Unsticking the flypaper effect in an uncertain world*

Carlos Vegh
Johns Hopkins University and NBER

Guillermo Vuletin
Brookings Institution

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Abstract

We provide a novel explanation for the flypaper effect based on insurance arguments. In particular, 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 for Argentinean provinces supports these hypotheses and shows that the proposed mechanism explains about 12 percent of the overall flypaper effect observed.

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> "*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's utility is maximized 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 citizen's 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 model of citizen fiscal choice might be misspecified because either 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), he/she is not fully informed and fails to see the public budget (Filimon et al, 1982) or, even when fully informed, he/she 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 (a *differential volatility effect*) and (ii) how precautionary savings react to the change in the variance of total income (a *precautionary savings effect*).

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 (i.e., the differential volatility effect is zero), 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

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

stochastic structure is such that fiscal transfers do not provide any insurance.

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 it.[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 the fact that two non-perfectly correlated sources of income affect the variance of total income differently and thus lead to differential reactions of precautionary savings and hence of government spending. The only key friction is the assumption of incomplete markets.[3]

To fix ideas, we have considered the case of zero correlation. But an analogous argument holds for any positive or negative value of ρ as long as it is smaller than one. Figure 1 illustrates this idea by plotting the flypaper effect against ρ. As discussed above, when $\rho = 1$, the flypaper effect is zero (point A). For any other value of ρ, the flypaper is positive. The case of zero correlation would correspond to point B. Furthermore, as the figure shows, the flypaper effect is a decreasing function of ρ. Intuitively, as the correlation increases, the two sources of income become more similar in terms of risk (i.e., insurance falls). As they become more similar, the difference in how precautionary savings react becomes smaller and hence the flypaper effect becomes smaller.

In addition to offering a new theoretical take on the flypaper effect, our model yields two testable empirical implications:

[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.

[3] As casual observation suggests and Kose (2009) *et al* formally show, markets are more incomplete in developing than industrial countries.

1. The flypaper effect is a decreasing function of the correlation between private income and federal transfers (as just discussed above).[4]

2. The effect of the correlation on the flypaper effect becomes stronger the higher is the volatility of private income and/or transfers. In terms of Figure 1, we can imagine the curve pivoting around point A and shifting outward. Intuitively, the role of ρ on the differential volatility effect and precautionary savings becomes smaller as variances become smaller. If variances are close to zero, the correlation coefficient plays no role and the curve in Figure 1 would almost coincide with the horizontal axis.

We test the 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 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 (including political structure, economic and demographic geography, and fiscal federalism) 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 Theoretical contribution: Insurance argument

The flypaper effect literature has traditionally relied on a standard one-period model to illustrate the flypaper effect as an anomaly (e.g., Henderson, 1968; Gramlich, 1969; Knight, 2002; Inman, 2008). The representative citizen (RC) maximizes her utility which depends upon 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.[5] Defining the flypaper effect (FP) as

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

[4] While we have described the basic intuition assuming equal variances, this theoretical implication does not require such an assumption.

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

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, it follows that $FP = 0$.[6] 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.

We contribute to the flypaper effect literature by offering a new theoretical explanation based on macroeconomic insurance arguments. For this purpose, we use a two-period model under the presence of uncertainty and incomplete markets.[7] We first discuss the stochastic structure of income (see Section 2.1) and some basic portfolio theory implications regarding the impact of income shocks on the volatility of total income (see Section 2.2). We then solve the model obtaining a reduced-form expression for the flypaper effect. In the presence of incomplete markets, our simple model can rationalize a positive flypaper effect (see Section 2.3). The model also generates some key theoretical implications that will allow us to take our model to the data (see Section 2.4).

2.1 Stochastic structure of income

We assume that there is no uncertainty in the first period and private income and fiscal transfers are given by y_1 and f_1, respectively. Private income and fiscal transfers are uncertain in the second period. Specifically, we assume that

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

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

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

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

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 private income and fiscal transfer shock, respectively. In order to evaluate the effects of a private income and a fiscal transfer shock, we define 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. The parameter ρ is the correlation between ε_y and ε_f. If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} = 0$, then

[6] Please see online appendix for the derivations.

[7] It is straightforward to show that the flypaper puzzle also remains in a two-period model under certainty or uncertainty with complete markets. See online appendix for the derivations.

the income structure characterized by (2)-(5) would be that of certainty.

In this context, we define a private income shock as consisting in an increase in s_y such that $\triangle y_1 = \triangle E[y_2] = 1$ (i.e., $s_y = 1$), while a fiscal transfer shock consists in 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.[8] This structure of shocks allows us to keep constant the coefficient of variation before and after the shock.[9] This is a desirable feature as it maintains constant the relative volatility of private income and fiscal transfers before and after the shock.

We also assume 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 one 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.[10] Henceforth, we will assume that $1 > \phi > 0.5$, which is equivalent to assuming that $\overline{y} > \overline{f}$.

2.2 Portfolio theory implications: Differential volatility effect

We now discuss some stochastic properties of the income portfolio in period 2.[11] Recall that total income in period 2 is given $y_2 + f_2$. Let $\sigma^2_{y_2+f_2}$ denote the variance of total income in period 2. Further, let $\triangle(\sigma^2_{y_2+f_2})^f$ and $\triangle(\sigma^2_{y_2+f_2})^y$ denote the change in $\sigma^2_{y_2+f_2}$ as a result of a fiscal transfer shock and private income shock, respectively. We now define the *differential volatility effect* (DVE) as

$$DVE \equiv \triangle(\sigma^2_{y_2+f_2})^y - \triangle(\sigma^2_{y_2+f_2})^f. \tag{8}$$

The DVE thus captures the different effect that a fiscal transfer shock may have on the variance of total income ($\sigma^2_{y_2+f_2}$) compared to a private income shock. It captures the differential

[8] 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). Our main results would not change if shocks were assumed to be temporary in a multi-period or infinite horizon framework.

[9] 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 $cv_{f_2} = \sigma_{\varepsilon_f}$.

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

[11] Naturally, this analysis does not apply to period 1 because there is no uncertainty.

effect on total income's volatility when both shocks are present.

Taking into account (2)-(7), we can derive the following stochastic properties of the income portfolio:

$$\sigma_{y_2}^2 = (\phi\overline{x} + s_y)^2 \sigma_{\varepsilon_y}^2, \tag{9}$$

$$\sigma_{f_2}^2 = [(1-\phi)\,\overline{x} + s_f]^2 \sigma_{\varepsilon_f}^2, \tag{10}$$

$$\rho_{y_2,f_2} = \rho, \tag{11}$$

$$\sigma_{y_2+f_2}^2 = \sigma_{y_2}^2 + \sigma_{f_2}^2 + 2\rho_{y_2,f_2}\sigma_{y_2}\sigma_{f_2}, \tag{12}$$

where $\sigma_{y_2}^2$ and $\sigma_{f_2}^2$ are the variances of private income and fiscal transfer in period 2, respectively, and ρ_{y_2,f_2} is the correlation between y_2 and f_2. From (9) and (10), it is clear that if, for example, $\sigma_{\varepsilon_y}^2 = \sigma_{\varepsilon_f}^2$, a private income shock (i.e., $s_y = 1$) increases $\sigma_{y_2}^2$ by more than an equivalent fiscal transfer shock (i.e., $s_f = 1$) increases $\sigma_{f_2}^2$. This occurs because $\overline{y} > \overline{f}$ or, alternatively, $1 > \phi > 0.5$. If, in addition, $\rho = 0$, this difference would also imply that $\sigma_{y_2+f_2}^2$ increases by more for a private income shock than for an equivalent fiscal transfer shock (see equation (12)). Hence, from equation (8), $DVE > 0$.

Intuitively, both shocks increase $\sigma_{y_2+f_2}^2$ because the increase in resources available does not occur with certainty, but rather in expected value terms. In other words, the overall risk of the income portfolio increases with each shock. However, while a private income shock increases the relative importance or weight of private income in total income from $\bar{y}/(\bar{y}+\bar{f})$ to $(\bar{y}+1)/(\bar{y}+\bar{f}+1)$, a fiscal transfer shock reduces such weight from $\bar{y}/(\bar{y}+\bar{f})$ to $\bar{y}/(\bar{y}+\bar{f}+1)$. As a result, a fiscal transfer shock increases $\sigma_{y_2+f_2}^2$ by less than a private income shock. In portfolio theory terms, an increase in private income reduces diversification while a rise in fiscal transfers increases it. Moreover, if both shocks are present, diversification increases because the share of private income falls from $\bar{y}/(\bar{y}+\bar{f})$ to $(\bar{y}+1)/(\bar{y}+\bar{f}+2)$ (recall that, by assumption, $\bar{f} < \bar{y}$).

