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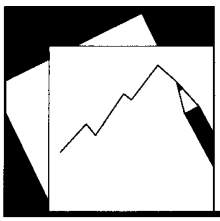

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Market Discipline and Conflicts of Interest between Banks and Pension Funds

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Abstract

We study the behavior of private pension funds as large depositors in a banking system. Using panel data analysis, we examine whether, and if so how, pension funds influence market discipline in Argentina in the period 1998-2001. We find evidence that pension funds exert market discipline and this discipline gets stronger as the share of pension fund deposits in a bank rises. However, conflicts of interest undermine the disciplining role of pension funds. Specifically, pension funds allocate deposits to banks with weak fundamentals that own pension fund management companies. We conclude that forbidding banks' ownership of companies involved in pension fund management can enhance market discipline.

JEL Classification Numbers: G2, G3

Keywords: conflicts of interest, institutional investors, pension funds, banks, market discipline

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I. INTRODUCTION

In the last three decades, a surge in the frequency and intensity of banking crises has destabilized economies worldwide, motivating research aimed at explaining their causes. A common view holds that government guarantees of bank liabilities weaken depositors' response to changes in bank-specific fundamentals ("market discipline") and result in excessive risk taking which ineffective regulation and supervision are unable to tame.[1] An important unanswered question is whether large depositors enhance market discipline. Private pension funds are large depositors in many Latin American and Central and Eastern European countries which implemented pension reforms from pay-as-you-go to fully funded systems over the last three decades. In these countries, pension funds as large depositors could exert influence on market discipline.

This paper studies the behavior of private pension funds as large depositors in Argentina in the period 1998-2001. Argentina provides an excellent case study to investigate the role of pension funds as depositors because it introduced a funded pension scheme in 1994 and suffered a dramatic banking panic episode seven years later, in 2001.

We define market discipline as a situation in which depositors withdraw deposits in response to increases in banks' risks as measured by a deterioration in bank fundamentals.[2] In theory,

[1] For a database documenting the high frequency and intensity of systemic banking crises in the period 1970-2007, see Laeven and Valencia (2008). On the connection between government guarantees and market discipline, see for example Demirguc-Kunt and Huizinga (2004) and Demirguc-Kunt and Detragiache (2002).

[2] A broader definition would also include situations where depositors demand higher interest rates in response to a deterioration in fundamentals—see Berger (1991) and Martinez Peria and Schmukler (2001). Our goal is to compare the disciplining behavior of pension funds and other depositors; but we have no data on interest rates earned on pension fund deposits.

pension funds can influence market discipline in banking systems through different channels. On the positive side, in contrast to individuals, pension funds are *sophisticated* and *large* depositors. Pension funds' advantage in monitoring implies that they could enhance market discipline, penalizing banks for fundamental weaknesses or excessive risk-taking by withdrawing deposits. On the negative side, pension fund behavior could be affected by *conflicts of interest* in relation to banks. Pension funds could favor connected banks, undermining instead of enhancing market discipline. In Argentina, banks' ownership of Pension Fund Management Companies raised the possibility that conflicts could have influenced the deposit allocation of pension funds.

For these reasons, the case of Argentina is of particular interest. We conduct panel data analysis over the period 1998-2001 to address the questions whether, and if so how, pension funds influence market discipline in a banking system.

The first question that we address is, "do pension funds *exert* market discipline on banks?" We find evidence that pension funds do exert market discipline; specifically, we obtain the following two results. First, pension funds exert discipline with respect to two CAMEL-type fundamentals: capital adequacy and the non-performing loans ratio—an asset quality indicator. We find no evidence that pension funds exert discipline with respect to changes in bank profitability and liquidity. Second, the discipline exerted by pension funds gets stronger as the share of pension fund deposits in a bank rises; this suggests that a larger presence of pension funds in a bank's deposit base improves their disciplining incentives.

There are, however, sharp differences in pension funds' behavior toward different types of banks. We classify banks according to their connection to the pension fund industry through ownership of Pension Fund Management Companies and obtain the third and main result: the

disciplining behavior of pension funds is tainted by *conflicts of interest*. We find that the observed market discipline holds only for unconnected banks; furthermore, pension funds undermine overall market discipline by shifting deposits toward connected banks with weakening fundamentals. In sharp contrast to unconnected banks, connected banks gain pension fund deposits as their capitalization declines and their non-performing loan ratios increase.

The second question that we address is, "do pension funds *enhance* market discipline?" In other words, "does pension fund behavior *differ* from that of other depositors?" We find evidence that other (non-pension fund) depositors exert discipline with respect to some CAMEL-type fundamentals—capital adequacy and net provision of financing to the government[3]—when the share of pension fund deposits is small. As the share of pension fund deposits rises, however, the discipline exerted by non-pension fund depositors vanishes—possibly due to a crowding out effect whereby a larger presence of pension funds in a bank's deposit base reduces the incentives for other depositors to exert market discipline.

Having established that conflicts of interest undermine the disciplining role of pension funds, we examine their behavior during the crisis period. By the time crisis hit Argentina's banking system in January of 2001,[4] pension funds held 5.7 percent of the system's time deposits. A striking fact about the crisis is that pension funds increased their deposits sharply, despite a generalized panic. Specifically, deposits held by pension funds increased 19.0 percent from January to November of 2001 while term deposits in the system declined 18.8 percent in the

[3] Exposure to the government sector is a highly relevant bank fundamental in the case of Argentina. The study period includes a banking crisis and a protracted sovereign debt crisis. Thus, we interpret high provision of government financing by a bank as a fundamental weakness—a high exposure to sovereign default risk.

[4] We date the beginning of the Argentine banking crisis at the end of January of 2001, when time deposits in the banking system reached a peak. Note that all pension fund deposits were in the form of time deposits.

same period. When deposit convertibility was suspended on December 1, 2001, the share of pension fund deposits in the system had increased to 8.5 percent. In part, this happened because of tight regulations that limited pension funds' investment options—including foreign investment restrictions preventing international diversification. These regulations, however, applied only to broad asset categories such as 'bank deposits,' so pension funds were free to exert discipline by reallocating deposits across banks.

