$\Delta R_{i,t}$	-0.897^{*} (0.378)	-0.435 (0.368)	-0.166 (0.185)	-0.552^{***} (0.220)	0.005 (0.161)	-0.450^{**} (0.193)
$\Delta R_{i,t-1}$			0.24^{**} (0.097)	-0.250^{**} (0.115)	0.145 (0.109)	-0.262^{**} (0.131)
$\Delta R_{i,t-2}$					-0.350^{***} (0.1)	-0.207^{*} (0.12)
$\Delta Y_{i,t}$	0.017^{*} (0.009)	0.000 (0.009)	-0.002 (0.007)	0.004 (0.009)	-0.005 (0.007)	-0.002 (0.009)
$\Delta Y_{i,t-1}$			0.005 (0.007)	-0.001 (0.008)	0.005 (0.007)	0.000 (0.009)
$\Delta Y_{i,t-2}$					-0.025^{***} (0.007)	-0.009 (0.008)
Observations	360	360	336	336	312	312
R^2	0.175	0.488	0.494	0.511	0.536	0.519
AIC[a]	-81.8		-311.74		-313.84	

Standard errors in parenthesis. All regressions include provincial and year fixed effects.

Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

[a] Akaike Information Criterion statistic.

Besfamille et at. (2019): Robustness checks II

Groups of similar provinces

- One can suspect that there are groups of provinces with particular characteristics that may bias the estimations.

Besfamille et at. (2019): Robustness checks II

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Besfamille et at. (2019): Robustness checks II

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Besfamille et at. (2019): Robustness checks II

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  - Poor provinces: They react like the other, except that they increase their debt by 12 cents when they face a two-period lagged increase in Coparticipation transfers.

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  - Hydrocarbon producer provinces: concerning Coparticipation transfers, they react like the other.

Besfamille et at. (2019): Robustness checks III

Specific provinces

- Now we examine whether some specic provinces, with particular characteristics, may bias the results obtained in the basic estimation. We proceed to estimate the 3SLS specication of (1), but eliminating these particular provinces from the data, one by one.

Besfamille et at. (2019): Robustness checks III

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Besfamille et at. (2019): Robustness checks III

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Besfamille et at. (2019): Robustness checks III

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- CABA and Tierra del Fuego: the provinces whose coefficients in the Secondary distribution were modified because they became provinces.
- Salta: a poor hydrocarbon producer province.

Besfamille et at. (2019): Discussion

- Provinces react not only to contemporaneous changes in their different sources of public income.

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Besfamille et at. (2019): Discussion

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- When we focus on hydrocarbon producer provinces, their reactions depended heavily upon which was the particular source of income that changed.
  - When they faced a one AR$ increase in royalties, these provinces did not modify their public consumption; instead much of the adjustment was channeled towards a large decrease in debt of approximately 75 cents.

Besfamille et at. (2019): Discussion

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- When we focus on hydrocarbon producer provinces, their reactions depended heavily upon which was the particular source of income that changed.
  - When they faced a one AR$ increase in royalties, these provinces did not modify their public consumption; instead much of the adjustment was channeled towards a large decrease in debt of approximately 75 cents.
- We provide two alternative explanations for why hydrocarbon producer provinces might have proceeded in this way.

Besfamille et at. (2019): Discussion

Volatility of different sources of public income

- Authorities in hydrocarbon producer provinces may have perceptions that changes in royalties are more volatile than changes in Coparticipation transfers, for a given level of correlation between them. If this were the case, a precautionary savings argument could be made to explain the abovementioned different reactions.

Table 17: Coefficients of variation by source of income, by province

Province	Coparticipation transfers	Royalties
Chubut	0.2088	0.69
La Pampa	0.1761	0.5061
Mendoza	0.1492	0.5795
Neuquén	0.1535	0.4102
Río Negro	0.146	0.4748
Salta	0.1386	1.0886
Santa Cruz	0.1965	0.447
Tierra del Fuego	0.3903	0.4394

Besfamille et at. (2019): Discussion

Volatility of different sources of public income

- We estimate different specifications of the stochastic processes of both sources of provincial public income, and we choose the best according to information criteria.