Formally, we can use equations (9)-(12) to compute a reduced-form expression for DVE:

$$DVE = (1+B)\,\sigma_{\varepsilon_y}^2 - (1+\alpha B)\sigma_{\varepsilon_f}^2 - (1-\alpha)B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho. \tag{13}$$

where $B \equiv 2\phi\overline{x} > 0$ and $\alpha \equiv (1-\phi)/\phi \in (0,1)$ under our maintained assumption that $1 > \phi > 0.5$ (i.e., $\overline{y} > \overline{f}$). If $DVE > 0$, the private income shock increases total income's volatility by more than the fiscal transfers. The converse is true if $DVE < 0$.

Two important implications follow:

1. The DVE is a decreasing function of ρ. From (13), we obtain

$$\frac{dDVE}{d\rho} = -(1-\alpha)B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0. \tag{14}$$

Since $\alpha \in (1,0)$, as ρ decreases (increases), $\sigma^2_{y_2+f_2}$ decreases (increases) by a larger magnitude in response to a fiscal transfer shock than in response to a private income shock. Intuitively, as ρ increases, the impact of the fall in the share of private income (i.e., an increase in diversification) decreases because the stochastic structure has become more similar.

2. The effect $dDVE/d\rho$ is, in absolute value, an increasing function of the volatility of $\sigma^2_{\varepsilon_y}$ and/or $\sigma^2_{\varepsilon_f}$. From (14), we obtain

$$\frac{d^2(DVE)}{d\rho d\sigma_{\varepsilon_f}} = -(1-\alpha)B\sigma_{\varepsilon_y} < 0, \tag{15}$$

$$\frac{d^2(DVE)}{d\rho d\sigma_{\varepsilon_y}} = -(1-\alpha)B\sigma_{\varepsilon_f} < 0, \tag{16}$$

$$\frac{d^3(DVE)}{d\rho d\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}} = -(1-\alpha)B < 0. \tag{17}$$

Intuitively, for a higher volatility, the impact of diversification, and hence DVE, decrease as ρ increases.

Having characterized the properties of the income portfolio, we now turn to the optimization problem faced by the RC under incomplete markets.

2.3 Solution to the model

RC's preferences are given by

$$\begin{aligned} W &= u(c_1) + v(g_1) \\ &+\beta \iint p\left(\varepsilon_y, \varepsilon_f\right)\left(u(c_2\left(\varepsilon_y, \varepsilon_f\right)) + v(g_2\left(\varepsilon_y, \varepsilon_f\right))\right) d\varepsilon_y d\varepsilon_f, \end{aligned} \tag{18}$$

where $p\left(\varepsilon_y, \varepsilon_f\right)$ is the joint density distribution of ε_y and ε_f. This is a small open economy perfectly integrated into world goods and capital markets. To abstract from consumption tilting, we will assume that $\beta = 1/\left(1+r\right)$, where $\beta > 0$ is the discount factor and $r > 0$ is the world real interest rate. We assume that preferences are given by constant absolute risk aversion (CARA) functions $u\left(c\right) = -e^{-c}$ and $v\left(g\right) = -(1/\theta)e^{-\theta g}$.[12]

[12] The CARA function has two key properties in the presence of uncertainty and incomplete markets. First, it belongs to a family of utility functions for which the third derivative is positive; this property is key to

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

$$y_1 + f_1 + \frac{y_2(\varepsilon_y) + f_2(\varepsilon_f)}{1+r} = (g_1 + c_1) + \frac{c_2(\varepsilon_y, \varepsilon_f) + g_2(\varepsilon_y, \varepsilon_f)}{1+r}. \tag{19}$$

The RC chooses c_1, $c_2(\varepsilon_y, \varepsilon_f)$, g_1, and $g_2(\varepsilon_y, \varepsilon_f)$ to maximize (18) subject to constraint (19). Solving the model, we obtain[13]

$$\frac{c_1}{\theta} = g_1 = \frac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) - \frac{1}{1+\theta}PS, \tag{20}$$

$$\frac{E[c_2]}{\theta} = E[g_2] = \frac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) + (1+r)\frac{1}{1+\theta}PS, \tag{21}$$

$$PS = A\sigma^2_{y_2+f_2}, \tag{22}$$

where $A \equiv \theta/(2(2+r)(1+\theta)) > 0$ and PS stands for precautionary savings.[14]

Expressions (20) and (21) show that, as we would expect, part of the resources allocated to consumption and government spending depends upon the resources available. This is captured by the first term on the right-most side of expressions (20) and (21). As in the one-period model used in this literature, this typical income effect is incapable of explaining the flypaper effect. However, and as captured by the second term on the right-most side of expressions (20) and (21), consumption and government spending also depend on precautionary savings. If $PS = 0$, then the incomplete markets solution would coincide with the certainty case and the uncertain case with complete markets. If $PS > 0$ ($PS < 0$), then consumption and government spending in period 1 would be smaller (bigger) than the corresponding figures for period 2, measured in expected value terms.

Equation (22) makes clear that, as one would expect, PS is a monotonically increasing function of $\sigma^2_{y_2+f_2}$. That is to say,

$$\triangle PS^f = A\triangle\left(\sigma^2_{y_2+f_2}\right)^f, \tag{23}$$

$$\triangle PS^y = A\triangle\left(\sigma^2_{y_2+f_2}\right)^y, \tag{24}$$

where $\triangle PS^f$ and $\triangle PS^y$ denote the change in precautionary savings that results from a shock to fiscal transfers and private income, respectively. Hence, all the discussion in Section 2.2

obtaining precautionary savings. Second, it will also allow us to obtain reduced-form solutions.

[13] See derivations in Appendix 9.

[14] It is important to recall that given the flat structure of initial (i.e., pre-shock) income characterized by (2)-(5), there is no consumption smoothing motive. As a result, savings equal precautionary savings. However, if this were not the case, it is easy to check that the overall savings could be negative in spite of positive precautionary savings.

on the implications of private income and fiscal transfer shocks on $\sigma^2_{y_2+f_2}$ remains valid for PS.

2.3.1 Reduced-form expression for the flypaper effect

This section derives a reduced-form expression for the flypaper effect. Using (9)-(12) and (20), we obtain[15]

$$\triangle g_1^f = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^f, \tag{25}$$

$$\triangle g_1^y = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^y. \tag{26}$$

The first term on the right hand side of expressions (25) and (26) captures the typical income effect according to which part of the newly available resources are allocated to government spending. The second term shows that any difference regarding the optimal response of government spending to private income and fiscal transfer shocks must be the result of a different response of precautionary savings to those shocks. In particular, a positive flypaper effect is associated with a situation where $\triangle PS^f < \triangle PS^y$, which would occur if $\triangle\left(\sigma^2_{y_2+f_2}\right)^y > \triangle\left(\sigma^2_{y_2+f_2}\right)^f$ (i.e., if $DVE > 0$). The converse is true if $DVE < 0$.

Using (8), (23)-(24) and (25)-(26) we can derive the following reduced-form expression for the flypaper effect[16]

$$FP = \frac{1}{1+\theta}\left[\triangle PS^y - \triangle PS^f\right] = \frac{1}{1+\theta}A\left(DVE\right), \tag{27}$$

$$FP = \frac{1}{1+\theta}A\left[\left(1+B\right)\sigma^2_{\varepsilon_y} - \left(1+\alpha B\right)\sigma^2_{\varepsilon_f} - B\left(1-\alpha\right)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho\right]. \tag{28}$$

Notice that FP is directly related to DVE. To fix ideas, let us discuss some particular cases depending on the particular stochastic structure of incomes, which are instructive in clarifying the role of precautionary savings and portfolio theory arguments on the size and sign of the flypaper effect.

1. If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} = 0$, then $FP = 0$. This occurs because $\triangle PS^f = 0$ and $\triangle PS^y = 0$ and hence $DVE = 0$. This case resembles the one-period model typically used in this literature.

2. If $\sigma^2_{\varepsilon_y} > 0$, $\sigma^2_{\varepsilon f} = 0$ and, naturally, $\rho = 0$, then $FP = \left(1/(1+\theta)\right)A\left(1+B\right)\sigma^2_{\varepsilon_y} > 0$. Since private income is risky while fiscal transfers are not, a private income shock

[15] See derivations in Appendix 9.
[16] See derivations in Appendix 9.

increase $\sigma^2_{y_2+f_2}$ and, hence, precautionary savings (i.e., $\triangle PS^y > 0$). A fiscal transfer shock, in contrast, generates no precautionary savings (i.e., $\triangle PS^f = 0$) and hence leaves more resources available for spending (because $DVE > 0$). As a result, government spending increases more in the case of a fiscal transfer shock (i.e., the flypaper effect is positive).