The behavior of aggregate pension fund deposits during the crisis—increasing while other depositors were withdrawing funds—suggests that pension funds could have played a stabilizing role in the banking system. From a market discipline perspective, however, we focus on disaggregated data and show that pension funds conducted a massive reallocation of deposits from unconnected to connected banks. Thus, motivated by conflicts of interest, pension funds undermined market discipline during the crisis.

Consistent with our econometric results, we find that pension funds allocated deposits to banks with poor fundamentals. At the beginning of the banking crisis, pension fund deposits were concentrated in a small number of banks (15 out of 86 banks received 90 percent of pension fund deposits) that were "weak" in terms of capitalization, liquidity, and government exposure. Interestingly, due to poor fundamentals, banks that attracted pension fund deposits before the crisis suffered larger deposit losses than other banks during the crisis.

These results point to an important policy implication: forbidding banks' ownership of companies involved in pension fund management can enhance market discipline.

The rest of the paper is organized as follows. Section II discusses related literature. Section III describes the data. Section IV describes the panel data methodology. Section V presents

the panel data results. Section VI describes the behavior of pension funds during the banking crisis. Section VII concludes.

II. RELATED LITERATURE

In relation to previous research, this is the first paper that studies the behavior of a type of institutional investor (pension funds) as a depositor in a banking system. It connects to several strands of literature.

First, it is related to the literature on market discipline in the banking sector. Park and Peristiani (1998) develop the basic empirical framework to test whether depositors respond to higher bank risk by withdrawing deposits or increasing interest rates. They propose a two-equation procedure: the first equation estimates the probability of bank failure based on observable fundamentals, and the second equation estimates how depositors respond to the estimated probability. Applying this framework to U.S. thrifts in the late 1980s, the authors find evidence of market discipline through both the deposit growth and interest rate channels. Other studies use a single equation approach, whereby depositor behavior is directly determined by the set of bank fundamentals.[5] Martínez Pería and Schmukler (2001) find evidence of market discipline in Argentina, Chile, and Mexico during the 1980s and 1990s. Barajas and Steiner (2000) examine Colombian banks during 1985-99, and find that depositors prefer banks with higher capital and loan-loss provisions, those that are state-owned, and banks that offer a wider branch network. Schumacher (1996) studies the deposit runs in Argentina in 1995 and finds that banks with weaker fundamentals suffered larger

[5] Martínez Pería and Schmukler (2001) point out advantages of the single equation approach: (1) it permits a market discipline test in cases where a lack of actual bank failures precludes an estimation of the probability of failure, and (2) it allows one to study specifically which fundamentals are affecting depositor behavior the most.

deposit withdrawals. Levy-Yeyati et. al. (2010) examine depositor behavior in Argentina in the run-up to the 2001 crisis and find that depositor discipline remains significant once macroeconomic factors are accounted for.[6] Barajas at. al. (2007) also study the 2001 Argentine crisis, and find that depositors favored banks with higher loan quality and lower exposure to the government.

Some studies focus on market discipline in a cross-country setting. Demirguc-Kunt and Huizinga (2004) estimate panel regressions for 30 countries during 1990-97 and find that explicit deposit insurance schemes weaken market discipline. Berger and Turk-Ariss (2010) examine depositor behavior in the U.S. and EU during the 11-year period leading up to the global financial crisis and find evidence of stronger market discipline in the U.S. and for smaller banks; also, depositors are more sensitive to the equity-asset ratio than to measures of loan portfolio performance.

To date, however, the issue of whether market discipline varies across types of depositors has not been studied. Presumably, certain groups of large and well-informed depositors are driving market discipline in all of the above cases. Our contribution to the literature is to address the question whether private pension funds serve this function.

The second strand of literature to which this paper contributes is the incipient literature on the effects of financial crises on retirement systems. In light of the global crisis, Mitchell (2010) discusses risks and vulnerabilities associated with existing pension systems and calls for the development of a new framework for retirement security. Whitehouse (2009) documents the heavy losses inflicted by the crisis on private pension funds and the policy

[6] From an institutional perspective, Calomiris and Powell (2000) provide a detailed account of regulatory developments aimed at establishing discipline during the 1990s.

responses adopted in OECD countries; and Munnell et. al. (2008) discuss the effects of the crisis on public pension systems in the U.S. These studies focus on the current crisis; however, our knowledge about the impact of previous crises on funded pension systems remains anecdotal. In this paper, we show that a risk that has been ignored in the literature—originated in conflicts of interest between banks and pension funds—can undermine market discipline during a crisis.

This paper also contributes to a third strand of literature, on pension fund governance, by documenting behavior of pension funds that is inconsistent with their fiduciary duty to act in the best interest of beneficiaries.[7] Related literature studies conflicts of interest in financial institutions, including universal banks and mutual funds.[8] In connection with this literature, we identify a new conflict—created because pension funds act as depositors in banks that own Pension Fund Management Companies—and show evidence supporting its existence.

III. DATA DESCRIPTION

We exploit a unique dataset showing pension fund deposit allocation across banks in Argentina for the period January 1998-December 2001.

Our empirical analysis combines macroeconomic data with two types of panel data: bank-specific balance sheet information and pension fund deposit holdings. All data are available at a monthly frequency. We obtained the macroeconomic data from the Central Bank of Argentina and the IMF *International Financial Statistics*; the banking data comes from the

[7] Central references in the literature on pension fund governance are Clark (2000 and 2004). Catalán (2004) offers an early discussion of conflicts of interest between pension funds and banks in Latin America.

[8] Conflicts of interest within universal banks include those associated with bank lending/underwriting; sell side analysis/underwriting; analysis/brokerage; and asset management/underwriting; Mehran and Stulz (2007) offer an excellent literature review. Conflicts within the mutual fund industry are reviewed by Mahoney (2004). Ljungqvist et. al. (2007) show that institutional investors moderate conflicts in sell-side research.

Central Bank of Argentina; and the pension funds data comes from the pension funds regulator, *Superintendencia de Administradoras de Fondos de Jubilaciones y Pensiones* (SAFJP). From the pension funds regulator, we also obtained data on ownership of Pension Fund Management Companies.

