NBER WORKING PAPER SERIES

UNSTICKING THE FLYPAPER EFFECT IN AN UNCERTAIN WORLD

Carlos A. Vegh
Guillermo Vuletin

Working Paper 21436
http://www.nber.org/papers/w21436

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2015

We are grateful to David Aschauer, Malcolm Getz, Samara Gunter, George Perkins, Daniel Riera-Crichton, two anonymous referees, an editor, and seminar participants at the World Bank, Inter-American Development Bank, Universidad Católica de Chile, American Economic Association, LACEA, Bates College, and Colby College for helpful comments and suggestions. We would also like to thank Roberto Delhy Nolivos, Lyoe Lee, Jingyan Guo, Bradley Turner, and Ling Zhu for excellent research assistance. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Unsticking the Flypaper Effect in an Uncertain World
Carlos A. Vegh and Guillermo Vuletin
NBER Working Paper No. 21436
July 2015
JEL No. E21,E62,H62,H77

ABSTRACT

We provide a novel explanation for the flypaper effect based on insurance arguments. In our model, the flypaper effect arises due to the differential response of precautionary savings to private income or fiscal transfers shocks in an uncertain world with incomplete markets. The model generates two testable implications: (i) the flypaper effect is a decreasing function of the correlation between fiscal transfers and private income, and (ii) such relationship is stronger the higher is the volatility of fiscal transfers and/or private income. An empirical analysis of Argentinean provinces for the period 1963-2006 finds strong support for the model's implications.

Carlos A. Vegh
School of Advanced International Studies (SAIS)
Johns Hopkins University
1717 Massachusetts Avenue, NW
Washington, DC 20036
and NBER
cvegh1@jhu.edu

Guillermo Vuletin
Brookings Institution
1775 Massachusetts Avenue, NW
Washington, DC 20036
gvuletin@brookings.edu

> "*The flypaper effect results when a dollar of exogenous grant-in-aid leads to significantly greater public spending than an equivalent dollar of citizen income: Money sticks where it hits. Viewing governments as agents for a representative citizen voter, this empirical result is an anomaly.*"
> Robert Inman (2008)

1 Introduction

The flypaper effect is a widely-documented empirical regularity in public finance that holds that the propensity of subnational governmental units to spend out of intergovernmental unconditional fiscal transfers (hereafter, fiscal transfers) is higher than the propensity to spend out of private income. According to Inman (2008), 3,500 research papers have documented this stylized fact for numerous countries and levels of government in the world. These studies show that while an extra dollar in private income increases public spending by \$0.02-\$0.05, an equivalent increase in fiscal transfers triggers a rise in spending that lies between \$0.25 and \$1.3. The term "flypaper effect" was coined in early papers that uncovered this stylized fact (Henderson, 1968; Gramlich, 1969). This catchy expression captures the idea that money sticks where it hits: money in the private sector (i.e., from private income) tends to be allocated to private consumption rather than being taxed away, while money in the public sector (i.e., from fiscal transfers) tends to be spent by the public sector rather than being rebated back to citizens.

As Inman's quote illustrates, the flypaper effect has been regarded as a puzzle or an anomaly. This is indeed the case if one thinks in terms of a model in which a representative citizen maximizes her utility subject to her total income — composed by the sum of private income and her share of fiscal transfers. Such a model would predict an identical propensity to spend out of private income or fiscal transfers. After all, money is fungible and the source of financing should not affect the optimal allocation of resources.

Explanations for the flypaper effect have abounded and can be divided into five different groups, two of them pointing to potential specification errors and the remaining three based on theoretical arguments. A first group of explanations argues that non-fungible conditional fiscal transfers, like the ones American states receive from matching grants, are misclassified as unconditional ones. A second group holds that omitted variables could also falsely support the flypaper effect if unobserved community characteristics, which affect the technology or effective cost of public spending, were systematically related with citizens' private income (Hamilton, 1983). Knight (2002) also argues that the omitted variable could reflect an unobserved preference for the targeted local public good (in his case public spending in highways).

The flypaper puzzle, however, remains after using truly unconditional grants (Inman, 1971; Gramlich and Galper, 1973; Bowman, 1974) or controlling for population characteristics. A third group holds that the choice model of the representative citizen might be misspecified because the citizen confuses the income effect generated by fiscal transfers with a price effect that reduces the average effective cost of public spending (Courant et al, 1979; Oates, 1979), is not fully informed and fails to see the public budget (Filimon et al, 1982) or, even when fully informed, might not behave completely rationally (Hines and Thaler, 1995). Building upon bureaucratic capture, Lutz (2010) shows that the flypaper effect tends to vanish in a setting with a strong presumption that public good provision decisions reflect the preferences of voters (i.e., direct democracy). In a related paper, Strumpf (1998) argues that one shortcoming of the flypaper effect literature is that it presumes all communities have an identical propensity to consume from an intergovernmental grant. He shows that the flypaper effect should be more important in high overhead communities (which implies a lower provision of public services and a stronger role for revenue-maximizing forces in the budget-setting process). A fourth group uses political science arguments that exploit the role that inefficient political institutions have in revealing citizens' preferences (Chernick, 1979). A fifth group relies on real collection costs (Hamilton, 1986; Aragón, 2009) or distortionary taxation arguments (Vegh and Vuletin, 2013).

This paper provides a novel additional explanation for the flypaper effect based on insurance arguments. Consider an uncertain world with incomplete markets in which a subnational unit (hereafter, province) has two stochastic sources of income: private income and fiscal transfers. In such a world, how will government spending react to an increase in fiscal transfers relative to an increase in private income?[1] We show that the answer depends on (i) how each shock affects the variance of total income and (ii) how precautionary savings react to the change in the variance of total income.

To understand the basic intuition behind our results, consider, as a benchmark, the extreme case in which the variance of private income and fiscal transfers is the same and the correlation is one. In such a case, both sources of income are identical in terms of risk. Since either shock will increase the variance of total income by the same amount, precautionary savings will increase by the same amount and, therefore, government spending will rise by the same amount in response to either shock. In other words, the flypaper effect is zero. In fact, in this case of perfect positive correlation, our stochastic model reduces to the standard static model with no uncertainty because the stochastic structure is such that fiscal transfers do not provide any insurance.

[1] By increase in either fiscal transfers or private income, we mean an increase in their expected value.

Suppose now that the correlation between private income and fiscal transfers is zero. In this case, fiscal transfers are providing some insurance to the province because it now has two uncorrelated sources of income. Suppose also that, as is the case in practice, the share of fiscal transfers in total income is less than half (i.e., private income represents the main source of total income). An increase in private income will then raise the variance of total income by more than the same increase in fiscal transfers because an increase in private income raises the share of private income in total income but an equivalent increase in fiscal transfers reduces it. In other words, from a portfolio point of view, an increase in private income decreases diversification, while an increase in fiscal transfers increases diversification.[2] As a result, precautionary savings will increase by more in the case of an increase in private income than in the case of an increase in fiscal transfers. This implies that overall spending will be higher in response to an increase in fiscal transfers than in response to an increase in private income. Since overall spending is allocated to both private and government consumption, government spending increases by more in response to an increase in fiscal transfers than in response to an increase in private income (i.e., the flypaper effect is positive). In sum, our model rationalizes a positive flypaper effect as the result of two non-perfectly correlated sources of income affecting the variance of total income differently and thus leading to different reactions in precautionary savings and hence of government spending. The only key friction is the assumption of incomplete markets.

In addition to offering a new theoretical take on the flypaper effect, our model yields two testable empirical implications. First, the flypaper effect is a decreasing function of the correlation between private income and federal transfers. Intuitively, the lower the correlation between private income and fiscal transfers, the more diversified is the province's income portfolio and thus the larger the difference in precautionary saving in response to an increase in private income relative to fiscal transfers. Second, the effect of the correlation on the flypaper effect becomes stronger the higher is the volatility of private income and/or transfers. Intuitively, the larger the variance of the province's income portfolio, the riskier the portfolio is, and hence the larger the difference in precautionary saving in response to an increase in private income relative to fiscal transfers.

We test these two predictions of the model by using a dataset for Argentinean provinces. After addressing the possible endogeneity of grants, our empirical findings for Argentinean provinces support the two theoretical implications described above and show that the proposed

[2] Remember from basic portfolio theory that if a portfolio is comprised of two uncorrelated sources of income with equal variances, the total variance is minimized if each source represents one half of the portfolio. Of course, while in portfolio theory the shares of different assets is chosen optimally, the provinces take as given these shares.

mechanism explains about 12 percent of the overall flypaper effect observed.

The paper proceeds as follows. Section 2 develops our theoretical contribution. Turning to the empirical evidence, Section 3 describes basic background information on Argentina that will prove critical in understanding the nature and determinants of fiscal transfers from the federal government to provinces as well as the identification strategy proposed in Section 4 to deal with endogeneity considerations. Section 5 documents the presence of the flypaper effect in Argentinean provinces, after controlling for endogeneity concerns, various other possible determinants of fiscal spending, as well as for provincial and year fixed-effects. We then test, and find strong support for our two key empirical implications in Section 6. Concluding remarks are presented in Section 7.

2 A simple model of insurance

The flypaper effect literature has traditionally relied on a standard one-period model to describe the flypaper effect as an anomaly (e.g., Henderson, 1968; Gramlich, 1969; Knight, 2002; Inman, 2008). In the typical model – spelled out in appendix 8.2.1 – a representative citizen (RC) maximizes her utility, which depends on private consumption (c) and government spending (g), subject to her total income, which is the sum of her private income y and her share of fiscal transfers f. In this context, define the flypaper effect (FP) as

$$FP \equiv \triangle g^f - \triangle g^y, \tag{1}$$

where $\triangle g^y$ and $\triangle g^f$ denote the change in government spending in response to an increase of one dollar in private income or fiscal transfers, respectively. As shown in the appendix 8.2.1, in this model $FP = 0$. In other words, the optimal allocation of resources does not depend on the source of financing. In particular, the propensity to spend on g does not depend on whether additional resources come in the form of private income or fiscal transfers.

This section offers a new theoretical explanation based on macroeconomic insurance arguments. We develop a two-period model with uncertainty and incomplete markets.[3] After discussing the stochastic structure of income, we derive a reduced-form expression for the flypaper effect and show that, in the presence of incomplete markets, the model can rationalize a positive flypaper effect. The model also generates some key theoretical implications that will allow us to take our model to the data in the following section.

[3]It is straightforward to show that the flypaper remains zero in a two-period model under certainty or uncertainty with complete markets (see appendices 8.2.2 and 8.2.3).

2.1 Stochastic structure of income

Consider a small open economy perfectly integrated into world goods markets. Capital markets are incomplete in the sense that there is only an international risk-free bond available.

In period 1 there is no uncertainty, and private income and fiscal transfers are given by y_1 and f_1, respectively. In the second period, private income and fiscal transfers are uncertain and given by

$$y_1 = \overline{y} + s_y, \tag{2}$$

$$y_2 = (\overline{y} + s_y)(1 + \varepsilon_y), \tag{3}$$

$$f_1 = \overline{f} + s_f, \tag{4}$$

$$f_2 = \left(\overline{f} + s_f\right)(1 + \varepsilon_f), \tag{5}$$

where $\overline{y}$ and $\overline{f}$ are initial (i.e., pre-shock) levels of private income and fiscal transfers, respectively, and s_y and s_f denote the shocks to private income and fiscal transfers, respectively. To evaluate the effects of a shock to private income and fiscal transfers, we consider an initial equilibrium characterized by $s_y = s_f = 0$. The terms ε_y and ε_f represent mean-preserving spreads of each dollar the RC receives as private income and fiscal transfers, respectively. We assume that $\varepsilon_y \sim N\left(0, \sigma^2_{\varepsilon_y}\right)$, $\varepsilon_f \sim N\left(0, \sigma^2_{\varepsilon_f}\right)$ and that ε_y and ε_f are jointly normally distributed, where $\sigma^2_{\varepsilon_y}$ and $\sigma^2_{\varepsilon_f}$ are the variances of ε_y and ε_f, respectively. The parameter ρ is the correlation between ε_y and ε_f.[4] If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} = 0$, there is, of course, no uncertainty.

A shock to private income consists of an increase in s_y such that $\triangle y_1 = \triangle E[y_2] = 1$ (i.e., $s_y = 1$), while a shock to fiscal transfers consists of an increase in s_f such that $\triangle f_1 = \triangle E[f_2] = 1$ (i.e., $s_f = 1$). In other words, second-period private income and fiscal transfers increase, in expected value, by the same amount as they do in the first period.[5] This structure of shocks allows us to keep constant the coefficient of variation before and after the shock.[6] This is a desirable feature as it maintains constant the relative volatility of private income and fiscal transfers before and after the shock.

[4] Note that this implies that the correlation between y_2 and f_2 is also ρ.

[5] In line with the literature on the flypaper effect and, more importantly, in order to have analytical solutions, we model private income and fiscal transfer shocks as permanent (i.e., they occur in both periods). This implies, of course, that total savings equal precautionary savings since there is no motive to save based on consumption smoothing. Our main results would not change if shocks were assumed to be temporary in a multi-period or infinite horizon framework.

[6] Recall that the coeficient of variation (cv) is defined as $cv \equiv$ standard deviation/expected value. For our two random variables y_2 and f_2; $cv_{y_2} = \sigma_{\varepsilon_y}$ and $cv_{f_2} = \sigma_{\varepsilon_f}$.

Assume also that

$$\overline{y} = \phi\overline{x}, \tag{6}$$

$$\overline{f} = (1-\phi)\,\overline{x}, \tag{7}$$

where $\overline{x} \equiv \overline{y} + \overline{f}$. Thus, ϕ represents the proportion of initial (i.e., pre-shock) total income corresponding to private income and $1-\phi$ the proportion corresponding to fiscal transfers. While, in theory, $\phi \in [0,1]$, in practice $1 > \phi > 0.5$. In other words, private income represents the largest fraction of total income.[7] Henceforth, we will assume that $1 > \phi > 0.5$, which is equivalent to assuming that $\overline{y} > \overline{f}$.

2.2 Model implications

The RC's preferences are given by

$$\begin{aligned} &W = u(c_1) + v(g_1) \\ &+\beta \iint p\left(\varepsilon_y, \varepsilon_f\right)\left(u(c_2\left(\varepsilon_y, \varepsilon_f\right)) + v(g_2\left(\varepsilon_y, \varepsilon_f\right))\right) d\varepsilon_y d\varepsilon_f, \end{aligned} \tag{8}$$

where $\beta > 0$ is the discount factor and $p\left(\varepsilon_y, \varepsilon_f\right)$ is the joint density distribution of ε_y and ε_f. To abstract from consumption tilting, assume that $\beta = 1/(1+r)$, where $r > 0$ is the world real interest rate. Assume that preferences are given by the constant absolute risk aversion (CARA) functions $u(c) = -e^{-c}$ and $v(g) = -(1/\theta)e^{-\theta g}$, where θ is a positive parameter that captures preferences for public spending.[8]

The RC's intertemporal total income constraint for each possible realization of ε_y and ε_f takes the form

$$y_1 + f_1 + \frac{y_2\left(\varepsilon_y\right) + f_2\left(\varepsilon_f\right)}{1+r} = (g_1 + c_1) + \frac{c_2\left(\varepsilon_y, \varepsilon_f\right) + g_2\left(\varepsilon_y, \varepsilon_f\right)}{1+r}. \tag{9}$$

The RC chooses c_1, $c_2\left(\varepsilon_y, \varepsilon_f\right)$, g_1, and $g_2\left(\varepsilon_y, \varepsilon_f\right)$ to maximize (8) subject to constraint (9). Solving the model – and as shown in appendix 8.2.3 – we can derive a reduced form for the flypaper effect, given by

$$FP = \frac{1}{1+\theta} A\left[(1+B)\,\sigma^2_{\varepsilon_y} - (1+\alpha B)\,\sigma^2_{\varepsilon_f} - B\,(1-\alpha)\,\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho\right], \tag{10}$$

[7] Fiscal transfers as a share of gross subnational product average 12 percent for Argentinean provinces, ranging from 3 percent in Buenos Aires to 32 percent in Formosa.