3. If $\sigma^2_{\varepsilon_y} = 0$, $\sigma^2_{\varepsilon f} > 0$ and, naturally, $\rho = 0$, then $FP = -\left(1/(1+\theta)\right) A\left(1+\alpha B\right)\sigma^2_{\varepsilon_f} < 0$. Since only fiscal transfers are risky, the intuition is analogous to case 2 and the private income shock leaves more resources available for spending (i.e., $\triangle PS^y = 0$, $\triangle PS^f > 0$, $DVE < 0$). Hence, we obtain an "anti-flypaper" effect.

4. If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} > 0$ and $\rho = 1$, then $FP = 0$. Each source of income is equally risky and, because $\rho = 1$, each shock increases $\sigma^2_{y_2+f_2}$ and, hence, PS by the same amount (i.e., $\triangle PS^y = \triangle PS^f > 0$, $DVE = 0$). Each shock thus leads to the same change in government spending, which implies a zero flypaper effect. (This case corresponds to point A in Figure 1.)

5. If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} > 0$ and $\rho = 0$, then $FP = (1/(1+\theta))\, A(1-\alpha)\sigma^2_{\varepsilon_y} B > 0$ because $1 > \alpha > 0$. Each source of income is equally risky. The fact that fiscal transfers represent only a fraction of private income (i.e., $1 > \alpha > 0$) implies that a private income shock increases $\sigma^2_{y_2+f_2}$ by more than a fiscal transfer shock (i.e., $\triangle PS^y > 0$, $\triangle PS^f > 0$, $\triangle PS^y > \triangle PS^f$, $DVE > 0$). A fiscal transfer shock thus leaves more resources available for spending, which leads to a positive flypaper effect. (This case corresponds to point B in Figure 1.)

6. If $\sigma^2_{\varepsilon_y} = \sigma^2_{\varepsilon_f} > 0$ and $\rho = -1$, then $FP = (2/(1+\theta))A(1-\alpha)\sigma^2_{\varepsilon_y} B > 0$ because $1 > \alpha > 0$. This case, which corresponds to point C in Figure 1, is where the flypaper reaches its highest value (for the equal variance scenario). In fact, the flypaper at point C is twice as large as in point B. Intuitively, since $\rho = -1$, the income portfolio achieves its maximum diversification and, hence, the DVE becomes the largest.

From Case 3 it is clear that the flypaper effect could, in principle, be negative. Similarly, when positive, the FP is not constrained to be between zero and one. If the model were static, clearly the increase in government spending could not be higher that the increase in resources. However, the dynamic nature of our model allows the use of resources previously allocated to precautionary savings. If the insurance offered by a fiscal transfer shock were sufficiently important, the increase in government spending could, in principle, be bigger than one.

2.4 Theoretical implications

In addition to providing a novel theoretical explanation for the flypaper effect, our model provides two key empirical implications:

1. The flypaper effect is a decreasing function of the correlation between private income and fiscal transfers. How does the flypaper effect respond to changes in ρ?[17] From (25) and (26),

$$\frac{d\left(\triangle g_1^y\right)}{d\rho} = \alpha \frac{d\left(\triangle g_1^f\right)}{d\rho} = -\alpha \frac{1}{1+\theta} AB \sigma_{\varepsilon_y} \sigma_{\varepsilon_f} < 0. \tag{29}$$

   From (28),we obtain

$$\frac{dFP}{d\rho} = -\frac{1}{1+\theta} AB \left(1-\alpha\right) \sigma_{\varepsilon_y} \sigma_{\varepsilon_f} < 0. \tag{30}$$

   As illustrated in Figure 1 (for the equal-variance case), the flypaper effect is a decreasing function of ρ. This is a direct result of the fact that, as discussed above, DVE – and hence precautionary savings – is a decreasing function of ρ.

2. The relationship described in 1 above is stronger the higher is the volatility of private income and/or fiscal transfers. This follows directly from the discussion on the DVE in Section 2.2. From (29),

$$\frac{d^2(\triangle g_1^y)}{d\rho d\sigma_{\varepsilon_f}} = \alpha \frac{d^2(\triangle g_1^f)}{d\rho d\sigma_{\varepsilon_f}} = -\alpha \frac{1}{1+\theta} AB \sigma_{\varepsilon_y} < 0, \tag{31}$$

$$\frac{d^2(\triangle g_1^y)}{d\rho d\sigma_{\varepsilon_y}} = \alpha \frac{d^2(\triangle g_1^f)}{d\rho d\sigma_{\varepsilon_y}} = -\alpha \frac{1}{1+\theta} AB \sigma_{\varepsilon_f} < 0, \tag{32}$$

$$\frac{d^3(\triangle g_1^y)}{d\rho d\sigma_{\varepsilon_y} d\sigma_{\varepsilon_f}} = \alpha \frac{d^3(\triangle g_1^f)}{d\rho d\sigma_{\varepsilon_y} d\sigma_{\varepsilon_f}} = -\alpha \frac{1}{1+\theta} AB < 0. \tag{33}$$

   Hence, from (30), we obtain

$$\frac{d^2(FP)}{d\rho d\sigma_{\varepsilon_f}} = -\frac{1}{1+\theta} AB \left(1-\alpha\right) \sigma_{\varepsilon_y} < 0, \tag{34}$$

$$\frac{d^2(FP)}{d\rho d\sigma_{\varepsilon_y}} = -\frac{1}{1+\theta} AB \left(1-\alpha\right) \sigma_{\varepsilon_f} < 0, \tag{35}$$

$$\frac{d^3(FP)}{d\rho d\sigma_{\varepsilon_y} d\sigma_{\varepsilon_f}} = -\frac{1}{1+\theta} AB \left(1-\alpha\right) < 0. \tag{36}$$

   Equation (34) thus indicates that the effect described in 1 above becomes stronger (i.e., more negative) if the variance of fiscal transfers increases. The same is true for an increase in the variance of private income (equation (35)) and for an increase in both

[17] As can be easily checked, and for reasons that follow from the above discussion, the effects of σ_{ε_y} and σ_{ε_f} on the flypaper effect are ambiguous and hence do not offer a refutable empirical implication.

variances (equation (33)).

3 Key background information about Argentina[18]

We test our theoretical model using a perfectly balanced dataset on subnational income, total spending, and fiscal transfers for Argentinean provinces for the period 1963-2006. This section provides some basic background on Argentina that will prove critical in understanding the nature and determinants of fiscal transfers from federal government to provinces as well as the identification strategy proposed in Section 4 to deal with endogeneity concerns.

3.1 Political structure

Argentina is a federal constitutional republic and representative democracy. It has a multi-party system with two strong 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.

3.2 Economic and demographic provincial geography

A federal republic, Argentina consists of 24 subnational jurisdictions: 23 provinces (see Table 1) and the Autonomous City of Buenos Aires.[19] 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 1).[20] Not surprisingly, these 4 provinces account for 61 percent of total population (column 2, Table 1).

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

[18] This section builds upon Porto (1990, 2003, and 2004), Porto and Sanquinetti (1993), Núñez Miñana (1998), and Sturzenegger and Werneck (2006). See these references and online Appendix for further details.

[19] 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 short data availability and also because it has a special status in terms of the system of fiscal transfers.

[20] 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.

Mexico and Kazakhstan (about 17 habitants per square mile).[21] 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 1), comparable to El Salvador, Guatemala, and Paraguay. In contrast, some provinces like Neuquén, Santa Cruz, and Tierra del Fuego have the highest GDP per capita, of about twice the national average (column 3, Table 1), comparable to Cyprus, Spain, and Singapore.[22]

3.3 Fiscal federalism

Each province has constitutional power enabling it to run 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 (column 6, Table 1).

The most important component of intergovernmental transfers (about 65 percent) is based on a tax-sharing law called "coparticipación" which dates from 1935.[23] 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

[21] 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).

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

[23] Before the Great Depression, most domestic taxes were under provincial jurisdiction, and taxes on trade under the orbit of the federal government. Because of the high trade openness before the 1930s crisis (trade as share of GDP represented 90 percent of GDP between WWI and the Great Depression), the federal government was responsible for most public revenue and spending. After the 1930s crisis, federal revenues collapsed due to the drastic deterioration of the external sector (trade as share of GDP fell to about 30 percent). After a short transition period (1930-1934) characterized by increasing double taxation (due to new domestic taxes imposed by the federal government), in 1935 provinces and the federal government agreed on the so-called "coparticipación" tax-sharing law.