A. Bank-Specific Data

We follow previous literature and use time deposits and CAMEL-type fundamental variables that provide proxies of risk.[9] The latter variables include measures of capital adequacy, asset quality, profitability, and liquidity. Capital adequacy is measured by the capital to assets ratio (*CAPR*). Asset quality is measured by credit risk related variables: the ratio of non-performing loans to total loans (*NPLL*) and the ratio of net government borrowing from banks to total assets (*NGOVB*). Profitability is measured by the ratio of before-tax profits to total assets (*PROFIT*). Liquidity is measured by the ratio of liquid assets to total assets (*LIQ*).[10] We also include bank size, measured by each bank's market share in terms of assets (*SIZE*). Note that all these variables are standard and widely considered in the literature as possible determinants of deposit growth. In particular, banks of larger size that have higher capitalization, more liquidity, and higher-quality assets, are considered stronger. The variable *NGOVB* is relevant given that our study period includes a banking crisis which coincided

[9] Specifically, we select variables based on previous studies of depositor discipline in Argentina, in particular Martinez Peria and Schmukler (2001) and Barajas and others (2007).

[10] The numerator of *NGOVB* is calculated as bank holdings of government bills and bonds, and loans to the non-financial public sector (net of government deposits) denominated in both domestic and foreign currency. The numerator of *PROFIT* is calculated as monthly before-tax profits. The numerator of *LIQ* includes gold and cash assets and reserves (required and voluntary) denominated in domestic and foreign currency; it excludes government bills and bonds as well as private sector assets.

with a protracted sovereign debt crisis.[11] Thus, we interpret a priori a high amount of government financing by a bank as a fundamental weakness—a growing exposure to sovereign default risk. Also, in the dataset we identify the ownership of each bank, whether public, private, or foreign, and construct the dummy variables *PRIVATE* and *FOREIGN*. Finally, using data on ownership of Pension Fund Management Companies, we construct the dummy variable *CONNECT* that takes the value 1 if a bank is "connected" to the pension fund industry—owns a Pension Fund Management Company—and 0 otherwise.[12]

B. Pension Fund Deposit Data

We obtained the deposits held by pension funds on individual banks on a monthly basis. Combining pension fund deposit data with bank-specific data, we constructed a series of pension fund deposits as a fraction of total time deposits for each bank (*PFDEP*).
There were 18 pension funds at the beginning of our sample period in January of 1998. A process of consolidation reduced the number of pension funds to 13 by the end of 1999. The 13 pension funds in operation at the beginning of the banking crisis in January of 2001 held time deposits with fixed and variable interest rates and almost fully denominated in domestic

[11] A standard measure of sovereign default risk, the EMBI+, was below 400 basis points in the first semester of 1998. Since a recession started in the second semester of 1998, the EMBI+ increased over time and reached the 600-700 basis points range in the second semester of the year 2000. After the beginning of the banking panic, the EMBI+ increased sharply in March of 2001, and crossed the 1000 basis point barrier in July. See Mussa (2002) for an account of macroeconomic developments in Argentina in this period.

[12] During the study period, banks owned 80 percent of the Pension Fund Management Companies; the remaining ownership was divided among insurance companies, labor unions, and non-financial companies.

currency.[13] The duration (average maturity) of pension fund deposits was 6 months, and 12 percent of the deposits matured in December of 2001 or later.

C. Macroeconomic Data

Previous studies show that macroeconomic developments also influence the evolution of bank deposits. Calomiris and Gorton (1991) show that historically they help to explain the origin and dynamics of banking panic episodes, which occur near business-cycle and stock market peaks. Levy-Yeyati et al. (2010) study the role of macroeconomic factors during the Argentine banking crisis of 2001 and find that they affect deposits regardless of bank-specific fundamentals. Following this literature, we include in our analysis a measure of aggregate production available at monthly frequency (*PRODUCTION*) and the "non-bank" stock market price index (*MERVALNB*).[14]

We also include variables that account for specific features of Argentina's macroeconomic environment, such as the currency board monetary regime and market perceptions of regime-switch risk. Specifically, we consider the following macroeconomic variables. Currency risk (*CURISK*), calculated as the spread between dollar and peso-denominated interbank rates (in basis points), measures devaluation risk—the risk of exit from the currency board system. The central government balance as a share of GDP (*FISCAL*) captures the growing financing

[13] By January of 2001, pension fund deposits were distributed as follows: 86 percent were fixed-rate deposits denominated in pesos; 4.5 percent were fixed-rate deposits in foreign currency (2.6 percent in US dollars and 1.9 percent in euros); 6.5 percent were floating-rate deposits in pesos; and 3.5 percent were peso-denominated deposits embedding early withdrawal options.

[14] *PRODUCTION* is the index of industrial production. Regarding the stock market price index, it is widely used as a leading indicator of future macroeconomic conditions. The variable *MERVALNB* is a stock market price index that excludes stocks of publicly traded banks to prevent an endogeneity problem in our regressions.

requirements of the public sector.[15] Note that the macroeconomic framework provided connections among the variables *CURISK, FISCAL*, and sovereign default risk as measured by the EMBI+. Specifically, unlimited central bank financing of fiscal deficits was inconsistent with Argentina's currency board regime—such financing, if sustained, would imply a depletion of official international reserves and an eventual collapse of the currency board system. Table 1 reports averages across banks and over the study period for the variables used in the analysis.

IV. Econometric Methodology

In subsection A., we present the panel data models that we use to evaluate whether pension funds exert market discipline on banks and whether such discipline is more intense than the discipline exerted by other depositors. In subsection B., we explain how we measure market discipline using partial influence functions obtained from the panel data models. In subsection C., we present the models that we use to evaluate the effect of bank connection to the pension fund industry on market discipline.

A. Models

We separate the total time deposits of individual banks (DEP) into two components: those held by pension funds (DEP^{PF}) and those held by other depositors (DEP^{OTHER}), where $\mathrm{DEP} = \mathrm{DEP}^{PF} + \mathrm{DEP}^{OTHER}$.

