

# Determinants and consequences of property tax collection in Mexico

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# Determinants and consequences of property tax collection in Mexico

1. Why this is relevant.

2. Database and statistical model.

3. Estimations using STATA.

4. Presentation and interpretation of my results.

5. Concluding remarks.

# Main hypothesis and theories

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- Do the transfer system and electoral competition influence the behavior of local governments in Mexico?
  - What determines the collection of the property tax by mexican municipalities?
    - Is the availability of unconditioned transfers a dissincentive?
    - Does political ideology make a difference?
    - How do geographic and socioeconomic variables enter into the equation?

# Previous literature

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- Model:

- Tiebout (1956),
- Fischell (2001),
- Sennoga et.al (2007).

- Role of local government:

- Stigler (1957),
- Olson (1969),
- Oates (1972),
- Stiglitz (1998);

- Flypaper effect:

- Gramlich (1977),
- Gamkhar & Oates (1991, 1996),
- Stine (1994);

- Determinants of property tax collection:

- LAO of California (1996),
- Iregui et.al (2005).

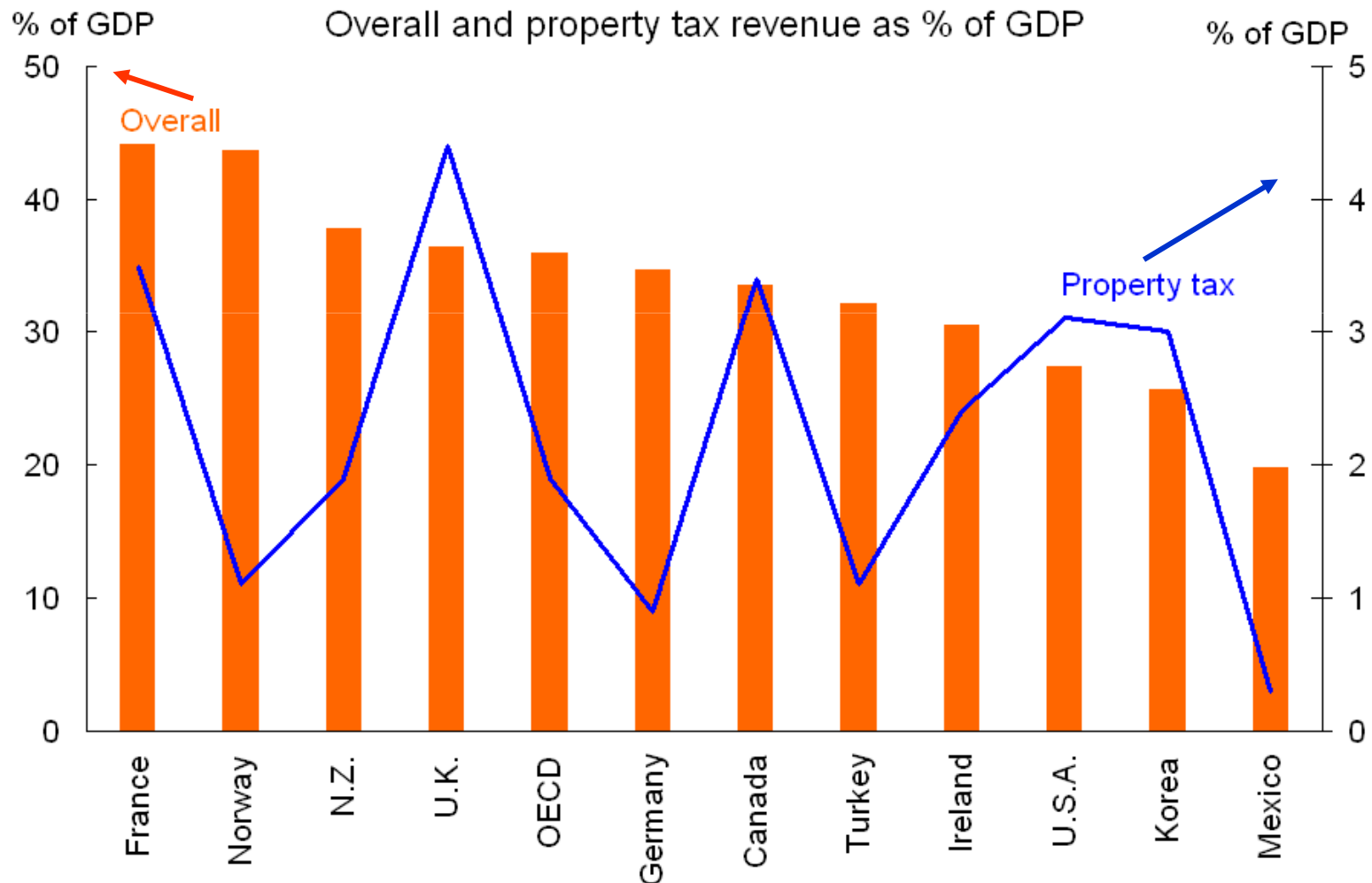
# Contribution of this investigation.