Table 20: Estimation of autoregressive equations in first differences for royalties and Coparticipation transfers

	Royalties			Coparticipation transfers		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.029 (0.027)	0.038 (0.029)	0.058* (0.031)	0, 032 (0.038)	0.036 (0.035)	0.021 (0.035)
1 lag	0.334* (0.169)	0.133 (0.270)	−0.008 (0.289)	0.188 (0.254)	0.222 (0.234)	0.163 (0.290)
2 lags		0.288 (0.189)	0.032 (0.270)		−0.637** (0.26)	−0.510* (0.262)
3 lags			0.255 (0.207)			−0.208 (0.328)
AIC[a]	−23.784	−21.748	−19.716	−13.167	−15.519	−14.714
B-G[b]	0.3025	0.2372	0.7139	0.512	0.875	0.194
CV[c]	2.171				2.086	

Standard errors in parenthesis.* Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

[a] Akaike Information Criterion statistic. [b] Breusch-Godfrey statistic for the highest lag.

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Besfamille et at. (2019): Discussion

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- Royalties follow a mean reverting process, while Coparticipation transfers evolve according to an AR(2).

Besfamille et at. (2019): Discussion

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- Royalties follow a mean reverting process, while Coparticipation transfers evolve according to an AR(2).
- The estimated coefficient of variation of the error term in the autoregressive equations is higher for royalties than for Coparticipation transfers.

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- Barnett and Ossowski (2003) explained that the best known strategy for hydrocarbon producing units is a fiscal policy that preserves the government hydrocarbon and non hydrocarbon wealth.

Besfamille et at. (2019): Discussion

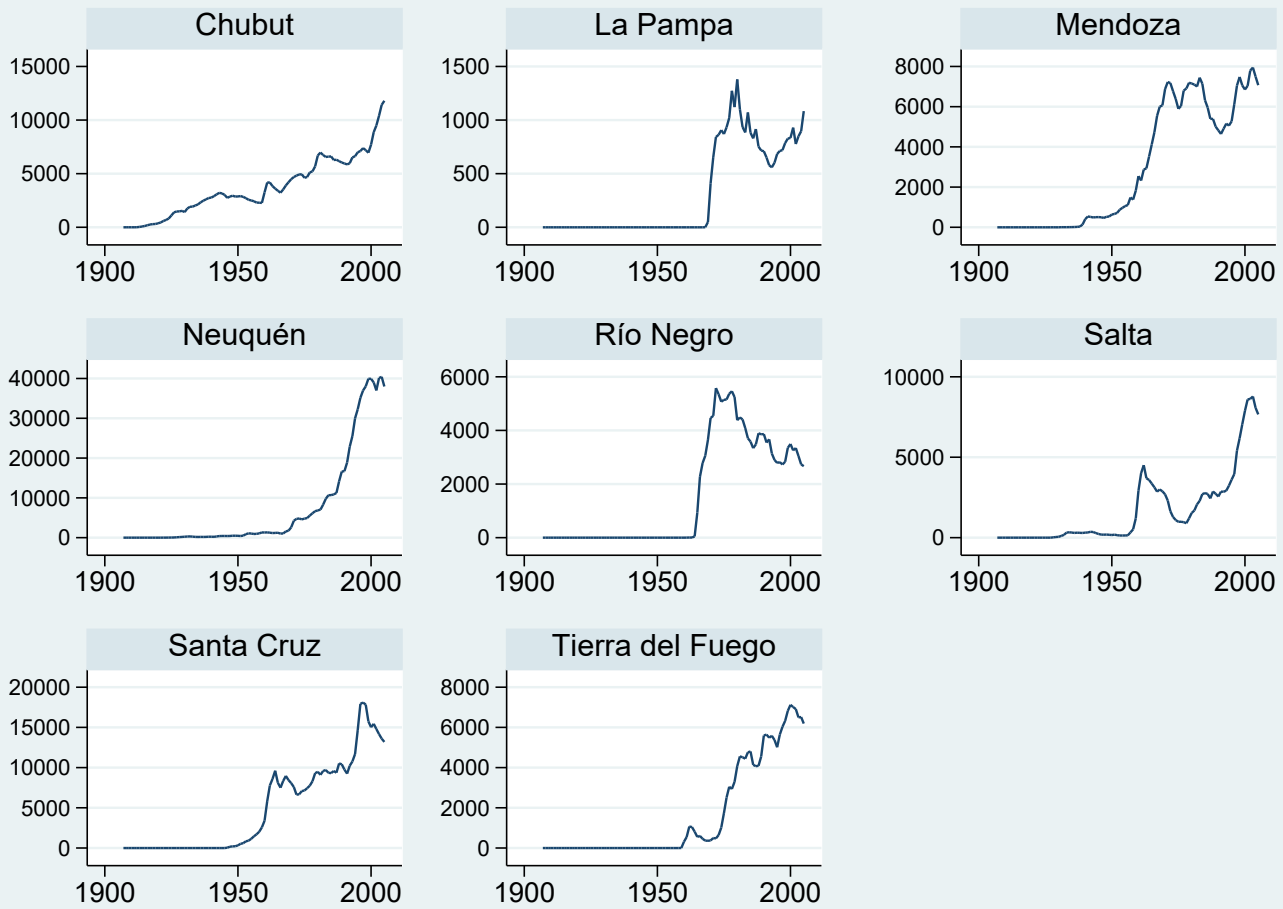
Intergenerational concerns and the non-renewable nature of hydrocarbons