We define a two-level model with depositors nested within banks, which is given by:

[15] The variable *FISCAL* was calculated as the ratio of monthly overall fiscal balances multiplied by 12 and divided by annual nominal GDP.

$$
\begin{aligned}
\Delta \mathrm{DEP}_{i,t-l}^{j} = {} & \alpha_0 + \alpha_1^{'} \cdot \mathrm{DUM}_i + \alpha_2^{'} \cdot \mathrm{MACRO}_{t-l} + \beta^{'} \cdot \mathrm{FUND}_{i,t-l}^{j} + \beta_d^{'} \cdot d^j \cdot \mathrm{FUND}_{i,t-l}^{j} \\
& + \gamma^{'} \cdot \mathrm{FUND}_{i,t-l}^{j} \times \mathrm{PFDEP}_{i,t-l} + \gamma_d^{'} \cdot d^j \cdot \mathrm{FUND}_{i,t-l}^{j} \times \mathrm{PFDEP}_{i,t-l} \\
& + \delta^{'} \cdot \mathrm{SIZE}_{i,t-l} + \delta_d^{'} \cdot d^j \cdot \mathrm{SIZE}_{i,t-l} \\
& + \theta^{'} \cdot \mathrm{SIZE}_{i,t-l} \times \mathrm{PFDEP}_{i,t-l} + \theta_d^{'} \cdot d^j \cdot \mathrm{SIZE}_{i,t-l} \times \mathrm{PFDEP}_{i,t-l} \\
& + \eta^{'} \cdot \mathrm{PFDEP}_{i,t-l} + \eta_d^{'} \cdot d^j \cdot \mathrm{PFDEP}_{i,t-l} + \varepsilon_{i,t}^{j} \ ,
\end{aligned}
\tag{1}
$$

where $i = 1,...,I;\ t = 1,...,T;\ j = \mathrm{OTHER,PF}$; and $d^j = \begin{cases} 0 & \text{if} \quad j\text{=OTHER} \\ 1 & \text{if} \quad j\text{=PF} \end{cases}$.

The indexes i, t, j, and l indicate, respectively, the banking institution, the time period, the type of depositor, and the measurement lag. The panel is unbalanced, so T, the number of observations per bank, varies across institutions. The dependent variable $\Delta \mathrm{DEP}_{i,t-l}^{j}$ measures the growth rate of time deposits held by depositor type j in bank i between the times t and $t-l$.

Determinants of bank deposit growth are lagged by l months—measured at the beginning of the corresponding growth period. Bank-specific characteristics are collected in the vector $\mathrm{DUM}_i = \left[CONNECT_i, FOREIGN_i, PRIVATE_i \right]^{'}$. These variables are time-invariant and thus act as an intercept shift in ordinary least square (OLS) regressions. Macroeconomic variables are collected in the vector $\mathrm{MACRO}_{t-l} = \left[CURISK_{t-l}, FISCAL_{t-l}, MERVALNB_{t-l}, PRODUCTION_{t-l} \right]^{'}$. CAMEL-type bank-specific and time-variant fundamentals are collected in the vector $\mathrm{FUND}_{i,t-l}^{j} = \left[CAPR_{i,t-l}, LIQ_{i,t-l}, PROFIT_{i,t-l}, NPLL_{i,t-l}, NGOVB_{i,t-l} \right]$.

Estimated coefficients on interaction terms of the CAMEL-type fundamentals with the dummy variable d^j will indicate whether the disciplining behavior of pension funds is different from that of other depositors. Standard t-tests performed on those coefficients will determine whether such differences are statistically significant.

As mentioned earlier, the variable PFDEP measures the share of bank i time deposits held by pension funds. It is of particular interest for our purposes: we assess whether higher shares of pension fund deposits affect market discipline—measured by how strongly deposits respond to changes in bank fundamentals—through interaction effects. The vector $\text{FUND} \times \text{PFDEP}$ collects the interactions between the bank fundamentals and the share of pension fund deposits. Finally, the treatment of the variable *SIZE* in equation (1) is similar to that of CAMEL-type fundamentals.[16]

To obtain robust conclusions, we consider variations of the model. In addition to equation (1), we estimate a pooled version of the model that includes time specific effects. Specifically, we replace the terms $\alpha_2^{'} \cdot \text{MACRO}_{t-l}$ by the time specific variables λ_t to possibly control more broadly for the macroeconomic and banking sector developments that have common effects across banks.

A further variation of the model includes bank and depositor specific fixed effects. We replace the terms α_0 and $\alpha_1^{'} \cdot \text{DUM}_i$ in equation (1) with intercepts μ_i^j. As the intercept varies across banks and depositors' groups, it captures unobserved characteristics of bank i and depositor type j. In the final variation of the model, we estimate fixed effects regressions that include bank-specific and time-specific intercepts.

[16] On theoretical grounds, the relation between size and market discipline is ambiguous and complex. First, a "too big to fail" problem could weaken the market discipline exerted on big banks relative to small banks. In the case of Argentina, however, the capacity of the government to bailout banks was severely constrained by the widespread dollarization of deposits and the currency board monetary regime. Second, large depositors could account for a larger share of deposits in big banks than in small banks—wealthy families, corporations, and institutional investors could prefer to do business with big banks that offer a broader set of financial and support services. In such case, large banks would be subject to more strict discipline than small banks.

B. Market Discipline Measures Based on Partial Influence Functions

Our model specifications assume that depositor responses to changes in bank fundamentals can vary depending on the share of pension fund deposits and depositor type. A partial influence function summarizes these interactions by measuring the effect on deposit growth of a marginal change in a fundamental.

Let F be any CAMEL-type bank fundamental: $F \in \{CAPR, LIQ, PROFIT, NPLL, NGOVB\}$.

Denote β_F and β_{dF} the coefficients (elements of the vectors β and β_d) corresponding to the variables $F_{i,t-l}$ and $d^j \cdot F_{i,t-l}$ in equation (1). Similarly, denote γ_F and γ_{dF} the coefficients corresponding to the variables $F_{i,t-l} \times \text{PFDEP}_{i,t-l}$ and $d^j \cdot F_{i,t-l} \times \text{PFDEP}_{i,t-l}$.