[8] The CARA function has two key properties in the presence of uncertainty and incomplete markets. First, the third derivative is positive, which will generate precautionary savings. Second, it will enable us to obtain reduced-form solutions.

where $A \equiv \theta/(2\,(2+r)\,(1+\theta))$ and $B \equiv 2\phi\overline{x}$ are positive constants and $\alpha \equiv (1-\,\phi)/\phi$ is between zero and one, given the assumption that $1 > \phi > 0.5$.

Based on expression (10), we can derive three propositions. Proposition 1 provides a conceptual benchmark, while Propositions 2 and 3 offer refutable hypotheses that we will take to the data.

Proposition 1 *Assume that shocks to private income and fiscal transfers have the same variance (i.e.,* $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f}$*). Then the flypaper effect is zero for* $\rho = 1$ *and positive for any* $\rho < 1$*.*

Proof. Setting $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f}$ and $\rho = 1$ in (10) implies that $FP = 0$. Since the partial derivative with respect to ρ is negative, $FP > 0$ for any $\rho < 1$. ■

Figure 1, which plots the flypaper effect as a function of ρ for the case of equal variances, illustrates this proposition.[9] Intuitively, when $\rho = 1$, both sources of income are identical in terms of risk. Either shock will increase the variance of total income by the same amount and, therefore, government spending will rise by the same amount in response to either shock. The flypaper effect is thus zero (point A in Figure 1).

Suppose now that the correlation between the two shocks is zero (Point B in Figure 1). In this case, fiscal transfers are providing some insurance to the province because it now has two uncorrelated sources of income. Since, by assumption, the share of fiscal transfers in total income is less than half, an increase in private income will raise the variance of total income by more than the same increase in fiscal transfers because an increase in private income raises the share of private income in total income but an equivalent increase in fiscal transfers reduces it. In other words, from a portfolio point of view, an increase in private income decreases diversification, while an increase in fiscal transfers increases it. As a result, precautionary savings will increase by more in the case of an increase in private income than in the case of an increase in fiscal transfers. This implies that overall spending will be higher in response to an increase in fiscal transfers than in response to an increase in private income. Since overall spending is allocated to both private and government consumption, government spending increases by more in response to an increase in fiscal transfers than in response to an increase in private income (i.e., the flypaper effect is positive).

Finally, consider the case in which $\rho = -1$, which corresponds to point C in Figure 1. At that point, the flypaper effect reaches it maximum value because the two sources of income are perfectly negatively correlated and diversification is therefore at its peak. An increase

[9] If variances are not the same, then the flypaper effect is not zero when $\rho = 1$. In fact, the flypaper effect will be positive for $\rho = 1$ as long as the variance of private income is larger than the variance of fiscal transfers. Propositions 2 and 3 do not depend on variances being equal.

in private income will thus lead to a large amount of precautionary saving compared to an increase in fiscal transfers.

Proposition 2 *The flypaper effect is a decreasing function of the correlation between private income and fiscal transfers.*

Proof. Follows immediately from expression (10) by taking the derivative with respect to ρ.[10] ■

Figure 1, of course, illustrates this proposition for the particular case of equal variances even though the result holds for any value of the variances. Intuitively, as the correlation between the two shocks decreases, fiscal transfers provide more diversification. The more diversified the income portfolio, the lower the response of precautionary saving (i.e., the larger the increase in government spending) in response to an increase in fiscal transfers relative to an increase in private income.

Proposition 3 *The relationship described in Proposition 2 is stronger the higher is the volatility of private income and/or fiscal transfers.*

Proof. Consider the partial derivative of expression (10) with respect to ρ, and further differentiate with respect to (i) σ_{ε_y}, (ii) σ_{ε_f} and (iii) both σ_{ε_y} and σ_{ε_f}. ■

In terms of Figure 1 (i.e., for the case of equal variances), we can think of the curve pivoting upwards around point A as variances increase, so that for any given value of ρ, the flypaper effect becomes larger. Intuitively, the higher are the variances (i.e., the riskier is the income portfolio), the larger is the increase in precautionary saving in response to an increase in private income relative to fiscal transfers.

3 Argentina: Fiscal background[11]

We will test our theoretical model using a perfectly-balanced dataset on subnational income, total spending, and fiscal transfers for all of 23 Argentinean provinces for the period 1963-2006.[12] As a prelude, this section provides some basic background on Argentina's fiscal

[10] The particular expressions for both Propositions 2 and 3 may be found in appendix 8.2.3.

[11] This section builds upon Porto (1990, 2003, and 2004), Porto and Sanquinetti (1993), Núñez Miñana (1998), and Sturzenegger and Werneck (2006). See also appendix 8.3.1 for further details.

[12] See the appendix 8.3.1 for demographic and economic information on Argentinean provinces. Like other papers in this literature (e.g., Porto and Sanguinetti, 2001), we exclude the Autonomous City of Buenos Aires from the analysis due to both short data availability and its special status in terms of the system of fiscal transfers.

structure that will prove critical in understanding the nature and determinants of fiscal transfers from the federal government to provinces as well as the identification strategy proposed in Section 4 to deal with endogeneity concerns.

Argentina is a federal constitutional republic and representative democracy. It has a multi-party system with two main political parties (Partido Justicialista, PJ, and Unión Cívica Radical, UCR), and about 20 other smaller provincial parties that have had representation in the National Congress and 15 provincial governments. During the last two-thirds of the twentieth century, the country faced severe political instability and was ruled by military regimes between 1966-1972 and 1976-1983.

Each province has the constitutional power to run an autonomous fiscal policy. The size of the overall government, measured by the ratio of consolidated government expenditure to GDP, averages 35 percent of GDP. Government spending is highly decentralized; on average, Argentinean provinces are responsible for about 40 percent of consolidated fiscal spending. On the other hand, tax collection is highly centralized at the federal level. These vertical imbalances are financed by a system of intergovernmental fiscal transfers from the federal government which represent, on average, about 60 percent of provincial expenditure.

The most important component of intergovernmental transfers (about 65 percent) is based on a tax-sharing law called "coparticipación" which dates from 1935. Such tax-sharing law established: (i) the taxes to be shared (most direct and indirect domestic taxes), (ii) how shared tax collection would be distributed between the federal government and provinces (which is referred as "primary distribution"), and (iii) how provincial funds would be distributed between provinces (which is referred as "secondary distribution"). It is important to note that these fiscal transfers from federally-collected taxes to provinces are unconditional (and automatic) in the sense that, by law, provinces are entitled to them based on their mere existence.

Periodically, typically every ten years to allow the system to adjust, new modifying laws were enacted to regulate the primary and secondary distribution of funds. The tax-sharing law established that secondary shares were to be determined using formulas that weighed various time-varying indicators such as each province's contribution to total tax collection (proxied by population), cost of providing public goods (proxied by population density), and redistributive considerations favoring low income provinces. Since 1988, primary distribution coefficients have not changed and secondary distribution coefficients have been fixed and not determined by any explicit formula.

Other intergovernmental transfers (about 35 percent) are discretionary in nature and have typically responded to political factors. Specifically, these transfers have been used by

the federal government (i) in exchange for support of provincial legislators in the National Congress for laws and reforms pushed by the federal government and (ii) to favor politically-protected provinces.[13]

4 Endogeneity concerns and identification strategy

As just discussed, Argentina's fiscal structure exhibits a key feature that proves to be particularly useful for our study: fiscal transfers from the federal government to provinces are essentially unconditional in nature (i.e., they are not a direct function of provincial spending).[14] While necessary, the unconditionality of fiscal transfers is not sufficient to guarantee exogeneity. This section discusses these endogeneity problems and provides an identification strategy to address them.

4.1 Endogeneity problems.

As just mentioned, unconditionality is not sufficient to ensure that fiscal transfers are truly exogenous to provincial spending. The reasons are twofold. First, while the secondary shares for coparticipated funds have been fixed since 1988 (thus ensuring exogeneity relative to provincial spending), this was not the case before 1988. If formulas for secondary shares before 1988 reflected, for instance, redistributive considerations, we could have endogeneity problems to the extent that low-income provinces with a strong preference to spend on low income households in bad times could have gotten more funds in bad times. In such cases, more coparticipated funds would not have "caused" more provincial spending but instead accommodated an already-existing preference to redistribute in bad times.

Second, total fiscal transfers (the variable that we use in our regressions) include about 35 percent of non-coparticipated and discretionary funds. While unconditional, we cannot rule out that lobbying from congressional representatives of provinces with, for example, a strong preference to spend could have succeeded in getting more funds for their respective provinces. Again, in this case, larger transfers would not be "causing" more provincial spending but

[13] For instance, Centrangolo and Jimenez (2003) show that between 1989 and 2001 the federal government favored the small province of La Rioja, – where Carlos Menem (the president at the time) had built his political career – which received 26.5 percent of the so called "fondos de aportes del tesoro nacional" (funds aimed at alleviating critical circumstances), with the closest province receiving less than 6 percent. Similar criticisms of the political and electoral use of federal funds have been levied during the Kirchners' administration (2003 to present).

[14] This is in sharp contrast to the American federal fiscal system which mainly relies on the federal government sharing with states the cost of some selected programs such as Medicaid, Food Stamp Program, and State Children's Health Insurance Program, among others. By design, then, American federal transfers are conditional (and hence endogenous) to state spending on those particular programs.

simply reflecting an already existing preference for more spending.

The typical inclusion of provincial fixed-effects may help in reducing the bias introduced by endogeneity concerns deriving from time-invariant preferences for public spending that are correlated with fiscal transfers. Indeed, this type of concern seems to be supported by the data. Columns 4 and 5 in Table A1 (in appendix 8.3.1) show that, on average, provinces with higher transfers per capita tend to be the ones with larger spending per capita (and this relationship is significant at the one percent level). However, one could argue that even after controlling for provincial and year fixed-effects, the residual variation may still be contaminated by endogeneity concerns (Knight, 2002; Gordon, 2004; Lutz, 2010).[15] This would certainly be the case if, for instance, preferences for public spending at a provincial level have not been time-invariant and/or have evolved differently over time across provinces.

4.2 Identification strategy: Over-representation in National Congress

We now address the endogeneity concerns just discussed by providing a plausible exogenous variation in fiscal transfers. Based on well-established political economy arguments (e.g. Holcombe and Zardkoohi, 1981; Atlas et al., 1995 and 1997; Knight, 2008), we exploit the fact that over-represented jurisdictions (defined as provinces where the number of legislators is larger than that based on proportional representation) have tended to receive larger federal transfers *per capita,* as evidenced by the following. First, regarding coparticipated funds (about 65 percent of total fiscal transfers), Porto and Sanguinetti (2001) take issue with the idea that the tax-sharing system mainly reflected each province's contributions, cost of providing public goods, and redistributive considerations. Instead, they show that, since the process that ultimately determines the allocation of federal grants is decided by the National Congress whose members are elected representatives from specific geographical areas, over-represented jurisdictions tended to receive larger federal transfers *per capita* from the tax-sharing system (even after including indicators capturing income per capita and cost of provision of public goods).[16]

Second, regarding non-coparticipated and discretionary funds (about 35 percent of total fiscal transfers) – and as mentioned in Section 3 – these funds have been used by the federal government in exchange for the support of provincial legislators in the National Congress

[15] Including year fixed-effects also helps reducing the omitted variable bias that may occur when any systematic country-wide shocks simultaneously influence the level of fiscal transfers and provincial public spending (e.g., country-wide processes of centralization and/or decentralization).

[16] Atlas et al. (1995 and 1997) offers several arguments as to why constituencies of over-represented jurisdictions in the United States Senate (there is no over-representation in the United States House of Representatives) may be more effective in receiving larger transfers per capita. For example, senators from smaller states may allocate more efforts to local benefit-seeking than to national policy-making because such strategy would be more beneficial (in per capita terms) to both constituents and themselves, the less populous the senator's state.

for laws and reforms pushed by the federal government. Since over-represented jurisdictions have more legislators *per capita*, these provinces should, *ceteris paribus*, be an easier target for lobbying by the federal government using discretionary funds. The reason is that, for a certain amount of discretionary funds, the *per capita* benefit in an over-represented province is larger, making it easier/"cheaper" to gain the support of a legislator standing for an over-represented province. In other words, when it comes to obtaining support for laws and reforms, it should be less costly for the federal government to obtain the support of provincial legislators from over-represented provinces.

The next two subsections describe the proposed identification strategy based on constitutional reforms that altered provincial representation in the National Congress and that were driven by national political and governability reasons.

4.3 Constitutional reforms of 1949, 1972, 1983, and 1994

Following the model of the American 1787 Constitution, the 1853 Argentinean founding Constitution established: (i) two national senators per province, and (ii) proportional representation in the National Chamber of Deputies, with seats being allocated proportionally to provincial population, with the specific number of people per deputy to be updated after each national population census, and the provision that seats cannot decrease over time (art. 45).[17] These principles, however, were abandoned starting in mid-twentieth century, when both Peronist and military governments, each for their own national political and governability reasons, introduced constitutional amendments that (i) altered the degree of over-representation in the Senate and (ii) notoriously bolstered the over-representation of less populated provinces in the National Chamber of Deputies.[18] The latter goes against the principle of "one person, one vote" articulated in the still valid Argentinean Constitution.

Changes in the provincial representation in the National Congress were introduced by the constitutional reforms of 1949, 1972, 1983, and 1994. These reforms, whose effects are briefly summarized below, capture the only changes made to provincial representation in the National Congress within the sample period. In the 1972 and 1994 constitutional reforms, the change in the number of representatives per province was common across the board (e.g., equal increase in the number of senators/deputies per province), which eliminates any remaining

[17] According to article 47 in the Constitution, national population census are to be conducted every ten years. Since 1947, there have been seven census: 1947, 1960, 1970, 1980, 1991, 2001, and 2010.