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.[24]

Other intergovernmental transfers (about 35 percent) are discretionary in nature and have been usually related to two political considerations. They have been used by the federal government (i) in exchange for the support of provincial legislators in the National Congress for laws and reforms pushed by the federal government and (ii) to favored politically-protected provinces.[25]

4 Endogeneity concerns and identification strategy

As discussed in the previous section, Argentina offers 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).[26] While necessary, unconditionality is not sufficient to ensure that fiscal transfers are truly exogenous to provincial spending for the following reasons:

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. As long as 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 would 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

[24] Since 1988, primary distribution coeficients have not changed and secondary distribution coeficients have been fixed and not determined by any explicit formula.

[25] 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" (which were aimed to alleviate 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).

[26] 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.

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 would have gotten their way and managed to get more funds for their province. Again, in this case, larger transfers would not be "causing" more provincial spending but 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 1 show that, on average, provinces with higher transfers per capita tend to be the ones with larger spending per capita.[27] 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).[28] 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.

4.1 Identification strategy: Over-representation in National Congress

This section addresses the previously discussed endogeneity concerns 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 that over-represented jurisdictions (defined as provinces where the number of legislators is larger than that based on proportional representation) tended to receive larger federal transfers *per capita*. Why? 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. 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

[27] We can reject that the correlation between average fiscal transfers per capita (column 5, Table 1) and average government spending (column 4, Table 1), which is 0.91, is statistically equal to zero at the 1 percent level.

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

indicators capturing income per capita and cost of provision of public goods).[29]

Second, regarding non-coparticipated and discretionary funds (about 35 percent of total fiscal transfers), as discussed in Section 3.3, these funds have been used by the federal government in exchange for the support of provincial legislators in the National Congress for laws and reforms pushed by the federal government. Since over-represented jurisdictions have more legislators *per capita*, these provinces should ceteris paribus be easier to be lobbied by the federal government using discretionary funds. Why? Because 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, ceteris paribus, it should be less costly for the federal government to obtain the support of provincial legislators from over-represented provinces for laws and reforms.

Following the model of the American 1787 Constitution, Argentinean foundational Constitution of 1853, established: (i) two national senators per province, (ii) that seats in the National Chamber of Deputies per province would be allocated proportionally to provincial population, with the specific number of people per deputy to be updated after each national population census, and that they cannot decrease over time (art. 45).[30] However, these principles 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.[31] The latter goes against the principle of "one person, one vote" articulated in the still valid Argentinean Constitution.[32]

Sections 4.1.1, 4.1.2, 4.1.3, and 4.1.4 describe the change in the provincial representation in the National Congress introduced by each constitutional reform in 1949, 1972, 1983, and

[29] Atlas et al. (1995 and 1997) offer 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.

[30] According to article 47 in the Constitution, national population census are to be conducted every ten years. Since 1947, there have been 7 such census: 1947, 1960, 1970, 1980, 1991, 2001, and 2010.

[31] 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.

[32] Over the years, Argentinean constitutionalists have coined different terms to refer to national deputies that are not assigned as a consequence of the principle of proportional representation: "gifted" (Bidart Campos, 2005), "extra-constitutional" (Rossetti, 1993), or plain "unconstitutional" (Gelli, 2001).

1994, respectively.[33] On many occasions the change in the number of representatives per province is common across the board (e.g., equal increase in the number of senators/deputies per province), which eliminates any remaining concern about such a change possibly being the result of a province successfully lobbying for more representation. In cases where the change in the number of representatives per province is not common across the board, but rather the result of a common provision that effectively favors a group of provinces (e.g., a provision that sets a minimum number of deputies per province), we also provide a brief description of the national level political nature of each representation change, which is crucial to providing plausible exogenous variation. For these latter cases, Appendix 10 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.

For presentational purposes, column 2 in Table 2 (Table 3), shows for each National Congress election following each constitutional amendment modifying the structure of the Camber 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.[34] For the Chamber of Senators, the number of national senators per jurisdiction based on proportional representation is calculated dividing the provincial population by the ratio of total country population to the total number of senators.[35] 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 latter measure, controls for

[33] These 4 reforms are the only changes made to provincial representation in the National Congress within the sample period.

[34] 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.

[35] 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.

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.

4.1.1 Perón'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 the indefinite re-election of the president (which was prohibited by the still-valid 1853 Constitution). To grant support from "perypherical" 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.[36]

This amendment first affected our sample period in the 1958 National Congress election.[37] Columns 1a, 2a, and 3a in Table 2 show that, naturally, provinces with the smallest population were the most benefited by this provision. Column 2a indicates that the overall magnitude of this distortion involves 5 seats in the Chamber of Deputies, that is to say, about 2.7 percent (5 out of 188).[38] Column 3a shows, for example, that while both Formosa and Santa Cruz received one "extra" deputy, because Formosa had a population more than 2 times as large as Santa Cruz, the individual (or per person) gain in terms of provincial over-representation is larger for the province of Santa Cruz than for Formosa.

4.1.2 Military regime 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).

[36] See Appendix 10 for a more detailed discussion about the national level political nature of this constitutional reform as well as complementary evidence regarding the heterogeneity, both in terms of income per capita and spending per capita, of provinces favored by this provision.

[37] Results from the 1960 national population census did not change the Chamber of Deputies representation structure (Reynoso, 2012). Therefore, the number of Deputies per province did not change until the military coup of 1966.

[38] The total number of deputies was 193. Based on proportional representation it should have been 188.

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.

In the same vein to Perón's Constitutional reform of 1949, this amendment continued and deepened in both legislative cameras the process of over-representation of less populated provinces. In the Chamber of Deputies, the overall magnitude of the absolute distortion increased from 2.7 percent (5 seats out of 188; see column 2a in Table 2) to 41.3 percent (71 out of 172; see column 2b in Table 2).[39,40] This significant change is also captured by the effective distortion measure; with Buenos Aires and Tierra del Fuego being the least and most favored (column 3b, Table 2). In the Chamber of Senators, the overall magnitude of the absolute distortion increased about 56 percent, from 45.1 in the 1958 election to 70.2 in the 1973 one (see columns 2a and 2b in Table 3).[41]

4.1.3 Military regime Constitutional reform of 1983

Between 1976 and December 1983 Argentina was ruled by a 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 foundational 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 law (i) adding 3 deputies per province and 2 to the National Territory of Tierra del Fuego (like the 1972 reform), and (ii) also increased 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).

[39] The total number of deputies was 243. Based on proportional representation it should have been 172.

[40] To help fix ideas, while in the 1958 elections the 5 most populated jurisdictions (Buenos Aires, City of Buenos Aires, Córdoba, Mendoza, and Santa Fé) accounted for 69.5 percent of total population and 67.9 percent of the seats in the Chamber of Deputies, for the 1973 elections these 5 provinces accounted for 72.4 percent of total population but only 58.0 percent of the seats in the Chamber of Deputies.

[41] To help fix ideas, let us compare the impact on provincial over/under-representation in the provinces of Buenos Aires (the most populous jurisdiction with 8.78 million people, or 38 percent of total population) and the province of Santa Cruz (among the least populous ones with 85 thousand people, or 0.4 percent of total population). An increase in one senator per province across the board, increased the size of the Chamber of Senators by 23 senators. Based on proportional representation, the provinces of Buenos Aires and Santa Cruz would have been assigned 9 and one senators, respectively. Instead, each province received one additional senator, regardless of their provincial population, ultimately increasing the number of senators per capita of Santa Cruz by a larger margin than in Buenos Aires.

While provincial over-representation was reduced in the Senate (see columns 2c and 3c in Table 3), it increased in the Chamber of Deputies from 41.3 percent (71 out of 172; see column 2b in Table 2) to 46.8 percent (81 out of 173; see column 2c in Table 2).[42] The increase in the absolute distortion by 10 seats (from 1972 reform to 1983 reform) responds to two provisions:

First, as a consequence of the restoration of the 1853 Constitution, the City of Buenos Aires and Santa Fe benefited from 4 and 1 seats, respectively, based on a provision that guaranteed that the number of provincial representatives in Chamber of Deputies could not decrease over time (1853 Constitution, Art. 45) in spite of the reduction in the share of national population in these jurisdictions. Naturally, this benefit is the automatic result of applying a constitution dating back more than a hundred years and not the result of specific lobbying by these jurisdictions. As discussed above, the main reason to reinstate the 1853 Constitution was to prohibit the indefinite re-election of the president.

Second, the other five seats favored Catamarca, La Pampa, La Rioja, San Luis, and Santa Cruz as a consequence of the provision establishing a minimum of 5 deputies per province. The military regime argued that these changes responded to the need "to compensate the peculiar differences among provinces" (decree law 22847, 1983). Indeed, constitutional scholars (e.g., Borello, 2013) have argued that, like in the past, this provision aimed at giving provincial parties a larger legislative participation.[43]

4.1.4 Menem's Constitutional reform of 1994

President Menem, from the PJ party, served his first period from 1989 to 1995. After a couple of years in power, 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).