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- The perspective of taxes as another means to match incentives of citizens and elected officials.
- The effects of a growing federalism and fiscal decentralization are only beginning to be studied in Mexico at a subnational level, and even more so at municipal level.
- The scope of the work is unheard of: all municipalities with available data, for the past 16 years.
- Estimates place lost revenue from the property tax equivalent to the gains from the recent Fiscal Reform (2-3% of GDP).
- A political economy approach combined with solid econometric foundations to propose policy improvements that will impact public good provision.

# Comparison of property tax collection

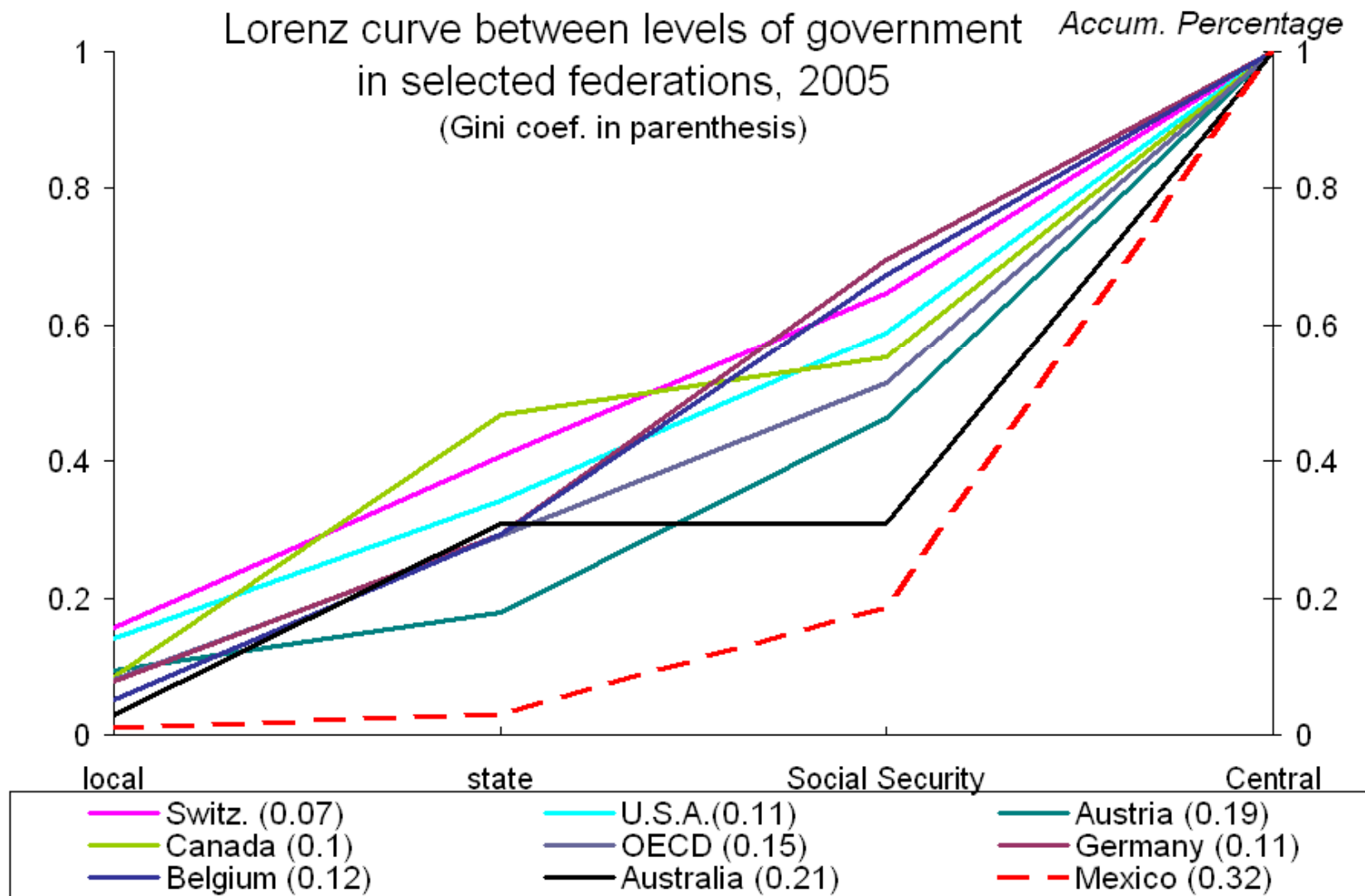
Mexico has the lowest tax revenue to GDP ratio of all OECD countries, and fares just as bad with the property tax in particular.



