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How to almost knock down a market inadvertently and not fail in the attempt? The case of the tax on "luxury cars" in Argentina

¿Cómo casi destruir un mercado sin querer y no fallar en el intento? El caso del impuesto sobre los "automóviles de lujo" en Argentina

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Abstract

Under the pressure of a growing capital outflow, by the end of 2013 the Argentine government implemented what was known as the tax on "luxury cars". Even when not explicitly declared, the main objective was to reduce imports of most expensive cars to reduce the trade deficit of the automotive sector, which was contributing heavily to the capital account deficit. Even when the policy could be categorized as "successful" in terms of reducing a USD 4.5 billion deficit in 2013 to one of just over USD 0.7 billion in 2014, it had a devastating and lasting impact on the internal market, that just in 2013 had achieved a record in sales. We obtain that during the first year of the implementation of the tax, the overall impact on sales of models reached by the tax was 53.7%. Despite some differences, the negative impact took place throughout the whole year. Not surprisingly, cars reached by the highest tax rate were most affected, as well as carmakers that produce more expensive varieties. However, even when the measure may have been designed to have a direct impact on a small part of the market, the negative effects extended to the whole market.

Keywords: Internal Tax, Automotive Sector, Impact Evaluation, Argentina.

JEL Code: A10, D04, H20.

Resumen

Bajo la presión de una creciente salida de capitales, a fines del año 2013 el gobierno argentino implementó lo que se conoció como el impuesto a los "autos de lujo". Aunque no declarado explícitamente, el objetivo principal era reducir las importaciones de los automóviles más caros para reducir el déficit comercial del sector automotriz, que contribuía de manera importante al déficit de la cuenta de capital. Más allá del hecho de que la política podría calificarse de "exitosa" en cuanto a la reducción de un déficit de USD 4.500 millones en 2013 a uno de poco más de USD 700 millones en 2014, tuvo un impacto devastador y duradero en el mercado interno, que apenas un año antes, en 2013, había alcanzado un récord de ventas. Los resultados muestran que durante el primer año de la aplicación del impuesto, el impacto global en las ventas de los modelos alcanzados por el mismo fue del 53,7%. A pesar de algunas diferencias, el impacto negativo se produjo a lo largo todo el año 2014. No sorprende que los automóviles alcanzados por la tasa del 50% fueran los más afectados, así como los fabricantes de modelos más caros. Sin embargo, incluso cuando la medida puede haber sido diseñada para tener un impacto directo en una pequeña parte del mercado, los efectos negativos se extendieron a la totalidad del mismo.

Palabras clave: Impuesto Interno, Sector Automotriz, Evaluación de Impacto, Argentina.

Código JEL: A10, D04, H20.

I. Introduction

By the end of November 2011, and after a deepening in the rate of capital outflows, the Argentine government started to implement a set policy measures directed to restrict access to foreign currencies, and especially to reduce capital outflows. The main measure was known as *"cepo cambiario"*, which meant the need to obtain a previous authorization to buy foreign currency, imposing increasing restrictions on imports, the sending

of profits abroad, etc. Later other measures followed, such as the implementation of non-automatic import licenses.[1] Despite these and other measures, the Capital Account of the Balance of Payment continued to deteriorate. Even more, the difficulties in access to the foreign currency market have a negative effect on the evolution of exports, especially from sectors highly dependent on imported inputs.

In December 2013, the government implemented yet another measure. Law 26929 established an internal tax on the sales of cars whose producer prices were above two thresholds: $A 170 thousand and $A 210 thousand.[2] Even when it was not a measure designed to directly impact on the foreign currency market, the idea behind it was to reduce substantially the sales of the most expensive cars, which were, in most cases, imported from abroad, representing a small share of the automotive market.

In terms of its impact on the currency trade balance, we could say that the measure was a success, reducing the foreign trade deficit of the automotive sector[3] from USD 4.5 billion in 2013 to one of just USD 0.7 billion in 2014. This change was the result of a massive reduction in imports, from USD 15 billion in 2013 to USD 9.5 billion in 2014, but also an important reduction in exports by USD 1.8 billion. Among other reasons behind this turnaround was the reduction in the overall economic activity, and not least the increasing difficulties in importing intermediate inputs, on which the automotive sector is highly dependent.

However, the implementation of the tax had also devastating and lasting impacts on the whole market, with a reduction in sales of new cars by almost 31% in 2014 and a further 8.3% in 2015, and with production dropping by 28.2% and 15.1%[4] respectively. The magnitude of the fall in sales is evident from Figure 1, with a reduction of 47.5% in the case of car models

1.These were known as *"Declaración jurada anticipada de importación"* (Early affidavit import), which by mid-2015 were declared in violation of WTO regulations. From January 2016 they are not in force.

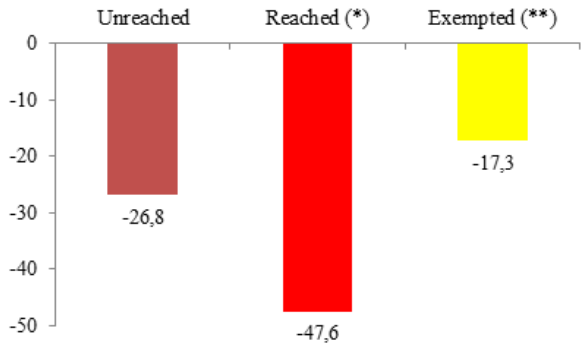
2. About USD 27000 and USD 33000 respectively, at the moment of the Law being passed. These thresholds were updated at the end of 2014, and once again in June 2015 distinguishing also between domestically produced and foreign models.

3. Code 34 of the International Standard Industry Classification (Revision 3): Manufacture of motor vehicles, trailers and semi-trailers.

4. This figure excludes the production by one unidentified car maker.

for which the tax reached at least one variety, however, sales of unreached car models also dropped by 26.8%, while for exempted vehicles there was a reduction of 17.3%. Figure 2 shows clearly that after the implementation of the new tax rates, reached varieties fell much abruptly than unreached ones did. From Figure 2 we can observe that both series exhibit a quite similar temporal pattern before the implementation of the new tax rates.

Figure 1: Annual growth rate of sales of 0 Km vehicles: 2014



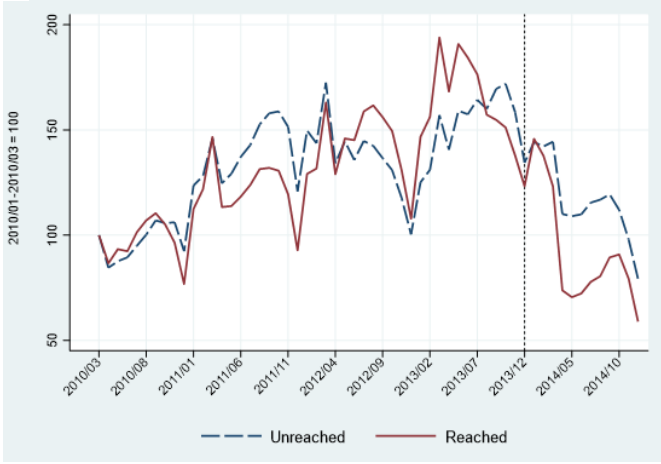
(*) The tax reached at least one variety of the car model in 2014.

(**) Trucks, heavy trucks, and other heavy vehicles.

Source: own calculations based on ACARA.

An interesting pattern arises when we look at the evolution of prices. As Table 1 reports, all prices started to increase as soon after the new tax rates were in force, with prices of varieties reached by the car doing at a faster pace. However, by the end of 2014 prices of unreached varieties have increased almost in the same percentage of those varieties subject to the 30% tax rate. This result may find its explanation in the fact that as the new tax rates came into force, carmakers saw an opportunity to also increase the prices of cars which were not taxed because their prices fell below the reference values, but which were the closest substitutes for those affected by the 30% rate. As 2014 progressed, the evolution of the average price of the car models that were not reached by the tax meant a reduction of the price gap generated at the beginning of the implementation of the tax with respect to the models for which some of their varieties were reached by the different tax rates. This pattern may help explaining why as the new tax rates were implemented, the entire market experienced an astonishing reduction in sales, and not only those varieties reached by the new rates.

Figure 2: three-month moving average sales



Source: own calculations based on ACARA.

Table 1: average percentage change in prices (w.r.t. December 2013)

	Unreached	Reached (tax rate)		
		0/30/50%(*)	30%	50%
January 2014	3.6	33.5	22.7	90.3
February 2014	19.9	62.8	37.4	116.1
March 2014	23.8	75.5	35.4	118.0
April 2014	24.9	74.9	36.6	121.4
May-14	24.9	66.7	37.3	122.5
June 2014	27.7	72.3	38.7	119.2
July 2014	28.6	73.3	39.3	120.0
August 2014	30.3	74.3	42.0	123.5
September 2014	34.7	76.8	43.7	125.8
October 2014	36.5	76.5	44.8	127.2
November 2014	40.6	81.5	45.4	128.6
December 2014	48.2	86.2	46.0	129.9

(*) It includes car models whose varieties during the year 2014 were reached by different tax rates.

Source: own calculations based on ACARA.

Were these side effects on the rest of the sector unforeseen by policy makers? Even when there is no direct answer to this question, we believe that in the light of other policies pursued by economic policymakers at the time, a positive response could be an educated guess. The reason behind this assertion is that if we look at the set of policies implemented over several years, it would seem that there was an (implicit?) understanding that the economic system works as separate compartments, with an astonishing inability, on the edge of even malpractice to recognize that agents and markets in an economy are parts of an interrelated system.

The objective of the paper is twofold. On the one hand, to quantify, through the use of some standard econometric techniques, the impact the implementation of the tax "on luxury cars" had on sales, both on car models directly reached by the tax as well as on those that were not directly affected. On the other hand, to raise awareness on the importance of proper design of policy measures. As we show later, the case under analysis, whose intention was originally directed to affect only a small and specific part of the automotive market, had a devastating impact on the entire sector. The next section briefly discusses the dataset we work with, while in section 3 we lay out the empirical approach and present the results. Section 4 is of summary and conclusions.

II. DATA

Using two separate datasets for cars 0 Km, one with monthly information on sales and the other with monthly information on prices[5], we managed to build up a new and until now unavailable database for the period January 2013 to December 2014.[6] The comparison of these two years is quite informative for our purposes because after that the most important part of the world economic crisis that began at the end of 2008 was over, the domestic car market experienced an important upward tendency reaching in 2013 a record of sales[7], dropping abruptly in 2014 during the first of the two years the new tax was in force.

5. Prices are "suggested sale prices" by car makers to car dealerships. There is no information on prices actually set by car dealerships.

6. We thanks the collaboration of ACARA (*Asociación de Concesionarios de Automotores de la República Argentina)* for the provision of the raw data.

7. With a minor proportion of models produced locally, especially for high-brand models, this explains in part the magnitude of the foreign trade deficit experienced by the sector in 2013.

In both datasets, we have information on the carmaker, the car model, and within each model the different varieties. However, we need to deal with some issues that do not allow us to merge the two datasets directly at the variety level. The first issue is that either because of real changes or marketing policies, the identification of vehicles at the variety level changes substantially over time, so, in many cases, it is not possible to have data for the entire period for a given variety. The second issue is that the definitions of the varieties by carmakers are not necessarily identical to the ones available on the sales dataset, with the latter determined by the official denomination at the moment the car is registered after being sold. Because of these two problems, we are forced to work at the car model level.[8]

With prices set at the level of variety, and so if whether the tax reached a variety, there is a need to decide how to deal with those cases where some varieties of a car model fell under the tax, while others did not, and also when some varieties were reached by the rate of 30%, while others by the rate of 50%. Here we adopt two alternative criteria:

i) in a given month of 2014 we identify a car model as reached by the tax if at least one variety fell under the tax, either with the 30% or 50% rate,

ii) in a given month of 2014 we distinguish between models fully and partially reached, as well as in function of the applied tax rate. In this way, we work with three groups: i) all varieties were reached by the 30%, ii) all varieties were reached by the 50%, iii) all other possible combinations.

In summary, we have a balanced panel with 155 car models for which we have consistent data on prices and sales. Of the car models for which the tax reached at least one variety, in 4 cases the tax rate was in all cases 30%, in 51 was always 50%, and in the remaining 42 cases there is a mix of situations. For the year 2014, when the tax was in force, we have 1860 observations, with 696 corresponding to cases where no variety fell under the tax, 972 observations where all varieties for a given car model were reached by the tax, and 192 observations with a mixed situation, some varieties reached by the tax while others were not. Finally, because in 243

8. The impossibility of working at a greater level of detail most likely means that our estimates are underestimating the true magnitude of the negative impact.

observations we have zero sales, and because our dependent variable is measured in logs, the sample we work with is 3477 observations.[9]

III. EMPIRICAL METHODOLOGY AND RESULTS

To obtain a first estimate of the impact of the internal tax on sales, we apply a Difference-in-Difference (DD) equation of the following form:

$$\ln S_{it} = \alpha_0 + \alpha_1 d_{2014} + \alpha_2 d_T + \alpha_3 \left(d_{2014} \times d_T \right) + \alpha_4 d_{PCA} + u_{it} \qquad (1)$$

where S_{it} are sales of model i in month t, d_{2014} is a dummy variable for the year 2014 that captures aggregate factors that would cause changes in S_{it} even in the absence of the implementation of the tax in that year, d_T is a dummy variable equal to 1 if car model i was subject to the tax (belongs to the treated group), which captures possible differences between the treatment and control groups before the tax, d_{PCA} is a dummy variable equal to 1 for car models of which some varieties were included in the *ProCreAuto* plan, implemented between July and December 2014 under which the government subsidized the interest rate on loans to buy some locally produced models, u_{it} is an error term assumed to be i.i.d. Our coefficient of interest is α_3, which measures the difference in the average changes in sales for the treated and control groups because of the tax:

$$\hat{\alpha}_3 = \text{Average change in E } (\ln S_{it} \mid d_T=1, d_{PCA}) \\ \text{- Average change in E } (\ln S_{it} \mid d_T=0, d_{PCA})$$

We also modify equation (1) accordingly to allow α_3 to vary depending on the month of 2014, car maker, and the tax rate.

A potential drawback of equation (1) is that it does not allow to control for the unobserved heterogeneity amongst car models since it assumes that within each group, treated and not treated, there is no heterogeneity. Since our dataset has a panel structure, with car models observed in 2013

9. Our sample represents 96% of sales in 2013 and 92% in 2014. We exclude models with very small and intermittent sales in both years, but more important, we exclude models that were introduced to the market later in 2013, as well as those that were withdrawn early in 2014. In the first case it appears the Ford K (2.5% of sales in 2013), while in the second case two models stand out: Toyota Etios (3.9% of sales in 2014) and Citroen C4 Lounge (1.3% of sales in 2014).

before the implementation of the tax and also in 2014 when the tax was in force, to account for the unobserved heterogeneity among car models, we also estimate a fixed effect model:

$$\ln S_{it} = \beta . d_{iT} + \phi d_{PCA} + \lambda_t + \eta_i + u_{it} \quad (2)$$

where λ_t is a monthly effect, η_i is a car model fixed effect, and d_{iT} ($=d_{2014}$ x d_T) is a dummy variable equal to 1 in all months of the year 2014 if car model i was subject to the tax, and 0 otherwise. Similarly to equation (1), the coefficient β is the difference-in-difference estimator but now it differentiates the means of the same units over time (Imbens and Wooldridge, 2007). As before, we also adapt equation (2) to allow coefficient β to vary depending on the month of 2014, car maker, and the tax rate. As pointed out before, an advantage of equation (2) over (1) is the former allows to control for the unobserved heterogeneity among car models, and by the inclusion of a set of monthly effects we can control for the heterogeneity over time of changes in aggregate factors that may have affected the whole market.

Both previous specifications are aimed at answering the question of what was the effect of the tax on car models reached by the tax (the treated group) *vis* a *vis* car models that because their prices were unreached (the untreated group). However, another important and different question is to what extent the tax also affected unreached car models, compared to the hypothetical situation in which the tax had not existed. Here we can expect the effect to go in either direction. For instance, if reached and unreached car models are close substitutes, we could expect a positive effect on sales of cheaper cars that fell short of the tax thresholds. On the contrary, if the implementation of the tax had a depressing effect on the whole market, then all car models, even those that were not reached by the tax, would have seen their sales diminished.

To answer to this last question, we compare the aggregate evolution of sales of car models that because of their prices were not reached by the tax (which constitutes now the *pseudo* treated group) with three categories of vehicles that were left on purpose outside from the tax: light trucks, heavy trucks, and other heavy vehicles (these three categories constitute the untreated group). The intuition behind this exercise is as follows: if car models that were not directly reached by the tax were not affected by it, then, after

controlling for other factors, there should be no systematic difference in the evolution of sales when compared with vehicles that were excluded explicitly from the tax:

$$\ln S_{it} = \beta . d_{iT} + \lambda_t + \eta_i + u_{it} \quad (3)$$

In equation (3), the unit of analysis is not the car model as before, but aggregate sales of car models not reached by the tax, light trucks, heavy trucks, and other heavy vehicles, respectively. Since now we are comparing more heterogeneous types of vehicles than in the analysis carried out so far, we also extend equation (3) to allow for a specific trend for each of the four groups of vehicles, which helps to control for other factors that may explain differences in the evolution of sales not explained by the implementation of the tax. In this way, we relax the assumption that in the absence of the treatment, the treated and untreated groups would show the same time evolution. However, we could not reject the null hypothesis that the four categories of vehicles share a common time evolution after controlling by the effect of the tax.[10]

III.1. Results

Tables 2 to 5 present the results for different specifications and estimators.[11] The first two columns in Tables 2 and 3 show the results from the Difference-in-Difference (DD) and fixed-effect panel data (PD) estimators in which we compare car models reached by the tax (the treated group) with car models that because of their prices were not reached (the untreated group). In column 3 (labeled Pseudo T), using a fixed-effect estimator, we compare car models because their prices were not reached by the tax (the *pseudo* treated group) with other vehicles that were left purposely out from the tax (the untreated group[12])[13]. In Table 2, we estimate a single overall effect, while in Table 3, this is allowed to vary over time. In Tables 4 and 5, the comparison is again between reached and unreached car models, but now allowing for differential effects according to the tax rate (Table 4) and car makers (Table 5).

10. These results are available from the authors upon request.

11. For a matter of space, we only report the results for the variables we are interested. The complete results are available upon request.

12. Trucks, heavy trucks, and other heavy vehicles.

13. We also tried with a specification that allowed for each type of vehicle to have a different time trend, however the null that time trends were statistically equal was not rejected. Results are available upon request.

Table 2: Common effect across all dimensions

	DD	PD	Pseudo T.
	-0.2976*	-0.7705***	-0.1498**
Observations	3,477	3,477	96
R-squared	0.455	0.538	0.829
Number of id		155	4

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

Table 3: Differential effects across time

	DD	PD	Pseudo T.
January 2014	0.7972***	-0.3705***	0.0636
February 2014	-0.1663	-0.6838***	-0.1935
March 2014	-0.5038***	-0.9364***	-0.1410
April 2014	-0.3121*	-0.8087***	-0.0861
May-14	-0.2584	-0.8651***	-0.0622
June 2014	-0.3757**	-0.8434***	-0.0657
July 2014	-0.4749***	-1.0558***	-0.0240
August 2014	-0.4720***	-1.0334***	0.0259
September 2014	-0.3039*	-0.8471***	-0.1834**
October 2014	-0.3861**	-0.7056***	-0.3108**
November 2014	-0.5493***	-0.5980***	-0.4122**
December 2014	-0.7223***	-0.5166***	-0.4112**
Observations	3,477	3,477	96
R-squared	0.464	0.544	0.863
Number of id		155	4

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

Table 4: Differential effects across tax rates

Tax rate	DD	PD
30%	-0.6628*	-0.8022**
50%	-1.0866***	-0.8548***
0/30/50% (#)	0.4726**	-0.6860***
Observations	3,477	3,477
R-squared	0.493	0.539
Number of id		155

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

(#) It includes car models whose varieties during the year 2014 were reached by different tax rates.