[18] While some degree of over-representation has been documented in other federations, particularly in less developing countries, Gibson and Calvo (2000) and Reynoso (2004) show that this feature is most extreme and notorious in the case of Argentina. For example, in the year 2000, a vote for a National Senator in Tierra del Fuego was equivalent to about 141 votes in Buenos Aires. Similarly –and even more notably because it occurs in the Chamber of Deputies– a vote for a National Deputy in Tierra del Fuego was equivalent in the year 2000 to about 10 votes in Buenos Aires.

concerns about such a change possibly being the result of a province successfully lobbying for more representation. In the case of the 1949 and 1983 constitutional amendments, where the change in the number of representatives per province was not the same across the board but rather the result of a common provision that effectively favored a group of provinces (e.g., a provision that set a minimum number of deputies per province), we provide further context regarding the political nature of each change in representation to argue in favor of an exogenous variation.[19]

The main effects of the reforms were as follows:

- Peron's constitutional reform of 1949. President Perón served his first period from 1946 to 1952. After two years in power, and in order to consolidate his political grasp, Perón called for a broad constitutional reform allowing for the indefinite re-election of the president (which was prohibited by the still-valid 1853 Constitution). To gather support from "peripherical" provinces, this new constitution departed, for the first time, from the proportional representation principle in the Chamber of Deputies by establishing a minimum of two deputies per province, regardless of population. The provinces of Chubut, Formosa, La Rioja, Neuquen, and Santa Cruz benefited from this provision obtaining an extra deputy (see column 2a in Table 1). On a per-capita basis, Santa Cruz was the most favored given its very low population.

- Military regime's constitutional reform of 1972. Between 1966 and 1972 Argentina was ruled by a military dictatorship. Threatened by a growing popular insurrection, it organized an election in 1973 to leave power. In preparation for the democratic transition, the regime introduced in 1972 a constitutional reform which: (i) increased the number of senators per province from 2 to 3, (ii) added 3 deputies per province (independently of the number of seats based on strict proportional representation), and (iii) assigned 2 deputies to the National Territory of Tierra del Fuego. The fact that the reform increased the number of senators and deputies for all provinces equally is clearly a strong indicator that this reform was not the result of certain provinces (with stronger preference for public spending) lobbying for more representation. The military regime argued that these changes responded to the "need to strengthen the federal system" (decree law 19608, 1972). Indeed, constitutional scholars (e.g., Borello, 2013) have argued that this change also aimed at giving provincial parties a larger legislative role given the expected victory of the PJ in the presidential election. Like Perón's constitutional reform of 1949, this Constitutional amendment continued and deepened

[19] For these latter cases, the appendix 8.3.2 also provides complementary evidence regarding the heterogeneity, both in terms of income per capita and spending per capita, of provinces favored by these type of provisions.

in both legislative cameras the process of over-representation of less populated provinces. In the Chamber of Deputies the least and most favored provinces were Buenos Aires and Tierra del Fuego (see column 2b in Table 1). In the Chamber of Senators the most favored province was Santa Cruz.

- Military regime's constitutional reform of 1983. Between 1976 and December 1983, Argentina was ruled by another military dictatorship. A failing economy, increasing awareness of government repression, and the loss of the Falklands/Malvinas War forced the military to leave power in 1983. In preparation for the democratic transition, the regime (with support from leaders of the five larger political parties) introduced in 1983 a constitutional reform restoring the founding Constitution of 1853, primarily to abolish the indefinite re-election of the president introduced by the 1949 amendment. Since the restoration of the 1853 Constitution also abolished the 1972 reform, the regime issued a decree (i) adding 3 deputies per province and 2 to the National Territory of Tierra del Fuego (like the 1972 reform), and (ii) increasing to 5 the minimum number of deputies per province (from a minimum of 2 in the 1949 reform). The return to the 1853 Constitution also implied that, in the October 1983 elections, each province had a representation of 2 senators (as opposed to 3 senators based on the 1972 reform). The most benefited provinces were Catamarca, La Pampa, La Rioja, San Luis, Santa Cruz, and Santa Fe (all receiving four extra deputies). Columns 2c and 3c in Table 1 show the number of deputies and senators per-capita for the 1983 National Congress election.

- Menem's constitutional reform of 1994. President Menem, from the PJ party, served his first term from 1989 to 1995. After a couple of years in office, President Menem called for a constitutional reform mainly to allow the re-election of the president (prohibited by the reinstated 1853 Constitution). To obtain the necessary support, President Menem negotiated with main opposition leader and former President Raúl Alfonsín (from the UCR) an increase in the number of senators per province from 2 to 3. Alfonsín thought that such a change would increase the UCR's representation in the Senate (Lopez, 2007). Like the 1972 constitutional amendment, the increase in one senator per province increased the over-representation of less populated provinces such as Catamarca, La Pampa, La Rioja, Neuquén, and Santa Cruz relative to more populated provinces such as Buenos Aires, Cordoba, Mendoza, and Santa Fe (see column 3d in Table 1)

4.4 Lack of revision of representation in Chamber of Deputies since 1983

With the exception of a modification in 1991, when Tierra del Fuego became a province (thus obtaining 5 national deputies), the provincial representation of the Chamber of Deputies has remained intact since 1983. This unchanged provincial representation is a clear violation of the National Constitution, which requires a revision of provincial representation after every national census. While there have been three census since 1983 (in 1991, 2001, and 2010), no modification to the number of deputies per province has taken place. According to Reynoso (2012) this policy (or lack of thereof) has continuously harm relatively more populous provinces in favor of less populated ones.[20] While Argentinean politicians are well aware of this lack of revision in legislative representation based on new population census, the surrounding political sensitivity has prevented a serious debate and legislative action.

To sum up, the constitutional reforms of 1949, 1972, 1983, and 1994, as well as the lack of revision in representation in the Chamber of Deputies since 1983, have altered the over-representation in the Senate and greatly increased the over-representation of less populated provinces in the Chamber of Deputies. More importantly for identification purposes, changes over time in provincial representation in both legislatures have been driven by political and governability considerations at the national level and were *not* the result of provinces with stronger preferences/need for public spending successfully lobbying for more political representation. The next section exploits the changes over time in provincial over-representation in the National Congress as a plausible source of exogenous variation that helps explaining the residual variation in fiscal transfers per capita.

5 Flypaper effect: Basic evidence

This section evaluates the presence of the flypaper effect in Argentina. For this purpose we resort to a commonly-used regression in this literature. Specifically,

$$g_{it} = \alpha_0 + \beta_y y_{it} + \beta_f f_{it} + \textstyle\sum_h \beta_h x_{it}^h + \varepsilon_{it}, \tag{11}$$

where i and t capture province and year, respectively. The variables g, y and f represent provincial government spending, income, and total fiscal transfers (both coparticipated and

[20] For example, he shows that while Buenos Aires should have increased the number of deputies between 1983 and 2010 by 42.8 percent (from 70 to 100), less populated provinces like Catamarca, La Rioja, La Pampa, Santa Cruz, and Tierra del Fuego should keep (as currently) their 1983 representation in the Chamber of Deputies.

not), respectively, all expressed in real and per capita terms.[21] We use x to denote additional control variables. We include (i) population to proxy for heterogeneity in preferences due to provincial size (Knight, 2002), (ii) population density and urban population to proxy for the cost of providing public goods, and (iii) political economy determinants (like governor pre-electoral period and governor's party affiliation).[22] All specifications include provincial and year fixed-effects. Residuals are calculated using robust variances and relaxing the assumption of independence within groups by allowing the presence of error autocorrelation within provinces.

Building upon our identification strategy detailed in Section 4, we exploit the plausible exogenous variation in provincial over-representation in the Argentinean National Congress to instrument the residual variation in fiscal transfers per capita. For comparability with existing literature, we first measure provincial over or under representation using the ratio of provincial senators and deputies over local population.

Table 2 shows the first and second stage instrumental variables regressions. Columns a show the results from the first stage regression (i.e., the dependent variable is fiscal transfers per capita) and columns b the one from the second stage (i.e., the dependent variable is government spending per capita).

In Table 2, columns 1 we use national deputies per capita (normalized, for presentational purposes, to per hundred thousand people) as instrument.[23,24] Column 1a shows that provinces with greater representation in the Chamber of Deputies tend to receive larger fiscal transfers per capita. For example, an additional deputy in a low populated province like Santa Cruz increases transfers per capita by about 71 pesos; which represents about 5.6 percent of historical provincial transfers per capita.[25] In contrast, an additional deputy in a populous province like Buenos Aires increases transfers per capita by about 0.85 pesos; which represents about 0.5 percent of historical provincial transfers per capita.[26] The excluded instrument

[21] Based on the theoretical model developed above, ideally we would like to measure income for each province using gross national product as opposed to gross domestic product. Unfortunately, since there is no such data for provinces, we substract fiscal transfers from gross domestic product. All of our results remain valid if we use, instead, gross domestic product.

[22] Party affiliation of governor is a dummy variable equal to 1 if governor's affiliation is PJ. We tried several variations of political afiliation and still found that the governor's political affiliation does not seem to matter.

[23] Since there was no National Congress during military regimes, we replace the number of representatives during such periods with 0. Porto and Sanguinetti (2001) have argued that even during military regimes the pre-existing structure of representation in Congress mattered because "the distribution of federal transfers was done using the legal framework given by the last law passed by Congress." Results do not vary much if this alternative strategy is used. Results are not shown for brevity.

[24] According to Knight (2008), the number of representatives from each province should be scaled by the total size of the legislative body. Results are virtually unchanged and are not shown for brevity.

[25] We computed this figure using the historical provincial average population (135,084 inhabitants); that is $71 = (96.256 * 100,000)/135,084$.

[26] We computed this figure using the historical provincial average population (11,277,649 inhabitants); that

test shows that such instrument is not weak. Column 1b shows that there is a flypaper effect: the marginal propensity to spend out of local income is less than that out of fiscal transfers.[27] The size of the flypaper effect is 1.6. Because we have a single instrument we cannot perform an over-identification test. In columns 2 we use national senators per capita (normalized to per hundred thousand people) as instrument. Similar results are obtained. In columns 3 we use both national deputies and senators per capita. Similar results are obtained and we cannot reject the over-identification test.

In Table 2, columns 4 interact national deputies per capita and national senators per capita in order to explore whether having greater representation in both chambers provides an extra boost to pressures for even larger federal transfers. Column 4a indeed supports this conjecture and also shows an important increase in the already statistically significant excluded instruments' F-test.[28,29] Moreover, it seems that over-representation in the Chamber of Deputies plays a much more important role than in the Senate. This seems to be a puzzle given the fact that over-representation is, by design, more evident in the Senate. Porto and Sanguinetti (2001), who also find this puzzling fact, convincingly argue on page 10 that "this phenomenon can be explained by the fact that in Argentina, in general, political power (votes) has been less concentrated in the lower chamber compared to the senate. Consequently, the lower chamber represents the strongest constraint to pass laws involving interregional redistribution. In these circumstances, coalitions of provincial parties could have played the role of referees in key congressional voters. This possibility makes their votes in the low chamber very valuable allowing them to obtain special benefits in terms of federal grants. This phenomenon is less likely in the senate as the ruling national party has in general a solid majority there."

5.1 Robustness of source of identifying variation

For comparability with existing literature, we first measured provincial over- and under- representation using the ratio of provincial senators and deputies to local population. It is not desirable, though, for any of the identifying variation to come from changes over time in population which may, for example, shift the demand for public spending per capita independently

is, $0.85 = (96.256 * 100,000)/11,277,649$.

[27] Control variables are typically not significant in our regression analysis due to the presence of year fixed-effects (in particular, due to the high degree of synchronization and/or common time profile exhibited by these control variables).

[28] The excluded instruments' F-test increases from 70.12, 9.63, and 32.12 in columns 1a, 2a, and 3a to 155.85 in column 4a.

[29] Our findings strongly hold to the exclusion of Santa Cruz and Tierra del Fuego from the analysis. This eliminates any concern that our findings may be driven by the conditional variation in the instruments provided by these two small provinces with almost no population.

of changes in fiscal transfers.

To remove this possibility, we perform two robustness tests. First, we include population squared or in cubic form. Results continue to hold and are not shown for brevity's sake. Second – and given our identification strategy based on changes in provincial over- and under-representation associated with constitutional reforms – we restrict the instrument to the portion of the over- and under-representation episodes discussed in Section 4.2. To this end, we use the "effective distortion measure" in Tables A2 and A3 (in appendix 8.3.3) as the instrument. This measure is computed as the ratio of the "absolute distortion" (term coined to refer to the difference between the number of national deputies/senators per jurisdiction, including the provisions established in each reform, and that based on proportional representation) to population.[30] Table 3 shows the results of using these alternative measures. Our main results continue to hold. It is worth noting that the correlation between national deputy per capita (instrument used in Table 2) and the effective distortion in national chamber of deputies (instrument used in Table 3) is 0.94 and that we reject the null hypothesis that such correlation is zero. The same occurs for the senator instrumental variables with a correlation of 0.93. This extremely high degree of correlation across these alternative measures is robust to demeaning the variables by province and/or by year.

To sum up, the source of identifying variation frequently used in the literature (legislators per capita) is essentially driven by the identification strategy based on provincial over-representation changes associated with constitutional reforms proposed in Section 4.2 and not by the change in population over time.

6 Flypaper effect: Insurance arguments

Before proceeding with the econometric analysis we should note that – conveniently for identification purposes – the correlation between income and fiscal transfers (ρ) as well as the volatility of income (σ_y^2) and fiscal transfers (σ_f^2) vary considerably even after de-trending these variables by provinces and years. This residual variation (i.e., standard deviation) accounts for about 55 to 75 percent of the overall variation. In all cases we use a 10-year rolling window to compute these statistical measures.[31] The overall standard deviation of ρ is 0.51; with a mean of 0.12. While the standard deviation across provinces (i.e., between) is 0.18, the standard deviation within provinces over time is 0.48. Moreover, if we further decompose

[30] See appendix 8.3.3 (and Tables A2 and A3 therein).

[31] In particular, ρ is the correlation between the cyclical components of income and fiscal transfers, while σ_y^2 and σ_f^2 stand for the variance of the cyclical component of income and fiscal transfers, respectively. We use the cyclical components to perform these calculations because our story is related to precautionary saving (i.e., self-insurance arguments) and hence, in terms of the data should depend on cyclical volatility.

the within standard deviation between a common component over time (i.e., within year) and a residual one, we find that both components are fairly similar; the first one is 0.36 and the second one is 0.32. In other words, even after accounting for both provincial and year de-trending, the residual variability observed in ρ is quite large. Indeed, Table 4 (columns 1-3) shows an important cross-province as well as time variation. On average, the median ρ (column 2) is close to zero (0.06), yet it varies greatly across provinces (from 0.68 in Córdoba to -0.37 in Río Negro). The within variability is also quite pronounced for most provinces, ranging from negative to positive values. The volatility of income (σ_y^2) and fiscal transfers (σ_f^2) also shows significant variability both across provinces and over time.[32]

Since ρ, σ_y^2, and σ_f^2 are calculated using 10-year rolling windows, the sample size of the regression used to test the role of insurance arguments will shrink with respect to those of Tables 2 and 3. In particular, the first observation will now date back to 1972. The results obtained in Tables 2 and 3 strongly hold if we restrict our sample to begin in 1972. Replicating our preferred specification (column 3, in Table 2), the magnitude of the flypaper effect is 1.2 with a 95 percent confidence interval of [0.8,1.6].[33]

Our first empirical implication (Proposition 2) states that the flypaper effect is a decreasing function of the correlation between private income and fiscal transfers. This occurs because $d(\triangle g_1^f)/d\rho < d\left(\triangle g_1^y\right)/d\rho < 0$. Moreover, our second empirical implication (Proposition 3) indicates that such relationship becomes stronger the higher is the volatility of private income and/or fiscal transfers. To test such implications, we add to the basic regression – given by (11) – additional terms that control for ρ, σ_y^2, σ_f^2 and all relevant interactions (relevant terms involving interactions with income and federal transfers are specified in Table 5).