As shown in columns 2d and 3d in Table 4 – and 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, Córdoba, Mendoza, and Santa Fé.

[42] The total number of deputies was 254. Based on proportional representation it should have been 173.

[43] See Appendix 10 for complementary evidence regarding the heterogeneity, both in terms of income per capita and spending per capita, of provinces favored by this provision.

4.1.5 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 population 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.[44] 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.[45]

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,

$$g_{it} = \alpha_0 + \beta_y y_{it} + \beta_f f_{it} + \textstyle\sum_h \beta_h x_{it}^h + \varepsilon_{it}, \tag{37}$$

[44] 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.

[45] In a newspaper article (La Nación, November 1, 2010) national deputy (for the City of Buenos Aires) Laura Alonso argues that "this is a taboo issue that nobody wants to talk about" (authors' translation). In a similar vein, Professor of Political Institutions (Universidad Torcuato Di Tella) Ana Maria Mustapic argues (in the same newspaper article) that given the potentially large political costs associated with such a discussion, most politicians prefer to leave the issue as is.

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 not), respectively, all expressed in real and per capita terms.[46] 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).[47] 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 4 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 4, columns 1 we use national deputies per capita as instrument.[48,49,50] 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.[51] In contrast, an additional deputy in a populous province like Buenos Aires increases transfers per capita by about 0.85

[46] Based on the theoretical models developed in previous sections, ideally we would like to measure income using gross national product as opposed to gross domestic product for each province. 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.

[47] 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 mater.

[48] For presentational purposes we normalize national deputies per hundred thousand people.

[49] Since there was no National Congress during military regimes, we replace the number of representative 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.

[50] Based on 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.

[51] We calculated this figure using the historical provincial average population (135,084 inhabitants).

pesos; which represents about 0.5 percent of historical provincial transfers per capita.[52] The excluded instrument 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.[53] 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 as instrument.[54] 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 4, columns 4 interact national deputies per capita and national senators per capita in order to explore whether having greater representation in both Chambers boosts by an extra margin the possibility of pressuring 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.[55,56,57] Moreover, it seems that over-representation in the Chamber of Deputies plays a much 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."

[52] We calculated this figure using the historical provincial average population (11,277,649 inhabitants).

[53] 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.

[54] For presentational purposes we normalize national senators per hundred thousand people.

[55] 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.

[56] In Section 4 we discussed in great length that the proposed instruments are uncorrelated with the error term in the main equation. To investigate the exclusivity assumption further, we also run regressions like the one in columns 3 and 4 in Table 4, but adding one-at-a-time each proposed instrument as an additional regressor(s) in the main equation. In each case we instrument fiscal transfers per capita with the remaining instrument. These exclusion restriction "tests" support our argument that over-representation in Congress only affects government spending through its effect on fiscal transfers, and not directly. Results are not shown for brevity.

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

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 over 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 of changes in fiscal transfers. To remove any doubt about this possibility we perform two robustness tests. First, we include population square and/or cubic instead of linearly. Results continue to hold and are not shown for brevity.

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 4.1. For this purpose, we use the "effective distortion measure" in Tables 2 and 3 as the instrument. Table 5 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 4) and the effective distortion in national chamber of deputies (instrument used in Table 5) is 0.94 and that we reject the null hypothesis that such correlation is statistically not different from 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 are 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 virtually driven by the identification strategy based on provincial over-representation changes associated with Constitutional reforms proposed in Section 4.1 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 calculate these statistical measures.[58] The overall standard deviation of ρ is 0.51;

[58] 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.

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 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 6 (columns 1 to 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.[59,60]

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 4 and 5. In particular, the first observation will now date back to 1972. The results obtained in Tables 4 and 5 strongly hold if we restrict our sample to begin in 1972. Replicating our preferred specification (column 3, in Table 4) the magnitude of the flypaper effect is 1.204 with a 95 percent confidence interval of [0.781,1.627].[61]

Our first empirical implication states that the flypaper effect is a decreasing function of the correlation between private income and fiscal transfers (equation (30)). This occurs because $d(\triangle g_1^f)/d\rho < d\left(\triangle g_1^y\right)/d\rho < 0$ (equation (29)). Moreover, our second empirical implication indicates that such relationship becomes stronger the higher is the volatility of private income and/or fiscal transfers (equations (34-36)). To test such implications, we add to the basic regression – given by (37) – additional terms that identify the interaction of output and fiscal transfer shocks with the correlation between output and fiscal transfers as well as with their

[59] 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 6 (columns 4 to 6) shows important cross province as well as over time variation.

[60] The overall standard deviation of σ_f^2 is 0.16; with a mean of 0.21. While the variation across provinces (i.e., between) is 0.08, the variation within provinces over time is 0.14. Moreover, if we further decomponse the within variation between a common component over time (i.e., within year) and a residual one, we find that the first one is 0.11 and the second one is 0.09. In other words, even after accounting for both provincial and year de-trending the residual variability observed in σ_y^2 is still quite large. Indeed, Table 6 (columns 7 to 9) shows important cross province as well as over time variation.

[61] Results are not shown for brevity.

volatilities:

$$
\begin{aligned}
g_{it} \;=\; & \alpha_0 + \beta_y y_{it} + \beta_f f_{it} + \textstyle\sum_h \beta_h x_{it}^h + \\
& + \alpha_1 \rho_{it} + \alpha_2(\rho_{it} \cdot y_{it}) + \alpha_3(\rho_{it} \cdot f_{it}) + \\
& + \alpha_4 \sigma_{y_{it}}^2 + \alpha_5(\sigma_{y_{it}}^2 \cdot y_{it}) + \alpha_6(\sigma_{y_{it}}^2 \cdot f_{it}) + \\
& + \alpha_7 \sigma_{f_{it}}^2 + \alpha_8(\sigma_{f_{it}}^2 \cdot y_{it}) + \alpha_9(\sigma_{f_{it}}^2 \cdot f_{it}) + \\
& + \alpha_{10}(\sigma_{y_{it}}^2 \cdot \rho_{it}) + \alpha_{11}(\sigma_{y_{it}}^2 \cdot \rho_{it} \cdot y_{it}) + \alpha_{12}(\sigma_{y_{it}}^2 \cdot \rho_{it} \cdot f_{it}) + \\
& + \alpha_{13}(\sigma_{f_{it}}^2 \cdot \rho_{it}) + \alpha_{14}(\sigma_{f_{it}}^2 \cdot \rho_{it} \cdot y_{it}) + \alpha_{15}(\sigma_{f_{it}}^2 \cdot \rho_{it} \cdot f_{it}) + \\
& + \alpha_{16}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2) + \alpha_{17}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2 \cdot y_{it}) + \alpha_{18}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2 \cdot f_{it}) + \\
& + \alpha_{19}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2 \cdot \rho_{it}) + \alpha_{20}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2 \cdot \rho_{it} \cdot y_{it}) \\
& + \alpha_{21}(\sigma_{y_{it}}^2 \cdot \sigma_{f_{it}}^2 \cdot \rho_{it} \cdot f_{it}) + \varepsilon_{it}. \qquad (38)
\end{aligned}
$$

Table 7, column 1 shows the regression results.[62] Based on the theoretical model developed in Section 2, the coefficients α_2, α_3, α_{11}, α_{12}, α_{14}, α_{15}, α_{20} and α_{21} 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. $|\alpha_3| > |\alpha_2|$ as a result of the first theoretical implication (equations (29) and (30)).

2. $|\alpha_{12}| > |\alpha_{11}|$, $|\alpha_{15}| > |\alpha_{14}|$, and $|\alpha_{21}| > |\alpha_{20}|$ as a result of the second theoretical implication (equations (31)-(36)).

Table 7 supports our first two empirical implications. Most coefficients have the expected signs. While α_2 and α_{20} are positive, this occurs because of multicollinearity.[63] 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.[64]

The rest of this section proceeds as follows. Sections 6.1 and 6.2 use the findings of column 1 in Table 7 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 and second empirical implications, respectively. While the findings of column 1 in Table 7 support our first two empirical implications,

[62] Naturally, given the endogeneity concerns previously discussed, we instrument all terms involving f including the variables used in Table 4, column 3. For all terms involving f (i.e., the one associated with coefficients β_f, α_3, α_6, α_9, α_{12}, α_{15}, α_{18}, and α_{21}), the excluded instrument tests show that such instruments are not weak.

[63] 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.