Table 5: Differential effects across carmakers

Carmaker (&)	DD	PD
ALFA ROMEO	-1.2135***	-0.6529***
AUDI	-1.2186***	-1.2890***
BMW	-1.9517***	-1.1115***
CHEVROLET	0.9991	0.0904
CHRYSLER	-2.2574***	-0.4071***
CITROEN	-0.7268	-1.0226**
DODGE	0.5859***	-0.6494***
FORD	-1.1846***	-0.0275
HONDA	-0.0453	-0.3360**
HYUNDAI	-0.1617	-0.3767
JEEP	-0.5280*	-0.6714***
KIA	-0.8810*	-1.1064**
MERCEDES BENZ	-0.7509**	-0.6209***
MITSUBISHI	-0.7351***	0.0082
NISSAN	-1.3959**	0.0807
PEUGEOT	1.3567**	-0.2352
PORSCHE	-2.0607***	-0.6970***
RENAULT	0.4679**	-0.6549**
TOYOTA	0.8705	-0.3580
VOLKSWAGEN	-0.0268	-0.6633***
VOLVO	-1.9952***	-0.9719***
Observations	2,875	2,875
R-squared	0.466	0.581
Number of id		125

(&) For Chery, Fiat, and Smart, no car model was reached by the tax.

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

The application of the tax on most expensive cars had a very important impact on sales of models reached by the tax in comparison with those that because of their prices were left out. As reported in Table 2, the overall impact was between 25.7% (DD estimator) and 53.7% (PD estimator). But it also significantly affected the sales of varieties not reached by the tax (because of their price) in comparison with vehicles that were left purposely out; in this case the estimated effect is about 14%.

When we allow the effect to vary over time, and looking at the estimates from the fixed-effect model, the magnitude of the impact is between 31% (January 2014) and 58% (July 2014) for the comparison between reached and unreached car models. When the comparison is made between unreached car models with exempted vehicles, some differences emerge relative to the reached/unreached comparison. For this last case, the negative impact took place over the whole year, with the larger magnitudes during the period March-September 2014, especially July and August, while for the unreached/exempted case the estimates are negative and statistically significant in the last four months of 2014, with the impact in November and December 2014 approaching that for the reached/unreached comparison. A possible reason for this finding is that by the end of 2014, and because of the increasing inflationary process Argentina was experiencing, there were strong expectations about an increase in the threshold prices over which the tax would reach a car variety. These expectations, which were later fulfilled, could have induced a further reduction in sales of both reached and unreached varieties (which are closer substitutes), while a similar impact on exempted vehicles did not take place. It seems this was the case, with the drop in sales of unreached models approaching and even surpassing, in October 2014, that of reached models during the last months of 2014.

Finally, with regards to the effects according to the tax rate (Table 4) and car makers (Table 5), the results are in line with what was a priori expected. In the first case, the negative impact on models that fell under the 50% tax rate is almost 40% higher than for models reached by the 30% rate. In the second case, it is possible to observe an important heterogeneity (between 3% and 77%), with car manufacturers of more expensive models affected harder, especially those who do not have local production in Argentina. For carmakers with local production, the most affected were Citroen (66%), Volkswagen (58%) and Renault (57%), followed by Honda, Peugeot, and Toyota (39%-40%), while for Ford and Chevrolet even when the estimated coefficients are negative, they are not statistically significant. In the case of Fiat, no model was reached by the tax.

IV. Summary and conclusions

As a response to an increasing outflow of foreign capital, the Argentinean government designed a set of policy measures directed to turn

around, or at least to reduce, the rate at which capital flows were leaving the country. One of the most important measures, whose implementation started in February 2012, was a widespread system of non-automatic import licenses. Another measure, which was not less controversial, was implemented earlier in November 2011, implying the need of having a previous approval to buy foreign currency, as well a tax on foreign transactions when using either debit or credit cards, as well on the purchase of tickets for international travels and international tourism packages. Despite these explicit measures, and others that were implemented less formally (some on the edge of illegality), the outflow of foreign capital, if something did, increased continuously. Confronted with a scenario that was deteriorating sharply, the government implemented yet another measure, a tax on sales of more expensive cars, which in Argentina are almost completely imported.

As a result of the new tax, but also due to other reasons, the trade balance of the automotive sector experienced a drastic change, going from a stunning USD 4.5 billion deficit in 2013 to one of just over USD 0.7 billion in 2014. However, as our analysis shows, the new tax had devastating effects on the whole market, which had reached record sales only the previous year, and not only on those car models that were reached by the tax, which constitute a smaller share of the market. These results, which for any competent policymaker should not have been unforeseeable, highlight the importance of a careful, responsible and well-informed policy design.

V. References

Imbens, G. and J. Wooldridge (2007). "Difference-in-Differences Estimation. In What's New in Econometrics?" NBER Summer Institute.

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Robust Clustering of Banks in Argentina

Agrupación robusta de Bancos en Argentina

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Abstract

The purpose of this paper is to classify and characterize 64 banks, active as of 2010 in Argentina, by means of robust techniques used on information gathered during the period 2001-2010. Based on the strategy criteria established in (Wang 2007) and (Werbin 2010), seven variables were selected. In agreement with bank theory, four "natural" clusters were obtained, named "Personal", "Commercial", "Typical" and "Other banks". In order to understand this grouping, projection pursuit based robust principal component analysis was conducted on the whole set showing that essentially three variables can be attributed the formation of different clusters. In order to reveal each group inner structure, we used R package `mclust` *to fit a finite Gaussian mixture to the data. This revealed approximately a similar component structure, granting a common principal components analysis as in (Boente and Rodrigues, 2002). This allowed us to identify three variables which suffice for grouping and characterizing each cluster. Boente's influence measures were used to detect extreme cases in the common principal components analysis.*

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Keywords: Robust clustering, Projection pursuit, Common Principal Components, Robust K-means, Influence measures, Theory of the firm.

JEL Codes: C23, G21, L2

Resumen

El propósito de este documento es clasificar y caracterizar 64 bancos, activos en 2010 en la Argentina, mediante técnicas robustas utilizadas con información para el período 2001-2010. En base a los criterios de estrategia establecidos en (Wang 2007) y (Werbin 2010), se seleccionaron siete variables. De acuerdo con la teoría bancaria, se obtuvieron cuatro conglomerados "naturales", denominados "Personal", "Comercial", "Típico" y "Otros bancos". Para comprender este agrupamiento, se utilizó el todo el conjunto de banco y se realizó un análisis de los componentes principales basado en la proyección, que mostró que esencialmente tres variables pueden atribuirse a la formación de diferentes agrupaciones. A fin de revelar la estructura interna de cada grupo, utilizamos el paquete R `mclust` *para ajustar una mezcla gaussiana finita a los datos. Esto reveló aproximadamente una estructura de componentes similar, lo que garantiza un análisis de componentes principales comunes como en (Boente y Rodrigues, 2002). Esto nos permitió identificar tres variables que son suficientes para agrupar y caracterizar cada cluster. Las medidas de influencia de Boente se utilizaron para detectar casos extremos en el análisis de componentes principales comunes.*

Palabras clave: Agrupación robusta, Búsqueda de proyecciones, Componentes principales comunes, K-media robusta, Medidas de influencia, Teoría de la empresa.

Códigos JEL: C23, G21, L2

I. Introduction and some literature review

It has become evident only recently that banking segmentation might be the starting point of studies on different aspects of the banking industry, such as efficiency, cost structure, determinants of profitability or market strategy.

Sørensen and Puigvert Gutiérrez, 2006, use hierarchical cluster analysis with the objective of detecting some basic patterns in the euro area financial system in terms of the degree of homogeneity of countries. They focus on the degree of integration of the banking sector in the euro area countries over time in the period 1998-2004. They show that despite of the tendency to homogeneity induced by the euro differences still remain that tend to cluster banks together according to well defined geographical regions.

Dan Wang in two essays on US banking industry (Wang, 2007) reveals how market niches are created by selection of different market strategies to gain competitiveness, instead of the more traditional assumption of homogeneous technology from the cost function approach. For the same data set, he shows that those similarities among banks can be revealed by clustering techniques based on proxies of how banks create value.

In Kassani et al. (2015) branch performance and efficiency is analyzed on some 589 branches of a particular bank in Iran. They do so first by some hierarchical clustering (HCA) on efficiency scores obtained with data envelopment analysis (DEA) based on knowledge of bank management. At that stage, they perform a Reduced Multivariate Polynomial Pattern Classifier to model the class of the branches.

Ercan and Sayaseng (2016) conduct an exploratory study on the European banking sector by gathering ranges of consolidated banking indicators from the European Central Bank. They explore whether the foreign ownership of the banks contribute to the characteristic or clustering of these banks or it is a country specific composition. The data in their study is comprised of consolidate data from 26 countries in the European Union (EU) zone covering the period from 2008 to 2013. In their study they employ a Hierarchical Cluster Analysis to identify the clusters in EU Banking Sector. The variables used are Leverage, ROA, Tier 1, Capital requirement and equity/asset ratios.

Farné and Vouldis (2017) identify business models of the banks in the euro area by adopting an enhanced version of Vichi (2001) factorial k-means algorithm which incorporates a procedure to identify outliers within clusters. This approach combines dimensionality reduction and clustering. Their sample consists of 365 banks residing in the 19 euro area coun-

tries. They focus on Financial Reporting (FINREP) variables, providing a detailed decomposition of the balance sheet.

Werbin's study of Argentine banks during 2005-2007 period (Werbin, 2010), replicates Wang's analysis concluding that the ideal number of banks clusters is four. She used Hartigan (1975) F-test of variability reduction to determine the optimal number of clusters and K-means. However the methods used were not statistically robust.

The present work intends to group banks in Argentina adopting a criterion of offered products, following Wang (2007), which is characterized by a specific set of variables that define a particular market strategy on which decisions in the firm are made. In our work we use the same variables as in Werbin' work but on a larger period, comprising financial states from 2005 to 2010. This clustering is recovered by use of robust K-means R function RSKC. Being aware of work by Ding and He (2004), by which principal components of variance matrix are essentially the continuous solutions to cluster membership indicator functions of the K-means algorithm, as they span the same subspace as cluster centroids, we look into the principal components structure of the whole set of banks finding that the data is essentially bi-dimensional. As a byproduct, three variables can be selected among the seven to reproduce Werbin's clustering of banks with minimum loss. We further look into the principal components of each group finding approximately a similar structure, granting the assumptions necessary for a common principal components analysis of the four clusters. This allowed us to characterize each cluster membership in terms of three variables containing the previous two variables that suffice for clustering. Both PCA and CPC are performed in their robust projection pursuit version following Croux and Ruiz-Gazen (2005) and Boente et al. (2002).

The rest of this paper is organized as follows, in section 2 we make a somewhat detailed description of all the methods used specially for robust common principal components model as this topic might be novel to our readership; in section 3 we present and discuss our results paying attention as to how each method grants the next, in section 4 we make some concluding remarks highlighting the main findings of this research.

II. Methodology

II.1 Data

The sixty four active banks in Argentina as to the year 2010 were considered for this study. For each one of them the financial states corresponding to December months during the years from 2005 to 2010 were obtained from the Argentine central bank (BCRA).

In this work cluster analysis aims at identifying relatively homogeneous groups based on certain variables pertaining to a market strategy or offered products, following Wang (2007). The resulting groups should be characterized by a set of "strategic" variables that affect the decision making of the firm. In banking industry, these market strategies manifest themselves in several dimensions which include product mixtures, client perspective, size, geographical reach and sources of funding among others. As in Werbin (2010), we use seven variables:

1.Service revenues / Total income

2.Titles / Total assets

3.Deposits / Total assets

4.Implicit passive rate

5.Personal loans and credit cards / Total loans

6.Advances in checking accounts, document discounts and other commercial loans / Total loans

7.Net worth / Total assets

In contrast with Werbin's, we use a larger period base information and robust techniques.

II.2. Robust statistical methods

At its minimum, robust statistical methods solve similar problems than classical methods but are less affected by unusual cases. An advantage of robust estimation is a better detection of atypical cases through some form of influence measures. Frequently, classical methods perform poorly

in presence of atypical values. In order to classify banks, we choose robust versions of K-means and to characterize them robust PCA.

II.2.1 K-means

The algorithm *K*-means finds a partition $\pi=\{C_1,...,C_K\}$ of a given finite data set into *K* clusters such that within cluster variance is minimized. Some distance among pairs of data points is used and the number of clusters *K* is assumed to be known. If the euclidean distance is used, cluster variance within can be expressed in terms of cluster centroids (Kondo, 2011, p. 11) facilitating algorithmic computation of local optimal partitions. If π^* is an optimal partition,

$$\pi^* = \underset{\pi:|\pi|=K}{\operatorname{argmin}} SSW(\pi)$$

where

$$\mathrm{SSW}(\pi)=\sum_{k=1}^{K}\frac{1}{2n_k}\sum_{i,j\in C_k}\|x_i-x_j\|^2=\sum_{k=1}^{K}\sum_{j\in C_k}\|x_j-\bar{x}_k\|^2$$

No analytical solutions is known for an optimal partition. To solve the problem, several algorithms have been proposed, being Lloyd (1982) the most commonly used. Gordaliza (1991a and 1991b) introduced a robust version of Lloyd's algorithm known as "trimmed K-means" which is less influenced by outliers by trimming certain small proportion of most distanced cases in the computation of centroids before cluster reassignment is made. As minimizing within cluster dissimilarities can be viewed as maximizing between cluster dissimilarities, finding an optimal partition can be posed as a maximization problem. An alternative that solves a maximizing objective, known as "sparse K-means", was proposed by Witten and Tibshirani (2010) in order to make K-means algorithm less affected by certain type of noise. (Kondo, 2011) introduces a robust version of sparse K-means, known as "robust sparse K-means", by combining the idea behind trimmed K-means with that of sparse K-means. This algorithm is implemented in the R package RSKC and is the one we use in this work. For further details and a thorough review of the K-means algorithms, the reader is encouraged to read Kondo (2011).

2.2.2 Robust principal components

Classical principal component analysis seeks an orthogonal transformation of a set of observations of correlated variables into a set of linearly uncorrelated ones, named principal components. The first component is taken so that the set of observations has the largest possible variance in that direction; successively taking directions orthogonal to the previous ones that maximize the variance, a new set of variables is obtained which are independent if the original data is jointly normally distributed. In the original approach, the principal components are eigenvectors of the empirical covariance matrix giving each eigenvalue the variance in each component. Following Croux et al. (2005), this procedure can be made robust in two possible ways, one by robust estimation of the covariance matrix and the other by direct estimation of eigenvectors and eigenvalues with no use of the covariance matrix through a technique called projection pursue (PP) developed by Li and Chen (1985). The algorithm can be easily described. If $x_1,\ldots,x_n$ is the sample data in R^p, let $\hat{\mu}$ be a location center of the sample and S_n a scale estimator; then use the directions provided by the data in the hope that it will be dense in the principal components directions and define $\Gamma_1=\{(x_i-\hat{\mu})/\| x_i-\hat{\mu}\| \mid 1 \leq i \leq n\}$. Compute the first "eigenvector" as

$$\hat{\alpha}_1 = \underset{z \in \Gamma_1}{\operatorname{argmax}} S_n^2(z^t \mathbf{x_1}, \ldots, z^t \mathbf{x_n})$$

The scores on the first component are $S_{i,1} = \hat{\alpha}_1^t x_i$ for $1 \leq i \leq n$. Define recursively for $k=2,\ldots,p$, the scores on the previous components $S_{i,k-1} = \hat{\alpha}_{k-1}^t x_{i,k-1}$, the projected data on the orthogonal complement of the previous components by $x_{i,k} = x_{i,k-1} - s_{i,k-1}\, \hat{\alpha}_{k-1}$ and

$$\Gamma_{1,k}=\{(x_{1,k} - \hat{\mu})/\| x_{1,k} - \hat{\mu} \| \mid 1 \leq i \leq n\}$$

then the k-th component is

$$\hat{\alpha}_k = \underset{z \in \Gamma_k}{\operatorname{argmax}} S_n^2(z^t \mathbf{x_1}, \ldots, z^t \mathbf{x_n})$$

Estimation of the *k*-th eigenvalue is $\hat{\lambda}_k = S^2 (\hat{\alpha}_k^t \quad x_1,\ldots,\hat{\alpha}_k^t \quad x_n)$ and the covariance matrix can be estimated from $C = \sum_{k=1}^{p} \hat{\lambda}_{kk} \hat{\alpha}_k \hat{\alpha}_k^t$. In R language, this is implemented as PCAproj in the package `pcaPP` by (Filzmoser, 2012).

II.2.3 Common Principal Components

The model of Common Principal Components (CPC) generalizes the model of principal components to a given number of subpopulations which share the same principal components but with possibly different variances in each of the principal directions. In more detail, *K* sub-populations $x_{1j}, \ldots, x_{n_j j}$, $1 \leq j \leq K$, constituting the sample data in R^p, have a common dispersion structure according to a common principal components model if the covariance matrix of each subpopulation admits an orthogonal decomposition as follows

$$\Sigma_i = \beta^t \Lambda_i \beta; \quad 1 \leq i \leq K$$

where Σ_i is the covariance matrix of the i-th sub-population, Λ_i is the diagonal matrix with the variances of each principal direction corresponding to the *i*-th sub-population, and β is the orthogonal matrix whose columns are the principal components common to all the sub populations. The model CPC was introduced by Flury (1984) for the special case in which all Λ_i are assumed proportional among them, and by Flury (1988) for the more general case where maximum likelihood estimators of the model were studied. Croux and Ruiz-Gazen (1996) used the Projection-Pursuit algorithm to estimate the parameters of the usual model PCA. Simple and fast, this algorithm easily lends itself for robust estimation of PCA model parameters simply by considering robust estimators of position and dispersion in one dimension. A first implementation of this algorithm was written in Matlab and is still available in Croux (n.d.). R language implementations exist through the packages rrcov and pcaPP. Boente and Orellana (2001) introduced the Projection-Pursuit algorithm in the case of the CPC model by maximization of an aggregate variance obtained as a weighted sum by sub-population proportions. The first principal direction $\widehat{\beta_1}$ is selected to maximize the aggregate variance:

$$\hat{\beta}_1 = \underset{\|\beta\|=1}{\operatorname{argmax}} \sum_{j=1}^{K} \tau_j s^2(\beta^t \mathbf{x_{1j}}, \ldots, \beta^t \mathbf{x_{n_j j}})$$

where $\tau_j=n_j/n$ is the proportion of the j-th sub-population. As in the case of projection-pursue for PCA, data is orthogonally projected on the orthogonal complement of $\widehat{\beta_1}$, $\tilde{x}_{ij} = x_{ij} - \widehat{\beta_1}' x_{ij}$; the procedure is repeated to select the second principal direction $\widehat{\beta_2}$:

$$\hat{\beta}_2 = \underset{\|\beta\|=1}{\operatorname{argmax}} \sum_{j=1}^{K} \tau_j s^2(\beta^t \tilde{\mathbf{x}}_{\mathbf{1j}}, \ldots, \beta^t \tilde{\mathbf{x}}_{\mathbf{nj}})$$

In p steps, p mutually orthogonal principal directions are obtained. Individual variances are then obtained as the univariate variances of the projections of each sub-population along the principal directions. The implementation of this algorithm in Boente and Orellana (2001) is based on a modified version of Croux and Ruiz-Gazen algorithm in Matlab. In Boente and Rodrigues (2002) and Boente et al. (2010), the influence measures iml, for eigenvalues, and imb, for eigenvectors, were obtained. These functions are defined by:

$$IML_i(x,\hat{\beta},\hat{\lambda})^2 = \frac{1}{2}\sum_{r=1}^{p}\left(\frac{(\hat{\beta}_r^t x)^2 - \hat{\lambda}_{ir}}{\hat{\lambda}_{ir}}\right)^2$$

to measure the influence of a point x when estimating lambdas (eigenvalues) and:

$$IMB_i(x,\hat{\beta},\hat{\lambda})^2 = \sum_{r=1}^{p}\sum_{s\square r}\frac{(\hat{\beta}_r^t x \hat{\beta}_s^t x)^2}{\hat{\lambda}_{ir}\,\hat{\lambda}_{is}}$$

to measure the influence of a point x when estimating principal directions beta (eigenvectors). For this work we wrote R language implementations of the projection-pursue CPC algorithm and the corresponding influence functions iml and imb. Under assumption of normality, their asymptotic distributions are

$$G_\lambda^2 = \frac{1}{2}\sum_{r=1}^{p}(z_r^2 - 1)^2$$

for *IML*, and

$$G_\beta^2 = \sum_{r=1}^{p}\sum_{s\neq r} z_r^2 z_s^2$$

for imb, where $z_1,\ldots,z_p$ independent, N(0,1) distributed, variables. In order to compute critical values for these distributions, Monte Carlo simulations were conducted in R.