Source: OECD revenue Statistics 1965-2006, (2007).

# Comparison of property tax collection

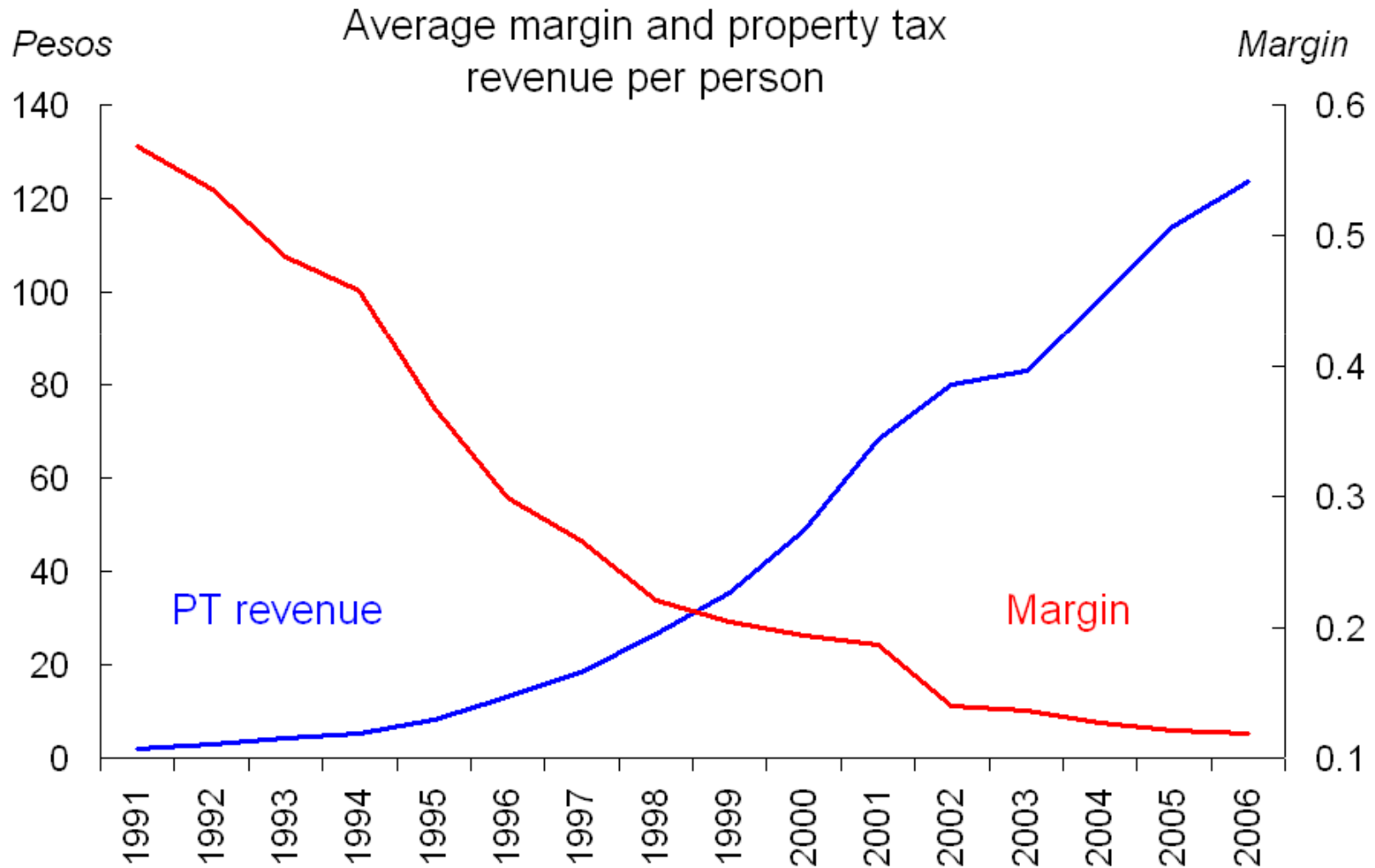
Tax collection is more concentrated than in any other OECD federation.