Table 5, column 1 shows the regression results. Based on the theoretical model developed in Section 2, the coefficients α_1, α_2, α_7, α_8, α_9, α_{10}, α_{13} and α_{14} are expected to be negative and the rest of the coefficients could be positive or negative. These expected signs are summarized in column 2. We also expect that:

1. $|\alpha_2| > |\alpha_1|$ as a result of the first theoretical implication (Proposition 2).

2. $|\alpha_8| > |\alpha_7|$, $|\alpha_{10}| > |\alpha_9|$, and $|\alpha_{14}| > |\alpha_{13}|$ as a result of the second theoretical implication (Proposition 3).

[32] The overall standard deviation of σ_y^2 is 0.08; with a mean of 0.05. While the variation across provinces (i.e., between) is 0.05, the variation within provinces over time is 0.06. Moreover, if we further decomponse the within variation between a common component over time (i.e., within year) and an residual one, we find that the first one is 0.02 and the second one is 0.06. In other words, even after accounting for both provincial and year de-trending, the residual variability observed in σ_y^2 is quite large. Indeed, Table 4 (columns 4 to 6) shows important cross province as well as over time variation. Similar findings are obtained for σ_f^2.

[33] Results are not shown for brevity.

Table 5 supports our two empirical implications. Most coefficients have the expected signs. While α_1 and α_{13} are positive, this occurs because of multicollinearity.[34] Furthermore, and as predicted by our model, the coefficients associated with fiscal transfers tend to be higher in absolute value than those associated with output.[35]

We now use the findings of column 1 in Table 5 and alternative values of ρ, σ_y^2, and σ_f^2 to check whether the econometric model is capable of replicating our theoretical model's two empirical implications. While the findings of column 1 in Table 5 support our two empirical implications, the illustrations below aim at showing the econometric results in a way that is easier to visualize. Further, Sub-section 6.3 uses public savings rate data to provide additional evidence to the effect that the empirical findings are indeed driven by the proposed mechanism (i.e., insurance arguments). Finally, Sub-section 6.4 assesses the quantitative importance of the insurance arguments in explaining the flypaper effect observed in Argentina.

6.1 Illustration of first empirical implication

We now use our findings of column 1 in Table 5 and alternative values of ρ, σ_y^2, and σ_f^2 to check whether the econometric model is capable of replicating our theoretical model's first empirical implication, which states that the flypaper effect should be a decreasing function of the correlation between local income and fiscal transfers. As a reference point, notice that the flypaper effect evaluated for the median (i.e., 50th percentile) of all three arguments ($\sigma_y^2 = 0.03$, $\sigma_f^2 = 0.17$, and $\rho = 0.06$) is 0.55 (and statistically different from 0). Figure 2 plots the flypaper effect obtained keeping constant σ_y^2 and σ_f^2 at their median values and varying ρ (in our sample ρ varies between -0.96 and 0.99). We can see that, as predicted by the theoretical model, the flypaper effect is a decreasing function of the correlation between local income and fiscal transfers.

6.2 Illustration of second empirical implication

Our second empirical implication indicates that the first empirical implication becomes stronger (weaker) the higher (lower) is the volatility of local income and/or fiscal transfers. Like Figure 2, Figure 3 shows the magnitude of the flypaper effect obtained for the median values of σ_y^2 and σ_f^2, and alternative values of ρ (solid black line). To explore the role of higher and lower variance, we also compute the flypaper effect for different values of σ_y^2.[36] In particular,

[34] The correlation between $\rho \cdot y$, and $\sigma_y^2 \cdot \rho \cdot y$, $\sigma_f^2 \cdot \rho \cdot y$, and $\sigma_y^2 \cdot \sigma_f^2 \cdot \rho \cdot y$ is, respectively, 0.55, 0.82, and 0.50. In all cases we cannot reject that such correlation is significatively different from zero at the one percent level.

[35] Specifically, we cannot reject the null that $|\alpha_2| > |\alpha_1|$, $|\alpha_8| > |\alpha_7|$, $|\alpha_{10}| > |\alpha_9|$, and $|\alpha_{14}| > |\alpha_{13}|$ at the one percent level of significance.

[36] Recall that local income is the main source of total income (i.e., $1 > \phi > 0.5$ from Section 2.1).

Figure 3 also shows the results obtained when using the 75th percentile value of $\sigma_y^2 = 0.05$ (solid grey line) and 25th percentile value of $\sigma_y^2 = 0.02$ (dashed black line).

A couple of observations are in order. First, notice that for the maximum ρ, all calculations result in the same flypaper effect, independently of the value of σ_y^2. This finding confirms that for extremely high ρ values, there is no space for fiscal transfers to provide any insurance (even for relatively high uncertainty). Second, as the value of ρ decreases, the insurance role of fiscal transfers becomes stronger as uncertainty becomes higher (i.e., for the 75th percentile value of σ_y^2, given by the solid grey line) and weakens when uncertainty is lower (i.e., 25th percentile value of σ_y^2, given by the dashed black line). Hence, the econometric evidence fully supports our theoretical model's second empirical implication.

6.3 Evidence of the transmission mechanism

So far in this section, we have shown strong evidence supporting the role of insurance arguments in determining the flypaper effect. Yet further evidence is required if one wants to be fully convinced that these findings are indeed driven by the proposed mechanism (i.e., insurance arguments) and not changes in private consumption (via changes in taxes). Specifically, the concern is that an increase in the flypaper effect when ρ decreases may not be driven by lower saving in response to a fiscal transfer relative to the response to an increase in local income (as suggested by the theoretical model), but rather by increases in taxes (and therefore, lower consumption). We now show that this is not the case, and that the mechanism operating in our previous findings is, indeed, via savings/insurance arguments. For this purpose, we use provincial public savings rate data (S).[37,38] For further reference, define the differential effect in public savings rate (DS) as

$$DS \equiv \Delta S^y - \Delta S^f,$$

where $\triangle S^f$ and $\triangle S^y$ denote the change in provincial public savings rate that results from a shock to fiscal transfers and private income, respectively.

Using the same strategy as in column 1 in Table 5, in column 3 we use provincial public savings rate as the dependent variable. Like column 2, column 4 summarizes the model's predicted results for this variable. Most coefficients have the correct sign, yet in some cases they are not statistically significant. This is due to multicollinearity. Like Figure 2 (in which

[37] Unfortunately, we do not have information about private savings rate or private consumption in each province.

[38] Provincial public savings rate is defined as the ratio of provincial primary fiscal balance (i.e., difference between provincial current revenues and government spending) to provincial revenues.

we plot the flypaper effect for median variances and varying ρ) and Figure 3 (in which we also compute the flypaper effect for different values of σ_y^2), Figure 4 plots the results when using provincial public savings rate (DS is in the y-axis). Figure 4 strongly supports the transmission mechanism proposed. As ρ decreases (becoming less positive or more negative), provincial governments save less in response to an increase in fiscal transfers than in response to an equivalent increase in local income. Moreover, this effect becomes larger (smaller) as uncertainty becomes higher (lower). While less obvious than in the flypaper case (Figure 3), it is also worth noting that DS tends to converge across different uncertainty levels when $\rho = 1$. This further supporst our model's prediction that as ρ becomes closer to 1, the role of insurance arguments tends to weakens.

6.4 Quantifying the importance of insurance arguments

The results presented in Table 5 as well as the evidence presented in Sub-sections 6.1, 6.2, and 6.3 strongly support the mechanism based on insurance arguments proposed in our theoretical model. This sub-section assesses the quantitative importance of the insurance arguments in explaining the flypaper effect observed in Argentina. Recall that for the time period used in Table 5 (i.e., 1972-2006), the magnitude of the flypaper effect is 1.2.

Our starting point is to compute the flypaper effect predicted by the econometric model for the case in which our theory indicates that the flypaper effect explained by insurance arguments should be zero. Recall that our theoretical model tells us (Proposition 1) that when the variance of the shock to income and fiscal transfers is the same and the correlation is one, the flypaper is zero. Using the median sample output variance in our sample as a proxy for both the variance of the income shock and fiscal shock and $\rho = 1$, we obtain[39]

$$FP|_{\sigma_y^2=\sigma_f^2=0.03,\ \rho=1} = 0.42.$$

We interpret this figure as saying that 0.42 of the flypaper effect *cannot* be explained by our insurance arguments.

In order to evaluate the importance of the proposed mechanism with respect to that of the empirical estimates, we evaluate the flypaper effect for the median sample value of ρ (0.06),

[39] Alternatively, we could have performed this calculation using the median sample variance of fiscal transfers (equal to 0.17), in which case we would have obtained a flypaper of size 0.45 (i.e., $FP|_{\sigma_y^2=\sigma_f^2=0.17,\ \rho=1} = 0.45$). This confirms our model's prediction that when $\rho = 1$ and $\sigma_y^2 = \sigma_f^2$, the precise level of variances does not seem to matter.

σ_y^2 (0.03), and σ_f^2 (0.17) to obtain:

$$FP|_{\sigma_y^2=0.03,\ \sigma_f^2=0.17,\ \rho=0.06} = 0.56.$$

Therefore, the insurance arguments explain about 12 percent of the observed flypaper effect ($(0.56 - 0.42)/1.2$).

7 Conclusions

This paper has offered a new theoretical explanation for the flypaper effect based on macroeconomic insurance arguments. In our view of the world, subnational units have two uncertain sources of income: private income and fiscal transfers. As long as the correlation between the two is not one (and assuming that, as is the case in practice, fiscal transfers are less than private income), an increase in fiscal transfers will raise the variance of total income by less than an increase in private income. As a result, the amount of additional precautionary savings is lower in response to the increase in fiscal transfers and the increase in public spending correspondingly higher. The only friction required for our arguments to go through is incomplete markets. If markets were complete, the flypaper effect would vanish. Since nobody would argue that financial markets are complete in practice, especially in the developing world, our model provides an extremely plausible additional explanation for the flypaper effect puzzle.

In addition, the theoretical model yields two testable empirical implications: (i) the flypaper effect should be a decreasing function of the correlation between fiscal transfers and private income, and (ii) such relationship should become stronger the higher is the volatility of transfers and/or private income. We show that these hypotheses hold for a sample of Argentinean provinces. We also show that this novel mechanism accounts for about 12 percent of the observed flypaper effect and may thus complement other well-known explanations in the literature.

References

Aragón, Fernando. 2009. "The Flypaper Effect and Costly Tax Collection," mimeo (London School of Economics).

Atlas, Cary, Thomas Gilligan, Robert Hendershott, and Mark Zupan. 1995. "Slicing the Federal Government Net Spending Pie: Who Wins, Who Loses and Why." *American Economic Review*, Vol. 85: 624-629.

Atlas, Cary, Robert Hendershott, and Mark Zupan. 1997. "Optimal Effort Allocation by U.S. Senators: The Role of Constituency Size." *Public Choice*, Vol. 92: 221-229.

Borello, Raúl. 2013. "La Elección de los Diputados de la Nación." mimeo (Universidad Nacional de Rosario).

Bowman, John. 1974. "Tax Exportability, Inter-governmental Aid, and School Finance Reform." *National Tax Journal*, Vol. 27 (June): 163-173.

Centrangolo, Oscar, and Juan Jimenez. 2003. "Política Fiscal en Argentina Durante el Régimen de Convertibilidad." Serie Gestion Pública N^o 35, CEPAL, Santiago de Chile.

Chernick, Howard. 1979. "An Economic Model of the Distribution of Project Grants." In *Fiscal Federalism and Grants-in-Aid*, ed. Peter Mieszkowski and William Oakland, 81-103. Washington, D.C.: Urban Institute Press.

Courant, Paul, Edward Gramlich, and Daniel Rubinfeld. 1979. "The Stimulative Effects of Intergovernmental Grants: or Why Money Sticks Where It Hits." In *Fiscal Federalism and Grants-in-Aid*, ed. Peter Mieszkowski and William Oakland, 5-21. Washington, D.C.: Urban Institute Press.

Filimon, Radu, Thomas Romer, and Howard Rosenthal. 1982. "Asymmetric Information and Agenda Control." *Journal of Public Economics*, Vol. 17 (February): 51-70.

Gibson, Edward, and Ernesto Calvo. 2000. "Federalism and Low-Maintenance Constituencies: Territorial Dimensions of Economic Reform in Argentina." *Studies in Comparative International Development*, Vol. 35: 32-55.

Gordon, Nora. 2004. "Do Federal Grants Boost School Spending? Evidence from Title I." *Journal of Public Economics*, Vol. 88: 1771-1792.

Gramlich, Edward. 1969. "State and Local Governments and their Budget Constraint." *International Economic Review*, Vol. 10 (June): 163-182.

Gramlich, Edward, and Harvy Galper. 1973. "State and Local Fiscal Behavior and Federal Grant Policy." *Brookings Papers on Economic Activity*, Vol. 1: 15-58.

Hamilton, Bruce. 1983. "The Flypaper Effect and Other Anomalies." *Journal of Public Economics*, Vol. 22 (December): 347-362.

Hamilton, Jonathan. 1986. "The Flypaper Effect and the Deadweight Loss from Taxation." *Journal of Urban Economics*, Vol. 19 (March): 148-155.

Henderson, James. 1968. "Local Government Expenditures: A Social Welfare Analysis." *Review of Economics and Statistics*, Vol. 50 (May): 156-163.

Hines, James., and Richard Thaler. 1995. "Anomalies: The Flypaper Effect." *Journal of Economic Perspectives*, Vol. 9 (Fall): 217-226.

Holcombe, Randall and Asghar Zardkoohi. 1981. "The Determinants of Federal Grants." *Southern Economic Journal*, Vol. 48: 393-399.

Inman, Robert. 1971. "Towards an Econometric Model of Local Budgeting." In *Proceedings of the 64th Annual Conference on Taxation.* National Tax Association, 699-719.

Inman, Robert. 2008. "The Flypaper Effect." NBER Working Paper No. 14579.

Knight, Brian. 2002. "Endogenous Federal Grants and Crowd-Out of State Government Spending: Theory and Evidence form the Federal Highway Aid Program." *American Economic Review*, Vol. 92 (March): 71-92.

Knight, Brian. 2008. "Legislative Representation, Bargaining Power and the Distribution of Federal Funds: Evidence from the US Congress." *The Economic Journal*, Vol. 118 (October): 1785-1803.

Lopez, Griselda. 2007. "La Reforma Constitucional Argentina de 1994 y el Arte de la Negociacion Menemista (1992-1994)." *Revista de Ciencia Política*, Vol. 1.

Lutz, Byron. 2010."Taxation with Representation: Intergovernmental Grants in a Plebiscite Democracy." *The Review of Economics and Statistics*, Vol. 92 (May): 316-332.

Núñez Miñana, Horacio. 1998. *Finanzas Públicas*. Editorial Macchi Buenos Aires

Oates, Wallace. 1979. "Lump-sum Intergovernmental Grants Have Price Effects." In *Fiscal Federalism and Grants-in-Aid*, ed. Peter Mieszkowski and William Oakland, 23-30. Washington, D.C.: Urban Institute Press.

Porto, Alberto. 1990. *Federalismo Fiscal: El Caso Argentino*. Instituto Torcuato Di Tella (Editorial Tesis). Buenos Aires.