- Barnett and Ossowski (2003) explained that the best known strategy for hydrocarbon producing units is a fiscal policy that preserves the government hydrocarbon and non hydrocarbon wealth.
- Van der Ploeg and Venables (2011) discussed optimal policies for resource-rich developing economies within a model that includes private capital accumulation and public infrastructure construction. In general, the optimal use of an increase in government revenues is not to raise public consumption. But they also claim that in low-income countries with scarce capital, there might be a case for skewing consumption towards present generations in early stages of hydrocarbons production.

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

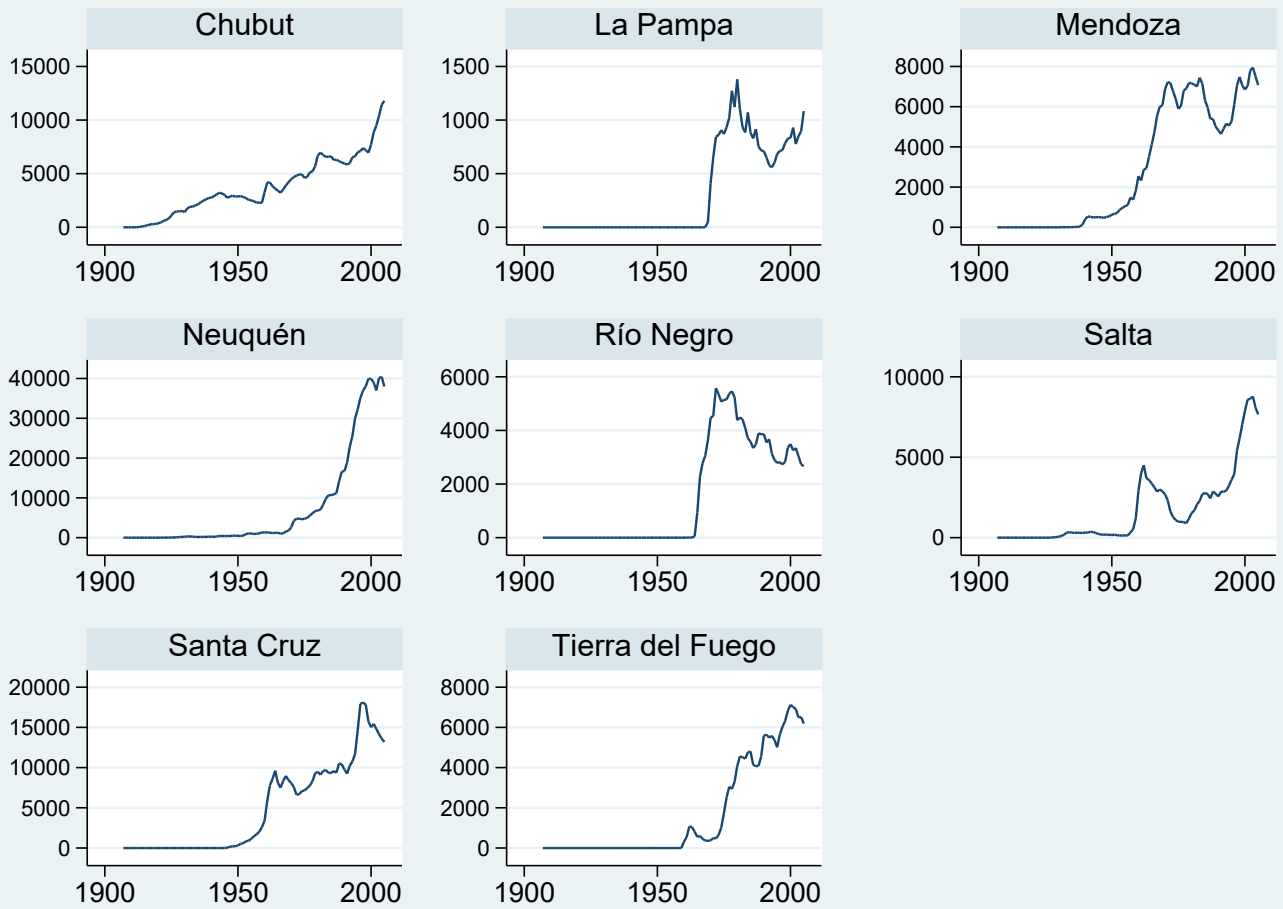
- During the period 1988-2003, Argentina was not a low-income country.



Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- During the period 1988-2003, Argentina was not a low-income country.
- Moreover, this period did not correspond to the early stages of oil and gas production in the eight hydrocarbon provinces.