II.2.4 Model based clustering

Finally we pay some attention to model based clustering through the R package `mclust` (Fraley and Raftery, 2007 and Fraley et al., n.d.)). In `mclust` data is treated as coming from a finite mixture of Gaussian distributions. Each cluster is modeled as a multivariate normal distribution and an EM algorithm is used to fit the model and estimate the model parameters. Covariance matrices of each component are parameterized through eigenvalue decomposition as follows:

$$\Sigma_k = \lambda_k D_k A_k D_k^t,$$

Table 1. Model options available in the R package `mclust`.
K is the number of Gaussian components, or groups, and d is the dimension of the underlying space. Best model fitted by `mclust` VVI, on 4 components.

Identifier	Model	Qty. of covariance parameters	Distribution
EII	λI	1	Spherical
VII	$\lambda_k I$	K	Spherical
EEI	λA	d	Diagonal
VEI	$\lambda_k A$	$K + (d-1)$	Diagonal
EVI	λA_k	$1 + K(d-1)$	Diagonal
VVI	$\lambda_k A_k$	Kd	Diagonal
EEE	$\lambda D A D^t$	$d(d+1)/2$	Ellipsoidal
EEV	$\lambda D_k A D_k^t$	$1 + (d-1) + K[d(d-1)/2]$	Ellipsoidal
VEV	$\lambda_k D_k A D_k^t$	$K + (d-1) + K[d(d-1)/2]$	Ellipsoidal
VVV	$\lambda_k D_k A_k D_k^t$	$K[d(d+1)/2]$	Ellipsoidal

K is the number of Gaussian components, or groups, and d is the dimension of the underlying space. Best model fitted by mclust VVI, on 4 components.

III. RESULTS

As a first step we investigated the optimal number of clusters. We looked into several methods, within sum of squares and an F statistics proposed by Hartigan (1975), partitioning around medoids to estimate the number of clusters using the pamk function of the R package `fpc` (Hennig, n.d.), Bayesian Information Criterion for expectation-maximization for parameterized Gaussian mixture models using the function `mclust` of the R package `mclust` (Fraley et al., n.d.)), and the gap-statistic from (Tibshirani, at al 2001) (see also Chen (2010) for code implementing the gap-statistic.) All

Table 2: F statistic of Hartigan showing significance for 4 clusters.

Clusters	3	4	5
WithinSS	8.83619	6.35087	5.49846
F test		23.48	9.15

of them agree on four clusters as the most reasonable estimation for cluster dimension. Hartigan's F statistic is less than 10 at five clusters, suggesting four clusters as the optimal number. A summary is in Table 2 and Figure 1.

It is particularly important to draw attention to the best model estimated by `mclust`: VVI. This implies two things: first, the best fit is attained at a model with equal orientation (Identity) for all clusters, and, second, the common eigenvectors should be very close to being coordinate axis (variables themselves). This is the hypothesis necessary for using Common Principal Components (CPC) and its results will be in agreement with those of `mclust`.

In a second step, we used robust sparse k-means implemented in R package `RSKC` (Kondo, 2011) allowing for 10% trimming of outliers for the computation of cluster centers. In agreement with bank theory, we recover four clusters, named "Typical", "Other Banks", "Commercial" and "Personal". `RSKC` identified six banks as atypical; see Table 3.

Table 3. Cluster size and atypical per cluster.

Cluster	Typical	Other Banks	Commercial	Personal	Total
Size	24	12	14	14	64
Atypical	0	1	1	4	6

A close look into the variable values, shows which values are affecting those six atypical banks. We summarized this in Table 4. For comparison, medians per variable in each group are shown in Table 5.

An analysis of the medians allows to point to some specific characteristics of each group. Cluster "Other Banks" is characterized by the variable PN, which exhibits the largest median index. These are banks with an important proportion of capital which tend to invest in titles or inter-banks

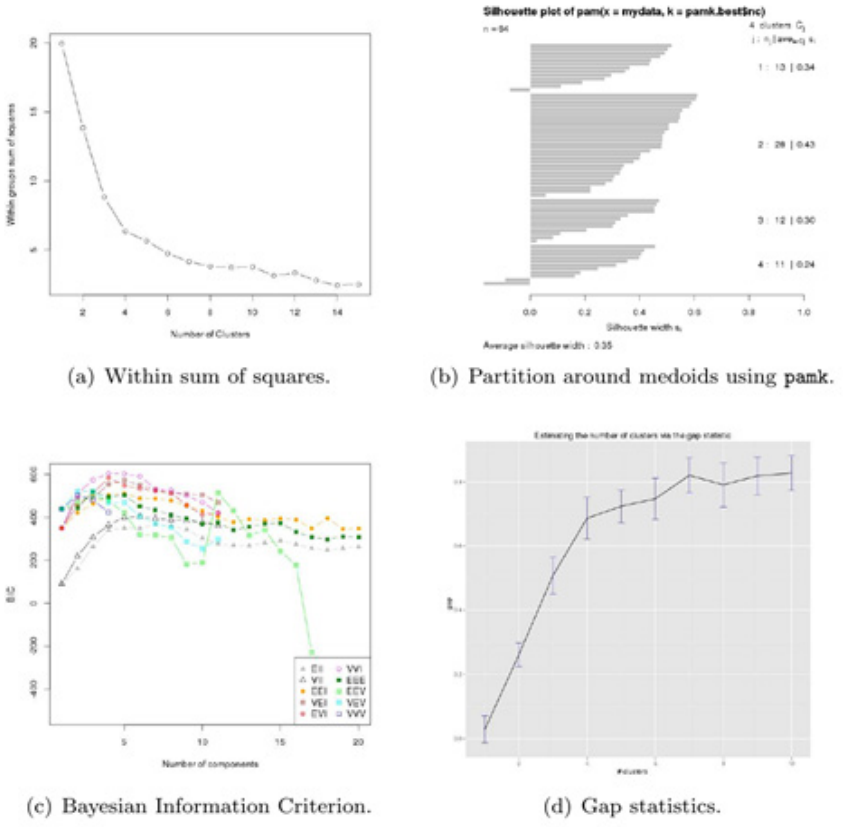
Table 4. Standardized values for atypical banks detected by RSKC.

	Other Banks	Commercial	Personal			
Atypical banks (codes)	(044)	(339)	(306)	(310)	(331)	(332)
Total income (ING)	0,8558	-1,7441	**3,6135**	**-3,6898**	-1,5170	**6,0935**
Titles (TIT)	0,0283	-1,2447	-0,6046	-1,4643	1,4738	-1,4738
Deposits (DEP)	0,2756	**-3,5217**	**-0,6681**	**-6,1929**	**-7,4279**	**-9,5485**
Implicit passive rate (TPI)	**5,7339**	-1,2500	**3,8088**	0,8000	**6,6765**	-1,4353
Personal loans (PER)	0,0000	-1,0000	1,6970	1,0396	1,3416	1,6118
Commercial loans (COM)	-0,3641	1,5611	-1,1703	-0,1566	-1,2482	-1,2482
Net worth / Total assets (PN)	**-2,5257**	**6,8237**	-1,6053	**7,8566**	0,1888	0,1581

Table 5. Medians of each variable per cluster

Variable	Typical Banks	Other Banks	Commercial	Personal
ING	0,2846	0,145	0,1782	0,2759
TIT	0,1891	0,2151	0,0931	0,1266
DEP	0,7631	0,1523	0,5277	0,7085
TPI	0,0386	0,0109	0,0547	0,0244
PER	0,3052	0,0000	0,0115	0,7567
COM	0,4067	0,2451	0,7878	0,1056
PN	0,1017	0,6044	0,12093	0,125

Figure 1. Optimal number of clusters by different methods.



(a) Within sum of squares.

(b) Partition around medoids using `pamk`.

(c) Bayesian Information Criterion.

(d) Gap statistics.

loans. One bank identified as atypical in this group shows unusually large value in the variable TPI and less than the group median in PN. "Commercial" banks are characterized by large values in variable COM, given that these banks have in their portfolios a majority of commercial loans. The atypical bank detected in this group shows unusually large value in the variable PN while a low value for DEP. "Personal" banks are characterized by large values in the variable PER, where this kind of loans represent most of their portfolio. The four atypical banks identified do not show a common pattern. Two of them exhibit larger values in TPI than the median of the group, while the opposite is true respect of DEP. Unlike the previous groups, "Typical Banks" do not show any particular variable to distinguish them from the rest. Even though high values are observed for DEP and ING, these

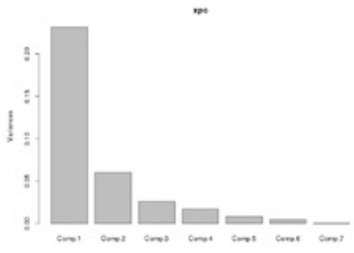
values are also high for "Personal" banks. These are banks having large proportion of deposits that intermediates as personal and commercial loans. No atypical cases are observed in this group.

In a third step, we investigated the principal components of the whole data set to obtain the smallest subset of the original variables that could reproduce the classification with little or no errors. We pay attention to those variables with highest loadings against the principal directions (see Table 6). We used R package `pcaPP` for robust estimation of principal components. The two largest eigenvalues represent 83.5% of the total variance and the three largest 91% (see Figure 2(a)).

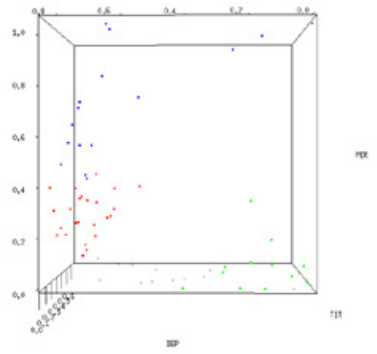
Table 6. Loadings for robust PCA.

	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6
ING	0.162	0.102		-0.216	-0.378	0.876
TIT			**0.818**	0.490	0.251	0.152
DEP	0.394	**0.576**		-0.379	0.603	
TPI					-0.116	
PER	**0.639**		-0.424	0.627		
COM	-0.591	0.560	-0.331	0.412		0.212
PN	-0.245	-0.576	-0.189		0.636	0.392

Figure 2. Robust PCA after pcaPP



(a) Eigenvalues after pcaPP.



(b) A view of data in variables PER, DEP and TIT.

Table 6 suggests that a classification is possible considering just three variables: PER, DEP and TIT. Even PER and DEP should suffice: PER separates "Personal" and "Typical" banks, assigning them high and moderate values respectively, from the other two clusters to which assigns them low values; while DEP separates "Commercial" from "Other Banks", by assigning higher values to the first. Afterwards, this becomes apparent from Table 6. Observe that, as far as the first three components, variable PN is almost opposite to DEP and it could be an alternative choice to DEP. We preferred DEP as its loading over the third component is near zero. Several reclassification runs with RSKC were made based on these three variables. With errors around 10%, the reassignment of banks to each cluster was almost the same as using the seven original variables. A view of the whole data set in these variables is in Figure 2(b), where Typical Banks are in red color, Personal Banks in blue, Other Banks in grey and Commercial Banks in green.

Finally, in a fourth step, in order to understand the structure of each cluster itself, we performed common principal components analysis to the entire data assuming each cluster as a subpopulation, expecting different spectra to identify each group. In each group, the three greatest eigenvalues are concentrated in the first three components, except for "Typical Banks" where the third largest eigenvalue is in the fourth component (see Table 7).

Table 7. Explained variance per group in the first three and four components for robust CPC.

	Typical Banks	Other Banks	Commercial	Personal
Three	64%	68%	87%	83%
Four	80%	83%	91%	88%

This suggests paying attention at the first three common components to explain variability in each group. Table 8 shows the spectra per group. Clearly the cluster "Personal Banks" is dominated by the first component, "Other Banks" by the second, and "Commercial" by the third; while "Typical Banks" show, as expected by bank theory, a rather spherical behavior.

Observe, Table 9, that the variables with greatest loadings to the first three components are again PER, DEP and TIT, on the first, third and second

Table 8: Eigenvalues per group and component for robust CPC

Cluster	β_1	β_2	β_3	β_4	β_5	β_6	β_7
1 Typical	0.017370821	0.013988463	0.008056388	0.01004638	0.008245744	0.003699692	0.0005975094
2 Other	0.017501731	**0.135473283**	0.038569694	0.04119667	0.035492990	0.011448319	0.0008632282
3 Commercial	0.007653666	0.021799816	**0.039045141**	0.00339211	0.002715343	0.002319646	0.0017347925
4 Personal	**0.127270866**	0.008729003	0.019920530	0.01030537	0.005329917	0.014645502	0.0024193412

Table 9: Eigenvectors for robust CPC

Variable	β_1	β_2	β_3	β_4	β_5	β_6	β_7
ING	-0.14353786	-0.34380395	-0.001988733	0.35534239	-0.14109858	-0.76793038	-0.353974122
TIT	0.19461777	**-0.61955159**	0.344908978	-0.58867978	-0.30862426	0.07476819	-0.109244879
DEP	0.47598782	-0.16643094	**-0.846316955**	-0.15075104	-0.01361848	-0.05016366	-0.063688420
TPI	-0.05116156	-0.06427680	-0.019018891	-0.19890461	0.03904271	-0.45791108	0.861463484
PER	**-0.65027730**	0.08347308	-0.351258534	-0.16220699	-0.63704264	0.12010890	0.015117275
COM	0.51546941	0.52053777	0.202244779	0.03829549	-0.61698167	-0.20069756	0.004041191
PN	-0.15417396	0.43381629	-0.011585638	-0.66115152	0.31087417	-0.37119812	-0.341097442

component, respectively. And in general, each component tends to weigh heavily on one particular variable; for example, PN dominates the fourth component, PER and COM dominate the fifth, ING the sixth and TPI the seventh. This explains why `mclust` prefers a model with the Identity matrix as common orientation for all clusters (model VVI).

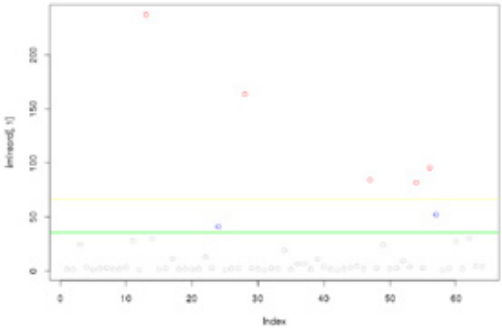
It is particularly important to note that the three variables producing the four clusters are also explaining the dispersion within each cluster.

Influence measures are an appreciated byproduct of robust CPC showing more atypical banks than `RSKC` and with some disagreement. All outliers detected by `RSKC` were detected by both, iml and imb, at 0.01 critical level, save one bank, coded (306), belonging to the "Personal" cluster, which was not detected by neither iml nor imb. This could be due to the way `RSKC` trims: it does it in a spherical way rather than considering the elongated dispersion natural to each cluster. Every outlier detected by iml was detected by imb (in general, this inclusion need not be the case). At a 0.001 critical level, iml detects three more banks as outliers than `RSKC`; and imb detects a total of eleven. This is an expected result given the relative low density of the data set. Yet, both influence measures pinpoint those banks which have special characteristics that deviate from their cluster of origin in a more sensitive way than `RSKC` does. In Figure 3, both influence measures are shown together with critical lines at 0.01 and 0.001. A summary of detected outliers is in Table 10.

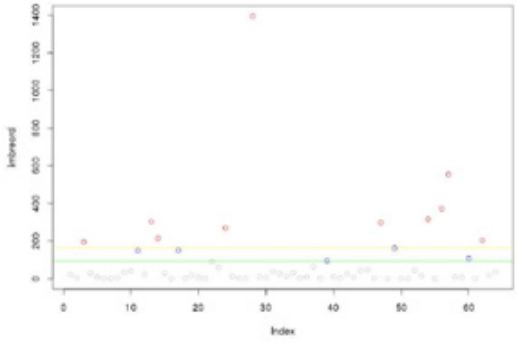
Table 10: Outliers detected by RSKC, iml and imb, at 0.001 level.

	Typical Banks	Other Banks	Commercial	Personal
RSKC		044	339	306, 310, 331, 332
iml		044, 147	198, 325	310, 331, 332
imb	011, 045, 341	044, 147	198, 312, 325	310, 331, 332.

Figure 3: Influence measures after robust CPC.



(a) Atypical banks detected by iml.



(b) Atypical banks detected by imb.

IV. CONCLUDING REMARKS

This research shows clear agreement of Wang's bank theory in the case of argentine banks; in particular, there is not one homogeneous group as classical bank theory predicts, but four well differentiated groups which can be characterized by a rather small set of economic variables defining strategic decisions of the firm. Correct assignment of banks to each group has been greatly improved by use of robust techniques, obtaining as a byproduct detection of outliers. Furthermore, robust spectral analysis through PCA and CPC, show that the phenomena producing the clusters are in fact dispersing

each cluster internally (except for the Typical Banks cluster, behaving in a rather spherical manner). Boente's influence measures associated to CPC have proved to be far more sensitive in detecting outliers than other usual methods.

V. References

Boente, G., and L. Orellana (2001). "A robust approach to common principal components". *Statistics in Genetics and in the Environmental Sciences*. Ed. by Birkhauser Basel et al., pp. 117–147.

Boente, G., A. M. Pires, and I. M.. Rodrigues (2002). "Influence functions and outlier detection under the common principal components model: A robust approach". *Biometrika* 89.4, pp. 861–875.

Boente, G., A. M. Pires, and I. M. Rodrigues (2010). "Detecting influential observations in principal components and common principal components". *Computational Statistics and Data Analysis* 54, pp. 2967–2975.

Chen, Edwin (2010). R Implementation of gap-statistics. [Retrieved from https://github.com/echen/gap-statistic/blob/master/gap-statistic.R].

Croux, C. personal website. [Retrieved from http://www.econ.kuleuven.be/public/NDBAE06/programs/\#pca].

Croux, C., P. Filzmoser, and M. R. Oliveira (2005). "Algorithms for projection-pursuit robust principal component analysis". Department of Decision Sciences an Information Management (KBI) KBI 0624.

Croux, C., and A. Ruiz-Gazen (1996). "A fast algorithm for robust principal components based on projection pursuit". *Compstat: Proceedings in Computational Statistics.* Ed. by A. Prat. Physica-Verlag, Heidelberg, pp. 211-217.

Croux, C., and A. Ruiz-Gazen(2005). "High breakdown estimators for principal components: The projection-pursuit approach revisited". *Journal of Multivariate Analysis* 95, pp. 206–226.