Porto, Alberto. 2003. "Etapas de la Coparticipación Federal de Impuestos. Un análisis Crítico." mimeo (Universidad Nacional de La Plata).

Porto, Alberto. 2004. *Disparidades Regionales y Federalismo Fiscal*. Editorial Edulp. La Plata.

Porto, Alberto, and Pablo Sanguinetti. 1993. "Descentralización Fiscal en América Latina: El Caso Argentino," Serie Política Fiscal N^o 45, CEPAL/GTZ, Santiago de Chile.

Porto, Alberto, and Pablo Sanguinetti. 2001. "Political Determinants of Intergovernmental Grants: Evidence from Argentina," Economics and Politics, Vol. 13 (November): 237-256.

Reynoso, Diego. 2004. "Bicameralismo y Sobre-representacion en Argentina en Perspectiva Comparada." *Revista Sociedad Argentina de Análisis Político*, Vol. 2 (December): 69-94.

Reynoso, Diego. 2012. "El Reparto de la Representación. Antecedentes y Distorciones de la Asignación de Diputados a las Provincias." *Revista POSTData*, Vol. 17 (April): 153-192.

Strumpf, Koleman.1998. "A Predictive Index for the Flypaper Effect." *Journal of Public Economics*. Vol. 69: 389-412.

Sturzenegger, Federico, and Rogerio Werneck. 2006. "Fiscal Federalism and Procyclical Spending: The cases of Argentina and Brazil." *Económica*, Vol. 52: 151-194.

Vegh , Carlos A., and Guillermo Vuletin. 2015. "Unsticking the Flypaper Effect Using Distortionary Taxation." mimeo (Johns Hopkins University and Brookings Institution).

8 Appendix

8.1 Definition of variables and sources

8.1.1 Definition of variables

Total provincial expenditure, total federal fiscal transfers from federal government to provinces, as well as all other provincial fiscal data for the period 1963-2000 is from Porto (2004) and from Dirección Nacional de Coordinación con las Provincias (Ministry of Economy, Argentina) for the period 2001-2006. Argentinean provinces do not receive intergovernmental transfers from municipalities.

Gross subnational product data for the period 1963-2000 is from Porto (2004) and from Ministry of Economy, Argentina for the period 2001-2006.

CPI data is from IMF/WEO.

Population data for the period 1963-2000 is from Porto (2004) and from Instituto Nacional de Estadística y Censos (Ministry of Economy, Argentina) for the period 2001-2006.

Population density is calculated as population/planar area.

Urban population is from Dirección Nacional de Población (Ministry of Interior).

Governor pre-electoral period is a dummy variable that equals one the previous and current year of governor election. Electoral data is from Atlas Electoral de Andy Tow and historical newspapers articles.

Governor party affiliation data is from Atlas Electoral de Andy Tow and historical newspapers articles.

8.1.2 Online sources

Porto, Alberto, 2004. Disparidades Regionales y Federalismo Fiscal. EDULP, Argentina. http://www.depeco.econo.unlp.edu.ar

Dirección Nacional de Coordinación con las Provincias (Ministry of Economy, Argentina). http://www.mecon.gov.ar/hacienda/dncfp/index.html

Instituto Nacional de Estadística y Censos (Ministry of Economy, Argentina). http://www.indec.mecon.ar

Dirección Nacional de Población (Ministry of Interior). http://www.mininterior.gov.ar/

Tow, Andy, 2003. Atlas de elecciones en Argentina. http://towsa.com/andy

8.2 Theoretical models

8.2.1 One-period model

Consider a one-period economy.[40] The exogenous levels of private income (y) and fiscal transfers (f) are given by, respectively:

$$y = \overline{y} + s_y, \tag{12}$$
$$f = \overline{f} + s_f, \tag{13}$$

where $\overline{y}$ and $\overline{f}$ are initial (i.e., pre-shock) levels of private income and fiscal transfers, respectively, and s_y and s_f denote the private income and fiscal transfer shocks, respectively. To evaluate the effects of shocks to private income and fiscal transfers, we consider an initial equilibrium characterized by $s_y = s_f = 0$. A private income shock consists of an increase in s_y such that $\triangle y = 1$ (i.e., $s_y = 1$), while a fiscal transfer shock consists of an increase in s_f such that $\triangle f = 1$ (i.e., $s_f = 1$).

Let preferences be given by

$$W = u(c) + v(\theta g), \tag{14}$$

where W stands for welfare and $\theta > 0$ captures preferences for public spending. For simplicity, assume also that $u(.)$ and $v(.)$ take the same functional form (i.e., $u(.) = v(.) = h(.)$).

The representative citizen's (RC's) income constraint is given by

$$y + f = c + g. \tag{15}$$

The RC chooses c and g to maximize (14) subject to (15). Combining the first order conditions, we obtain

$$h'(c) = h'(\theta g), \tag{16}$$

[40] We think of our economy as a small open economy but, in this one-period version, it is identical to a closed economy.

or, alternatively,

$$c = \theta g. \tag{17}$$

RC's total income is allocated between c and g depending on the value of θ.

Taking into account (12), (13), (15), and (17) we obtain

$$\frac{c}{\theta} = g = \frac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right). \tag{18}$$

If $s_y = 1$ (private income shock) and $s_f = 1$ (fiscal transfer shock), then $\triangle g^f = \triangle g^y$. Similarly, $\triangle c^f = \triangle c^y$. It thus follows from (18) that both private income and fiscal transfer shocks generate the same increase in g. Hence, $FP = 0$.

8.2.2 Two-period model with certainty

Consider a small open economy perfectly integrated into world goods and capital markets. To abstract from consumption tilting, assume that $\beta = 1/(1+r)$, where $\beta > 0$ is the discount factor and $r > 0$ is the world real interest rate. The exogenous levels of income and fiscal transfers, given by y_1 and f_1 in period 1 and y_2 and f_2 in period 2, take the form

$$y_1 = y_2 = \overline{y} + s_y, \tag{19}$$

$$f_1 = f_2 = \overline{f} + s_f. \tag{20}$$

In this two-period model, a private income shock is defined as a dollar increase in each period's private income (i.e., $\triangle y_1 = \triangle y_2 = s_y = 1$) and a fiscal transfer shock as an equivalent increase in fiscal transfers (i.e., $\triangle f_1 = \triangle f_2 = s_f = 1$).[41]

Preferences are now given by

$$W = u(c_1) + v(\theta g_1) + \beta\left[u(c_2) + v(\theta g_2)\right]. \tag{21}$$

Again, we assume that $u(c)$ and $v(g)$ take the same functional form.

The RC's intertemporal income constraint is given by

$$y_1 + f_1 + \frac{y_2 + f_2}{1+r} = c_1 + g_1 + \frac{c_2 + g_2}{1+r}. \tag{22}$$

Equation (22) has the usual interpretation that the present discounted value of private and public spending must equal the present discounted value of private income and fiscal transfers.

The RC chooses c_1, c_2, g_1 and g_2 to maximize (21) subject to (22). The first order conditions imply that

$$h'(c_1) = h'(c_2) = h'(\theta g_1) = h'(\theta g_2), \tag{23}$$

or, alternatively,

$$c_1 = c_2 = \theta g_1 = \theta g_2. \tag{24}$$

[41] In line with the literature on the flypaper effect and, more importantly, in order to have analytical solutions in the case of uncertainty and incomplete markets, we model private income and fiscal transfer shocks as permanent (i.e., they occur in both periods). Our main results would not change if shocks were assumed to be temporary in a multi-period or infinite horizon framework.

Taking into account equations (19), (20), (22), and (24), we obtain

$$\frac{c_1}{\theta} = \frac{c_2}{\theta} = g_1 = g_2 = \frac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right). \tag{25}$$

It follows that if $s_y = 1$ (income shock) and $s_f = 1$ (fiscal transfer shock), then $\triangle g_1^f = \triangle g_1^y$. Similarly, $\triangle c_1^f = \triangle c_1^y$. Hence, both private income and fiscal transfer shocks generate the same increase in g_1 and g_2 and, thus, $FP = 0$.[42,43]

8.2.3 Two-period model with uncertainty and complete markets

Based on (3) and (5), it follows that

$$\sigma_{y_2+f_2}^2 = \sigma_{y_2}^2 + \sigma_{f_2}^2 + 2\rho\sigma_{y_2}\sigma_{f_2}. \tag{26}$$

where $\sigma_{y_2+f_2}^2$, $\sigma_{y_2}^2$, and $\sigma_{f_2}^2$ denote the variance of total income, private income, and fiscal transfers, respectively.

We now turn to the RC's optimization problem. The RC's intertemporal total income constraint takes the form[44]

$$\begin{aligned} &y_1 + f_1 + \frac{1}{1+r}\iint q\left(\varepsilon_y, \varepsilon_f\right)\left[y_2\left(\varepsilon_y\right) + f_2\left(\varepsilon_f\right)\right]d\varepsilon_y d\varepsilon_f \\ &= g_1 + c_1 + \frac{1}{1+r}\iint q\left(\varepsilon_y, \varepsilon_f\right)\left[c_2\left(\varepsilon_y, \varepsilon_f\right) + g_2\left(\varepsilon_y, \varepsilon_f\right)\right]d\varepsilon_y d\varepsilon_f, \end{aligned} \tag{27}$$

where $q\left(\varepsilon_y, \varepsilon_f\right)$ is the price of the contingent asset that promises to pay one unit of output in each state of nature determined by the realization of ε_y and ε_f.

Preferences are given by (8). Once again, we assume that $u(c)$ and $v(g)$ take the same functional form (i.e., $u(.) = v(.) = h(.)$).

The RC maximizes (8) by choosing c_1, $c_2\left(\varepsilon_y, \varepsilon_f\right)$, g_1, and $g_2\left(\varepsilon_y, \varepsilon_f\right)$ subject to the constraint (27). Assuming actuarially fair insurance, which implies that $q\left(\varepsilon_y, \varepsilon_f\right) = p\left(\varepsilon_y, \varepsilon_f\right)$, the first order conditions can be expressed as

$$h'\left(c_1\right) = h'\left(c_2\right) = h'\left(\theta g_1\right) = h'\left(\theta g_2\right), \tag{28}$$

or, alternatively,

$$c_1 = c_2 = \theta g_1 = \theta g_2. \tag{29}$$

Taking into account (2)-(5), (29), and $q\left(\varepsilon_y, \varepsilon_f\right) = p\left(\varepsilon_y, \varepsilon_f\right)$, we obtain

$$\frac{c_1}{\theta} = \frac{c_2}{\theta} = g_1 = g_2 = \frac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right), \tag{30}$$

[42] In this two-period model with no uncertainty, we could define the flypaper effect in both period 1 and 2. When we introduce uncertainty, however, we will define the flypaper effect only in period 1 because that is the only period in which precautionary savings will play a role.

[43] Notice that, given the flat income structure specified in (19) and (20), there are no savings in our model for consumption smoothing motives. It is easy to check, however, that the flypaper effect would be zero even if this were not the case.

[44] As usual, we omit giving the RC a risk free bond since it would be redundant.

which, as expected, coincides with the solution for the certainty case, given in (25). From expression (30), it is clear that shocks to either private income or fiscal transfers generate the same increase in both c_1 and g_1. Therefore,

$$FP = 0. \tag{31}$$

As in the one-period model (section 8.2.1) or the two-period model with certainty (section 8.2.2), the optimal allocation of resources does not depend on the source of financing. This occurs because complete markets allow the RC to fully insure against all possible contingencies in period 2. Naturally, the presence of complete markets implies no precautionary savings.

8.2.4 Two-period model with uncertainty and incomplete markets

The RC chooses c_1, $c_2(\varepsilon_y, \varepsilon_f)$, g_1, and $g_2(\varepsilon_y, \varepsilon_f)$ to maximize expected utility, given by (8), subject to (9) which holds for every realization of ε_y and ε_f. Assuming $\beta(1+r) = 1$, the first-order conditions imply that

$$e^{-c_1} = e^{-\theta g_1} = E\left[e^{-c_2}\right] = E\left[e^{-\theta g_2}\right], \tag{32}$$

or, alternatively,

$$\frac{c_1}{\theta g_1} = \frac{c_2}{\theta g_2} = 1. \tag{33}$$

Use (32), (33), and (2)-(5) to express $g_2(\varepsilon_y, \varepsilon_f)$ as follows

$$g_2 = \frac{1}{1+\theta}(2+r)\left(\overline{y} + s_y + \overline{f} + s_f\right) + \frac{1}{1+\theta}\left(\varepsilon_y\left(\overline{y} + s_y\right) + \varepsilon_f\left(\overline{f} + s_f\right)\right) - g_1(1+r).$$

Taking into account this last expression, and since $\varepsilon_y \sim N\left(0, \sigma^2_{\varepsilon_y}\right)$, $\varepsilon_f \sim N\left(0, \sigma^2_{\varepsilon_f}\right)$, and ε_y and ε_f are jointly normally distributed, it follows that

$$-\theta g_2 \sim N\left(E\left[-\theta g_2\right], \sigma^2_{-\theta g_2}\right), \tag{34}$$

$$E\left[-\theta g_2\right] = -\tfrac{\theta}{1+\theta}(2+r)\left(\overline{y} + s_y + \overline{f} + s_f\right) + \theta(1+r)g_1, \tag{35}$$

$$\sigma^2_{-\theta g_2} = \left(\tfrac{\theta}{1+\theta}\right)^2 \sigma^2_{y_2+f_2}, \tag{36}$$

where ρ is the correlation between ε_y and ε_f and $\sigma^2_{y_2+f_2}$ is given by (26). Recalling that if a variable $x \sim N\left(E[x], \sigma^2_x\right)$ then $E[e^x] = e^{E[x]+\frac{\sigma^2_x}{2}}$, we can use (34)-(36) to obtain

$$E\left[e^{-\theta g_2}\right] = e^{E[-\theta g_2]+\frac{\sigma^2_{-\theta g_2}}{2}}.$$

Using this last expression, it follows from equation (32) that

$$e^{-\theta g_1} = e^{E[-\theta g_2]+\frac{\sigma^2_{-\theta g_2}}{2}},$$

which reduces to

$$E\left[\theta g_2\right] = \theta g_1 + \tfrac{1}{2}\left(\tfrac{\theta}{1+\theta}\right)^2 \sigma^2_{y_2+f_2}. \tag{37}$$

Since the intertemporal constraint holds for every state of nature, it holds in expected value. Hence:

$$c_1 + g_1 + \tfrac{E[c_2]+E[g_2]}{1+r} = y_1 + f_1 + \tfrac{E[y_2]+E[f_2]}{1+r}. \tag{38}$$

Precautionary savings (PS) are the additional savings that result from the fact that future incomes are uncertain and that asset markets are incomplete. In our two period model, PS is the difference in period 1 savings between the model with uncertainty and incomplete markets and the one under complete markets. Combining (2)-(5), (33), (37), and (38), we obtain

$$\tfrac{c_1}{\theta} = g_1 = \tfrac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) - \tfrac{1}{1+\theta} PS, \tag{39}$$

$$\tfrac{E[c_2]}{\theta} = E\left[g_2\right] = \tfrac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) + \tfrac{1}{1+\theta}\left(1+r\right) PS, \tag{40}$$

$$PS = A\sigma^2_{y_2+f_2}, \tag{41}$$

where $A \equiv \theta/(2\left(2+r\right)\left(1+\theta\right)) > 0$ and $\sigma^2_{y_2+f_2}$ is given by (26).