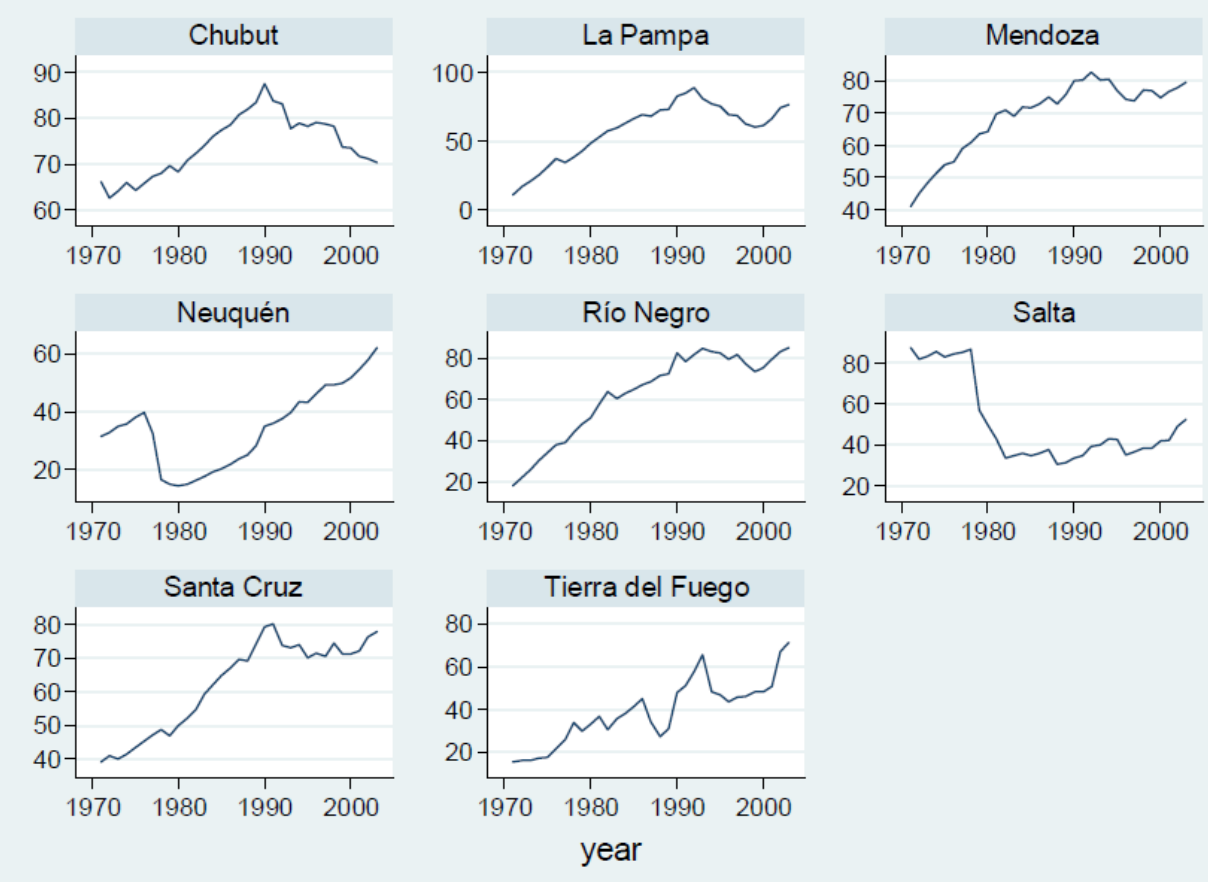


Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- During the period 1988-2003, the eight hydrocarbon provinces were neither at a depletion stage of production.

$$DI_{j,t} \equiv \frac{AP_{j,t}}{TR_{j,t}} = \frac{\sum_{s=0}^{t} q_{j,s}}{\sum_{s=0}^{t} q_{j,s} + R_{j,t}}$$



Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

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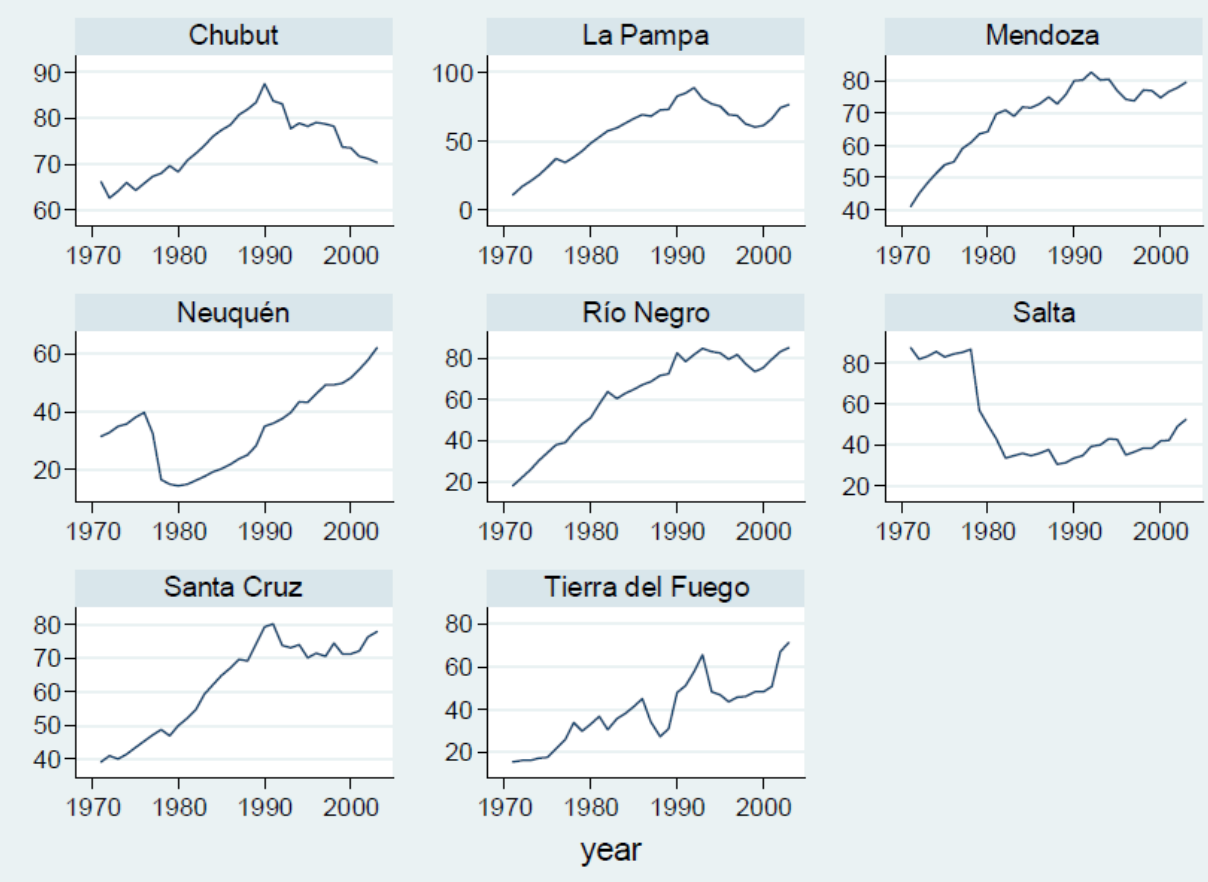

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- The index for La Pampa, Neuquén, Salta and Tierra del Fuego was, on average, well below 80 percent, between 1988 and 2003. Hence, we can assert that these four provinces were not at a stage of their hydrocarbon production cycle close to depletion.

Besfamille et at. (2019): Discussion

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- Although such a value seems high and may suggest that these provinces were approaching the end of their decline curve, it is common to countries or regions that have been producing for a long time (because historic production weights signicantly on the index).

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Besfamille et at. (2019): Discussion

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- But this observation does not prove per se that these four provinces were not close to depletion.
- To confirm that, we need to move one step further, and analyze the evolution of their hydrocarbon production.

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- For each hydrocarbon producer province j, we compute the annual Reserve-Replacement Rate

$$RRR_{j,t} \equiv d_{j,t}/q_{j,t}.$$

Table 18: Test of difference between average $RRR_{j,t}$ and one, by province

Province	Average RRR	p-value
Chubut	1.744	0.071
La Pampa	1.185	0.806
Mendoza	1.132	0.728
Neuquén	0.644	0.404
Río Negro	0.762	0.671
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- For these provinces, we cannot reject the hypothesis that between 1988 and 2003 their average $RRR_{j,t}$ was equal to one, except for the case of Chubut, where it was greater than this threshold.

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- We conclude that hydrocarbon producer provinces were, during 1988-2003, at a mature stage of production, far from the initiation of exploitation but also from depletion.

Besfamille et at. (2019): Discussion

Intergenerational concerns and the non-renewable nature of hydrocarbons

- We conclude that hydrocarbon producer provinces were, during 1988-2003, at a mature stage of production, far from the initiation of exploitation but also from depletion.
- Therefore, according to the abovementioned literature that studies the optimal use of revenues from a non-renewable source, it might have been optimal for these provinces to save their royalties.

Conclusions

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- Thank you!