The partial influence function corresponding to the fundamental F and depositor type j (PI_F^j) is given by the partial derivative of the function $\Delta\text{DEP}_{i,t-l}^j$ with respect to $F_{i,t-l}$:

$$\text{PI}_F^j = \frac{\partial \Delta\text{DEP}_{i,t-l}^j}{\partial F_{i,t-l}} = \begin{cases} \beta_F + \gamma_F \times \text{PFDEP}_{i,t-l} & \text{if} \quad j\text{=OTHER} \\ \left(\beta_F + \beta_{dF}\right) + \left(\gamma_F + \gamma_{dF}\right) \times \text{PFDEP}_{i,t-l} & \text{if} \quad j\text{=PF} \end{cases}.$$

Note that the PI_F^j functions are linear and differ across depositor types. The intercepts of the PI functions indicate the discipline exerted by both types of depositors—with respect to the CAMEL-type fundamental *F*—on a bank when the share of pension fund deposits is insignificant (as $\text{PFDEP}_{i,t-l} \to 0$). The sum of the intercepts and slopes ($\beta_F + \gamma_F$ and $\beta_F + \beta_{dF} + \gamma_F + \gamma_{dF}$) indicate the discipline exerted by depositors on a bank whose share of pension fund deposits approaches unity (as $\text{PFDEP}_{i,t-l} \to 1$).

We use the parameter estimates from equation (1) to construct empirical PI functions. To account for the stochastic nature of parameter estimates, we construct confidence bounds using the Fieller method described in the Appendix.

Our empirical definition of depositor discipline is as follows: a depositor type j exerts discipline with respect to the fundamental F for a given pension fund deposit ratio $\text{PFDEP}_{i,t-l}$ if all the points in the confidence interval are of the "correct" sign and strictly different from 0. More precisely, we take the "correct" sign to mean that deposits grow more rapidly in banks with higher *CAPR*, *LIQ*, and *PROFIT*; or lower *NPLL* and *NGOVB*. And we conclude that there exists market discipline when we reject the "no discipline" hypothesis at the 95 percent confidence level. Note that according to this definition, conclusions about depositor discipline can vary with the pension fund deposit share.

Finally, starting with the partial influence functions corresponding to the two depositors' groups, we can construct an *aggregate* partial influence function. The growth rate of total time deposits in bank i between the times t and $t-l$ $\left(\Delta\text{DEP}_{i,t-l}\right)$ can be expressed as follows: $\Delta\text{DEP}_{i,t-l} = \Delta\text{DEP}^{PF}_{i,t-l} \cdot \text{PFDEP}_{i,t-l} + \Delta\text{DEP}^{OTHER}_{i,t-l} \cdot (1 - \text{PFDEP}_{i,t-l})$. The aggregate partial influence function is quadratic and given by:

$$\frac{\partial \Delta\text{DEP}_{i,t-l}}{\partial F_{i,t-l}} = \beta_F + \left(\beta_{dF} + \gamma_F\right) \cdot \text{PFDEP}_{i,t-l} + \gamma_{dF} \cdot \left(\text{PFDEP}_{i,t-l}\right)^2 .$$

C. Models to Assess the Effects of Bank Connection to the Pension Fund Industry

We estimate an expanded version of equation (1) that includes interactions between bank fundamentals and the variable *CONNECT*. Specifically, we define equation (2) as equation

(1) expanded to include the following terms:

$$\phi_d^{'} \cdot d^j \cdot \text{FUND}_{i,t-l}^j \times \text{CONNECT}_\text{i} + \tau_d^{'} \cdot d^j \cdot \text{FUND}_{i,t-l}^j \times \text{PFDEP}_{i,t-l} \times \text{CONNECT}_\text{i}$$
$$+\psi_d \cdot d^j \cdot \text{SIZE}_{i,t-l} \times \text{CONNECT}_i + \chi_d \cdot d^j \cdot \text{SIZE}_{i,t-l} \times \text{PFDEP}_{i,t-l} \times \text{CONNECT}_\text{i}$$
$$+\rho_d \cdot d^j \cdot \text{PFDEP}_{i,t-l} \times \text{CONNECT}_\text{i}.$$

Our objective is to evaluate whether pension funds' disciplining behavior is different toward connected and unconnected banks; equation (2) allows us to estimate different PI functions of pension fund depositors for both types of banks, as follows:

$$\text{PI}_F^{PF} = \frac{\partial \Delta \text{DEP}_{i,t-l}^j}{\partial F_{i,t-l}} = \begin{cases} \left(\beta_F + \beta_{dF}\right) + \left(\gamma_F + \gamma_{dF}\right) \times \text{PFDEP}_{i,t-l} & \text{if} \quad CONNECT_i = 0 \\ \left(\beta_F + \beta_{dF} + \phi_{dF}\right) + \left(\gamma_F + \gamma_{dF} + \tau_{dF}\right) \times \text{PFDEP}_{i,t-l} & \text{if} \quad CONNECT_i = 1 \end{cases}.$$

The Appendix shows how to construct confidence intervals for these specific PI functions.

V. Econometric Results

In subsection A., we discuss regression results corresponding to equation (1), which we use to evaluate the disciplining behavior of pension funds and other depositors toward *banks considered as a single group*. In subsection B., we discuss regression results corresponding to equation (2), which we use to compare the disciplining behavior of pension funds toward *connected and unconnected banks*. Tables 2 and 3 display estimations corresponding to, respectively, equations (1) and (2); Figures 1 and 2 show related PI functions.

A. Do Pension Funds Exert Market Discipline? Is it More or Less Intense than the Discipline Exerted by Other Depositors?

In Table 2, regressions (1) and (2) show pooled estimations corresponding to equation (1). Regressions (3) and (4) show fixed effects estimations; they include bank and depositor specific fixed effects—the terms α_0 and $\alpha_1^{'} \cdot \text{DUM}_i$ in equation (1) are replaced by intercepts

μ_i^j . In all the regressions, the determinants of bank deposit growth are measured at the beginning of the growth period; thus, the reported lag is given by $l = 6$. We center our discussion on results corresponding to 6-month regressions because the average maturity of pension fund deposits is about 6 months during the study period.