With data from OECD.

# Comparison of property tax collection

Electoral margin has decreased significantly, parallel to the increase in property tax collection.

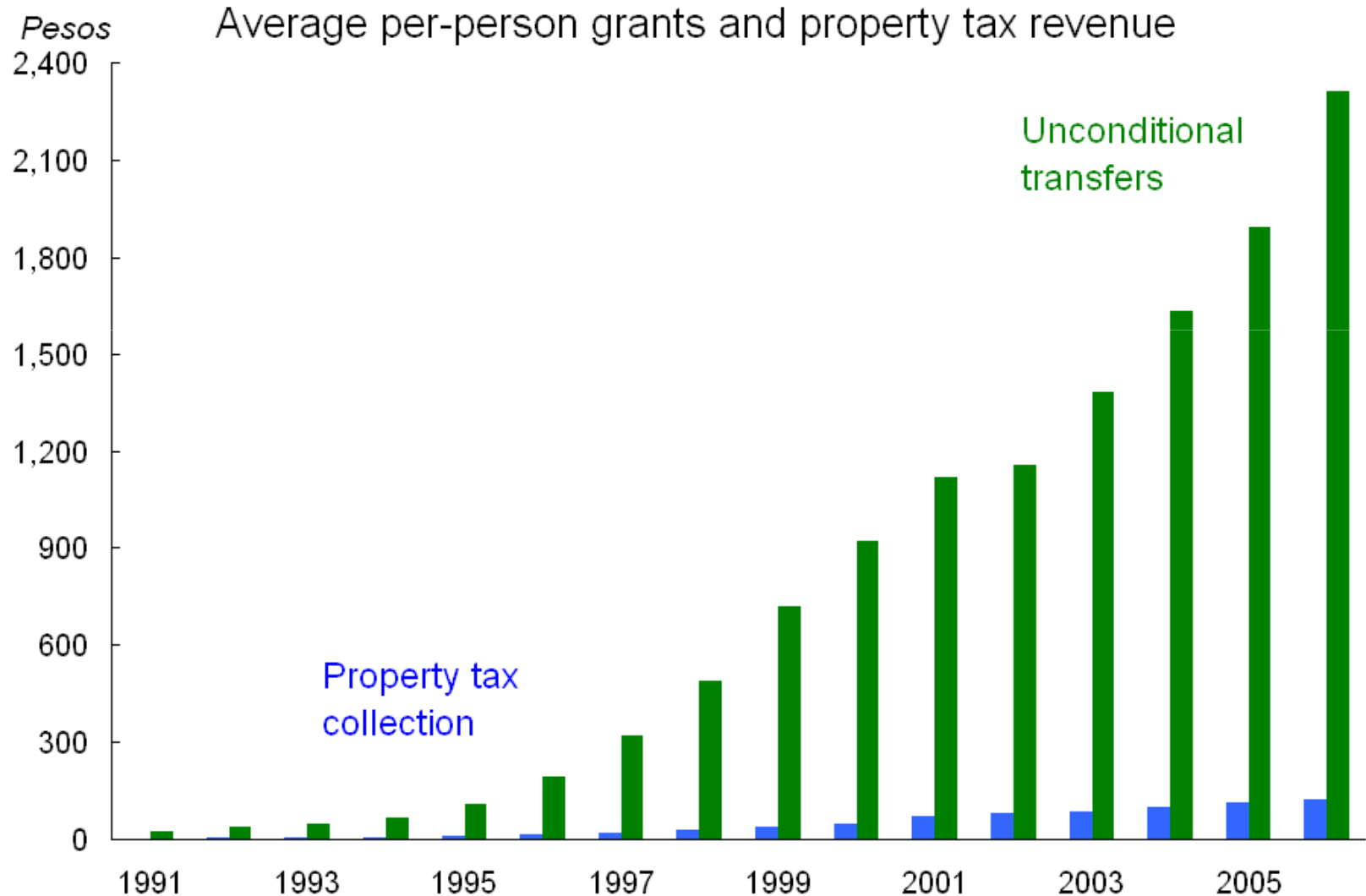


With information from SHCP, Banamex, CIDAC and local electoral institutes.