Ding, Chris, and Xiaofeng He (2004). "K-means clustering via principal component analysis". *Proceedings of the 21 St International Conference on Machine Learning*. Canada, 2004: Banff.

Ercan, H and S. Sayaseng (2016). "The cluster analysis of the banking sector in Europe". *Economics and Management of Global Value Chains,* pp. 111–127.

Farnè, M. and A. Vouldis (2017). "Business models of the banks in the euro area". Working Paper Series European Central Bank 2070.

Filzmoser, P. et al. (2012). Package "pcaPP".Peter Filzmoser, Heinrich Fritz and Klaudius Kalcher. [Retrieved from http://www.statistik.tuwien.ac.at/public/filz/]

Flury, B. K. (1984). "Common principal components in K Groups".*J. Amer. Statist. Assoc.* 79, pp. 892–898.

Flury, B. K. (1988). *Common principal components and related multivariate models*, Wiley, New York.

Fraley, C., and A. Raftery (2007). "Model-based methods of classification: Using mclust software in chemometrics". *Journal of Statistical Software* 18.6. [Retrieved from: http://www.jstatsoft.org/].

Fraley, C., A. Raftery, and Scrucca L. R package mclust Mantainer Luca Scrucca luca@stat.unipg.it.

Gordaliza, A. (1991a). "Best approximations to random variables based on trimming procedures". *Journal of Approximation Theory* 64.2, pp. 162–180.

Gordaliza, A. (1991b). "On the breakdown point of multivariate location estimators based on trimming procedures". *Statistics & Probability Letters* 11.5, pp. 387–394.

Hartigan, J. A. (1975). *Clustering Algorithms*. Inc: John Wiley & Sons.

Hennig, C. R Package fpc. c.hennig@ucl.ac.uk ucakche/ [Retrieved from http://www.homepages.ucl.ac.uk/].

Kassani, S.H., P. H. Kassani, and S. E. Najafi (2015). "Introducing a hybrid model of DEA and data mining in evaluating efficiency. Case study: Bank Branches". *Academic Journal of Research in Economics and Management* 3.2, pp. 72–80.

Kondo, Y. (2011). "Robustification of the sparse K-means clustering algorithm". University of British Columbia.

Kondo, Yumi, Matias Salibian-Barrera, and Ruben Zamar (2016). "RSKC: An R package for a robust and sparse K-means clustering algorithm". *Journal of Statistical Software* 72.5, pp. 1–26. [Retrieved from https://doi.org/10.18637/jss.v072.i05].

Li, G., and Z. Chen (1985). "Projection-pursuit approach to robust dispersion matrices and principal components: Primary theory and Monte Carlo". J*ournal of the American Statistical Association* 80.391, pp. 759–766.

Lloyd, S. P. (1982). "Least squares quantization in PCM". *IEEE Transactions on Information Theory* 28.2, pp. 129–136.

Sørensen, C. K. and J. M. Puigvert Gutiérrez (2006). "Euro area banking sector integration using hierarchical cluster analysis techniques". Working Paper Series EuropeanCentral Bank 627.

Tibshirani, R., G. Whalter, and T. Hastie (2001). "Estimating the number of clusters in a data set via the gap statistic". *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 63 Part 2, pp. 411–423.

Wang, D. (2007). "Three Essays on Bank Technology, cost Structure, and Performance". PhD Dissertation. State University of New York at Binghamton.

Werbin, Eliana (2010). "Los determinantes de la rentabilidad de los bancos en Argentina (2005 – 2007)". PhD thesis, Universidad Nacional de Córdoba.

Witten, D. M., and R. A Tibshirani (2010). "Framework for feature selection in clustering". *Journal of the American Statistical Association* 105.490, pp. 713–726.

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The EU real exchange rates: A structural Bayesian VAR. A note.

Los tipos de cambio reales de la UE: Un VAR bayesiano estructural. Una nota.

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Abstract

In this paper we contribute to the long literature on the real exchange determination by estimating a Bayesian structural vector autoregressive model. We aim at identifying the effect on the EU-28 RER of shock originating in its main fundamental variables, namely, current account, government consumptions, investment and real income. We find in most of the shocks that the RER moves away for long periods, proving yet again, that the purchasing power parity condition is rarely fulfilled empirically.

Key words: Real exchange rates, competitiveness, Bayesian, European integration.

JEL code: C22, F15.

Resumen

En este trabajo se contribuye a la larga literatura sobre la determinación del intercambio real mediante la estimación de un modelo autorregresivo del vector estructural bayesiano. Nuestro objetivo es identificar el efecto en

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la TRE de la UE-28 de los shocks originados en sus principales variables fundamentales, a saber, cuenta corriente, consumos del gobierno, inversión e ingresos reales. Encontramos en la mayoría de las perturbaciones que la TRE se aleja durante largos períodos, lo que demuestra una vez más, que la condición de paridad de poder adquisitivo rara vez se cumple empíricamente.

Palabras clave: Tipos de cambio reales, competitividad, bayesiano, integración europea.

Código JEL: C22, F15.

I. INTRODUCTION

Purchasing power parity (PPP) has probably been one of the most studied hypotheses in international macroeconomics since the monks of Salamanca introduced the concept. The main reason is that the fulfilment of the PPP hypothesis can be seen as a measure of economic integration (Wei and Parsley 1995).

Although it is proposed that the PPP is a long run equilibrium theory (Taylor, 2002) there is a vast literature on the empirical analysis of the PPP theory, with disappointing conclusions: only when some assumptions are relaxed, one can find some evidence on its empirical fulfilment. (See Cuestas 2009, and the references therein, amongst many others).

Given these results, in this note we focus on the analysis of the long run determinants of the real exchange rate (RER) for a group of European Union (EU) countries. The idea is to find which variables may be driving the RER from its long run equilibrium. This is of particular importance given that the RER can be also understood as a measure of competitiveness since it measures the ratio of home to foreign prices measured in common currency. In addition, for the Economic and Monetary Union (EMU) countries, is also of strategic importance given that they cannot use the exchange rate policy to enhance their competitiveness. Let's recall that the main trading partners of EU countries are other EU countries.

In this paper we analyse the relationship between the RERs of the EU28 and some of their main fundamentals, by means of estimating a structural Bayesian vector autoregressive model. The EU28 consists of several different countries with different degrees of economic integration and development (Cunado 2011). As shown in Figure 1 the *mainland* EU countries do not show any clear pattern of appreciation or depreciation, however it is quite clear the effect of the 2008-onwards crisis (Cuestas, et al. 2014). The RERs of the central and eastern European countries (CEECs) meanwhile show a clear upward trend until 2008.

All the member estates except Czechia and Croatia must fulfil the Euro Plus Pact and the Macroeconomic Imbalance Procedure of the Six Pack which, amongst other measures, target competitiveness. Hence, the importance of its analysis.

Given that it has been established by the previous literature that RERs are not stationary in the EU, we analyse the relationship between the RER (q) and its main fundamentals, which are current account as a proportion of gross domestic product (GDP) (ca); real government consumption (gco); real gross fixed capital formation as a proxy for investment ($gfcf$) and real GDP (y).[1] In order to avoid the problem of I(1) variables (Sims 1988) we estimate vector autoregressive models (VARs) using Bayesian methods.

The remainder of the paper is organised as follows. In section 2, the econometric model. In section 3, we present the data and the results and finally, the last section summarises the main conclusions.

II. The modelling

Our model builds upon the long-run equation proposed by Berg and Miao (2010), Vieira and MacDonald (2012) and Comunale (2017).[2]

Our equilibrium RER specification is as follows:

1.There may be other importance variables such as the terms of trade in determining the RER, Neary (1988), Amano and van Norden (1995 and 1998), and Benigno and Thoneissen (2003) among others, however, to keep the estimated model parsimonius they have not been included.

2. The starting point of theoretical models are the models developed by Obstfeld and Rogoff (1995) and Frenkel and Razin (1996).

$$q_{ti} = c + \beta_1 ca_{ti} + \beta_2 gco_{ti} + \beta_3 gfcf_{ti} + \beta_4 y_{ti} + \varepsilon_{ti} \qquad (1)$$

where *ca* is the current account, *gco* is government consumption, *gfcf* is gross fixed capital formation, and *y* is national real income. It is difficult to establish a priori expected signs for all the coefficients, as in many cases the sign depends on whether the tradeable or the non-tradeable sector dominates.

As aforementioned, we use Bayesian structural VAR (BSVAR) techniques to estimate the models and we treat them all as endogenous. These models are based on the estimation of structural vector autoregressive (SVAR) models such as:

$$\delta_0 Y_t = \delta(L) Y_t + \varepsilon_t \qquad (2)$$

where δ_0 is the matrix of contemporaneous parameters, δ is a matrix of coefficients for the lagged variables, and L is the lag operator in polynomial form. As δ_0 cannot be identified, we use Pesaran and Shin (1998) method which allow us to estimate generalised impulse response functions and eases our task since an ordering is not required.

We estimate equation (2) using Bayesian methods to obtain

$$\pi(\partial|Y) \propto f(Y|\partial)\pi(\partial) \qquad (3)$$

where ∂ is a vector of coefficients, $\pi(\partial \mid Y)$ is the posterior distribution conditional on the sample *Y*, $f(Y|\partial)$ is the likelihood function, and $\pi(\partial)$ is the prior distribution about the parameters. Bayesian methods have several advantages compared with frequentist methods, as they use a set of information that is enriched by priors. We use the Normal-Wishart (NW) prior, which is fairly common in the literature and is based on the Minnesota prior by Litterman (1986). The variance of the parameters is calculated as:

$$\sigma^2_{\delta_{ii}} = \left(\frac{\lambda_1}{l^{\lambda_3}}\right)^2 \qquad (4)$$

$$\sigma^2_{\delta_{ij}} = \left(\frac{\sigma_i^2}{\sigma_j^2}\right)\left(\frac{\lambda_1 \lambda_2}{l^{\lambda_3}}\right) \qquad (5)$$

with $\lambda_1 = 0.1$, $\lambda_2 = 1$ and $\lambda_3 = 1$.

III. Empirical analysis

The data consists of the log of the real effective exchange rate using the consumer price index for the 37 main industrial-country trading partners with an increase indicating an appreciation in real terms, q; the current account as proportion of the GDP, ca; the log of real government consumption, *gco*; the log of real gross fixed capital formation, *gfcf*, and the log of real GDP, *y* for our target EU28 countries. The data has been obtained from *Eurostat* and runs from 1995-2017 in quarterly observations. The model is estimated as an unbalanced panel for the 28 EU countries, since some observations were missing in a few cases.

All the models include three centred seasonal dummies to account for seasonal effects in the variables and individual fixed effects.

In Figure 2 we display the posterior distributions for the impulse-response functions (IRF) based on a BSVAR with two lags. Since our interest is to assess the effect of the RER main fundamentals we only show the IRF of shocks on the RER fundamentals.

We observe that the RER reacts positively in the contemporaneous period to a current account shock but then it depreciates with long lasting effects (Gil-Alana et al. 2008). Since the positive shock on the current account may be related to capital outflows it shows how the demand and supply of currency correct the increase in supply of home currency as a results of capital outflows.

The effect of a government consumption shock is overall negative, after some over shooting at the beginning. This first swings may be related to the uncertainty generated by an expansionary fiscal policy, which at the end depreciates the currency in real terms.

Investment seems to have an overall positive impact on the real exchange rate, since after a couple of quarters it appreciates having long lasting effects. This probably has to do with an increase in internal demand which may have increase the prices of non-tradeable goods, hence, appreciating the currency.

A positive shock on real income seems to have similar results than a shock on investment. We observe that the real exchange rate appreciates after two quarters. Again this mimics an aggregate demand shock, which causes an increase in internal prices and hence an appreciation of the exchange rate in real terms.

Finally, in the appendix we present the distributions of the IRFs, since when using Bayesian techniques we cannot talk about confidence intervals.

IV. CONCLUSION

In this paper we have aimed to analyse how shocks originating in a set of RER fundamentals affect this variable for a group of EU countries. Using an unbalanced panel for quarterly data 1995-2017 we have estimated BSVAR in a panel set up.

We find that in general the reaction of RER to shocks originating in its main fundamentals seem to have an aggregate demand origin, as the RER tends to appreciate in most cases.

As avenues for future research we propose to analyse the central and eastern European countries and the rest separately, and account for structural breaks caused by the Great Recession of 2008 onwards.

V. REFERENCES

Amano, R. A., and S. van Norden. (1995). ‘‘Terms of Trade and Real Exchange Rates: The Canadian Evidence’’. J*ournal of International Money and Finance* 14(1): 83–104.

Amano, R. and S. van Norden. (1998). ‘‘Oil Prices and the Rise and Fall of the US Real Exchange Rate’’. *Journal of International Money and Finance* 17(2): 299–316.

Benigno, Gianluca, and C. Thoenissen. (2003). ‘‘Equilibrium Exchange Rates and Supply-Side Performance’. *The Economic Journal* 113(486): C103–24.

Berg, A., and Y. Miao. (2010). ‘‘The Real Exchange Rate and Growth Revisited: The Washington Consensus Strikes Back?’’ IMF Working Papers WP/10/58.

Comunale, M.. (2017). ‘‘Dutch Disease, Real Effective Exchange Rate Misalignments and Their Effect on GDP Growth in EU’’. *Journal of International Money and Finance* 73: 350–70.

Cuestas, J. C. (2009). ‘‘Purchasing Power Parity in Central and Eastern European Countries: An Analysis of Unit Roots and Nonlinearities’’. *Applied Economics Letters* 16(1): 87–94.

Cuestas, J. C., Gil-Alana L. A. , and K. Staehr. (2014). ‘‘Government Debt Dynamics and the Global Financial Crisis: Has Anything Changed in the EA12?’’ *Economics Letters* 124(1): 64–66.

Cunado, J. (2011). ‘‘Structural Breaks and Real Convergence in OPEC Countries’’. *Journal of Applied Economics* 14(1): 101-117.

Frenkel, J.A, and A. Razin. (1996). *Fiscal Policies and Growth in the World Economy,* Third Edition. The MIT Press.

Gil-Alana, L. A., N. Luqui, and J. Cunado. (2008). ‘‘Trade Balance and Exchange Rate: Unit Roots, Co-Integration and Long Memory in the US and the UK’’. *Economic Notes* 37(1): 59–74.

Litterman, R.(1986). ‘‘Forecasting with Bayesian Vector Autoregressions: Five Years of Experience’’. *Journal of Business & Economic Statistics* 4(1): 25–38.

Neary, P. (1988). ‘‘Determinants of the Equilibrium Real Exchange Rate’’. *The American Economic Review* 78(1): 210–15.

Obstfeld, M., and K. Rogoff. (1995). ‘‘Exchange Rate Dynamics Redux’’. *Journal of Political Economy* 103(3): 624–60.

Pesaran, H., and Y. Shin. (1998). ‘‘Generalized Impulse Response Analysis in Linear Multivariate Models’’. *Economics Letters* 58(1): 17–29.

Sims, C. A. (1988). ‘‘Bayesian Skepticism on Unit Root Econometrics’’. J*ournal of Economic Dynamics and Control* 12(2–3): 463–74.

Taylor, A. M. (2002). ‘‘A Century of Current Account Dynamics’’. *Journal of International Money and Finance* 21(6): 725–48.

Vieira F., and R. MacDonald. (2012). ‘‘A Panel Data Investigation of Real Exchange Rate Misalignment and Growth’’. *Estudos Econômicos*, 42(3): 433–56.

Wei, S. and D. Parsley. (1995). ‘‘Purchasing Power Disparity During the Floating Rate Period: Exchange Rate Volatility, Trade Barriers and Other Culprits’’. National Bureau of Economic Research. Working Paper w5032.

Figure 1. RER EU28

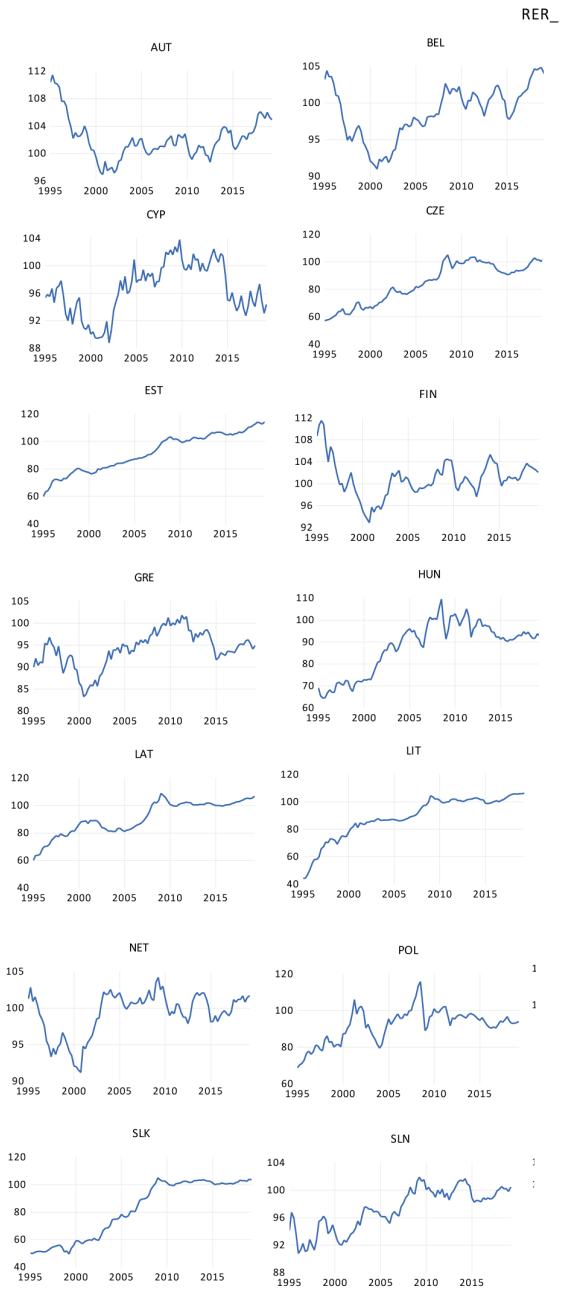


Figure 1. RER EU28 (cont.)