[64] Specifically, we cannot reject the null that $|\alpha_3| > |\alpha_2|$, $|\alpha_{12}| > |\alpha_{11}|$, $|\alpha_{15}| > |\alpha_{14}|$, and $|\alpha_{21}| > |\alpha_{20}|$ at the one percent level of significance.

these illustrations aim at showing the somewhat intricate nature of regression (38) in a way that is easier to visualize. Section 6.3 uses public savings rate data to further support that the empirical findings are indeed driven by the proposed mechanism (i.e., insurance arguments). 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 column1 in Table 7 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.[65] 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.[66] In particular, 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.

[65] It is important to note that in our sample ρ varies between -0.96 and 0.99.

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

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).[67,68] 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 7, 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 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 given an increase in fiscal transfers than an equivalent increase in local income. Moreover, this effect becomes larger as uncertainty becomes higher and and weakens when uncertainty is 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 $\rho = 1$.[69] This further support our model's prediction that as ρ becomes closer to 1, the role

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

[68] 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.

[69] Furhter examples show the same pattern $DS|_{\sigma_y^2=\sigma_f^2=0.03,\ \rho=1} = -0.043$, $DS|_{\sigma_y^2=\sigma_f^2=0.09,\ \rho=1} = -0.031$, and $DS|_{\sigma_y^2=\sigma_f^2=0.21,\ \rho=1} = -0.030$. Since all these figures are negative, it is also important to recall (see footnote 14) that in our theoretical model, given the flat structure of initial (i.e., pre-shock) income characterized by (2)-

of insurance arguments tends to weakens.

6.4 Quantifying the importance of insurance arguments

The results presented in Table 7 as well as the evidence presented in Sections 6.1, 6.2, and 6.3 strongly support the mechanism based on insurance arguments proposed by our macro model. This 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 our insurance argument regressions (i.e., from 1972-2006) the magnitude of the flypaper effect is 1.204.

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 (Section 2.3.1) 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:[70,71]

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

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), $\sigma_y^2(0.03)$, and $\sigma_f^2(0.17)$. We 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 $((0.56 - 0.42)/1.2)$.[72]

(5), there is no consumption smoothing motive. As a result, savings equal precautionary savings. However, if this were not the case, it is easy to check that the overall savings could be negative in spite of positive precautionary savings.

[70] We compute the flypaper effect using $\rho = 1$ because of the important theoretical relevance in terms of insurance (or lack of thereof). Having said that, it is important to remark that the maximum ρ observed in the data is 0.99. Using this last parameter value, the FP is virtually indistinguishable from that of using $\rho = 1$.

[71] 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 uncertainties do not seem to matter.

[72] This empirical quantification is supported by back-of-the-envelope theoretical calculation based on the reduced-form expression given by (28). Using "realistic" parameter values (not shown for brevity) and median sample value of ρ (0.06), $\sigma_y^2(0.03)$, and $\sigma_f^2(0.17)$, expression (28) points to a flypaper effect of 0.02 (about

7 Conclusions

This paper has offered a new theoretical explanation for the flypaper effect based on macro 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.

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2 percent of the observed flypaper effect). This suggestive evidence indeed support that the insurance and savings arguments can offer a partial explanation for the flypaper effect in the Argentina setting.

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8 Appendix of data

8.1 Original sources and 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.

8.2 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

9 Appendix of derivations

In this appendix we solve the 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 (18) subject to the intertemporal constraint (19). From the first order conditions, we obtain

$$e^{-c_1} = e^{-\theta g_1} = E\left[e^{-c_2}\right] = E\left[e^{-\theta g_2}\right], \tag{39}$$

or alternatively

$$c_1/\theta g_1 = c_2/\theta g_2 = 1. \tag{40}$$

We can use (19), (39), (40) and (3)-(5) to express $g_2(\varepsilon_y, \varepsilon_f)$ as follows

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

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

$$-\theta g_2 \sim N\left(E\left[-\theta g_2\right], \sigma^2_{-\theta g_2}\right), \tag{41}$$

$$E\left[-\theta g_2\right] = -\tfrac{\theta}{1+\theta}(2+r)\left(\overline{y} + s_y + \overline{f} + s_f\right) + \theta(1+r)g_1, \tag{42}$$

$$\sigma^2_{-\theta g_2} = \left(\tfrac{\theta}{1+\theta}\right)^2 \sigma^2_{y_2+f_2}, \tag{43}$$

where ρ is the correlation between ε_y and ε_f and $\sigma^2_{y_2+f_2}$ is characterized by (12). Knowing

that if a variable $x \sim N\left(E\left[x\right], \sigma_x^2\right)$ then $E\left[e^x\right] = e^{E[x]+\frac{\sigma_x^2}{2}}$, we can use (41)-(43) 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, we can rewrite the stochastic Euler equation (39) as

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

which reduces to

$$E\left[\theta g_2\right] = \theta g_1 + \tfrac{1}{2}\left(\tfrac{\theta}{1+\theta}\right)^2 \sigma^2_{y_2+f_2}. \tag{44}$$

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

$$c_1 + g_1 + \tfrac{E[c_2]+E[g_2]}{1+r} = y_1 + f_1 + \tfrac{E[y_2]+E[f_2]}{1+r}. \tag{45}$$

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), (40), (44), and (45), we obtain

$$\tfrac{c_1}{\theta} = g_1 = \tfrac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) - \tfrac{1}{1+\theta} PS, \tag{46}$$

$$\tfrac{E[c_2]}{\theta} = E\left[g_2\right] = \tfrac{1}{1+\theta}\left(\overline{y} + s_y + \overline{f} + s_f\right) + \tfrac{1}{1+\theta}\left(1+r\right) PS, \tag{47}$$

$$PS = A\sigma^2_{y_2+f_2}, \tag{48}$$

where $A \equiv \theta/(2\left(2+r\right)\left(1+\theta\right)) > 0$ and $\sigma^2_{y_2+f_2}$ is characterized by (12).

Taking into account (i) equations (1), (6), (7), (12), (46)-(48), (ii) the fact that $s_y = s_f = 0$ before the shock, (iii) that an income shock consists in 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 in 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

$$\triangle\left(\sigma^2_{y_2+f_2}\right)^y = \left(1+B\right)\sigma^2_{\varepsilon_y} + \alpha B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho, \tag{49}$$

$$\triangle\left(\sigma^2_{y_2+f_2}\right)^f = \left(1+\alpha B\right)\sigma^2_{\varepsilon_f} + B\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho, \tag{50}$$

$$\triangle PS^y = A\triangle\left(\sigma^2_{y_2+f_2}\right)^y, \tag{51}$$

$$\triangle PS^f = A\triangle\left(\sigma^2_{y_2+f_2}\right)^f, \tag{52}$$

$$\triangle g_1^y = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^y, \tag{53}$$

$$\triangle g_1^f = \tfrac{1}{1+\theta} - \tfrac{1}{1+\theta}\triangle PS^f, \tag{54}$$

$$FP = \tfrac{1}{1+\theta} A\left[\left(1+B\right)\sigma^2_{\varepsilon_y} - \left(1+\alpha B\right)\sigma^2_{\varepsilon_f} - B\left(1-\alpha\right)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f}\rho\right], \tag{55}$$

where $B \equiv 2\phi\overline{x} > 0$ and $\alpha \equiv (1-\phi)/\phi \in (0,1)$ assuming $1 > \phi > 0.5$. From (53) and (54), 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 (53) and (55) with respect to σ_y, σ_f, and ρ.

	$x = \triangle g_1^f$	$x = \triangle g_1^y$	$x = FP$[73]
$\frac{d(x)}{d\sigma_{\varepsilon_y}}$	$-GAB\sigma_{\varepsilon_f}\rho \gtrless 0$	$-GAE \gtrless 0$	$GAJ \gtrless 0$
$\frac{d(x)}{d\sigma_{\varepsilon_f}}$	$-GAH \gtrless 0$	$-GAB\alpha\sigma_{\varepsilon_y}\rho \gtrless 0$	$-GAK \gtrless 0$
$\frac{d(x)}{d\rho}$	$-GAB\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$	$-GAB\alpha\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_y}\sigma_{\varepsilon_f} < 0$
$\frac{d^2(x)}{d\sigma_{\varepsilon_y}d\sigma_{\varepsilon_f}}$	$-GAB\rho \gtrless 0$	$-GAB\alpha\rho \gtrless 0$	$-GAB(1-\alpha)\rho \gtrless 0$
$\frac{d^2(x)}{d\sigma_{\varepsilon_y}d\rho}$	$-GAB\sigma_{\varepsilon_f} < 0$	$-GAB\alpha\sigma_{\varepsilon_f} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_f} < 0$
$\frac{d^2(x)}{d\sigma_{\varepsilon_f}d\rho}$	$-GAB\sigma_{\varepsilon_y} < 0$	$-GAB\alpha\sigma_{\varepsilon_y} < 0$	$-GAB(1-\alpha)\sigma_{\varepsilon_y} < 0$
$\frac{d^3(x)}{d\sigma_{\varepsilon_y}d\sigma_{\varepsilon_f}d\rho}$	$-GAB < 0$	$-GAB\alpha < 0$	$-GAB(1-\alpha) < 0$

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 $K \equiv 2(1+\alpha B)\sigma_{\varepsilon_f} + B(1-\alpha)\sigma_{\varepsilon_y}\rho \gtrless 0$.