# Comparison of property tax collection

At the same time, federal transfers have grown at a much higher rate than local revenue.



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# The database

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## Public finance

- Unconditioned transfers;
- Dependency on federal transfers.

## Political

- Political party (*d*);
- Margin of election;
- Alternation of political party (*d*).
- Coalitions (*d*);
- Permanence (*d*);
- Election year (*d*);
- Unified government (*d*).

## Controls

- Income;
- Population density;
- Coast (*d*);
- Altitude;
- Latitude.

# Statistical model

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- Typical “panel error” assumptions:
  1. Panel heteroskedasticity (  $E(\varepsilon^2_{i,t}) \neq (\varepsilon^2_{j,t})$  ).
    - Test: Wald test for groupwise heteroskedasticity in fixed effects models.
  2. Contemporaneously correlated errors (  $E(\varepsilon^2_{i,t}\varepsilon^2_{j,t}) = E(\varepsilon^2_{i,t'}\varepsilon^2_{j,t'}) \neq 0$  ).
    - Test: Breusch-Pagan test for cross-sectional independence in the residuals of a fixed effect regression model.
  3. Serially correlated errors. (  $\varepsilon_{i,t} = \rho_t \varepsilon_{i,t-1} + \nu_{i,t}$  )
    - Test: Wooldridge test for serial correlation in panel-data models.
- If these turn out positive, then OLS does not make the most efficient use of the data. It over(under)estimates the standard errors, producing misleading confidence intervals.

# Statistical model

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- OLS is not optimal in these situations since it does not make an efficient use of the data.
- Generalized Least Squares or FGLS (Parks, 1967) and Panel Corrected Standard Errors or PCSE (Beck & Katz, 1995) can find consistent and efficient estimators for data with the previous characteristics.
- Nevertheless, FGLS only works if  $T > N$ . Even then it exhibits a serious overconfidence of the standard errors, leading to inaccurate confidence intervals.
- PCSE outperforms FGLS, and is at least as good as OLS and more efficient if confronted with the previous characteristics, even when  $T < N$  (as is the case).

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# Setup

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- First: setup of the database:
  - Append, merge, sort and tsset the data:

```
Merge codigo ano using filename
```

- Generate and transform variables (dummies, lags, natural logs, percentages, differences,...):

```
Gen predialpc = predial/pobexc  
Gen predialpcpos = predialpc+1  
Gen lpredialpc = log(predialpcpos)  
Gen laglpredialpc = L.lpredialpc
```

- Diagnostics graphs: scatterplots, spar1, histograms, correlation matrices:

```
spar1 margen predialpc if codigo==19006
```

## Second: test diagnostics and model

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- For serial correlation or the errors I used the Wooldridge test for autocorrelation in panel.

```
xtserial laglparti pdepavg lpibpc ldenspob costa latitud altitud  
PAN PRD Otros margen d_coal d_ah d_cont d_unif d_ae
```

- For contemporaneous correlation of the errors I used the Bresch-Pagan test.

```
xtreg lpredial laglparti pdepavg lpibpc ldenspob costa latitud  
altitud PAN PRD Otros margen d_coal d_ah d_cont d_unif d_ae, fe  
xttest2
```

- For heteroskedasticity I used the modified Wald test for groupwise heteroskedasticity in a FE model.

```
Quietly: xtreg lpredial laglparti pdepavg lpibpc ldenspob costa  
latitud altitud PAN PRD Otros margen d_coal d_ah d_cont d_unif  
d_ae, fe  
xttest3
```



## Second: test diagnostics and model

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- If you have heteroskedastic, contemporaneous and serially correlated data (typical in social sciences), then you may use FGLS or PCSE.
- As we have seen, PCSE is the most appropriate model given the characteristics of the data.
- **xtpcse** works like any regression command, with similar options and controls. It assumes the first two situations and you can control for the third.

```
xi: xtpcse lpredial laglparti pdepavg lpibpc ldenspob  
costa latitud altitud PAN PRD Otros margen d_coal d_ah  
d_cont d_unif d_ae tiempo i.d_edo, correlation(psar1)  
pairwise
```

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## Presentation of results: using outreg2.