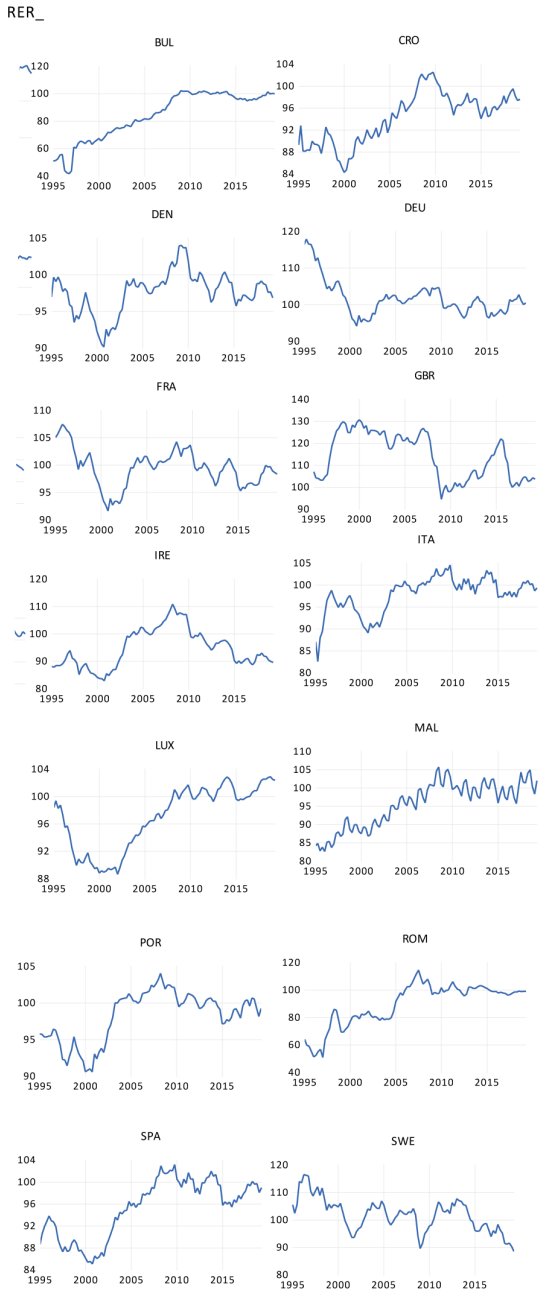


Figure 2 (a). IRFs. Response to Generalized One S.D. Innovations
Response of LRER to CA

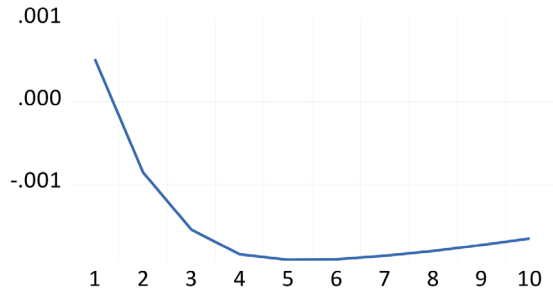


Figure 2 (b). IRFs. Response to Generalized One S.D. Innovations
Response of LRER to LGCO

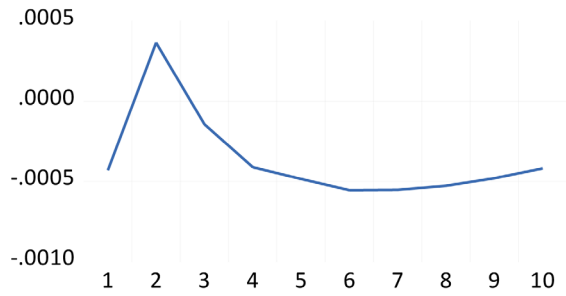


Figure 2 (c). IRFs. Response to Generalized One S.D. Innovations
Response of LRER to LGFCF

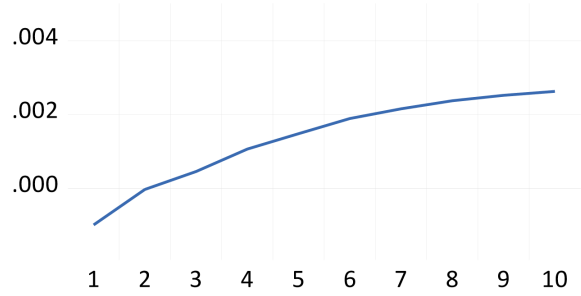
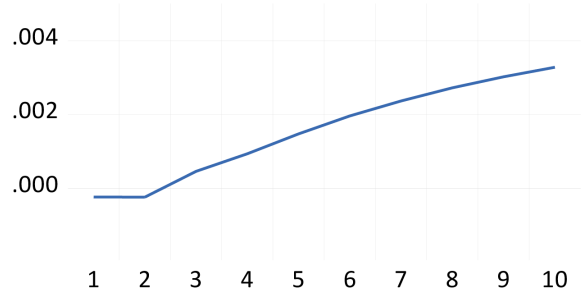
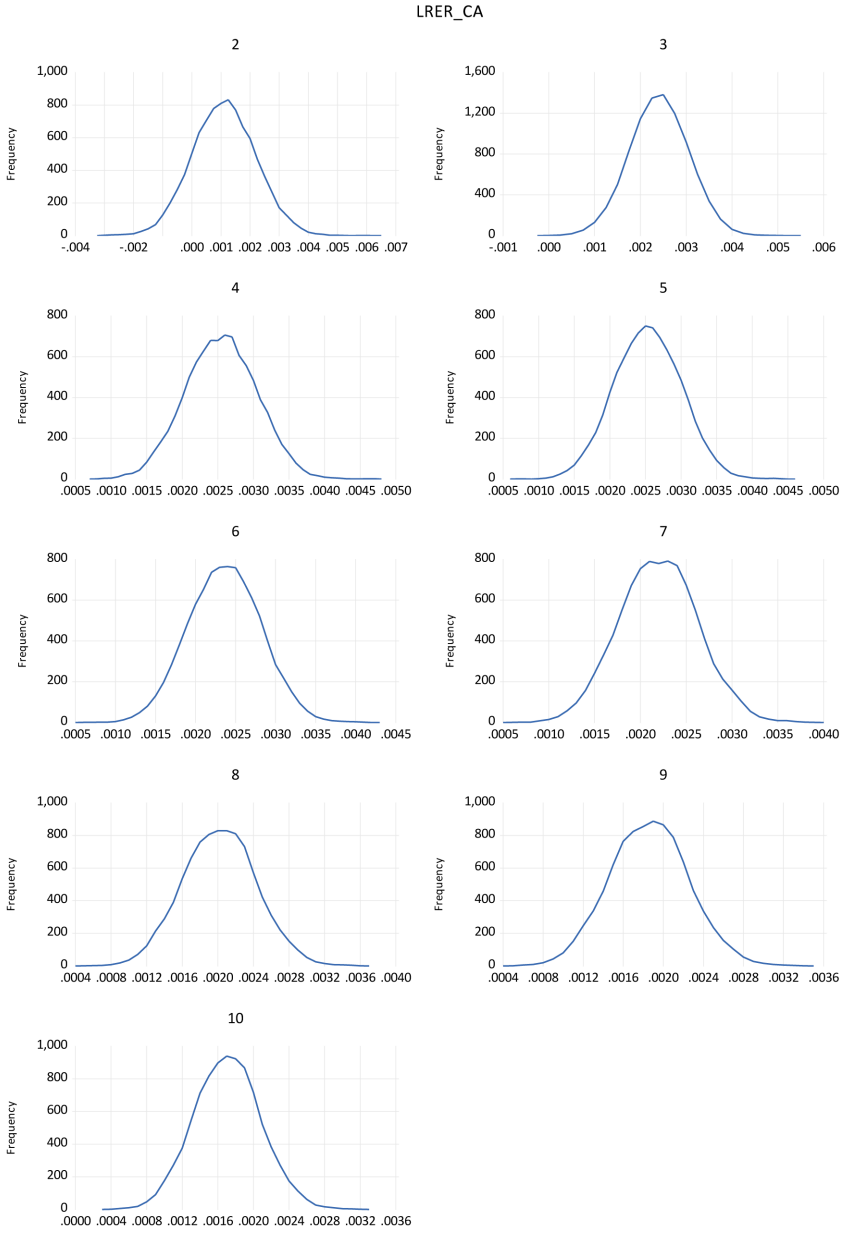
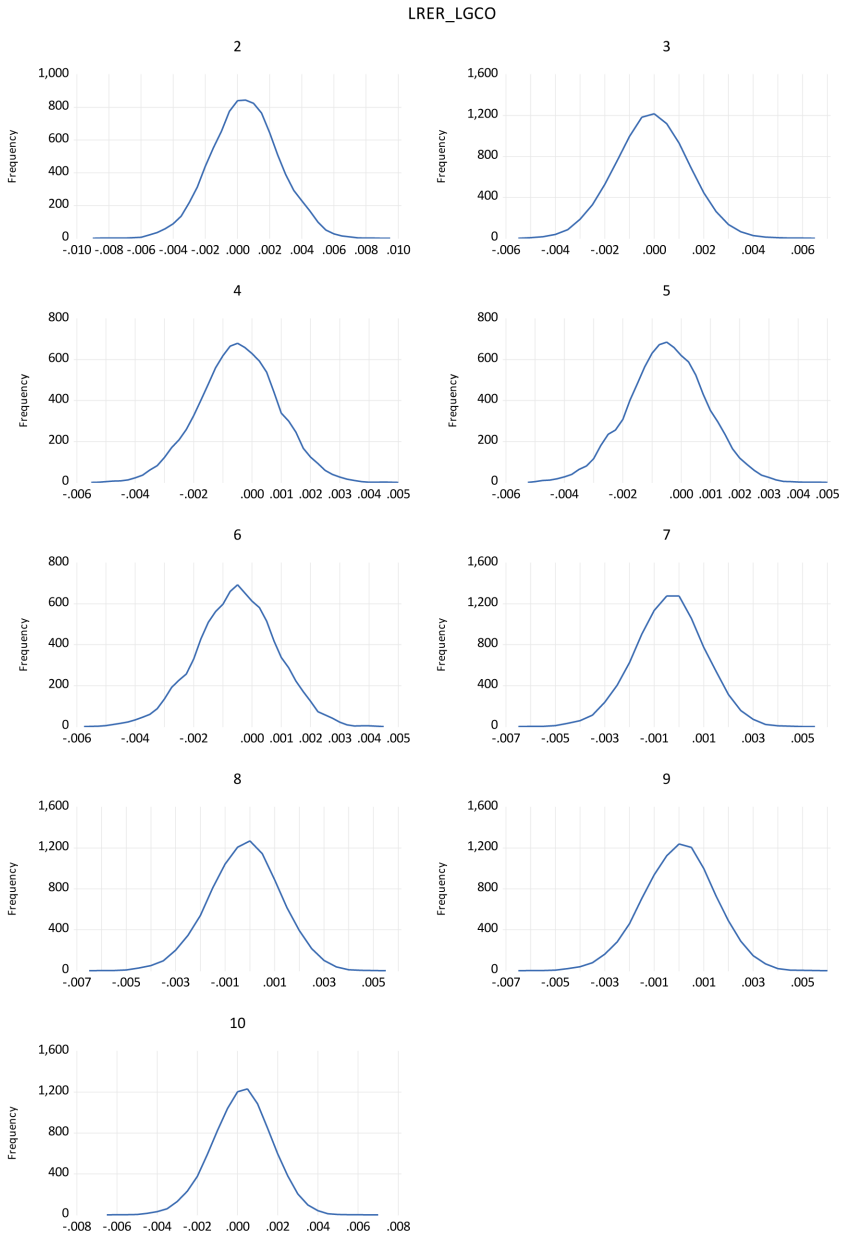


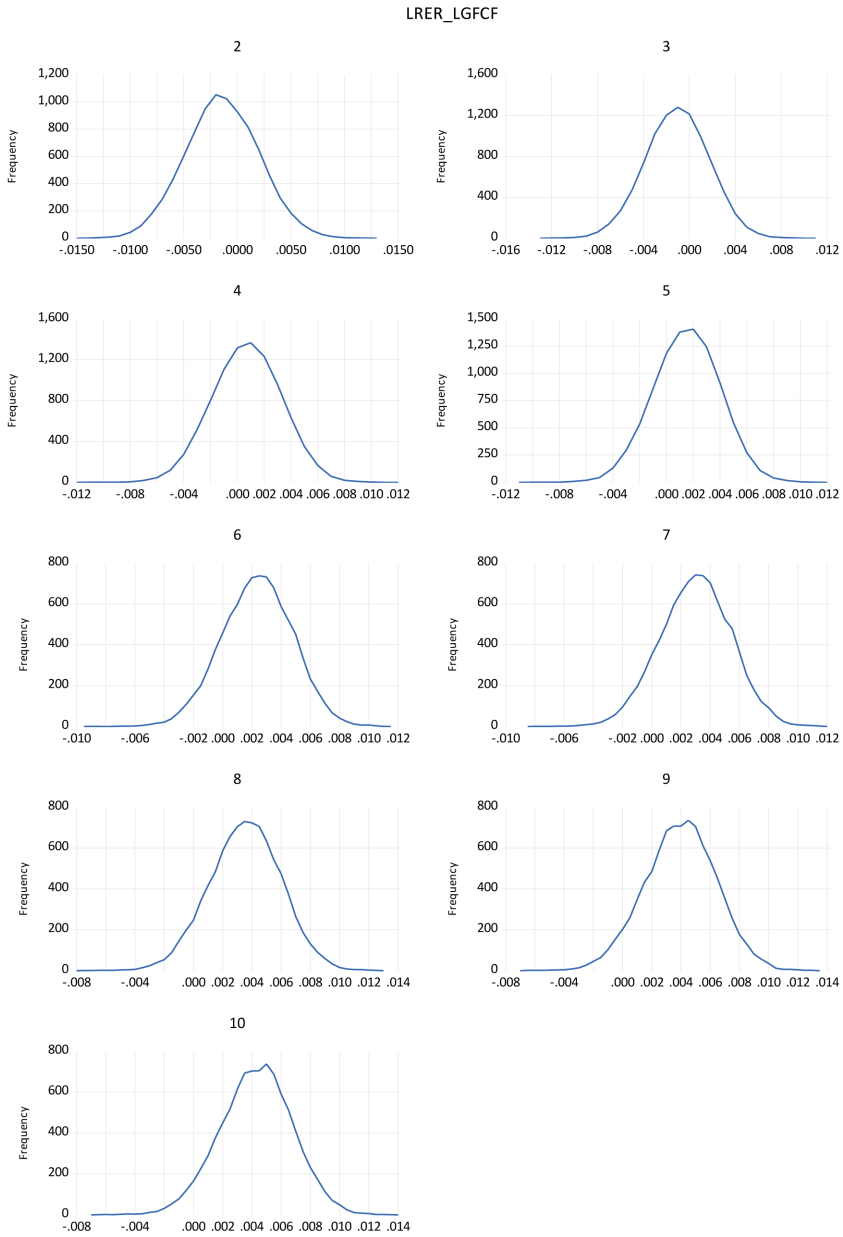
Figure 2 (d). IRFs. Response to Generalized One S.D. Innovations
Response of LRER to LY



Appendix: IRFs' posterior distributions




LRER_LGCO
2
3
4
5
6
7
8
9
10
Frequency


LRER_LGFCF
2
Frequency
1,200
1,000
800
600
400
200
0
-.0150 -.0100 -.0050 .0000 .0050 .0100 .0150
3
Frequency
1,600
1,200
800
400
0
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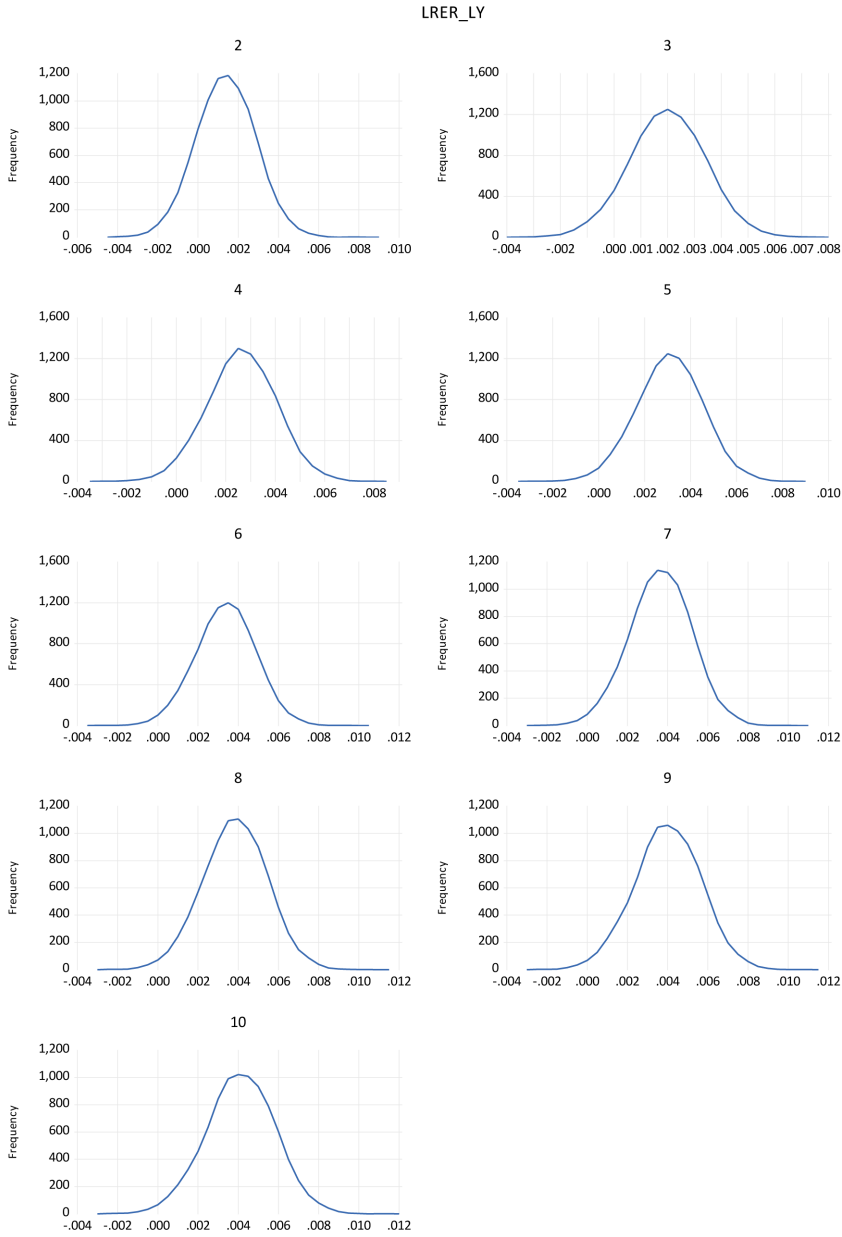
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Determinants of party and mayor reelection in local governments: An empirical examination for Argentina during 1983-2011| *Sebastián Freille y Víctor Mazzalay*
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Determinants of party and mayor reelection in local governments: An empirical examination for Argentina during 1983-2011*

Determinantes de la reelección de partido y de intendente en los gobiernos locales: Un examen empírico de la Argentina durante 1983-2011.

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Abstract

This paper examines the determinants of reelection of parties and mayors in Argentine local elections during the 1983-2011 period. Using a unique and comprehensive database recording local elecion results for over 1200 local governments, we test three potential sources of variation: structural factors, political/institutional variables and economic variables. We find that incumbency advantage is strongly and significantly related with a higher probability of reelection. We also find some evidence supporting the economic voting hypothesis, that local economic conditions are relevant for explaining re-election of local governments. We also find that local governments where parties and mayors have been in office for a long time have greater re-election chances. Finally, we find that governments with municipal charters have lower probability of reelection. Summing up, there seems to be both economic and politico-institucional factors behind re-election rates of parties and mayors in Argentine local governments.

Keywords: Reelection; Transfers; Fiscal Policy; Local Governments
JEL Codes: H72; C23; C25

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RESUMEN

En el presente documento se examinan los factores determinantes de la reelección de partidos e intendentes en las elecciones locales de la Argentina durante el período 1983-2011. Utilizando una base de datos única y completa que registra los resultados de las eleciones locales para más de 1200 gobiernos locales, probamos tres fuentes potenciales de variación: factores estructurales, variables políticas/institucionales y variables económicas. Encontramos que la ventaja de la titularidad está fuertemente y significativamente relacionada con una mayor probabilidad de reelección. También encontramos algunas pruebas que apoyan la hipótesis del voto económico, de que las condiciones económicas locales son relevantes para explicar la reelección de los gobiernos locales. También encontramos que los gobiernos locales donde los partidos y los alcaldes han estado en el cargo durante mucho tiempo tienen mayores posibilidades de reelección. Por último, encontramos que los gobiernos con cartas municipales tienen menores probabilidades de reelección. En resumen, parece haber factores tanto económicos como político-institucionales detrás de las tasas de reelección de partidos y alcaldes en los gobiernos locales argentinos.

Palabras clave: Reelección; Transferencias; Política fiscal; Gobiernos locales

Códigos JEL: H72; C23; C25.