Note that even-numbered regressions include macroeconomic variables MACRO as regressors, while odd-numbered regressions include time specific effects: in equation (1), the terms $\alpha_2^{'} \cdot \text{MACRO}_{t-l}$ are replaced by the time specific variables λ_t.[17]

The main results can be described as follows. Based on the fixed effects regressions reported in Table 2 and the confidence intervals associated with the PI functions presented in Figure 1 (upper panels), we find some evidence that pension funds and other depositors exert market discipline on *banks considered as a single group*.

First, non-pension fund depositors exert discipline only when the share of pension fund deposits (*PFDEP*) is small. Such discipline is exerted only with respect to the capitalization ratio (*CAPR*) and the net government financing ratio (*NGOVB*) and vanishes completely as the share of pension fund deposits rises above a threshold (somewhere in the range 0.2-0.4). Thus, the presence of large pension fund deposits in a bank possibly crowds out the market discipline exerted by non-pension fund depositors.[18]

[17] Constant terms and fixed effects coefficients are not reported in Tables 2 and 3.

[18] Strictly, according to our analysis of the disciplining behavior of non-pension fund depositors, we reject the "no discipline" hypothesis when the share of pension fund deposits is low, but we cannot reject it when the share of pension fund deposits is sufficiently high.

Second, pension funds also exert discipline only when the aggregate share of pension fund deposits in a bank is small. This discipline is exerted only with respect to the capitalization ratio (*CAPR*) and vanishes when the share of pension fund deposits rises above a threshold. We also find that, contrary to expected disciplining behavior, pension fund deposit growth favors less liquid banks. We interpret this result as follows. During non-crisis times, banks holding more liquid assets may exhibit slower credit growth and thus lower future profitability. From this perspective, pension funds may decide to move deposits from banks holding more liquid assets to banks pursuing more aggressive credit expansion strategies.[19] During crisis times, conventional wisdom interprets asset liquidity as a fundamental strength: more liquid assets allow banks to withstand larger deposit withdrawals if faced with bank runs; hence, banks with liquid assets should gain deposits relative to those holding illiquid assets. However, this conventional wisdom is reversed when deposit withdrawals are motivated by fear of a currency crisis. In this case, banks holding more liquid assets denominated in domestic currency may suffer withdrawals from large depositors—such as pension funds—who follow a rule of "selling liquid assets first." In particular, large depositors like pension funds may decide to liquidate their deposits when a bank has plenty of liquid assets to absorb those large withdrawals; but they may fear triggering a liquidity shortfall and a run on the bank if they attempt to withdraw funds from an illiquid bank. The inverse relation between bank asset liquidity and deposit growth that we find is consistent with the generalized perception that Argentina's currency board monetary regime

[19] This interpretation is consistent with previous results in the empirical banking literature in emerging market economies; see Barajas and Steiner (2000).

was becoming unsustainable as the year 2001 progressed. Based on this perception, pension funds acted as bank raiders who mopped up the liquidity of the banking system.

Thus, our result on the relation between bank liquidity and pension funds' deposit growth is consistent with rational behavior by pension funds in both crisis and non-crisis times.

Regarding the empirical validity of results corresponding to equation (1), note that F-tests performed on all fixed effects regressions reject the pooled model and support the inclusion of bank and depositor specific fixed effects.[20]

To summarize, we consider banks as a single group and find little evidence that pension funds contribute to depositor discipline. Pension funds exert some discipline when their weight as depositors is small and aggregate discipline is driven mainly by non-pension fund depositors. But we find no evidence that pension funds exert discipline when they are large, and hence, the main drivers of aggregate discipline. The aggregate PI functions shown in Figure 2 further support these conclusions, which are critically influenced by the effect of some banks' connection to the pension fund industry (conflicts of interest). In the next subsection, we show that pension funds exert discipline only on *unconnected* banks.

[20] Specifically, regressions (1) and (2) in Table 2 report F-tests on the joint significance of the variables DUM—these tests compare an "unrestricted" regression that includes the variables DUM against a "restricted" regression that includes a single constant term. Regressions (3) and (4) in Table 2 report F-tests on the joint significance of the bank and depositor specific fixed effects—such tests compare an "unrestricted" regression that includes the fixed effects against a "restricted" regression that includes the variables DUM.

B. Does Bank Connection to the Pension Fund Industry Affect Pension Funds' Discipline Behavior?

Table 3 shows fixed effects estimations corresponding to equation (2) and Figure 1 (lower panels) shows associated PI functions. These reveal a sharp contrast between pension funds' disciplining behavior toward connected and unconnected banks.

The contrasting results can be described as follows. First, unconnected banks gain pension fund deposits when their capitalization ratios increase. The opposite holds true for connected banks: they gain pension fund deposits when their capitalization ratios decrease.

Second, unconnected banks lose pension fund deposits when their asset liquidity ratios increase. That is not the case for connected banks, where higher liquidity has no significant effect on pension fund deposits (except when the share of pension fund deposits is small). Thus, we refine earlier results and conclude that pension funds raided only unconnected banks to mop up their liquidity.

Third, unconnected banks lose pension fund deposits when their non-performing loans ratio increases. In contrast, connected banks attract pension fund deposits when the non-performing loans ratio increases.

Fourth, bank size does not affect pension fund deposit growth in unconnected banks; in contrast, connected banks gain deposits as they become smaller in size.

All these results point to a detrimental impact of conflicts of interest—stemming from bank-pension fund connections—on depositor discipline.

VI. Pension Funds' Behavior as Depositors During the Crisis

This section describes pension fund deposit allocation and its relation to bank fundamentals at the beginning of the crisis and cross-bank deposit movements during the crisis.