- Instead of the usual display from STATA, you can install and use **outreg2** to create formatted tables:

```
outreg2 using tablregs090414, excel
bdec(3) rdec(3) parenthesis(se)
asterisk(coef) ctitle(PCSE ...)
```

PCSE with panel-specific AR1			
laglparti	0.105*** (0.005)	Otros	-0.019 (0.015)
pdepavg	-0.150*** (0.017)	margen	0.083*** (0.012)
lpibpc	0.428*** (0.008)	d_coal	0.037*** (0.011)
ldenspob	0.143*** (0.005)	d_ah	0.087*** (0.009)
costa	0.374*** (0.022)	d_cont	0.024*** (0.007)
latitud	0.000*** (0.000)	d_unif	0.016*** (0.005)
altitud	-0.000*** (0.000)	d_ae	-0.020*** (0.002)
PAN	-0.003 (0.007)	tiempo	0.081*** (0.003)
PRD	-0.069*** (0.009)	Constant	-5.523*** (0.205)

Observations: 14,838 Standard errors in parentheses  
 Number of codigo: 1341 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Interpretation of results: using Clarify.

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- As another means of presenting and interpreting the data, I made my first approach to clarify software.
- Clarify is a program that uses Monte Carlo simulation to simulate quantities of interest for several statistical models.
- It was developed by Tomz, Wittenberg and King (2000).
- To download go to <http://gking.harvard.edu>.
- Using three simple commands it produces information about your regressions that is easily interpreted and understood.

## Interpretation of results: using Clarify.

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- First you estimate the model and simulate the parameters:

```
estsimp model depvar idnepvars
```

- Then, you set the values of your indepvars before simulating the quantities of interest:

```
setx (depvars values)
```

- Third, you simulate the quantity of interest of your choice:

```
simqi qi (ev,pv,pr)
```

# Interpretation of results: using Clarify.

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- For example: we saw there is a significant difference between municipalities with a consolidated government. To measure the impact of that sole change, we:
  1. `estsimp reg predial lagparti pdepavg idh denspobexc PAN PRD Otros margen d_coal d_ah d_cont d_unif d_ae edos, r`
  2. `setx (median)`
  3. `simqi, pr(fd) changex(d_cont 0 1)`

## Interpretation of results: using Clarify.

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- Since we transformed the variables, the mean that Clarify estimates is easily interpreted:

First Difference: d\_cont 0 1

Quantity of Interest	Mean	Std. Err.	[95% Conf. Interval]	
dE(predial)	13.99142	9.043636	-3.475092	32.00988

- All else equal, municipalities that had seen a change of parties in government and then rewarded that party collected 14 pesos more per person vis-a-vis those without continuous government.
- This as opposed to a 0.024 coefficient calculated for our dummy variable to be interpreted in terms of the log of the percapita property tax revenue!

## Interpretation of results: using Clarify.

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- Some other interesting findings using clarify. All else equal:
  - Decreasing the dependency from transfers from the 90th to the 75th percentile means collecting 9 pesos per person more in the near future.
  - Tax collection falls by 21 pesos per person in election years;
  - Improving your HDI index from the median to the 60th percentile will imply collecting 10 pesos more per person; moving to the 75th percentile would imply 25 pesos more.
  - When population density increases from its mean (225 people) to 500 people, local governments collect 4 pesos more; from 500 to 1,000 7 pesos, from 1000 to 5000, 53 more.



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## Concluding remarks.

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- Municipalities in Mexico do not exploit the advantages of property taxes.
- This is explained in part by the lack of electoral competition but also because of the effects that unconditioned transfers have on their budgets.
- Said otherwise: political competition tends to improve the fiscal discipline of local governments, while unconditioned transfers have two contrary effects.
- Hard data on these issues is only starting to become available and trust-worthy.

## Concluding remarks.

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- STATA has several tools that allow for manipulating and testing the data, running the correct model and, most importantly, managing, interpreting and presenting your results.

A non-exhaustive list of such add-ons is:

- `spar1 yvar xvar, options`
- `xttest2`
- `xttest3`
- `Outreg2 using filename, options`
- `Clarify (estsimp, setx, simqi)`

by Nicholas J. Cox.

by Christopher F Baum.

by Christopher F Baum.

by Roy Wada.

by Tomz, Wittenberg, King.

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