10 Over and under representation in National Congress

10.1 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.[74] 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.[75] While normalizing provincial spending by income does affect the ranking just described, it does not change the finding about the

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

[74] 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).

[75] 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).

heterogeneity of the provinces that benefitted from the provision.[76]

10.2 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.[77] 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.[78] While normalizing provincial spending by income does affect the ranking just described, it does not change the finding about the heterogeneity of benefited provinces.[79]

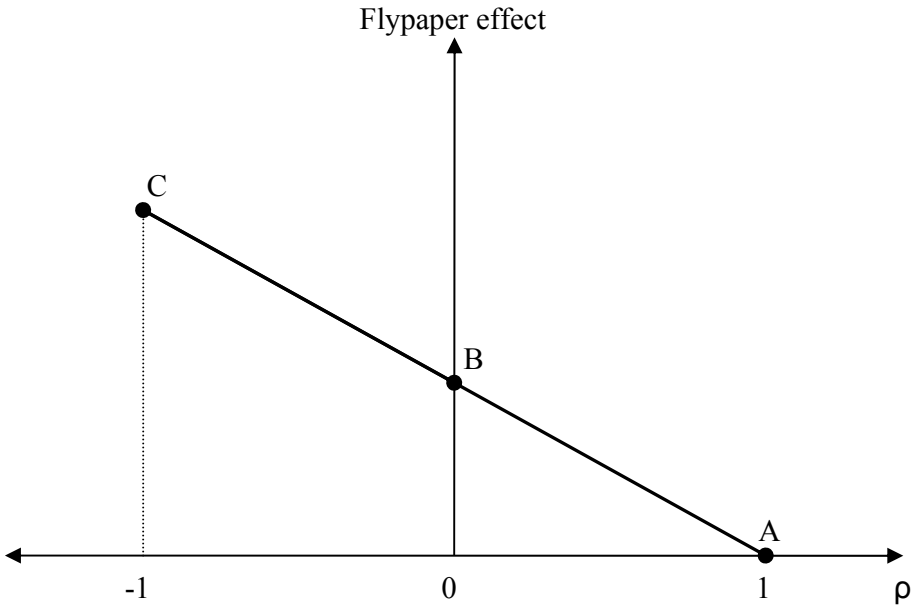
[76] Again, we cannot reject (at the one percent level) the null that the average (normalized) spending per capita of the 5 provinces that benefited from the provision (10.4%) is the same as that of the provinces that did not benefit (7.1%).

[77] 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).

[78] 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).

[79] 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%).

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 equal and that the initial share of fiscal transfers in total income is smaller than the one of private income.

Figure 2. Flypaper effect explained by insurance arguments.
Flypaper effect evaluated at 50th pctl σ_y^2 and 50th pctl σ_f^2 and alternative values of ρ.
Argentinean provinces (1972-2006).

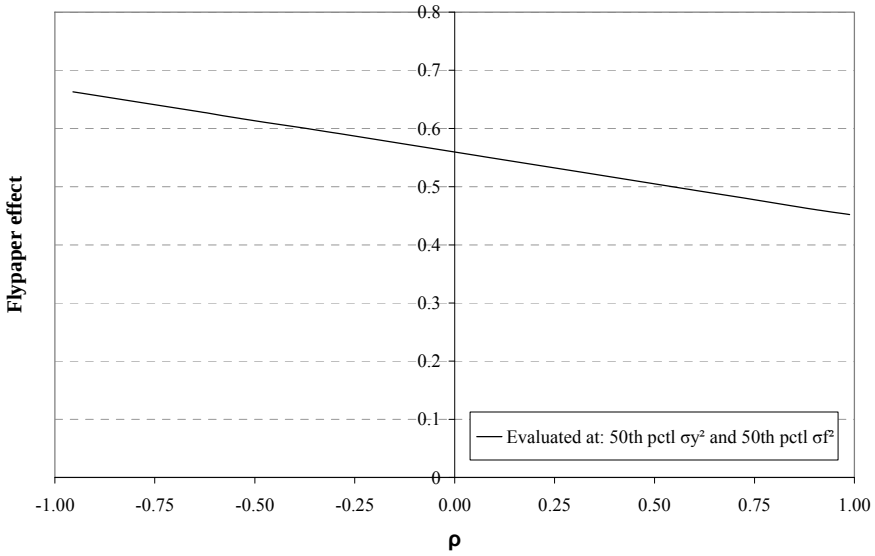


Figure 3. Flypaper effect explained by insurance arguments.
Flypaper effect evaluated at 50th pctl σ_f^2 and alternative values of ρ and σ_y^2.
Argentinean provinces (1972-2006).

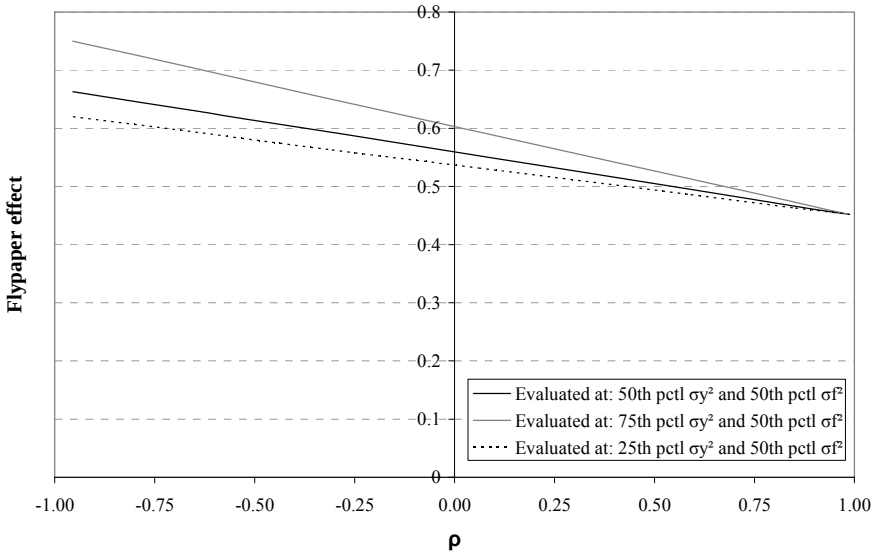


Figure 4. Differential public savings rate ($DS \equiv \Delta S^y - \Delta S^f$) explained by insurance arguments.
Evaluated at 50th pctl σ_f^2 and alternative values of ρ and σ_y^2.
Argentinean provinces (1972-2006).

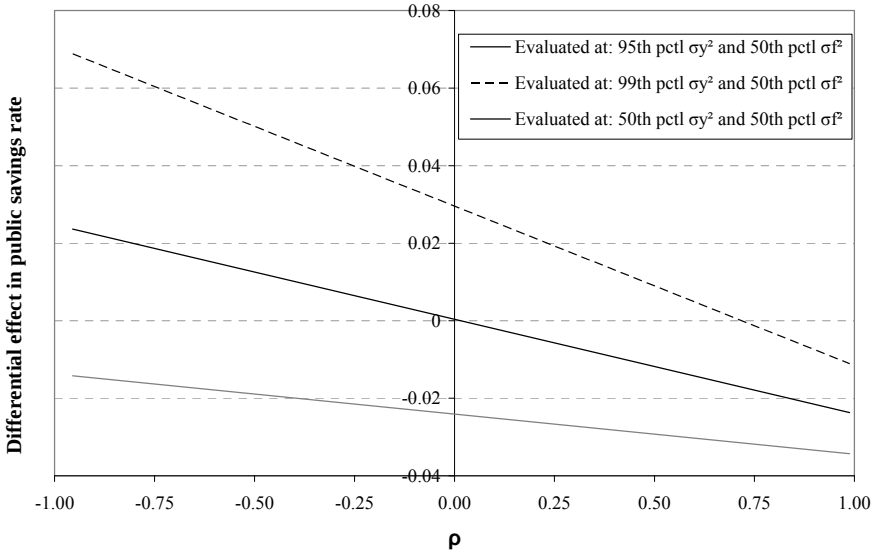


Table 1. Basic economic, demographic, and fiscal provincial indicators.
Historical average for Argentinean provinces (1963-2006).