I. BACKGROUND AND MOTIVATION

Most federal regimes are either of two types: a two-tiered layout with local governments integrated into state governments or three-or-more-tiered layout with autonomous or semi-autonomous local governments. The latter is for example the case of Argentina, Brazil, South Africa and Switzerland. However, there are stark differences in autonomy of the local level between these countries. One dimension where this is particularly true is regarding assymetries between political and financial autonomy. In this case, local governments are faced with strong electoral incentives having little (if any) financial autonomy.

While there has been much study on the relationship between economic and political variables and electoral outcomes in federal regimes, most of the work has focused on federal-state relations. Only a small frac-

tion of both theoretical and applied work has studied economic and political aspects of inter-governmental relations looking at the local level (Brollo & Nannicini, 2012; Timmons & Broid, 2013; Arvate, 2013; Sour, 2013; Boulding & Brown, 2014; Freille & Capello, 2014; Bracco et al. 2015; Rodríguez-Chamussy, 2015).

The study of electoral dynamics at the local level is important for several reasons. Firstly, local governments may be both economically and electorally relevant. A large part of economic activity is ultimately based in and around cities regardless of whether these are part of larger administrative unit. Therefore, the existence of high local tax bases may encourage a high degree of political competition and also some degree of inter-level conflict for those resources. Naturally, if the distribution of economic resources is concentrated in only a handful of cities across a country, then this argument may be less important. But even if a municipality is economically marginal it can still be politically relevant due to overrepresentation in provincial legislative bodies and to political alignment with the upper level government. The interaction between economic assymetries and political relevance may give rise to a wide range of inter-level coalitional dynamics.

Secondly, the existence of local elections allows us to draw better insights into voter preferences and the way they reward or punish politicians at different levels. This concern can be related to the long-standing literature on economic voting.[1] The central idea is known as the responsibility (accountability) hypothesis: voters hold the government responsible for economic events. In this sense, local economic conditions may influence national electoral results. This is especially true when there are no local elections and therefere voters use the local environment as a proxy for the country's general situation; they may also consider that national government policies have an impact on the local economy. When there are local elections, however, this idea may not always ring true. The problem is that the responsilibty hypothesis does not account for the fact that voters may have different beliefs and information when rewarding or punishing incumbents from different levels (Martins & Veiga, 2013). For instance, one could argue that local governments should not be held accountable for economic results which are beyond their control, like monetary or trade policy. It is clear that there may a problem of assigning responsability for local economic

1. For an excellent survey of this literature, see Paldam (1981).

conditions between local and the provincial and national levels of government. Unless voter preferences and political parties are homogeneous across jurisdictions, it would be reasonable to expect that the way in which voters allocate responsibility between different levels varies across jurisdictions.

Thirdly, in many countries, especially those with a federal regime, public goods provision has become more decentralized in recent decades. While the central level expenditures are dominated by transfers to governments and persons, sub-national governments are responsible for the provision of most public services. Local governments in particular are especially important in the provision of infrastructure. On the revenue side, there is great heterogeneity across countries. On most federations, states are exclusively entitled to collect at least one broad-based tax such as a sales tax and rely on transfers from the national government. Local governments, on the other hand, rely mostly on property taxes and transfers from the state government. There are significant disparities in the degree of financial dependence from upper-level jurisdictions. For example, the share of local governments own-source revenue averages 83% of total municipal revenues for Canada and over 40% for United States. In contrast, these shares are significantly lower in developing countries: local governments in Brazil, Mexico and Argentina collect locally on average around 35%, 30% and 25% of total revenues, respectively.

A high degree of financial dependence from the provincial and national government may create incentives to politically capture local governments by making them financially dependent from upper level governments (Gibson & Calvo, 2000). In these cases, it would be important to study whether inter-governmental transfers from upper to lower-level governments are related with local election outcomes. Unfortunately, we were unable to collect homogeneus data on transfers to municipalities in Argentina.[2]

In this paper, we undertake what we believe is the first comprehensive empirical study of the determinants of re-election of parties and mayors in local-level elections in Argentina. We explore several hypothesis ranging from economic voting to institutional explanations. Our contribution in this paper is two-fold. Firstly, we provide an explanation of the determinants of elec-

2. Each province has a different tax-sharing arrangement within its territory with multiple classifications of transfers and grants. In addition to this, there is just no publicly available data for 2/3 of the provinces.

toral outcomes in local elections for the entire democratic period from 1983 to 2011. Secondly, we contribute to the growing literature on sub-national politics in Argentina by focusing on local rather than provincial elections. The plan of the paper is as follows. In section 2, we review the literature and outline some theoretical considerations that motivate our analysis. Section 3 describes characteristis of the Argentine local government system. Section 4 describes the data and the methodology of estimation. Section 5 concludes.

II. Literature

There is a vast and expansive literature on the relation between electoral outcomes and economic, political and institutional characteristics. There are various competing and complementary hypotheses as to what drives electoral performance of incumbents and challengers both in economics and political science. Perhaps the most established and long-standing theory is that of political business cycles. This literature suggests a theoretical and empirical link between macroeconomic performance and electoral patterns. More specifically, incumbent governments can manipulate the economy to seek re-election and they will do that by increasing spending (and deficits) before elections. Alesina & Roubini (1992) provide an excellent review and comprehensive empirical tests of the early models of Nordhaus (1975), and Hibbs (1977) and the rational-choice models of Rogoff & Sibert (1988), Rogoff (1990), and Alesina (1987). While they find no evidence of a systematic opportunistic cyle of the Nordhaus type –increase of pre-electoral output and employment-, they do find post-electoral increases in inflation which may be consistent with pre-electoral budget cycles as suggested by the rational-choice models.[3] These findings were replicated in several empirical papers which found the existence of political budget cycles –larger deficits in election years due to spending for both developed and developing countries (Shi & Svensson 2002a; Shi & Svensson 2002b; Persson & Tabellini 2005; Brender & Drazen 2005; Brender & Drazen 2008). These cycles have also been found to be very relevant in countries with unstable and new democracies such as Latin American countries. Using different periods and countries, several papers find sizeable increases in expenditure and lower budget surpluses in the year before the election (Ames, 1987; Kraemer, 1997; Nieto Parra & Santiso, 2009; Barberia & Avelino, 2011)].

3. This may be particularly relevant for the case of fiscal favours to key constituencies.

The studies mentioned above examine political budget cycles at the country level. It is only in recent years, with the growing availability of data, that scholars have turned to study political business cycles and more generally the determinants of electoral performance at the sub-national level. Levitt (1995) shows that higher federal transfers to a constituency increases the congressional incumbent's vote share by a significant margin. Veiga & Veiga (2007) is one of few studies that focus on political budget cycles at the municipal level using Portuguese data. Their results support the hypothesis of strong opportunistic behaviour by incumbents. Akhmedov & Zhuravskaya (2004) use monthly regional-level data for Russia and find significant political budget cycles and also find these increase the probability of getting reelected. Using a panel for 268 US cities over a 30 year period, Bee & Moulton (2015) find a significant increase in public employment in the election year but no changes in spending or taxes. Using data from Chinese counties, Guo (2009) documents the existence of a political budget cycle even in a non-election setting: mayors increase spending to advance their chances of advancing their political careers. Finally, a recent study by Alesina & Paradisi (2017) finds significant political budget cycles for Italian cities by means of lowering tax rates as election nears. This result echoes Besley & Case (1995b) which suggest that a state's fiscal performance, as measured by tax policy relative to neighbouring jurisdictions, is central to voters' decision to reelect or oust an incumbent.

Several papers have studied the effect of political institutions on policy choices and election outcomes. Besley & Case (1995a) find that gubernatorial term limits have significant effects on economic policy choices. Governors who faced term limits and therefore could not run for reelection (known as lame ducks in the political science jargon) were associated with higher taxes and government spending relative to incumbents who were able to run for another term. Brender (2003) finds that fiscal perormance of mayors has a positive impact on incumbent's reelection in Israel local elections. Other authors have explored features of the political system as determinants of reelection of parties and mayors. Ferraz & Finan (2011) find a significant association with political institutions and reelection.

There has been growing interest to examine political budget and cycles and determinants of electoral outcomes at the sub-national level in Latin America. There has been a large number of studies exploring economic and

political determinants of state and local election outcomes in Brazil. Sakurai & Menezes-Filho (2008) finds that mayors with higher spending (especially capital spending) increase their (and their party's) reelection prospects. Titiunik (2009) finds that incumbency has a strong negative effect on the probability of reelection for Brazilian municipalities. Sakurai & Menezes-Filho (2011) find a significant political business cycle for Brazilian municipalities in the 1989-2005 period. Using state-level data, Arvate et al. (2009) find no evidence that a political budget cycle increased the reelection of governors and in fact they find quite the opposite: fiscally conservative states have a higher probability of re-election.

A large part of this research effort in Latin America may be loosely tied to the strand that studies inter-governmental relations. According to Cingolani, Mazzalay & Nazareno (2009), recent work on the area of intergovernmental relations stress the allocation and distribution of financial resources between the different levels of government. The literature on fiscal federalism has gradually shifted from the study of efficiency and welfare effects associated with different decentralized settings to the study of the political rents derived by governments from different levels from the allocation and distribution of funds and grants (Bordalejo, 2005; Paniagua 2012). In other words, this literature highlights the role and examines the consequences of the existing institutional arrangements, the different trends at the subnational level and the wide range of motivations of political actors.

In this sense, the study of political aspects of federalism involves a fundamental question: whether the logic behind the the inter-governmental allocation of resources is programatic or particularistic. This depends on different factors –economic, political, etc- as has been pointed out by Cingolani, Mazzalay & Nazareno (2009). Factors such as political power, electoral competition and the institutional design are relevant to explain the degree to which different parties and politicians can engage in either type of allocation. In light of this, it is important to note the role of the characteristics of the electoral and party system. This is all the more relevant in federal countries where electoral politics takes place amidst a mix of national, regional and local parties competing for offices at different levels of government.

There is also a small but growing literature studying determinants of electoral outcomes at the local level in Argentina. Porto & Porto (1999)

suggest that fiscal performance during the election year and the previous year is a significant predictor of the probability of reelection of local mayors in the Buenos Aires province. Similarly, Porto & Porto (2000) find that capital expenditures are associated with a greater probability of reelection. More recently, a paper by Cingolani, Mazzalay & Nazareno (2009) finds that municipalities and townships which receive discretionary transfers in the election year increase their probability of reelection. Another paper by Paniagua (2012) find that provincial transfers are distributed politically to municipal governments in her study of two Argentine provinces, Buenos Aires and Córdoba. Rumi (2014) shows evidence that suggest that the federal government manipulates total transfers to favour state governments which are politically aligned. Finally, Freille & (Capello 2014) examine the determinants of electoral outcomes for local governments of the province of Cordoba. They find that the probability of reelection is increasing in the amount of per capita discretionary transfers.

Suárez Cao (2011) examines whether Argentine political federalism has become more entrenched as political competition at the sub-national level has become ever more influential on national politics. The author suggests that the 1994 Constitutional reform strengthened the power assymetries between the President and the governors against the latter although governors still retain some bargaining power over two aspects: the legislative coalition and territorial support for the Presidential race.Other authors have suggested that it is not the state-level but rather the local-level government which has gained a prominent role in federal politics. This is what Fenwick (2010) argues suggesting that given certain institutional configurations, the national government may better achieve its policy goals by collaborating directly with local governments. She shows that this appears to have been the case in the area of social protection in Brazil. The type of institutional arrangements leading to an effective national-local coalition, she argues, is less likely to appear in a country like Argentina where local governments are more likely to be captured by state-level governments. González (2012) also provides a comparative study between Argentina and Brazil concluding that state-level governments have maintained (Argentina) or reduced (Brazil) their political power in the period 1983-2009.

Despite these recent contributions, determinants of re-election of local parties and mayors have been studied only either for selected provinces

and/or for certain elections. In this paper we aim to provide a more general study of the determinants of electoral outcomes at the local level covering a large number of local governments and elections. Using a uniquely assembled dataset, we study determinants of re-election of parties and mayors in Argentina.

III. Local governments in a federal country: The Argentine case

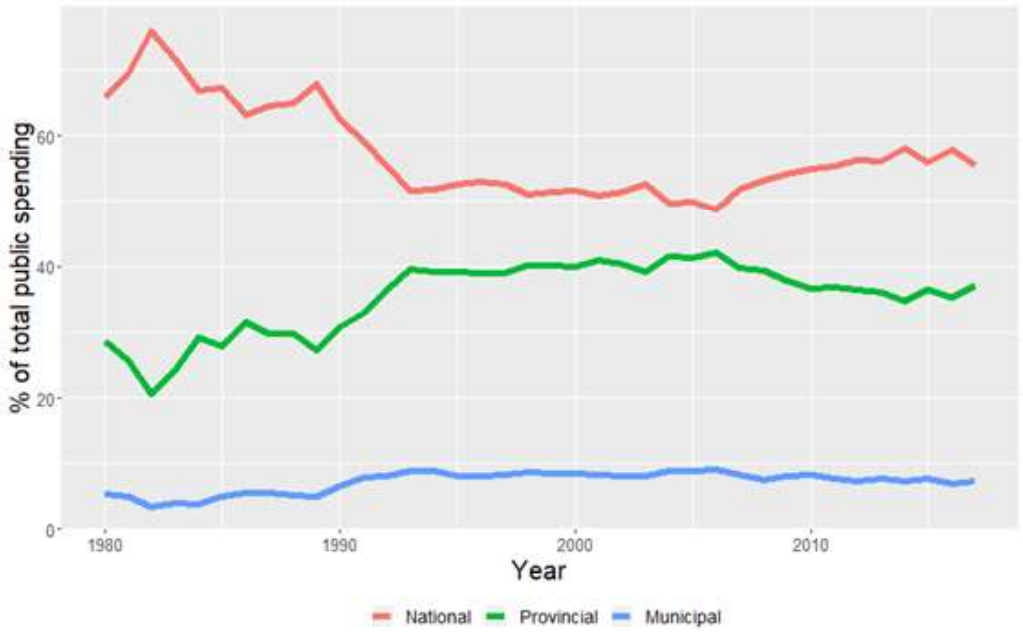
Argentina is a federal country divided into 23 provinces and one autonomous city, Buenos Aires. These provinces are divided into 2218 autonomous municipalities, the only exception being the autonomous city of Buenos Aires which consists of 15 communes comprising over 48 neighbourhoods. The financial relations between different levels of government are stipulated by the so-called Régimen de Coparticipación Impositiva. This regime basically sets up a tax-sharing scheme between the Federal and provincial levels of government: there are both nation- and province-level taxes. The latter are raised and collected by the provinces while the former are raised and collected by the Nation. A fraction of the amount collected in national taxes –called the Masa Co-participable– is "devolved" to the provinces (the so-called automatic transfers) while the rest goes to finance expenditures by the National government and the Social Security System. The Federal government also grants discretionary, non-automatic transfers to the provinces.

After the Federal level, provinces are the second most important level of government accounting for nearly 40% of total consolidated public spending. Provinces have political, judicial and administrative autonomy. The National Constitution of 1994 grants them autonomy to create and establish their own laws and to decide upon their electoral system, their administration of justice. They can create administrative or socio-economic regions, set up their own taxes and sign international agreements and treaties. Provinces are also autonomous to manage their own natural resources and are in charge of providing several social services as primary and secondary education.

Altough total spending by local (municipal) governments has been increasing in the last 40 years, it represents a minor fraction –around 8%- of total consolidated public spending. The composition of total public consoli-

dated spending from 1980 to 2017 can be seen in Figure 1. Spending by all local governments have slowly increased over the last 40 years going from around 5% of total consolidated public spending to around 8% in 2017. It can be noted, however, that there have been significant changes in the spending shares of provincial and national levels.

Figure 1. Composition of total consolidated spending by level of government



Fuente: elaboración propia

Local governments are autonomous in that they elect their own executive and legislative officers. Mayors and councillors are chosen through free regular elections held either autonomously or concurrently with provincial or national elections. Municipalities have exclusive and shared competences. The exclusive powers include waste collection and management, public transportation and street lighting. In practice, it is the provinces which grant legal status and autonomy their local governments. This means that the degree of local government autonomy varies across provinces. This is particularly true when it comes to financial autonomy. Each province regulates the fiscal arrangements with the local government level. In practice, this means that there are often tensions between the two levels over the financial arrangements.

Around a half of local governments have the legal status of municipality .In most provinces, a population of at least 10000 is required for a municipality to earn the right of sanctioning their own municipal charter equivalente to a Constitution for the national level. Smaller local governments are not given this right. In many aspects, Argentine municipalities are afforded a great deal of autonomy by law. Due to the tax-sharing system, however, in practice municipalities are heavily dependent on both automatic and discretionary transfers from above (both provincial and national level). This is the case for the large majority of Argentine local governments where own-source municipal revenues amount to less than half ot total revenues; in many cases, own-source revenues are less than 10% of total revenues. In other words, on average for municipalities in over half of the Argentine provinces, only around 3 out of 10 pesos –the local currency- are locally collected.[5]

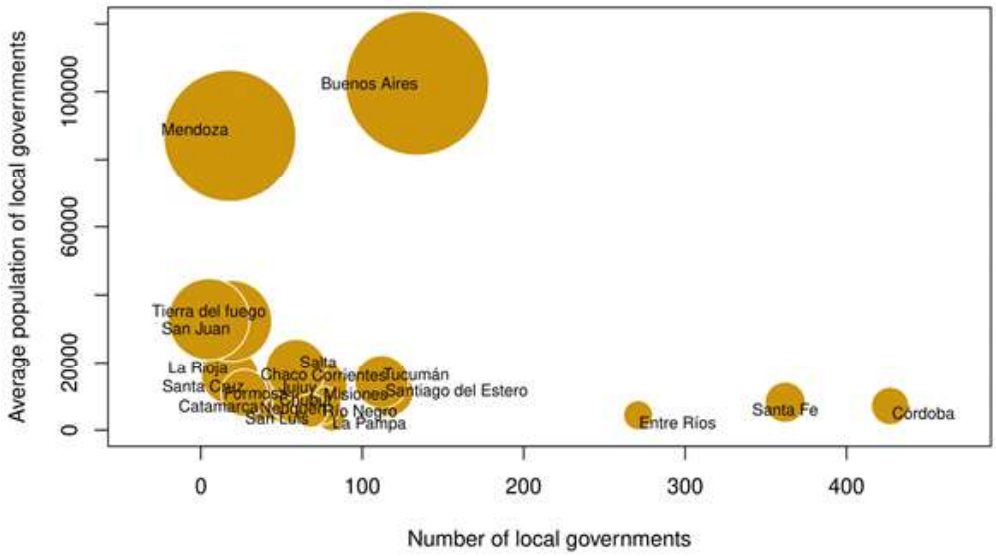
Municipal governments in Argentina are heterogenous in several aspects. They differ in total population –three municipalities with over a million inhabitants while several municipalities in Chaco, Corrientes and other provinces have less than 1000 inhabitants-, economic status –from rich and resourceful agricultural and industrial districts with large tax bases to desolate and impoverished municipalities with little own-source revenues-, and the extent of their capacity and autonomy –municipalities providing a wide range of public services to municipalities providing only the most basic set of services. Figure 2 shows the average local government population and the total number of local governments by province. The five largest provinces –Buenos Aires (BUE), Mendoza (MZA), Córdoba (CBA), Santa Fe (SFE), and Entre Ríos (ERI) have very different distributions of local governments. While the first two have the largest average population by local government, local governments in the latter are amongst the least populated districts on

4. Each province has its own municipal regime which, among other things, specify the population criteria for being considered a municipality and provisions regarding their autonomy. The population requirements are usually higher in larger provinces –criteria range from 2000 to 10000 for Santa Fe, Córdoba and Salta- than in smaller provinces –criteria range from 500 to 1000 for Catamarca, Corrientes, Chaco, La Pampa, Neuquén and Santa Cruz. Several provinces define different types of municipalities according with population size; this often entails different fiscal and political autonomy regimes. The legal status for units not meeting the population requirement for a municipality varies between provinces –Comisión de Fomento, Comuna, Comisión Municipal, Delegación Municipal, Comisión Rural– although most of them face similar restrictions on their fiscal and political autonomy.