Recalling that $FP \equiv \triangle g^f - \triangle g^y$, $\overline{y} = \phi\overline{x}$, and $\overline{f} = \left(1-\phi\right)\overline{x}$, and taking into account (i) equations (26) and (39)-(41), (ii) the fact that $s_y = s_f = 0$ before the shock, (iii) that an income shock consists of an increase in s_y such that $\triangle y_1 = \triangle E\left(y_2\right) = 1$ (i.e., $s_y = 1$) and (iv) that a fiscal transfer shock consists of an increase in s_f such that $\triangle f_1 = \triangle E\left(f_2\right) = 1$ (i.e., $s_f = 1$), it follows that

$$\triangle\left(\sigma^2_{y_2+f_2}\right)^y = \left(1+B\right)\sigma^2_{\varepsilon_y} + \alpha B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho, \tag{42}$$

$$\triangle\left(\sigma^2_{y_2+f_2}\right)^f = \left(1+\alpha B\right)\sigma^2_{\varepsilon_f} + B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho, \tag{43}$$

$$\triangle PS^y = A\triangle\left(\sigma^2_{y_2+f_2}\right)^y, \tag{44}$$

$$\triangle PS^f = A\triangle\left(\sigma^2_{y_2+f_2}\right)^f, \tag{45}$$

$$\triangle g_1^y = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^y, \tag{46}$$

$$\triangle g_1^f = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^f, \tag{47}$$

$$FP = \tfrac{A}{1+\theta}\left[\left(1+B\right)\sigma^2_{\varepsilon_y} - \left(1+\alpha B\right)\sigma^2_{\varepsilon_f} - B\left(1-\alpha\right)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho\right], \tag{48}$$

where $B \equiv 2\phi\overline{x} > 0$ and $\alpha \equiv (1-\phi)/\phi \in (0,1)$ assuming $1 > \phi > 0.5$. From (46) and (47), it is clear that the propensity of the government to spend out of output and federal transfers depends on the response of precautionary savings to those shocks.

The following table shows all possible derivatives of (46), (47), and (48) with respect to σ_y, σ_f, and ρ:

	$x \equiv \triangle g_1^f$	$x \equiv \triangle g_1^y$	$x \equiv FP$[45]
$\frac{d(x)}{d\sigma_{\varepsilon_y}}$	$-GAB\sigma_{\varepsilon_f}\rho \gtrless 0$	$-GAE \gtrless 0$	$GAJ \gtrless 0$
$\frac{d(x)}{d\sigma_{\varepsilon_f}}$	$-GAH \gtrless 0$	$-GAB\alpha\sigma_{\varepsilon_y}\rho \gtrless 0$	$-GAK \gtrless 0$
$\frac{d(x)}{d\rho}$	$-GAB\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$	$-GAB\alpha\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$
$\frac{d^2(x)}{d\sigma_{\varepsilon_y}d\sigma_{\varepsilon_f}}$	$-GAB\rho \gtrless 0$	$-GAB\alpha\rho \gtrless 0$	$-GAB(1-\alpha)\rho \gtrless 0$
$\frac{d^2(x)}{d\rho d\sigma_{\varepsilon_y}}$	$-GAB\sigma_{\varepsilon_f} < 0$	$-GAB\alpha\sigma_{\varepsilon_f} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_f} < 0$
$\frac{d^2(x)}{d\rho d\sigma_{\varepsilon_f}}$	$-GAB\sigma_{\varepsilon_y} < 0$	$-GAB\alpha\sigma_{\varepsilon_y} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_y} < 0$
$\frac{d^3(x)}{d\rho d\sigma_{\varepsilon_y}d\sigma_{\varepsilon_f}}$	$-GAB < 0$	$-GAB\alpha < 0$	$-GAB(1-\alpha) < 0$

where $B \equiv 2\phi\overline{x} > 0$, $E \equiv 2(1+B)\sigma_{\varepsilon_y} + \alpha B\sigma_{\varepsilon_f}\rho \gtrless 0$, $G \equiv 1/(1+\theta) > 0$, $H \equiv 2(1+\alpha B)\sigma_{\varepsilon_f} + B\sigma_{\varepsilon_y}\rho \gtrless 0$, $J \equiv 2(1+B)\sigma_{\varepsilon_y} - B(1-\alpha)\sigma_{\varepsilon_f}\rho \gtrless 0$ and $K \equiv 2(1+\alpha B)\sigma_{\varepsilon_f} + B(1-\alpha)\sigma_{\varepsilon_y}\rho \gtrless 0$.

In particular, the expression in cell (3,3), given by $-GAB(1-\alpha)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$, is the one relevant for Proposition 2 in the text. In turn, expressions (5,3), (6,3), and (7,3) are the ones relevant for Proposition 3 in the text.

8.3 Argentina: Background and fiscal structure

8.3.1 Provincial makeup

A federal republic, Argentina consists of 24 subnational jurisdictions: 23 provinces (see Table A1) and the Autonomous City of Buenos Aires. As in many other developing countries, production and population are highly concentrated in a few provinces. About half of Argentina's GDP is concentrated in 4 provinces (Buenos Aires, Cordoba, Santa Fe, and Mendoza), and just one province (Buenos Aires) accounts for about 35 percent of the country's output (column 1, Table A1).[46] Not surprisingly, these 4 provinces account for 61 percent of total population (column 2, Table A1).

The remaining 19 provinces (i.e., more than 80 percent of the total number of provinces) are typically sparsely populated with an average population density similar to that of New Mexico and Kazakhstan (about 17 habitants per square mile).[47] Importantly for our purposes, these 19 provinces show a very high degree of heterogeneity in many aspects, including their levels of GDP per capita, productive structure, economic development, and social indicators. Some provinces like Catamarca, Chaco, Corrientes, Formosa, Jujuy, La Rioja, Misiones, and Santiago del Estero have had, historically, GDP per capita of about a half of the national average (column 3, Table A1), comparable to El Salvador, Guatemala, and Paraguay. In contrast, some provinces like Neuquén, Santa Cruz, and Tierra del Fuego have the highest

[45] We assume that $1 > \phi > 0.5$.

[46] In comparison, the state of California (the state with the largest GDP in the United States) accounts for only 13 percent of the United State's output.

[47] The average population density of the 4 main provinces (Buenos Aires, Cordoba, Santa Fe, and Mendoza) is about 5 times that of the remaining 19 provinces, and similar to that of the United States (about 82 habitants per square mile).

GDP per capita, of about twice the national average (column 3, Table A1), comparable to Cyprus, Spain, and Singapore.[48]

8.3.2 Over and under representation in National Congress

Perón's Constitutional reform of 1949 The provision of a minimum of two deputies per province was driven by political considerations at the national level and was not the result of particular province(s) with unusually strong preference for public spending successfully lobbying for more political representation and power. As discussed in Gibson and Calvo (2000), "a look at Peronism's evolution provides a sense of the centrality of its own peripheral coalition to the party's electoral viability and national governing capabilities...Peronism was much about a party shaped by federalism and regional power structures as it was by class conflict in the metropolis...Peronism's seeming invincibility at the polls [...] was due not to the organized labor in the metropolis, but to its ties to clientelistic and traditional networks of power and electoral mobilization in the periphery." Indeed, the provinces that benefited the most from this provision involved high income provinces like Chubut and Santa Cruz, poor ones like Formosa and La Rioja as well as a middle income province like Neuquén.[49] Regarding government spending per capita, Santa Cruz and Neuquén spent above the provincial average, Chubut and La Rioja around the provincial average, and Formosa below the average.[50] While normalizing provincial spending by income does affect the ranking just described, it does not change the finding about the heterogeneity of the provinces that benefitted from the provision.[51]

Military regime reform of 1983 The 5 provinces favored by the minimum of 5 deputies per province provision were Catamarca, La Pampa, La Rioja, San Luis, and Santa Cruz. Moreover, the 5 provinces that benefited are very heterogeneous, in terms of both income and spending per capita. Again, this clearly suggests that lobbying on the part of certain provinces was not behind these changes. Provinces that benefited comprised high income provinces like Santa Cruz, poor ones like Catamarca and La Rioja, as well as a middle income provinces like San Luis and La Pampa.[52] Regarding government spending per capita, Santa Cruz spent above the provincial average, Catamarca, La Pampa and La Rioja around the provincial average, and San Luis below the average.[53] While normalizing provincial spending

[48] Chubut, Neuquén, and Santa Cruz are important oil producers.

[49] We cannot reject the null (at the one percent level) that the average income per capita of the 5 provinces that benefited from the provision of a minimum of two deputies per province ($5,769) is the same as that of the provinces that did not benefit ($4,864).

[50] We cannot reject (at the one percent level) the null that the average spending per capita of the 5 provinces that benefited from the provision ($524) is the same as that of the provinces that did not benefit ($306).

[51] Again, we cannot reject (at the one percent level) the null that the average (normalized) spending per capita of the 5 provinces that benefited from the provision (10.4%) is the same as that of the provinces that did not benefit (7.1%).

[52] We cannot reject the null (at the one percent level) that the average income per capita of the 5 provinces that benefited from the provision of a minimum of 5 deputies per province ($7,184) is the same as that of the provinces that did not benefit ($7,405).

[53] Again, we cannot reject the null (at the one percent level) that the average spending per capita of the 5 provinces that benefited from the provision ($1,124) is the same as that of the provinces that did not benefit ($767).

by income does affect the ranking just described, it does not change the finding about the heterogeneity of benefited provinces.[54]

8.3.3 Absolute and effective distortion

Column 2 in Table A2 (Table A3), shows for each National Congress election – following each constitutional amendment modifying the structure of the Chamber of Deputies (Senators) – the absolute distortion per province in the Chamber of Deputies (Senators).

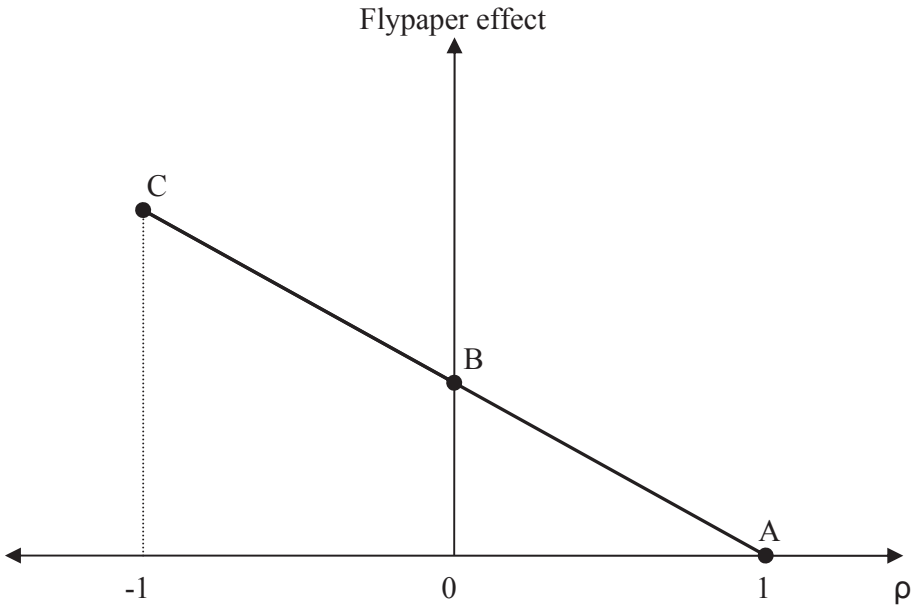
The absolute distortion is measured as the difference between the number of national legislators per jurisdiction including the provision(s) established in each reform and that based on proportional representation. For the Chamber of Deputies, the number of national deputies per jurisdiction based on proportional representation is calculated dividing the provincial population by the specific number of people per deputy officially updated after each national population census.[55] For the Chamber of Senators, the number of national senators per jurisdiction based on proportional representation is calculated by dividing the provincial population by the ratio of total country population to the total number of senators.[56] In column 3, we show the effective distortion per province, calculated as the ratio of the absolute distortion (column 2) to provincial population (column 1). This measure controls for the fact that, for a given level of absolute distortion, provinces with smaller population benefit on a per capita basis by a larger margin than more populous provinces.

[54] Again, we cannot reject (at the one percent level) the null that the average spending per capita of the 5 provinces that benefited from the provision (18.2%) is the same as that of those provinces that did not benefit (12.6%).

[55] For example, for the 1958 election, the specific number of people per deputy based on the 1947 national population census was established in 85,000. Based on this figure, Buenos Aires should have and indeed obtained 50 deputies (therefore its absolute distortion was zero). On the other hand, Santa Cruz should have obtained only one deputy, yet the provision included in the Perón's Constitutional reform of 1949 establishing a minimum of two deputies per province, regardless of population, gave Santa Cruz another "extra" deputy.

[56] For example, for the 1958 election, the Chamber of Senator had 46 members (2 senators per subnational elegible jurisdiction). Since the total population in the 1947 national census was 15.894 millions, the number of people per senator based on proportional representation would have been 345,521. Based on this principle, for example, the provinces of Buenos Aires and Santa Cruz would have received 12.37 and 0.12 senators. Instead they both received 2 senators, regardless of their population, which implied an absolute distortion of -10.37 (under-representation) and 1.88 (over-representation) for Buenos Aires and Santa Cruz, respectively. Since, by construction, the sum of absolute distortions across provinces is zero, we calculate the total absolute distotion by summing the absolute values of the absolute distortions for each province. Similar results are obtained if one represents the number of senators based on proportional representation rounding up (or down) to the next integer. Results are not shown for brevity.

Figure 1. Flypaper effect as a function of the correlation between private income and fiscal transfers (ρ).



Note: This plot assumes that the variances of private income and fiscal transfers are the same and that the initial share of fiscal transfers in total income is smaller than that of private income.

Figure 2. Flypaper effect evaluated at 50th pctl σ^2_y and 50th pctl σ^2_f and alternative values of ρ (1972-2006).

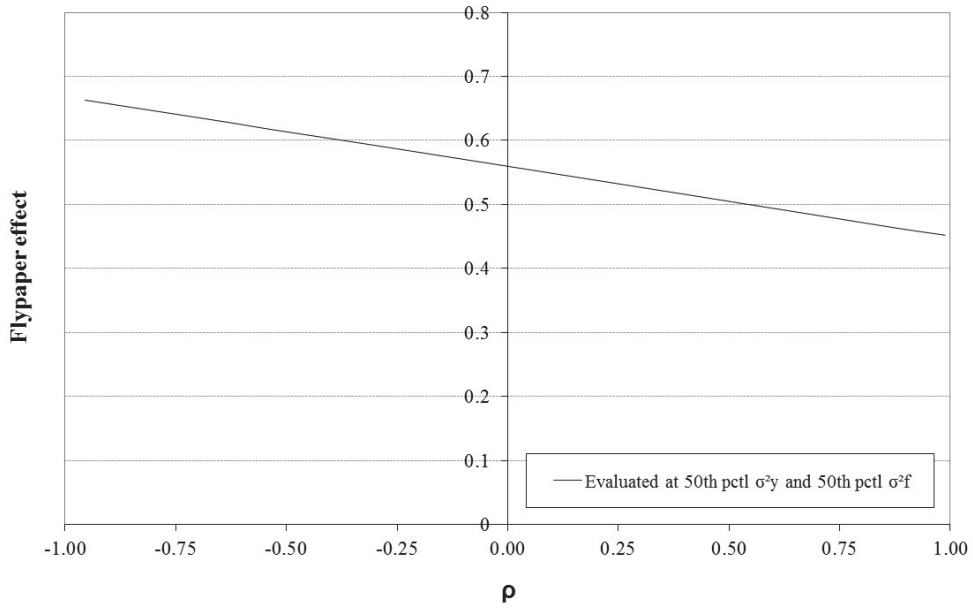


Figure 3. Flypaper effect evaluated at 50th pctl σ^2_f
and alternative values of ρ and σ^2_y (1972-2006).