	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 2. Over-representation of Argentinean provinces at 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	4.274	8.775	10.865	0	3	3	0	0.3	0.3
City of Buenos Aires	2.981	2.972	2.923	0	3	7	0	1.0	2.4
Catamarca	0.147	0.172	0.208	0	3	4	0	17.4	19.3
Chaco	0.431	0.567	0.701	0	3	3	0	5.3	4.3
Chubut	0.092	0.190	0.263	1	3	3	10.8	15.8	11.4
Cordoba	1.498	2.060	2.408	0	3	3	0	1.5	1.2
Corrientes	0.525	0.564	0.661	0	3	3	0	5.3	4.5
Entre Rios	0.787	0.812	0.908	0	3	3	0	3.7	3.3
Formosa	0.114	0.234	0.296	1	3	3	8.8	12.8	10.1
Jujuy	0.167	0.302	0.410	0	3	3	0	9.9	7.3
La Pampa	0.169	0.172	0.208	0	3	4	0	17.4	19.2
La Rioja	0.111	0.136	0.164	1	3	4	9.0	22.0	24.4
Mendoza	0.588	0.973	1.196	0	3	3	0	3.1	2.5
Misiones	0.246	0.443	0.589	0	3	3	0	6.8	5.1
Neuquen	0.087	0.154	0.244	1	3	3	11.5	19.4	12.3
Rio Negro	0.134	0.263	0.383	0	3	3	0	11.4	7.8
Salta	0.291	0.510	0.663	0	3	3	0	5.9	4.5
San Juan	0.261	0.384	0.466	0	3	3	0	7.8	6.4
San Luis	0.166	0.183	0.214	0	3	4	0	16.4	18.7
Santa Cruz	0.043	0.084	0.115	1	3	4	23.3	35.5	34.8
Santa Fe	1.703	2.136	2.466	0	3	4	0	1.4	1.6
Santiago del Estero	0.479	0.495	0.595	0	3	3	0	6.1	5.0
Tierra del Fuego*	0.005	0.016	0.027	0	2	2	0	127.7	73.1
Tucuman	0.593	0.766	0.973	0	3	3	0	3.9	3.1
Total	15.894	23.364	27.947	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 calculate 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 calculated as the ratio of the absolute distortion (column 2) to population (column 1).

Table 3. Over-representation of Argentinean provinces at 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	4.274	8.775	10.865	12.595	-10.37	-22.91	-15.88	-24.80	-2.43	-2.6	-1.5	-2.0
City of Buenos Aires	2.981	2.972	2.923	2.965	-6.63	-5.78	-2.81	-3.55	-2.22	-1.9	-1.0	-1.2
Catamarca	0.147	0.172	0.208	0.264	1.57	2.49	1.66	2.42	10.69	14.5	8.0	9.1
Chaco	0.431	0.567	0.701	0.840	0.75	1.33	0.85	1.15	1.75	2.3	1.2	1.4
Chubut	0.092	0.190	0.263	0.357	1.73	2.44	1.57	2.21	18.74	12.8	6.0	6.2
Cordoba	1.498	2.060	2.408	2.767	-2.34	-3.08	-1.96	-3.11	-1.56	-1.5	-0.8	-1.1
Corrientes	0.525	0.564	0.661	0.796	0.48	1.33	0.91	1.24	0.91	2.4	1.4	1.6
Entre Rios	0.787	0.812	0.908	1.020	-0.28	0.60	0.50	0.75	-0.35	0.7	0.6	0.7
Formosa	0.114	0.234	0.296	0.398	1.67	2.31	1.51	2.12	14.68	9.9	5.1	5.3
Jujuy	0.167	0.302	0.410	0.512	1.52	2.11	1.33	1.87	9.10	7.0	3.2	3.6
La Pampa	0.169	0.172	0.208	0.260	1.51	2.49	1.66	2.43	8.91	14.5	8.0	9.3
La Rioja	0.111	0.136	0.164	0.221	1.68	2.60	1.73	2.51	15.17	19.1	10.5	11.4
Mendoza	0.588	0.973	1.196	1.412	0.30	0.13	0.03	-0.12	0.51	0.1	0.0	-0.1
Misiones	0.246	0.443	0.589	0.789	1.29	1.69	1.03	1.26	5.22	3.8	1.7	1.6
Neuquen	0.087	0.154	0.244	0.389	1.75	2.54	1.60	2.14	20.11	16.5	6.6	5.5
Rio Negro	0.134	0.263	0.383	0.507	1.61	2.22	1.37	1.88	11.99	8.5	3.6	3.7
Salta	0.291	0.510	0.663	0.866	1.16	1.49	0.91	1.09	3.98	2.9	1.4	1.3
San Juan	0.261	0.384	0.466	0.529	1.24	1.87	1.23	1.83	4.76	4.9	2.6	3.5
San Luis	0.166	0.183	0.214	0.286	1.52	2.46	1.65	2.37	9.19	13.4	7.7	8.3
Santa Cruz	0.043	0.084	0.115	0.160	1.88	2.75	1.81	2.65	43.75	32.6	15.8	16.6
Santa Fe	1.703	2.136	2.466	2.798	-2.93	-3.31	-2.06	-3.18	-1.72	-1.5	-0.8	-1.1
Santiago del Estero	0.479	0.495	0.595	0.672	0.61	1.54	1.02	1.52	1.28	3.1	1.7	2.3
Tierra del Fuego*	0.005	0.016	0.027	0.069	0.00	0.00	0.00	2.85	0.00	0.0	0.0	41.0
Tucuman	0.593	0.766	0.973	1.142	0.28	0.74	0.40	0.48	0.48	1.0	0.4	0.4
Total	15.894	23.364	27.947	32.615	45.09*	70.21*	45.48*	69.51*	189.50*	177.43*	89.47*	138.27*

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 calculate 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 *) are calculated by summing the absolute values of the respective distortions for each province.

Table 4. Flypaper effect: Basic evidence
Argentinean provinces (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		1.631		1.633		1.631		1.574
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 statistically significant at the 10%, 5% and 1% levels, respectively.

Table 5. Flypaper effect: Robustness about source of identifying variation
Argentinean provinces (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		1.881		1.621		1.801		1.846
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 statistically significant at the 10%, 5% and 1% levels, respectively.

Table 6. Correlation between the cyclical components of income and fiscal transfers, income volatility, and fiscal transfers volatility. Argentinean provinces (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 presentation convenience we normalized σ_y^2, σ_f^2 between 0 and 1.

Table 7. Flypaper effect: Insurance arguments
Argentinean provinces (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_2)	0.037***	-	-0.0002	+
		[0.011]		[0.0005]	
$\rho \bullet f$	(coef. α_3)	-0.087	-	0.0179	+
		[0.285]		[0.0142]	
$\sigma_y^2 \bullet y$	(coef. α_5)	0.104**	+/-	-0.0003	+/-
		[0.045]		[0.0041]	
$\sigma_y^2 \bullet f$	(coef. α_6)	1.984*	+/-	-0.2187***	+/-
		[1.051]		[0.0704]	
$\sigma_f^2 \bullet y$	(coef. α_8)	-0.014	+/-	0.0005	+/-
		[0.029]		[0.0014]	
$\sigma_f^2 \bullet f$	(coef. α_9)	-0.147	+/-	-0.0353*	+/-
		[0.185]		[0.0198]	
$\sigma_y^2 \bullet \rho \bullet y$	(coef. α_{11})	-0.291***	-	0.0060	+
		[0.088]		[0.0039]	
$\sigma_y^2 \bullet \rho \bullet f$	(coef. α_{12})	-2.025	-	-0.2308	+
		[3.206]		[0.2406]	
$\sigma_f^2 \bullet \rho \bullet y$	(coef. α_{14})	-0.108**	-	-0.0042	+
		[0.042]		[0.0029]	
$\sigma_f^2 \bullet \rho \bullet f$	(coef. α_{15})	0.267	-	-0.0645*	+
		[0.851]		[0.0333]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet y$	(coef. α_{17})	-0.264**	+/-	-0.0044	+/-
		[0.105]		[0.0135]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet f$	(coef. α_{18})	-1.342	+/-	0.5217***	+/-
		[1.922]		[0.1379]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet \rho \bullet y$	(coef. α_{20})	0.910***	-	-0.0090	+
		[0.287]		[0.0234]	
$\sigma_y^2 \bullet \sigma_f^2 \bullet \rho \bullet f$	(coef. α_{21})	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 variable 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 in all regressions 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, and PJ party governor dummy are not reported either. Coefficients name (e.g., coef. α_3) refer to equation (38). Columns "expected sign" characterized the signs of the derivatives obtained in the theoretical model. Standard errors are in square brackets. *, ** and *** indicate statistically significant at the 10%, 5% and 1% levels, respectively.