5. This includes the sale of public assets and capital resources which are highly volatile.

average. For all the other provinces, however, a clear pattern emerges: there seems to be negative association between total number of local governments and average population size.

Figure 2. Number of local governments and average population by district size (total population)



Fuente: elaboración propia

IV. DATA AND METHODOLOGY

Our data includes 1804 local governments . If we rank municipal governments according to their population size, the top 1%, 5% and 10% comprised 35%, 68% and 80% of total population in 2011. Equivalently, the remaining 90% of the local governments –around 1750 local governments- comprise only around 20% of total population.

Our data comes from different sources. Data for the period 1983-1999 was obtained from Cao (1999). The remaining periods were assembled by consulting the Dirección Nacional Electoral and the electoral authority of each province. Economic data were obtained from various Census of Popu-

6. There are 1947 local governments in our original database but we exclude two provinces from consideration, Corrientes and Santiago del Ester. These provinces were intervened by the Federal government during the 90's decade. Due to these interventions, local elections were often held at irregular periods and did not follow the electoral calendar of other provinces. In our estimations, we also exclude all those local governments which do not have complete and full information on electoral results for the full period

lation. The gender of mayors was automatically assigned by matching mayor names with names in the directory of Registro Nacional de las Personas. All other data were obtained from municipalities and provincial official websites.

Although we have a balanced panel structure –1804 local units observed for 8 periods– we were unable to collect election data for all governments and periods. We have complete data –all 8 (eight) municipal elections for all local governments- only for a few provinces (Buenos Aires, Chaco, San Juan, Santa Fe, Mendoza). For most provinces we missing data particularly for the first 3 or 4 elections. If we exclude the 1983, 1987 and 1991 election, our data on election and re-election covers almost 94% (parties) and 87% (mayors) of total amount of elections in this period (a total of 9026 local government elections). In summary, we have complete electoral history on incumbency, releection/change for over 1245 local governments and 851 local mayors. This will be our sample for the empirical analysis.

As we noted earlier, local governments are heterogeneous along several dimensions. We have highlighted a few of these dimensions above but it is also important to see if there is heterogeneity along electoral lines. Table 1 shows aggregate electoral results grouping by the population size of the local government. We show the number of government units falling into each group, the number of elections (although our data covers 8 elections, 1983 is the base year so there is no re-election data). Several things are important to note. Firstly, there is significant heterogeneity in terms of population size. However, it can be seen that over 90% of governments in our sample are under 50000 inhabitants and 67% are under 10000 inhabitants. In other words, a large majority of local governmnets in Argentina are relatively small in terms of population. Secondly, re-election rates of both parties and mayors vary according to size. Re-election rates of parties tend to be around 60% for very small and small municipalities, they decrease to 52-55% for middle-sized municipalities and they are around 50% for very large municipalities. For mayors, the numbers are between 5 and 15% smaller than for parties although, unlike for parties, there is a marked downward trend as municipalities increase in population.

We build on a very basic model of re-election by just including two types of variables: incumbency dummies for 6 major parties (type of parties) identified in our dataset *–inc3JUS* if incumbent party is *Partido Justicial-*

Table 1: Re-election rates of parties and mayor - By local government population size (in thousands)

Population	0-0.5	0.5-1	1-Feb	2-Oct	Oct-50	50-100	100-500	500	Total
Parties									
of govs	85	111	189	451	299	53	46	11	1245
of elections	7	7	7	7	7	7	7	7	N/A
Total elections	666	953	1410	3233	1815	281	297	60	8715
Re-election	360	581	830	1872	957	156	177	30	4963
Change	306	372	580	1361	858	125	120	30	3752
RR	54.05	60.97	58.87	57.90	52.73	55.52	59.60	50.00	56.20
Mayors									
of govs	80	78	121	261	213	44	44	10	851
of elections	7	7	7	7	7	7	7	7	N/A
Total elections	576	657	885	1932	1321	246	282	58	5957
Re-election	323	372	479	908	557	109	123	25	2896
Change	253	285	406	1024	764	137	159	33	3061
RR	56.08	56.62	54.12	47.00	42.17	44.31	43.62	43.10	48.38

Note: RR, the re-election rate is calculated as the number of re-elections relative to total number of elections. For parties, there are 1245 government units and 7 election periods. For mayors, there are 851 government units and 7 election periods.

ista, *inc3UCR* for *Unión Cívica Radical*, *inc3PPPR* for a provincial-based party, *inc3PROG* for a progresist-oriented party, *inc3VEC* for local-based party; the remaining variables are political alignment with the state level government (*alignp3*) and population size. Due to data limitations, we were unable to collect enough data on the local government's degree of electoral competition and other political variables. We expand this baseline model to introduce a few aditional controls for structural (economic and social) factors that may have an effect on the probability of re-election. Our baseline model is therefore:

$$r_{i,t} = \alpha.INC_{i,t} + \beta.alignp3_{i,t} + \gamma.pop_{i,t} + \epsilon_{i,t}$$

where $r_{i,t}$ is a dummy taking value of 0 if a party/mayor of local government i is re-elected on election t; *INC* are a set of party incumbency dummies; and $alignp3_{i,t}$ is a dummy scoring 1 if the incumbent local party is politically aligned with the incumbent provincial party.[9]

V. Parties

We first examine the determinants of re-election of parties. Since the outcome variable is binary –1 when a party/mayor is reelected; 0 otherwise-, we use a generalized linear model to run the data models. Table 2 present the results of the regressions of re-election of parties and mayors respectively. Looking at column 1 we see that all variables have the expected sign. Incumbency is associated with higher probability of re-election, especially for the two major national parties –*Partido Justicialista* and *Unión Cívica Radical*- and for provincial-based parties. It is also important to note, that compared to other uncategorized parties (the reference category), also progresist-oriented party and local-based parties, they have associated a greater probability of re-election. Being aligned with the provincial party is associated with a greater probability of being reelected. Population size does not seem to be associated with the probability of being reelected.

The remaining three models split the full period in three sub-periods according to changes in political leadership and economic policies: the Alfonsin years (1983 through to 1991); the Menem years (1995, 1991 and 2003

9. In practice, we measure this if both incuments belong to the same party label. There is no easy way to build a more realistic political aligment variable.

Table 2. Re-election of parties: Baseline and sub-period models

	All	1983-1991	1995-2003	2007-2011
inc3JUS	2741***	2849***	13.549	2121***
	(0.538)	-1.066	-225.547	(0.634)
inc3PPPR	2694***	2459**	13.050	2897***
	(0.547)	-1.092	-225.547	(0.655)
inc3PROG	1903***	2961***	11.113	1645**
	(0.551)	-1.106	-225.548	(0.657)
inc3UCR	2190***	2807***	12.776	1928***
	(0.536)	-1.060	-225.547	(0.633)
inc3VEC	1997***	2318**	12.860	1524**
	(0.546)	-1.109	-225.547	(0.648)
factor(year)1991		0.527		
		(0.604)		
factor(year)1999			0.121	
			(0.094)	
factor(year)2003			0.565**	
			(0.091)	
factor(year)2011				0.092
				(0.098)
alignp3	0.731***	0.806***	0.352***	1531***
	(0.062)	(0.161)	(0.083)	(0.126)
Pop	0.00000	0.00000	0.00000**	0.00000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Constant	1935***	2717**	12.249	1828***
	(0.535)	-1.215	-225.547	(0.632)
Observations	7,458	1,249	3,719	2,49
Log Likelihood	4,275.618	700.320	2,163.605	1,323.391
Akaike Inf. Crit.	8,567.235	1,418.639	4,347.210	2,664.781

Note:*p<0.1 **p<0.05 ***p<0.01

elections); and the Kirchner period (2007 and 2011 elections). Although this may be arbitrary, the political dynamics and economic structure of each of these periods were starkly different and it is probably a good idea to consider them separately to see whether there are different regimes within eachs

sub-period. Results are very similar for both the intial and final sub-period but the middle period has several interesting results. Firstly, incumbency dummies are no longer significant. Secondly, the political alignment coefficient is much smaller than in the two other sub-periods. The main reason for these changes, we believe, is due to the unprecedent number of party changes around the 1999-2003 period, exacerbated by the huge socio-economic crisis of the year 2001-02.

Table 3 incorporates additional controls. Firstly, model 1 includes two variables that further captures political aspects: *alignn2* which is a dummy measuring whether the local government is aligned with the national party; *yrspr3* is a variable that records the number of years that the party has been in power. Somewhat surprisingly, *alignn2* is found to be negatively correlated with the probability of re-election at the local level. On the other hand, the longer the party has been in power is associated with a higher probability of re-election, which is expected. In the next model, we run the incumbency dummies, the political controls and some economic variables. Unfortunately, the economic indicators are only available at the department level.[10] This is the reason why column 2 sees a huge drop in the number of observations. Looking at the sign of the economic variables, regional economic conditions are positively associated with the probability of local re-election. It appears that short term indicators such as percent of population employed, *popocupdept* are more important when it comes to explaining re-election of incumbents. Long-term conditions, measured in this case using the percent of population with unmet basic needs, nbipobdept are not significantly associated with re-election of local governments.

The next two columns reproduce the same models analyzed above but we estimate them using generalized linear mixed-effects models. These models allow for estimation of random intercepts for groups and variables. In our case, since we have only a few economic and political variables, we aim at controlling at least partly for the unobserved heterogeneity in our sample. For this reason, we test for regional heterogeneity, including random effects terms for both province and department. Basically, we estimate a mean and a standard deviation for each random intercept both at province-level and department-level. Figure 3 shows a plot drawing means and

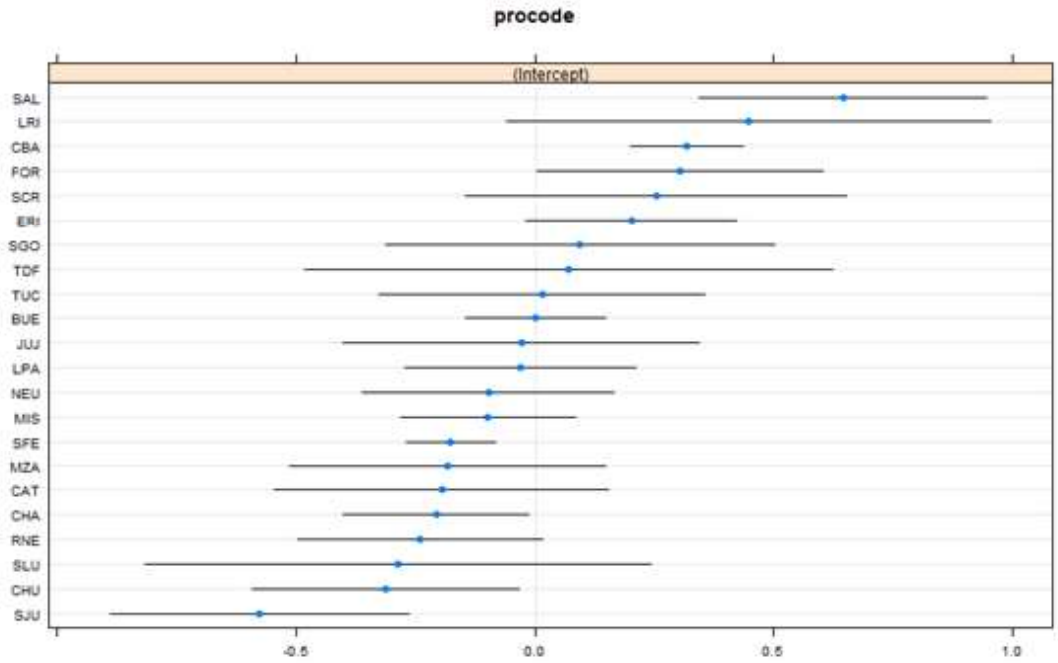
10. Departments are administrative units in which provinces are divided. They have no political or electoral relevance but they are often used since they are units of data aggregation.

Table 3. Re-election of parties: Economic controls and linear mixed models

	(1)	(2)	(3)	(4)
inc3JUS	2698***	1802***	1963***	2133***
	(0.539)	(0.646)	(0.326)	(0.670)
inc3PPPR	2617***	3105***	1983***	3862***
	(0.548)	(0.693)	(0.349)	(0.732)
inc3PROG	1883***	1633**	1163***	2062***
	(0.551)	(0.699)	(0.343)	(0.720)
inc3UCR	2166***	0.961	1374***	0.848
	(0.538)	(0.649)	(0.325)	(0.675)
inc3VEC	1949***	1605**	1124***	1616**
	(0.546)	(0.663)	(0.337)	(0.685)
alignp3	0.727***	1365***	0.578***	1095***
	(0.062)	(0.115)	(0.056)	(0.125)
alignn2	0.170***	0.219	0.155***	0.066
	(0.058)	(0.134)	(0.055)	(0.146)
yrsp3	0.020***	0.031***	0.011***	0.027***
	(0.004)	(0.006)	(0.004)	(0.007)
popocup_dept		0.021**		0.016*
		(0.008)		(0.009)
nbipob_dept		0.012		0.010
		(0.009)		(0.012)
pop	0.00000	0.00000		
	(0.00000)	(0.00000)		
Constant	2041***	2672***	1117***	2388***
	(0.535)	(0.761)	(0.331)	(0.821)
Observations	7,458	2,49	8,715	2,49
Log Likelihood	4,259.021	1,341.295	4,978.327	1,305.802
Akaike Inf. Crit.	8,538.043	2,706.589	9,978.654	2,637.603
Bayesian Inf. Crit.			10,056.450	2,713.264

Note:*p<0.1 **p<0.05 ***p<0.01

Figure 3: Random intercepts for "provinces" (Parties)



standard deviation for each province. It can be seen that there is a significant degree of heterogeneity being captured by these random intercepts.

VI. MAYORS

On average for the whole sample, mayor re-election rates are lower than those of parties. The mean re-election rate of parties stands at 56% while that of mayors stands at 48% (see Table 1. This may be due to several factors such as the existence of term limits, furthering political careers, and other institutional constraints such as party primaries. For example, our data shows that the re-election rate for mayors in governments with municipal charter is only 37% while it is almost 40% higher (reeelection rate of 49%) in governments without municipal charter. In this section we test a model of mayor re-election using a model much like that of the previous section but with a few variables controling for personal and local-level characteristics.

The first column in Table 4 includes all years. Columns 2 through 4 run the models using specific time periods. Model 2 includes elections from 1983, 1987 and 1991, model 3 includes the 1995, 1999 and 2003 election

and finally model 4 includes only 2007 and 2011. The choice of sub-periods is not entirely arbitrary as each period corresponds itself with a different political and economic structure (Alfonsin and aftermath during 1983 and 1991; Menem and aftermath during 1995 and 2003; Kirchners 2007, 2011.). All variables have the expected sign but party incumbency dummies are no longer significant: while this may seem odd, it may be partly explained due to the fact that mayors are often quite independent from party structures.[11] Only the alignment dummy seems to be significantly associated with the re-election of mayors.

In Table 5 we run additional models controling for other socioeconomic and institutional factors. We focus on several variables. Firstly, we include variables controling for the number of years the party and/or mayor has been in power. While the number of years a party has been in power is not significant, the number of years a mayor has been in office is indeed positive and significant. Secondly, the existence of municipal charter may affect the probability of re-election of mayors negatively since charters often include restrictions on candidate re-election and impose strict term limits.[12] We test for this using variable *carta* in column 2. The coefficient for this variable is negative and significant implying a negative association between re-election limits and the probability of re-election of mayors. Finally, we include economic controls measuring employment and poverty level. The results are similar for the re-election of parties: higher employment is associated with a higher probability of re-election. However, the poverty indicator is significantly and positively associated with the probability of re-eleciton. This results is a bit counterintuitive as we would expect citizens to punish incumbents with bad economic records. One likely explanation is that poverty is a more structural feature than employment and that citizens do not held their local mayors accountable for it. Finally, we include one individual-level control, the gender of incumbent mayors. It can be seen that being a male mayor is associated with a greater probability of re-election.

Table 6 provide additional regressions that are used as robustness checks on the variables tested throughout the previous models. Models 1

11. Departments are administrative units in which provinces are divided. They have no political or electoral relevance but they are often used since they are units of data aggregation.
12. We only record whether a municipality has sanctioned a municipal charter or not. Due to the large number of municipalities that have charters, it would be impossible to record a variable measuring term limits.

Table 4. Re-election of mayors: Baseline and sub-period models

	All	1983-1991	1995-2003	2007-2011
inc3JUS	0.594	0.084	13.476	0.717
	(0.381)	(0.594)	-308.038	(0.512)
inc3PPPR	0.101	0.045	13.161	0.420
	(0.404)	(0.599)	-308.038	(0.577)
inc3PROG	0.766*	0.870	14.064	0.554
	(0.400)	(0.620)	-308.038	(0.534)
inc3UCR	0.527	0.095	13.397	0.967*
	(0.379)	(0.572)	-308.038	(0.513)
inc3VEC	0.812**	0.387	13.899	0.847
	(0.395)	(0.618)	-308.038	(0.534)
factor(year)1991		0.043		
		(0.617)		
factor(year)1995		0.129		
		(0.624)		
factor(year)1999		0.756	0.127	
		(0.710)	(0.098)	
factor(year)2003		0.198	0.194**	
		(0.625)	(0.098)	
factor(year)2007		0.069		
		(0.627)		
factor(year)2011		0.691		0.204**
		(0.617)		(0.102)
alignp3	0.088	0.225	0.143	0.248**
	(0.068)	(0.186)	(0.096)	(0.126)
Pop	0.00000*	0.00000**	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Constant	0.580	0.308	13.487	0.855*
	(0.376)	(0.833)	-308.038	(0.507)
Observations	5,106	1,666	2,547	1,699
Log Likelihood	3,525.596	1,126.182	1,749.377	1,167.263
Akaike Inf. Crit.	7,067.192	2,280.364	3,518.754	2,352.526