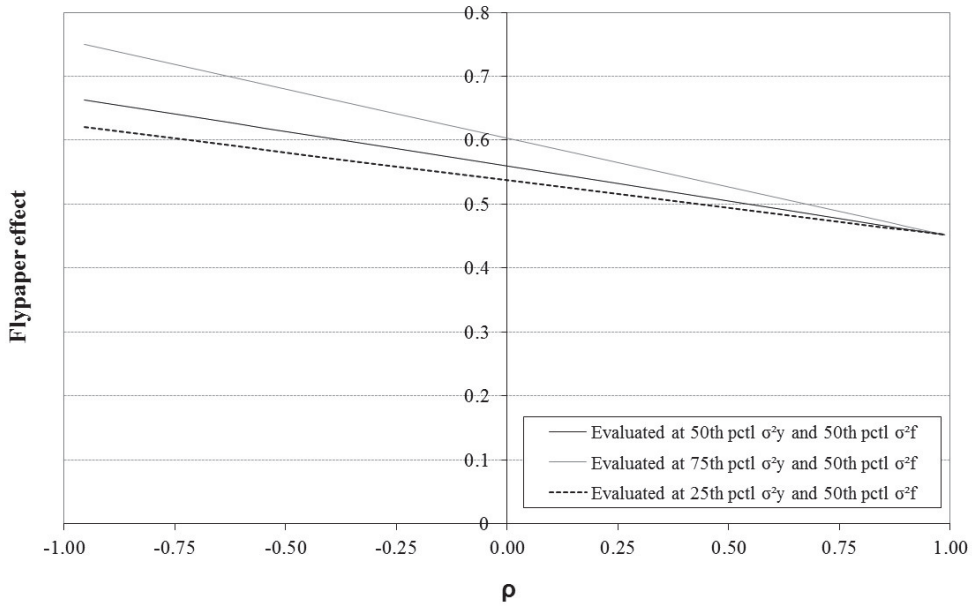


Figure 4. Differential public savings rate evaluated at 50th pctl σ^2_f and
alternative values of ρ and σ^2_y (1972-2006).

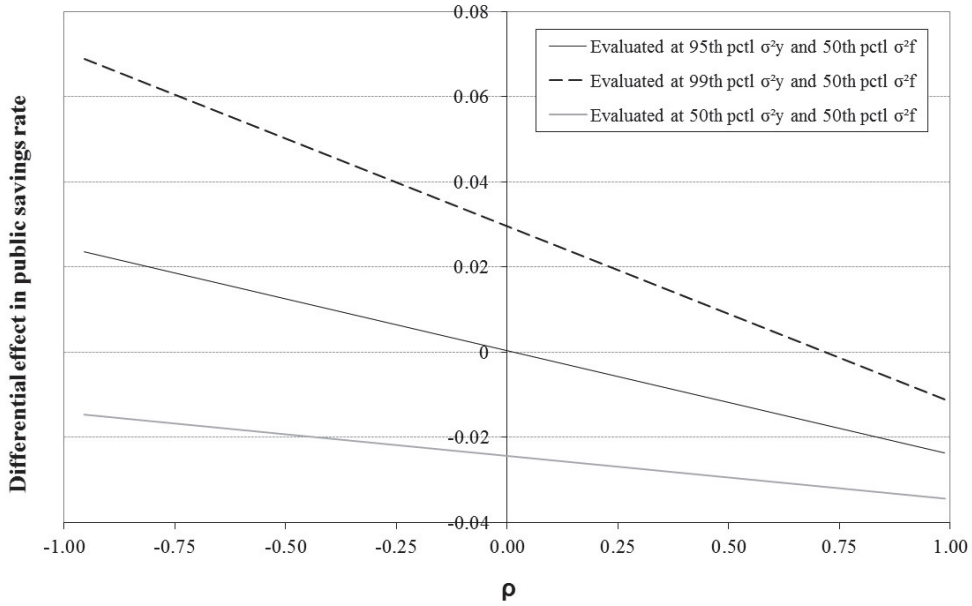


Table 1. Over-representation of Argentinean provinces at National Chambers of Deputies and Senators.

Jurisdiction	Population (in millions)				Deputies per capita			Senators per capita			
	census 1947	census 1970	census 1980	census 1991	1958 election	1973 election	1983 election	1958 election	1973 election	1983 election	1995 election
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(3d)
Buenos Aires	4.27	8.77	10.87	12.59	11.7	7.7	6.4	0.5	0.3	0.2	0.2
City of Buenos Aires	2.98	2.97	2.92	2.97	11.7	8.4	8.6	0.7	1.0	0.7	1.0
Catamarca	0.15	0.17	0.21	0.26	13.6	23.2	24.1	13.6	17.4	9.6	11.4
Chaco	0.43	0.57	0.70	0.84	11.6	12.4	10.0	4.6	5.3	2.9	3.6
Chubut	0.09	0.19	0.26	0.36	21.6	21.1	19.0	21.6	15.8	7.6	8.4
Cordoba	1.50	2.06	2.41	2.77	12.7	8.7	7.5	1.3	1.5	0.8	1.1
Corrientes	0.53	0.56	0.66	0.80	11.4	12.4	10.6	3.8	5.3	3.0	3.8
Entre Rios	0.79	0.81	0.91	1.02	11.4	11.1	9.9	2.5	3.7	2.2	2.9
Formosa	0.11	0.23	0.30	0.40	17.6	21.4	16.9	17.6	12.8	6.8	7.5
Jujuy	0.17	0.30	0.41	0.51	12.0	16.5	14.6	12.0	9.9	4.9	5.9
La Pampa	0.17	0.17	0.21	0.26	11.8	23.3	24.0	11.8	17.4	9.6	11.5
La Rioja	0.11	0.14	0.16	0.22	18.1	29.4	30.4	18.1	22.0	12.2	13.6
Mendoza	0.59	0.97	1.20	1.41	11.9	10.3	8.4	3.4	3.1	1.7	2.1
Misiones	0.25	0.44	0.59	0.79	12.2	13.5	11.9	8.1	6.8	3.4	3.8
Neuquen	0.09	0.15	0.24	0.39	23.0	25.9	20.5	23.0	19.4	8.2	7.7
Rio Negro	0.13	0.26	0.38	0.51	14.9	19.0	13.0	14.9	11.4	5.2	5.9
Salta	0.29	0.51	0.66	0.87	10.3	13.7	10.6	6.9	5.9	3.0	3.5
San Juan	0.26	0.38	0.47	0.53	11.5	15.6	12.9	7.7	7.8	4.3	5.7
San Luis	0.17	0.18	0.21	0.29	12.1	21.8	23.3	12.1	16.4	9.3	10.5
Santa Cruz	0.04	0.08	0.11	0.16	46.6	47.4	43.5	46.6	35.5	17.4	18.8
Santa Fe	1.70	2.14	2.47	2.80	11.7	8.9	7.7	1.2	1.4	0.8	1.1
Santiago del Estero	0.48	0.50	0.59	0.67	12.5	14.1	11.8	4.2	6.1	3.4	4.5
Tierra del Fuego*	0.01	0.02	0.03	0.07	0.0	127.7	73.1	0.0	0.0	0.0	43.2
Tucuman	0.59	0.77	0.97	1.14	11.8	11.7	9.3	3.4	3.9	2.1	2.6
Total† / Average ˣ	15.89†	23.36†	27.95†	32.62†	14.3ˣ	21.9ˣ	17.8ˣ	9.9ˣ	9.6ˣ	4.9ˣ	7.5ˣ

Notes: *National Territory until 1991. Tierra del Fuego did not have political representation in National Chamber of Deputies (Senators) until 1972 (1991). Deputies and Senators per capita are normalized, for presentational purposes, to per million people. The constitutional reforms of 1949, 1972, 1983, and 1994, first affected our sample in the 1958, 1973, 1983, and 1995 National Congress elections, respectively.

Table 2. Flypaper effect: Basic regressions (1963-2006).

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage
Dependent variable	Federal transfers	Provincial spending	Federal transfers	Provincial spending	Federal transfers	Provincial spending	Federal transfers	Provincial spending
				Panel A: primary coefficients				
y (coef. β_y)	-0.007*	0.061***	-0.001	0.063***	-0.002	0.063***	0.002	0.062***
	[0.003]	[0.012]	[0.006]	[0.013]	[0.006]	[0.012]	[0.006]	[0.012]
f (coef. β_f)		1.692***		1.696***		1.694***		1.636***
		[0.178]		[0.215]		[0.188]		[0.191]
population	-11.245	16.513	0.815	16.599	0.125	16.561	0.729	15.405
	[24.573]	[24.808]	[24.098]	[26.394]	[22.717]	[25.665]	[25.286]	[25.915]
pop. density	-2.556	-1.749	-2.624	-1.734	-2.310	-1.741	-3.021	-1.940
	[2.291]	[2.992]	[2.539]	[3.223]	[2.381]	[3.114]	[2.614]	[3.267]
urban population	14.336***	-13.336*	16.147***	-13.403**	15.282***	-13.373**	15.842***	-12.486**
	[3.724]	[7.260]	[3.853]	[6.177]	[3.859]	[6.604]	[3.802]	[5.772]
governor pre-electoral period	-27.459	-51.448	-57.163	-51.272	-44.114	-51.350	-53.599	-53.679
	[27.640]	[90.479]	[50.296]	[89.630]	[41.261]	[89.966]	[45.457]	[89.913]
PJ party governor	35.957	-19.207	39.430	-19.394	36.126	-19.311	51.909*	-16.832
	[31.265]	[77.163]	[34.023]	[79.519]	[30.710]	[78.429]	[29.214]	[80.120]
				Panel B: Instruments				
national deputy per capita	96.256***				60.570***		40.722**	
	[11.495]				[15.061]		[15.766]	
national senator per capita			182.889***		128.607*		-108.496	
			[58.941]		[70.346]		[78.674]	
national deputy per capita x national senator per capita							57.309***	
							[12.477]	
Flypaper effect observed:								
FP = β_f - β_y		1.6		1.6		1.6		1.6
F-test:								
Ho: FP = β_f - β_y = 0		90.58***		62.89***		82.34***		72.20***
Ho: FP = β_f - β_y = 1		13.50***		9.46***		12.33***		9.60***
Statistics:								
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster
Observations	1012	1012	1012	1012	1012	1012	1012	1012
Provinces	23	23	23	23	23	23	23	23
R^2	0.23	0.33	0.25	0.33	0.28	0.33	0.32	0.35
Excluded instrument F-test	70.12***		9.63***		32.12***		155.85***	
Overidentification J-test		.		.		0.973		0.489

Notes: y and f stand for income and fiscal transfers per capita, respectively. R^2 corresponds to within R^2. Constant term is not reported. Standard errors are in square brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Flypaper effect: Alternative source of identifying variation (1963-2006).

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage	IV. First stage	IV. Second stage
Dependent variable	Federal transfers	Provincial spending	Federal transfers	Provincial spending	Federal transfers	Provincial spending	Federal transfers	Provincial spending
				Panel A: primary coefficients				
y (coef. β_y)	-0.011***	0.065***	-0.004	0.063***	-0.008	0.065***	-0.005	0.065***
	[0.003]	[0.013]	[0.005]	[0.013]	[0.005]	[0.013]	[0.004]	[0.013]
f (coef. β_f)		1.946***		1.684***		1.866***		1.911***
		[0.223]		[0.323]		[0.229]		[0.179]
population	-9.087	21.581	-4.879	16.355	-2.840	19.989	-0.165	20.873
	[23.570]	[28.062]	[24.645]	[26.979]	[21.833]	[27.527]	[22.768]	[28.663]
pop. density	-2.357	-0.875	-2.829	-1.776	-2.229	-1.149	-2.332	-0.997
	[2.292]	[3.387]	[2.536]	[3.263]	[2.328]	[3.307]	[2.403]	[3.466]
urban population	14.522***	-17.231**	16.294***	-13.215**	15.218***	-16.008**	15.459***	-16.687**
	[3.733]	[8.528]	[3.860]	[6.512]	[3.868]	[7.694]	[3.887]	[7.270]
governor pre-electoral period	-23.919	-41.232	-47.264	-51.765	-31.017	-44.440	-35.162	-42.658
	[25.746]	[84.284]	[41.557]	[89.012]	[30.374]	[85.753]	[31.343]	[85.939]
PJ party governor	33.995	-30.085	32.684	-18.869	30.096	-26.669	30.511	-28.567
	[31.542]	[81.042]	[40.696]	[79.639]	[30.406]	[80.219]	[33.165]	[82.207]
				Panel B: Instruments				
effective distortion in national chamber of deputies	6.546***				5.271***		4.896***	
	[0.938]				[1.183]		[1.169]	
effective distortion in national chamber of senators			9.719***		5.396		-3.622	
			[3.143]		[3.947]		[5.327]	
effective distortion in national chamber of deputies x effective distortion in national chamber of senators							0.185**	
							[0.072]	
Flypaper effect observed:								
FP = β_f - β_y		1.9		1.6		1.8		1.8
F-test:								
Ho: FP = β_f - β_y = 0		74.89***		26.65***		66.13***		117.01***
Ho: FP = β_f - β_y = 1		16.43***		3.91**		13.10***		24.57***
Statistics:								
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster	robust and cluster
Observations	1012	1012	1012	1012	1012	1012	1012	1012
Provinces	23	23	23	23	23	23	23	23
R^2	0.22	0.20	0.19	0.33	0.24	0.25	0.25	0.22
Excluded instrument F-test	48.64***		9.56***		44.69***		51.01***	
Overidentification J-test						1.065		2.580

Notes: y and f stand for income and fiscal transfers per capita, respectively. R^2 corresponds to within R^2. Constant term is not reported. Standard errors are in square brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Correlation between the cyclical components of income and fiscal transfers, income volatility, and fiscal transfers volatility (1972-2006).

	ρ			σ^2_y			σ^2_f		
	5 percentile	median	95 percentile	5 percentile	median	95 percentile	5 percentile	median	95 percentile
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Buenos Aires	-0.53	0.56	0.99	0.004	0.013	0.057	0.047	0.166	0.470
Catamarca	-0.64	-0.23	0.74	0.005	0.033	0.332	0.017	0.189	0.456
Chaco	-0.71	0.13	0.72	0.027	0.067	0.188	0.020	0.152	0.479
Chubut	-0.56	0.34	0.90	0.005	0.018	0.066	0.057	0.149	0.267
Córdoba	-0.14	0.68	0.93	0.008	0.014	0.063	0.033	0.184	0.439
Corrientes	-0.92	-0.23	0.88	0.006	0.013	0.077	0.024	0.138	0.220
Entre Ríos	-0.87	-0.20	0.91	0.002	0.023	0.091	0.021	0.150	0.550
Formosa	-0.62	0.04	0.76	0.011	0.056	0.325	0.013	0.136	0.272
Jujuy	-0.76	0.04	0.94	0.008	0.021	0.050	0.048	0.182	0.561
La Pampa	-0.45	0.07	0.95	0.014	0.026	0.066	0.028	0.128	0.331
La Rioja	-0.82	0.10	0.97	0.020	0.072	0.326	0.090	0.409	0.765
Mendoza	-0.42	0.34	0.73	0.003	0.031	0.045	0.035	0.257	0.610
Misiones	-0.40	0.14	0.93	0.008	0.047	0.081	0.033	0.105	0.207
Neuquén	-0.60	0.01	0.70	0.014	0.034	0.117	0.044	0.155	0.408
Río Negro	-0.66	-0.37	0.93	0.005	0.012	0.026	0.036	0.142	0.490
Salta	-0.60	-0.15	0.88	0.003	0.015	0.040	0.022	0.149	0.441
San Juan	-0.42	-0.08	0.88	0.012	0.032	0.107	0.027	0.197	0.442
San Luis	-0.65	-0.03	0.79	0.007	0.046	0.439	0.009	0.146	0.535
Santa Cruz	-0.74	-0.19	0.88	0.014	0.034	0.082	0.048	0.212	0.714
Santa Fe	-0.49	0.09	0.95	0.003	0.014	0.049	0.023	0.168	0.388
Santiago del Estero	-0.82	-0.15	0.89	0.026	0.053	0.085	0.024	0.189	0.630
Tierra del Fuego	-0.70	-0.10	0.35	0.009	0.160	0.579	0.037	0.520	0.815
Tucumán	-0.35	0.63	0.90	0.006	0.029	0.092	0.021	0.130	0.449
Average	-0.60	0.06	0.85	0.010	0.038	0.147	0.033	0.189	0.476
Min	-0.92	-0.37	0.35	0.002	0.012	0.026	0.009	0.105	0.207
Max	-0.14	0.68	0.99	0.027	0.160	0.579	0.090	0.520	0.815

Notes: ρ stands for the correlation between the cyclical components of income and fiscal transfers. σ^2_y and σ^2_f stand for the variance of the cyclical component of income and fiscal transfers, respectively. In all cases, we use a 10-year rolling window. For presentational convenience, we normalize σ^2_y and σ^2_f to lie between 0 and 1.

Table 5. Flypaper effect: Insurance arguments (1972-2006).

Dependent variable		Provincial spending		Provincial public savings rate	
		Second stage	Expected sign	Second stage	Expected sign
		(1)	(2)	(3)	(4)
y	(coef. β_y)	0.050**		0.0022***	
		[0.022]		[0.0005]	
f	(coef. β_f)	0.584***		0.0362***	
		[0.145]		[0.0114]	
$\rho \bullet y$	(coef. α_1)	0.037***	-	-0.0002	+
		[0.011]		[0.0005]	
$\rho \bullet f$	(coef. α_2)	-0.087	-	0.0179	+
		[0.285]		[0.0142]	
$\sigma_y^2 \bullet y$	(coef. α_3)	0.104**	+/-	-0.0003	+/-
		[0.045]		[0.0041]	
$\sigma_y^2 \bullet f$	(coef. α_4)	1.984*	+/-	-0.2187***	+/-
		[1.051]		[0.0704]	
$\sigma_f^2 \bullet y$	(coef. α_5)	-0.014	+/-	0.0005	+/-
		[0.029]		[0.0014]	
$\sigma_f^2 \bullet f$	(coef. α_6)	-0.147	+/-	-0.0353*	+/-
		[0.185]		[0.0198]	
$\sigma_y^2 \bullet \rho \bullet y$	(coef. α_7)	-0.291***	-	0.0060	+
		[0.088]		[0.0039]	
$\sigma_y^2 \bullet \rho \bullet f$	(coef. α_8)	-2.025	-	-0.2308	+
		[3.206]		[0.2406]	
$\sigma_f^2 \bullet \rho \bullet y$	(coef. α_9)	-0.108**	-	-0.0042	+
		[0.042]		[0.0029]	
$\sigma_f^2 \bullet \rho \bullet f$	(coef. α_{10})	0.267	-	-0.0645*	+
		[0.851]		[0.0333]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet y$	(coef. α_{11})	-0.264**	+/-	-0.0044	+/-
		[0.105]		[0.0135]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet f$	(coef. α_{12})	-1.342	+/-	0.5217***	+/-
		[1.922]		[0.1379]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet \rho \bullet y$	(coef. α_{13})	0.910***	-	-0.0090	+
		[0.287]		[0.0234]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet \rho \bullet f$	(coef. α_{14})	1.002	-	0.6141	+
		[4.896]		[0.3868]	
Statistics:					
Province fixed effect		Yes		Yes	
Year fixed effect		Yes		Yes	
Standard errors		robust and cluster		robust and cluster	
Controls		Yes		Yes	
Observations		805		805	
Provinces		23		23	
R^2		0.52		0.20	

Notes: The dependent variables in columns 1 and 3 are the provincial government spending per capita (g) and provincial public savings rate, respectively. y and f stand for income and fiscal transfers per capita, respectively. R^2 corresponds to within R^2. Constant and interaction terms ρ, σ_y^2, σ_f^2, $\sigma_f^2 \bullet \sigma_y^2$, $\sigma_y^2 \bullet \rho$, $\sigma_f^2 \bullet \rho$, and $\sigma_f^2 \bullet \sigma_y^2 \bullet \rho$ are not reported. Population, population density, urban population, governor pre-electoral year, and PJ party governor dummy are not reported either. Columns "expected sign" indicate the signs of the derivatives obtained in the theoretical model. Standard errors are in square brackets. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A1. Economic, demographic, and fiscal indicators.
Historical averages for Argentinean provinces (1963-2006).

	Provincial GDP (as % of Argentinean GDP)	Population (as % of Argentinean population)	Real income per capita	Real spending per capita	Real fiscal transfers per capita	Fiscal transfers (as % of expenditures)
	(1)	(2)	(3)	(4)	(5)	(6)
Buenos Aires	34.2	39.0	6,405	472	189	40.0
Catamarca	0.5	0.8	3,497	1,170	883	75.4
Chaco	1.1	2.7	2,598	733	525	71.6
Chubut	1.8	1.0	12,614	1,192	582	48.8
Córdoba	7.3	8.9	5,910	611	288	47.2
Corrientes	1.5	2.6	4,094	662	485	73.4
Entre Ríos	2.5	3.5	5,121	700	436	62.2
Formosa	0.5	1.2	2,507	1,088	794	73.0
Jujuy	0.9	1.5	4,064	879	565	64.2
La Pampa	0.9	0.8	7,504	1,221	739	60.5
La Rioja	0.5	0.7	3,972	1,486	1,113	74.9
Mendoza	3.4	4.4	5,575	666	324	48.7
Misiones	1.2	2.3	3,375	602	425	70.6
Neuquén	2.0	1.0	13,011	1,659	625	37.7
Río Negro	1.5	1.4	7,499	1,056	565	53.5
Salta	1.6	2.6	4,186	714	442	61.9
San Juan	1.0	1.7	3,840	879	610	69.4
San Luis	1.1	0.9	8,621	989	739	74.7
Santa Cruz	0.9	0.4	13,654	2,825	1,264	44.8
Santa Fe	9.2	9.1	7,458	617	305	49.4
Santiago del Estero	0.9	2.2	2,448	694	552	79.6
Tierra del Fuego	0.4	0.2	18,675	3,148	1,583	50.3
Tucumán	2.6	3.7	4,997	605	392	64.8
Average	3.4	4.0	6,592	1,073	627	60.7
Min	0.4	0.2	2,448	472	189	37.7
Max	34.2	39.0	18,675	3,148	1,583	79.6

Table A2. Over-representation of Argentinean provinces in National Chamber of Deputies.

Jurisdiction	Population (in millions)			Absolute distortion			Effective distortion		
	census 1947	census 1970	census 1980	1958 election	1973 election	1983 election	1958 election	1973 election	1983 election
	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
Buenos Aires	4.27	8.77	10.87	0	3	3	0	0.3	0.3
City of Buenos Aires	2.98	2.97	2.92	0	3	7	0	1.0	2.4
Catamarca	0.15	0.17	0.21	0	3	4	0	17.4	19.3
Chaco	0.43	0.57	0.70	0	3	3	0	5.3	4.3
Chubut	0.09	0.19	0.26	1	3	3	10.8	15.8	11.4
Cordoba	1.50	2.06	2.41	0	3	3	0	1.5	1.2
Corrientes	0.53	0.56	0.66	0	3	3	0	5.3	4.5
Entre Rios	0.79	0.81	0.91	0	3	3	0	3.7	3.3
Formosa	0.11	0.23	0.30	1	3	3	8.8	12.8	10.1
Jujuy	0.17	0.30	0.41	0	3	3	0	9.9	7.3
La Pampa	0.17	0.17	0.21	0	3	4	0	17.4	19.2
La Rioja	0.11	0.14	0.16	1	3	4	9.0	22.0	24.4
Mendoza	0.59	0.97	1.20	0	3	3	0	3.1	2.5
Misiones	0.25	0.44	0.59	0	3	3	0	6.8	5.1
Neuquen	0.09	0.15	0.24	1	3	3	11.5	19.4	12.3
Rio Negro	0.13	0.26	0.38	0	3	3	0	11.4	7.8
Salta	0.29	0.51	0.66	0	3	3	0	5.9	4.5
San Juan	0.26	0.38	0.47	0	3	3	0	7.8	6.4
San Luis	0.17	0.18	0.21	0	3	4	0	16.4	18.7
Santa Cruz	0.04	0.08	0.11	1	3	4	23.3	35.5	34.8
Santa Fe	1.70	2.14	2.47	0	3	4	0	1.4	1.6
Santiago del Estero	0.48	0.50	0.59	0	3	3	0	6.1	5.0
Tierra del Fuego*	0.01	0.02	0.03	0	2	2	0	127.7	73.1
Tucuman	0.59	0.77	0.97	0	3	3	0	3.9	3.1
Total	15.89	23.36	27.95	5	71	81	63.5	357.9	282.7

Notes: *National Territory until 1991. Tierra del Fuego did not have political representation in National Chamber of Deputies until 1972. Absolute distortion (column 2) is measured as the difference between the number of national deputies per jurisdiction including the provision(s) established in each reform and that based on proportional representation. To compute the number of national deputies per province based on proportional representation for the 1949, 1972, and 1983 Constitutional reforms, we divided the provincial population in the 1947, 1970, and 1980 national population census by 85,000, 135,000, 161,000, respectively. The effective distortion (column 3) is computed as the ratio of the absolute distortion (column 2) to population (column 1).

Table A3. Over-representation of Argentinean provinces in National Chamber of Senators.

Jurisdiction	Population (in millions)				Absolute distortion				Effective distortion			
	census 1947	census 1970	census 1980	census 1991	1958 election	1973 election	1983 election	1995 election	1958 election	1973 election	1983 election	1995 election
	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)	(2c)	(2d)	(3a)	(3b)	(3c)	(3d)
Buenos Aires	4.27	8.77	10.87	12.59	-10.37	-22.91	-15.88	-24.80	-2.43	-2.6	-1.5	-2.0
City of Buenos Aires	2.98	2.97	2.92	2.97	-6.63	-5.78	-2.81	-3.55	-2.22	-1.9	-1.0	-1.2
Catamarca	0.15	0.17	0.21	0.26	1.57	2.49	1.66	2.42	10.69	14.5	8.0	9.1
Chaco	0.43	0.57	0.70	0.84	0.75	1.33	0.85	1.15	1.75	2.3	1.2	1.4
Chubut	0.09	0.19	0.26	0.36	1.73	2.44	1.57	2.21	18.74	12.8	6.0	6.2
Cordoba	1.50	2.06	2.41	2.77	-2.34	-3.08	-1.96	-3.11	-1.56	-1.5	-0.8	-1.1
Corrientes	0.53	0.56	0.66	0.80	0.48	1.33	0.91	1.24	0.91	2.4	1.4	1.6
Entre Rios	0.79	0.81	0.91	1.02	-0.28	0.60	0.50	0.75	-0.35	0.7	0.6	0.7
Formosa	0.11	0.23	0.30	0.40	1.67	2.31	1.51	2.12	14.68	9.9	5.1	5.3
Jujuy	0.17	0.30	0.41	0.51	1.52	2.11	1.33	1.87	9.10	7.0	3.2	3.6
La Pampa	0.17	0.17	0.21	0.26	1.51	2.49	1.66	2.43	8.91	14.5	8.0	9.3
La Rioja	0.11	0.14	0.16	0.22	1.68	2.60	1.73	2.51	15.17	19.1	10.5	11.4
Mendoza	0.59	0.97	1.20	1.41	0.30	0.13	0.03	-0.12	0.51	0.1	0.0	-0.1
Misiones	0.25	0.44	0.59	0.79	1.29	1.69	1.03	1.26	5.22	3.8	1.7	1.6
Neuquen	0.09	0.15	0.24	0.39	1.75	2.54	1.60	2.14	20.11	16.5	6.6	5.5
Rio Negro	0.13	0.26	0.38	0.51	1.61	2.22	1.37	1.88	11.99	8.5	3.6	3.7
Salta	0.29	0.51	0.66	0.87	1.16	1.49	0.91	1.09	3.98	2.9	1.4	1.3
San Juan	0.26	0.38	0.47	0.53	1.24	1.87	1.23	1.83	4.76	4.9	2.6	3.5
San Luis	0.17	0.18	0.21	0.29	1.52	2.46	1.65	2.37	9.19	13.4	7.7	8.3
Santa Cruz	0.04	0.08	0.11	0.16	1.88	2.75	1.81	2.65	43.75	32.6	15.8	16.6
Santa Fe	1.70	2.14	2.47	2.80	-2.93	-3.31	-2.06	-3.18	-1.72	-1.5	-0.8	-1.1
Santiago del Estero	0.48	0.50	0.59	0.67	0.61	1.54	1.02	1.52	1.28	3.1	1.7	2.3
Tierra del Fuego*	0.01	0.02	0.03	0.07	0.00	0.00	0.00	2.85	0.00	0.0	0.0	41.0
Tucuman	0.59	0.77	0.97	1.14	0.28	0.74	0.40	0.48	0.48	1.0	0.4	0.4
Total	15.89	23.36	27.95	32.62	45.09ˣ	70.21ˣ	45.48ˣ	69.51ˣ	189.50ˣ	177.43ˣ	89.47ˣ	138.27ˣ

Notes: *National Territory until 1991. Tierra del Fuego did not have political representation in National Chamber of Senators until it became province in 1991. Absolute distortion (column 2) is measured as the difference between the number of national senators per jurisdiction established in each reform and that based on proportional representation. To compute the number of national senators per province based on proportional representation we divided the provincial population by the ratio of total country population to the total number of senators. The total number of senators were 46, 69, 46, and 72 after the 1949, 1972, 1983, and 1994 Constitutional reforms, respectively. The effective distortion (column 3) is calculated as the ratio of the absolute distortion (column 2) to population (column 1). Total absolute and effective distortions (indicated by ˣ) are computed by summing the absolute values of the respective distortions for each province.