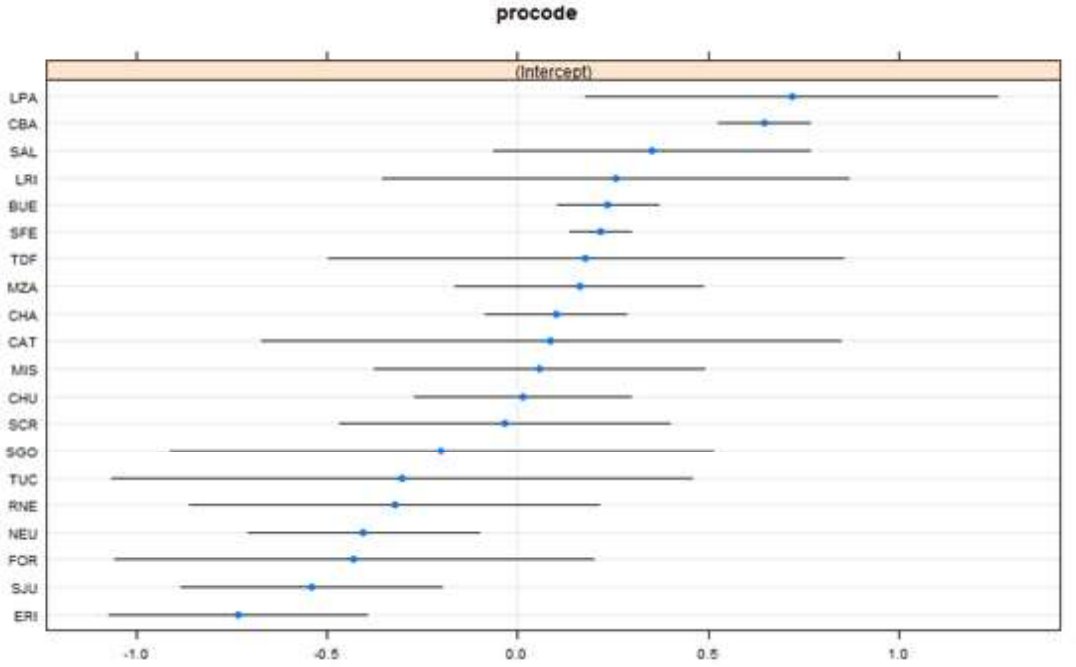
Note:*p<0.1 **p<0.05 ***p<0.01

Table 5. Re-election of mayors: Additional institutional and economic controls

	(1)	(2)	(3)	(4)
inc3JUS	0.654*	0.642*	0.672	0.641
	(0.383)	(0.382)	(0.559)	(0.561)
inc3PPPR	0.147	0.200	0.849	0.814
	(0.405)	(0.405)	(0.631)	(0.633)
inc3PROG	0.769*	0.754*	0.613	0.580
	(0.400)	(0.401)	(0.609)	(0.611)
inc3UCR	0.585	0.588	0.500	0.484
	(0.381)	(0.380)	(0.566)	(0.567)
inc3VEC	0.818**	0.813**	0.982*	0.939
	(0.395)	(0.396)	(0.588)	(0.590)
alignp3	0.086	0.093	0.375***	0.379***
	(0.068)	(0.068)	(0.129)	(0.129)
alignn2	0.093	0.101	0.005	0.003
	(0.062)	(0.062)	(0.146)	(0.146)
yrsp3	0.002			
	(0.005)			
yrsm	0.015**	0.012*	0.017*	0.016*
	(0.007)	(0.006)	(0.010)	(0.010)
carta		0.501***	0.543**	0.543**
		(0.141)	(0.217)	(0.218)
popocup_dept			0.032***	0.033***
			(0.009)	(0.009)
nbipob_dept			0.021**	0.022**
			(0.010)	(0.010)
gendM				0.553***
				(0.190)
pop	0.00000	0.00000	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Constant	0.686*	0.665*	2324***	2842***
	(0.379)	(0.380)	(0.699)	(0.724)
Observations	5,106	5,106	1,7	1,7
Log Likelihood	3,522.074	3,515.716	1,154.320	1,149.975
Akaike Inf. Crit.	7,066.148	7,053.432	2,334.639	2,327.950

Note:*p<0.1 **p<0.05 ***p<0.01

Figure 4: Random intercepts for "provinces" (Mayors)



and 2 include some interaction terms to check for the possibility that the effect of poverty on re-election is condition on the political alignment variables. We find that the poverty (*nbipobdept*) loses significance, both the non-interacted and the interacted term. Finally, including a control for the level of education (the percent of people who are eligible to attend school actually attending) does not bring a significant coefficient. Models 3 and 4 are run using generalized linear mixed effects for those variables that we find significant in previous tables. It can be seen that most of the significant variables we found when running pooled logit regression are also significant here. Incumbency dummies, however loose significance. This may be due to the fact that some of these effects are being captured by the mixed effects both at the department and province level. A visualization of the random intercepts for each province can be seen in Figure 4. These tables confirm the significant and positive association between the probability of re-election and incumbency, and the existence of municipal charter.

Table 6: Re-election of mayors: Economic controls and linear mixed models

	(1)	(2)	(3)	(4)
inc3JUS	0.846	0.707	0.308	0.786
	(0.544)	(0.558)	(0.296)	(0.580)
inc3PPPR	0.615	0.330	0.230	1.101
	(0.607)	(0.617)	(0.347)	(0.681)
inc3PROG	0.942	0.839	0.298	0.729
	(0.595)	(0.607)	(0.316)	(0.634)
inc3UCR	0.506	0.350	0.073	0.520
	(0.541)	(0.556)	(0.294)	(0.577)
inc3VEC	1105*	0.900	0.388	1089*
	(0.572)	(0.587)	(0.314)	(0.606)
alignp3	0.390**	0.184	0.046	0.335**
	(0.191)	(0.119)	(0.063)	(0.141)
nbipob_dept	0.001			0.014
	(0.010)			(0.014)
gendM				0.545***
				(0.194)
yrsm	0.022**	0.021**	0.014**	0.010
	(0.010)	(0.010)	(0.006)	(0.010)
carta	0.376*	0.426**	0.448**	0.635***
	(0.212)	(0.214)	(0.153)	(0.238)
alignp3:nbipob_dept	0.015			
	(0.013)			
edasiste_dept		0.018		
		(0.017)		
popocup_dept				0.030***
				(0.009)
Constant	1028*	1389*	0.554*	2811***
	(0.543)	(0.753)	(0.316)	(0.793)
Observations	1,883	1,716	5,944	1,7
Log Likelihood	1,281.821	1,171.262	4,049.284	1,137.344
Akaike Inf. Crit.	2,585.642	2,362.523	8,120.569	2,302.688
Bayesian Inf. Crit.			8,194.160	2,378.826

Note:*p<0.1 **p<0.05 ***p<0.01

VII. Concluding remarks

In this paper we have studied the determinants of electoral outcomes in local elections –municipalities and townships- for a large sample of Argentine local governments during the 1983-2011 period. Our results suggests that re-election rates for local parties and mayors are related with both structural, institutional and economic characteristics. The main three factors that we have found to be statistically relevant to explainign differences in re-election rates of local parties and mayors are the incumbency dummies, the existence of a municipal charter, and the percent of employed population. There seems to be important regional/provincial election effects although we do not find large heterogeneity at the department level.

We believe these findings are to be taken cautiously. There are main reasons to do so. Firstly, there are many economic, political and institutional variables we do not observe that may be relevant to explaining re-election rates of parties and mayors. Secondly, for several variables, we do not have data at the local level and only census-level data at the department level. Due to these data being available at a less frequent periods, the greater detail on economis aspects comes at the expense of reducing sample sizes.

VIII. References

Akhmedov, A. & Zhuravskaya E. (2004). Opportunistic Political Cycles: Test in a Young Democracy Setting.The Quarterly Journal of Economics 119 (4): 1301–38.

Alesina, A. (1987). Macroeconomic Policy in a Two-Party System as a Repeated Game. The Quarterly Journal of Economics 102 (3): 651–78.

Alesina, A. & Paradisi M. (2017). Political Budget Cycles: Evidence from Italian Cities. Economics and Politics 29 (2): 157–77.

Alesina, A. & Roubini N. (1992). Political Cycles in Oecd Economies. The Review of Economic Studies 59 (4): 663–88.

Ames, B. (1987). Political Survival. Berkeley and Los Angeles. University of California Press.

Arvate, P. (2013). Electoral Competition and Local Government Responsiveness in Brazil. World Development 43: 67–83.

Arvate P., Avelino G., Tavares J. & others. (2009). Budget Deficits and Reelection Prospects: Voters as Fiscal Conservatives in a New Democracy. Economic Letters 102 (2): 125–27.

Barberia, L. & George Avelino. (2011). Do Political Budget Cycles Differ in Latin American Democracies? Economía 11 (2): 101–34.

Bee C. & Moulton S. (2015).Political Budget Cycles in Us Municipalities. Economics of Governance 16 (4): 379–403.

Besley, T. & Case A. (1995a). Does Electoral Accountability Affect Economic Policy Choices? Evidence from Gubernatorial Term Limits. The Quarterly Journal of Economics 110 (3): 769–98.

Besley, T. & Case A. (1995b). Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Competition. The American Economic Review 85 (1): 25.

Bordalejo Mediavilla, M. (2005). Determinantes Políticos de Las Transferencias Discrecionales: Evidencia de La Provincia de Córdoba, Argentina. Revista de Economía Y Estadística 43 (1): 167–92.

Boulding C. & Brown D. (2014). Political Competition and Local Social Spending: Evidence from Brazil. Studies in Comparative International Development 49 (2): 197–216.

Bracco E., Lockwood B., Porcelli F. & Redoano M. (2015). Intergovernmental Grants as Signals and the Alignment Effect: Theory and Evidence. Journal of Public Economics 123: 78–91.

Brender, A. (2003). The Effect of Fiscal Performance on Local Government Election Results in Israel: 1989–1998. Journal of Public Economics 87 (9-10): 2187–2205.

Brender A. & Drazen A. (2005). Political Budget Cycles in New Versus Established Democracies." Journal of Monetary Economics 52 (7): 1271–95.

Brender A. & Drazen A. (2008).How Do Budget Deficits and Economic Growth Affect Reelection Prospects? Evidence from a Large Panel of Countries. American Economic Review 98 (5): 2203–20.

Brollo F. & Nannicini T. (2012). Tying Your Enemy's Hands in Close Races: The Politics of Federal Transfers in Brazil. American Political Science Review 106 (04): 742–61.

Cao, H.(1999). Elecciones Y Reelecciones En El Nivel Municipal Argentino: 1983-1999. Buenos Aires, Grupo Provincias/Jefatura de Gabinete de Ministros.

Cingolani, M., Mazzalay V. & Nazareno M. (2009). Gobiernos Locales, Redes Y Distribución Del Gasto Provincial En Argentina. El Caso de Córdoba. Prepared for the 2009 Congress of the Latin American Studies Association.

Fenwick, T. (2010). The Institutional Feasibility of National-Local Policy Collaboration: Insights from Brazil and Argentina. Journal of Politics in Latin America 2 (2): 155–83.

Ferraz C. & Finan F. (2011). Electoral Accountability and Corruption: Evidence from the Audits of Local Governments. American Economic Review 101 (4): 1274–1311.

Freille S. & Capello M. (2014a). Electoral Effects of Intergovernmental Fiscal Transfers: An Application to Local Elections in the Province of Cordoba, 1995-2011. Revista de Economía y Estadística 52 (1): 113–35.

Gibson E. & Calvo E. (2000). Federalism and Low-Maintenance Constituencies: Territorial Dimensions of Economic Reform in Argentina. Studies in Comparative International Development 35 (3): 32–55.

González L. (2012). The Power of Governors. Conceptualization, Measurement, and Comparative Analysis. Documentos de Trabajo de La Escuela de Política Y Gobierno, no. 1: 1–29.

Guo, G. (2009). China's Local Political Budget Cycles. American Journal of Political Science 53 (3): 621–32.

Hibbs D. (1977). Political Parties and Macroeconomic Policy. American Political Science Review 71 (4): 1467–87.

Kraemer, M.(1997). Electoral Budget Cycles in Latin America and the Caribbean: Incidence, Causes, and Political Futility.

Levitt, S. (1995). The Impact of Federal Spending on House Election Outcomes. National Bureau of Economic Research Cambridge, Mass., USA.

Martins R. & Veiga F. (2013). Economic Voting in Portuguese Municipal Elections. Public Choice 155 (3-4): 317–34.

Nieto Parra S. & Santiso J. (2009). Revisiting Political Budget Cycles in Latin America.

Nordhaus, W. (1975). The Political Business Cycle. The Review of Economic Studies 42 (2): 169–90.

Paldam, M. (1981). A Preliminary Survey of the Theories and Findings on Vote and Popularity Functions. European Journal of Political Research 9 (2): 181–99.

Paniagua, M. (2012).El Partido Justicialista y La Asignación Estratégica de Recursos: Un Estudio Comparado del Nivel Subnacional en Argentina. Revista SAAP 6 (1): 0–0.

Persson T. & Tabellini G. (2005). The Economic Effects of Constitutions.MIT press.

Porto A. & Porto N. (1999). Desempeño Fiscal Y Resultados Electorales. Mimeo, La Plata, Universidad Nacional de La Plata-Departamento de Economía.

Porto A. & Porto N. (1999). Influencia de Las Condiciones Económicas y Fiscales sobre los Resultados Electorales Provinciales y Municipales.Documento de Trabajo del Departamento de Economía Nro 26.

Rodríguez-Chamussy, L. (2015). Local Electoral Rewards from Centralized Social Programs: Are Mayors Getting the Credit? Inter-American Development Bank.

Rogoff, K. (1990). Equilibrium Political Budget Cycles. The American Economic Review, 21–36.

Rogoff K. & Sibert A. (1988). Elections and Macroeconomic Policy Cycles.The Review of Economic Studies 55 (1): 1–16.

Rumi, C. (2014). National Electoral Cycles in Transfers to Subnational Jurisdictions. Evidence from Argentina. Journal of Applied Economics 17 (1): 161–78.

Sakurai S. & Menezes-Filho N. (2011).Opportunistic and Partisan Election Cycles in Brazil: New Evidence at the Municipal Level. Public Choice 148 (1-2): 233–47.

Sakurai S. & Menezes-Filho N. (2008). Fiscal Policy and Reelection in Brazilian Municipalities. Public Choice 137 (1-2): 301–14.

Shi, M. & Svensson J. (2002a). Conditional Political Budget Cycles.

Shi, M. & Svensson J. (2002b). Political Budget Cycles in Developed and Developing Countries. Institute for International Economic Studies, Stockholm University, 18.

Sour, L. (2013). The Flypaper Effect in Mexican Local Governments. Estudios Económicos, 165–86.

Suárez Cao J. (2011). ¿Federal en teoría pero unitaria en la práctica?: Una discusión sobre el federalismo y la provincialización de la política en Argentina. Revista SAAP 5 (2): 0–0.

Timmons J. & Broid D. (2013). The Political Economy of Municipal Transfers: Evidence from Mexico. Publius: The Journal of Federalism, pjt007.

Titiunik, R. (2009). Incumbency Advantage in Brazil: Evidence from Municipal Mayor Elections. University of California-Berkeley, Mimeo.

Veiga L. & Veiga F. (2007). Political Business Cycles at the Municipal Level. Public Choice 131 (1-2): 45–64.

IX. Appendix and data sources

The data for this paper has been collected over several years from many different sources. Data on elections and incumbencies were originally collected from Cao (1999)'s book "Elecciones y reelecciones en el nivel municipal argentino: 1983-1999". We recoded and updated these data using information from the electoral bodies of all 24 Argentine electoral districts. We also obtained information from various secondary sources such as online local newspapers and radios, websites specializing in local affairs and think-tanks aggregating electoral information.

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- Crítica bibliográfica
- "Observatorio de Política"

III. NORMAS EDITORIALES

El autor enviará el trabajo de acuerdo con las siguientes normas editoriales:

Extensión: los artículos deberán estar escritos a doble espacio, con márgenes de 2,5 cm.; la extensión promedio será de veinticinco (25) páginas, numeradas consecutivamente (la página del título es la página 1) y en ningún caso podrán superarse las cuarenta (40) páginas.

La primer página del artículo deberá contener la siguiente información:

Título: debe ser corto, explicativo y contener la esencia del trabajo. Se debe consignar en inglés y castellano.

Autor (es): indicar los nombres y apellidos completos sin títulos profesionales, seguido de la dirección postal (institucional o particular según corresponda) y dirección de correo electrónico.

Resumen: los trabajos deberán ir acompañados por un resumen en español y en inglés. El resumen debe escribirse en un solo párrafo de no más de 100 palabras. Contendrá una descripción del problema, los objetivos, la metodología y las principales observaciones y conclusiones. Se debe consignar en inglés y castellano.

Palabras claves: se debe incluir la clasificación JEL (JOURNAL OF ECONOMIC LITERATURE CLASSIFICATION SYSTEM) disponible en Internet y hasta cinco palabras claves que definan el artículo, en inglés y castellano.

Referencias: todas las referencias bibliográficas citadas en el texto deberán ser presentadas alfabéticamente, y estar escritas según las normas de la APA (Manual de Publicación de la Asociación Americana de Psicología, como mínimo 5ta o 6ta Edición). Sólo los trabajos citados aparecen en la sección Referencias y viceversa. En Referencias no deben figurar trabajos que aún no han sido aceptados para publicación. Sólo pueden mencionarse en el texto aclarando que está en preparación (López, en preparación).

Tablas (cuadros) y Figuras (gráficos): tanto las tablas como las figuras se numerarán con números arábigos y cada una llevará una leyenda y

la fuente si fuera el caso. Deben insertarse como objeto de Office y/o adjuntar el archivo excel con los datos originales. Si en una figura se incluyen fotografías, deberán presentarse en forma de copias en blanco y negro, brillantes y de muy buena calidad. Ejemplos:

Figura 1
Precios de las acciones y riesgo/país
Fuente: JPMorgan

Tabla 1
Cambios de tipo de tenencia de la vivienda

Fuente: encuesta movilidad espacial en Bogotá, Centro de Estudios sobre el Desarrollo Económico (CEDE), 1993.

Las tablas, referencias y leyendas para figuras deberán ser escritas en páginas separadas.

Fórmulas: deberán ser numeradas consecutivamente como (1), (2), etc. sobre el lado derecho de la página. Si la derivación de fórmulas ha sido abreviada, se recomienda presentar por separado, cuando sea pertinente, la derivación completa (que no será publicada). Deben realizarse con el Editor de Ecuaciones de Word, siempre insertas en el documento como objeto editable.

Notas al pie de página: deberán ser en un mínimo y numeradas consecutivamente en todas partes del texto con números en superíndice. Deberán ser escritas a doble espacio y no incluir fórmulas.

Nombre de organizaciones y/o instituciones: deberá indicarse la denominación completa, con su correspondiente sigla entre paréntesis, de toda organización o institución mencionada en el trabajo.

Anexo: con la base de datos, cuando corresponda, es conveniente el envío en un archivo adjunto, de los datos utilizados para las estimaciones y/o construcción de tablas y gráficos.

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INSTITUTO DE ECONOMÍA Y FINANZAS
FACULTAD DE CIENCIAS ECONÓMICAS
UNIVERSIDAD NACIONAL DE CÓRDOBA

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II. Types of Contributions

- Articles
- Short Articles
- Bibliographical Reviews
- Contributions to Policy Watch

III. MANUSCRIPT PREPARATION

Papers' length. Submitted articles should typically be less tan 25 double-spaced pages with 2.5 cm margins on all sides, and should in no event exceed 40 pages. Pages should be consecutively numbered (the title page being number 1).

Title page. The title page will include:

The **article title,** which should be short, self explaining and bearing the paper´s essence, in Spanish and in English.

The authors´ name and permanent affiliations, followed by their current postal address, e-mail address and telephone or fax number.

The title page will also include single paragraph abstracts, in Spanish and in English, of not more than 100 words each and a list of two to five keywords in Spanish and in English. The JEL classification should be included.

Footnotes. Footnotes will be kept at a minimum and numbered consecutively and designated by superscripts in the text. All footnotes should be typed double-spaced and they will not include formula.

References. All bibliographical references cited in the text must be presented alphabetically and written according to the APA style (Publication Manual of the American Psychological Association, at least 5th or 6th Edition). Only the cited works should appear in the References section and vice versa. References should not include papers not yet accepted for publication. They can only be mentioned in the text clarifying that it is in progress (i.e. Lopez, in progress).

Formula. They should be numbered consecutively throughout the text [e.g. (1), (2), etc] on the right of the page. It is recommended, in case of abbreviated formula display, to separately submit their complete derivation (which will be not published). They must be done with the Word Equation Editor, always inserted in the document as an editable object.

Tables and Figures. Tables as well as figures should be identified with Arabic numbers and will have a legend and the source (whenever it

applies). Figures carrying photographs will be presented in brilliant, good quality white and black copies. Tables, references and figure legends should be written in separate pages.

Organizations and Institutions. Organizations and Institutions quoted or mentioned in the paper will be indicated with their complete denomination and the corresponding initials between brackets.

Annex. Authors are advised to send, enclosed to the paper, the file with the database used for estimations and the construction of tables and graphics.

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