A. Deposit Allocation of Pension Funds at the Beginning of the Crisis

Table 4 shows basic facts that characterize the cross-bank deposit allocation of pension funds at the beginning of the crisis in January of 2001. The following facts are noteworthy:

1) Pension funds held deposits in 29 out of 86 banks. They allocated 90 percent of their deposits to 15 banks and were "large depositors" in 9 banks—holding more than 10 percent of the banks' deposits;
2) Deposits from pension funds accounted for 5.7 percent of the system's deposits and 6.7 percent of the deposits of the 29 banks in which they invested. Within the group of 15 banks that attracted 90 percent of pension fund deposits, these accounted for 8.5 percent of total deposits. Within the group of 9 banks in which pension funds were large depositors, pension fund deposits represented 32.7 percent of total deposits;[21]
3) Pension funds allocated their deposits to banks that were fundamentally strong in terms of non-performing loans but "weak" in terms of capitalization, liquidity, profitability, and government financing.

B. Pension Funds' Behavior as Depositors during the Crisis

Turning to the banking panic, Figure 3 shows a striking fact: pension funds increased their deposits sharply, moving against the tide during this turbulent period. Specifically, deposits held by pension funds increased 19.0 percent from January to November of 2001 while term deposits in the system declined 18.8 percent in the same period. One reason why this

[21] Note that the numbers correspond to the weighted average calculations shown in Table 4.

happened is that tight regulations—including foreign investment restrictions preventing international diversification—limited pension funds' investment options. These regulations applied only to broad asset categories such as 'bank deposits,' so pension funds were free to reallocate deposits across banks.

Figure 4 shows relative frequency distributions of deposit changes across banks from January to November of 2001 for all banks in the system and for the group of "banks with large pension fund deposits"—the 9 banks in which pension funds held more than 10 percent of total deposits in January of 2001. Note that the distribution corresponding to "banks with large pension fund deposits" is skewed to the right compared to the distribution corresponding to all banks: *pension funds were large depositors in banks that suffered larger than average deposit losses during the crisis*.

Table 5 confirms this observation: on a simple average basis, deposit changes in three groups of banks are respectively -18.8 percent (all banks), -25.7 percent (banks receiving 90 percent of pension funds' deposits), and -24.7 percent (banks with large pension fund deposits).

Figure 5 shows a weak association between each bank fundamental variable at the beginning of the crisis and subsequent deposit changes across banks during the crisis. However, it also shows that banks which attracted 90 percent of the pension fund deposits were fundamentally "weak" in a number of dimensions, confirming the Fact 3 noted above.

Table 5 also shows the breakdown of deposit changes across bank groups by depositor type. Regarding the behavior of pension funds as depositors, we highlight the following facts:

4) Pension funds increased their aggregate deposits sharply;
5) Pension funds conducted a large reallocation of deposits across banks. Pension funds withdrew 17.7 percent of their deposits from the group of 29 banks in which they held

deposits at the beginning of the crisis, and reallocated them along with additional deposits toward a new group of banks;

6) Pension funds' behavior as depositors helps account for the fate of different bank groups. Banks that received pension fund deposits before the crisis lost on average 24.2 percent of deposits. In contrast, banks that had no pension fund deposits before the crisis lost 10.1 percent of deposits.

Table 6 shows the deposit reallocation conducted by pension funds during the crisis. Banks are listed in decreasing order by the size of the (net) pension fund deposit changes observed in the period January-November 2001. The following facts emerge:

7) 15 banks received net inflows of pension fund deposits: 12 were foreign owned, 2 were publicly owned, and one was domestically and privately owned;
8) Banks that received the largest inflows of pension fund deposits were connected to the pension fund industry—as owners of pension fund management companies;
9) The new group of banks that attracted pension fund deposits during the crisis consisted of only 5 banks: 4 were foreign owned and one was the largest public bank;
10) There was a large reallocation of pension fund deposits within the group of foreign banks, generally from unconnected to connected banks.

Consistent with our econometric results, these facts support the view that conflicts of interest hamper the disciplining role of pension funds. Note that although foreign banks are often considered more safe and sound than domestic banks in emerging markets, Fact 10 suggests that conflicts of interest dominated pension funds' behavior as depositors during the crisis, trumping even flight-to-safety concerns.

VII. CONCLUSION

We study the behavior of private pension funds as large depositors in Argentina in the period 1998-2001. Using panel data analysis, we address the questions whether, and if so how, pension funds influence market discipline. We reach two main conclusions. First, *pension funds do exert market discipline*; this discipline is exerted on unconnected banks and gets stronger as the share of pension fund deposits in a bank increases. Second, *conflicts of interest undermine the disciplining role of pension funds*. Banks' ownership of Pension Fund Management Companies has detrimental effects on pension funds' disciplining behavior. Banks connected to the pension fund industry tend to gain pension fund deposits as their fundamentals deteriorate. Our results also suggest that an increasing share of pension fund deposits in the deposit base might crowd out the discipline exerted by non-pension fund depositors. Finally, this paper has a clear policy implication: banks' ownership of companies involved in pension fund management should be forbidden if the objective is to enhance depositor discipline.

Appendix: Using the Fieller Method to Construct Confidence Intervals for PI Functions

The estimated values of $\text{PFDEP}_{i,t-l}$ that set the PI functions equal to 0 are given by:

$$\text{PI}_F^j = \frac{\partial \Delta \text{DEP}_{i,t-l}^j}{\partial F_{i,t-l}} = 0 \Leftrightarrow \begin{cases} \text{PFDEP}_{i,t-l} = -\dfrac{\widehat{\beta_F}}{\widehat{\gamma_F}} & \text{if} \quad j\text{=OTHER} \\ \text{PFDEP}_{i,t-l} = -\dfrac{\left(\widehat{\beta_F} + \widehat{\beta_{dF}}\right)}{\left(\widehat{\gamma_F} + \widehat{\gamma_{dF}}\right)} & \text{if} \quad j\text{=PF} \end{cases};$$

where $\widehat{\beta}$ and $\hat{\gamma}$ are estimates of β and γ, respectively. Following Hirschberg and Lye (2007, 2010), $100 \cdot (1-\alpha)\%$ confidence intervals (CI) for the empirical PI functions are defined by:

$$\text{CI} = \left(\widehat{\beta_F} + \widehat{\gamma_F} \cdot \text{PFDEP}_{i,t-l}\right) \pm t_{\alpha/2} \cdot \sqrt{\widehat{\sigma}^2_{\beta_F} + 2 \cdot \widehat{\text{Cov}}(\beta_F, \gamma_F) \cdot \text{PFDEP}_{i,t-l} + \text{PFDEP}^2_{i,t-l} \cdot \widehat{\sigma}^2_{\gamma_F}} \quad \text{if} \quad j\text{=OTHER};$$

$$\text{CI} = \left[\left(\widehat{\beta_F} + \widehat{\beta_{dF}}\right) + \left(\widehat{\gamma_F} + \widehat{\gamma_{dF}}\right) \cdot \text{PFDEP}_{i,t-l}\right] \pm t_{\alpha/2} \cdot \sqrt{\widehat{\sigma}^2_{(\beta_F + \beta_{dF})} + 2 \cdot \widehat{\text{Cov}}(\beta_F + \beta_{dF}, \gamma_F + \gamma_{dF}) \cdot \text{PFDEP}_{i,t-l} + \text{PFDEP}^2_{i,t-l} \cdot \widehat{\sigma}^2_{(\gamma_F + \gamma_{dF})}}$$

if j=PF.

In the previous expressions, $\widehat{\sigma}^2_{\beta_F}$, $\widehat{\sigma}^2_{\gamma_F}$, and $\widehat{\text{Cov}}(\beta_F, \gamma_F)$ are estimates of the variances and the covariance corresponding to $\widehat{\beta}_F$ and $\hat{\gamma}_F$. Similarly, $\widehat{\sigma}^2_{(\beta_F + \beta_{dF})}$, $\widehat{\sigma}^2_{(\gamma_F + \gamma_{dF})}$, and $\widehat{\text{Cov}}(\beta_F + \beta_{dF}, \gamma_F + \gamma_{dF})$ are estimates of the variances and the covariance corresponding to $\left(\widehat{\beta}_F + \widehat{\beta}_{dF}\right)$ and $\left(\hat{\gamma}_F + \hat{\gamma}_{dF}\right)$:

$$\widehat{\sigma}^2_{(\beta_F + \beta_{dF})} = \widehat{\sigma}^2_{\beta_F} + \widehat{\sigma}^2_{\beta_{dF}} + 2 \cdot \widehat{\text{Cov}}(\beta_F, \beta_{dF}); \quad \widehat{\sigma}^2_{(\gamma_F + \gamma_{dF})} = \widehat{\sigma}^2_{\gamma_F} + \widehat{\sigma}^2_{\gamma_{dF}} + 2 \cdot \widehat{\text{Cov}}(\gamma_F, \gamma_{dF});$$

$$\widehat{\text{Cov}}(\beta_F + \beta_{dF}, \gamma_F + \gamma_{dF}) = \widehat{\text{Cov}}(\beta_F, \gamma_F) + \widehat{\text{Cov}}(\beta_F, \gamma_{dF}) + \widehat{\text{Cov}}(\beta_{dF}, \gamma_F) + \widehat{\text{Cov}}(\beta_{dF}, \gamma_{dF}).$$

Numerical calculations are based on robust estimation of the variance-covariance matrix of regression coefficients.

Aggregate PI Funcion: in this case the aggregate PI function is non-linear and the Filler method cannot be applied directly. However, we can obtain confidence intervals associated with linear approximations to the PI function at each point $\text{PFDEP}_{i,t-l}$.

We approximate the PI function $\beta_F + \left(\beta_{dF} + \gamma_F\right) \cdot \text{PFDEP} + \gamma_{dF} \cdot \left(\text{PFDEP}\right)^2$ around the point $\overline{\text{PFDEP}}$.

The slope of the linearized function is given by: $\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}};$ and its intercept is given by:

$\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2$. Hence, the linear approximation to the function can be written as follows:

$$\frac{\partial\Delta\text{DEP}_{i,t-l}}{\partial F_{i,t-l}}\cong\left[\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2\right]+\left[\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}}\right]\cdot\text{PFDEP}_{i,t-l}.$$

Applying the Fieller method, a $100\cdot(1-\alpha)\%$ confidence interval (CI) for the (linearized) PI function at the point $\overline{\text{PFDEP}}$ is given by:

$$\text{CI}=\left[\left(\hat{\beta}_F-\hat{\gamma}_{dF}\cdot\overline{\text{PFDEP}}^2\right)+\left(\hat{\beta}_{dF}+\hat{\gamma}_F+2\cdot\hat{\gamma}_{dF}\cdot\overline{\text{PFDEP}}\right)\cdot\overline{\text{PFDEP}}\right]$$
$$\pm t_{\alpha/2}\cdot\sqrt{\hat{\sigma}^2_{\left(\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2\right)}+2\cdot\widehat{\text{Cov}}\left(\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2,\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}}\right)\cdot\overline{\text{PFDEP}}+\overline{\text{PFDEP}}^2\cdot\hat{\sigma}^2_{(\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}})}};$$

where $\hat{\sigma}^2_{\left(\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2\right)}=\hat{\sigma}^2_{\beta_F}+\hat{\sigma}^2_{\gamma_{dF}}\cdot\overline{\text{PFDEP}}^4-2\cdot\overline{\text{PFDEP}}^2\cdot\widehat{\text{Cov}}(\beta_F,\gamma_{dF});$

$$\hat{\sigma}^2_{(\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}})}=\hat{\sigma}^2_{\beta_{dF}}+\hat{\sigma}^2_{\gamma_F}+\hat{\sigma}^2_{\gamma_{dF}}\cdot\left(4\cdot\overline{\text{PFDEP}}^2\right)+2\cdot\widehat{\text{Cov}}(\beta_{dF},\gamma_F)+4\cdot\overline{\text{PFDEP}}\cdot\left[\widehat{\text{Cov}}(\beta_{dF},\gamma_{dF})+\widehat{\text{Cov}}(\gamma_F,\gamma_{dF})\right];$$

and $\widehat{\text{Cov}}\left(\beta_F-\gamma_{dF}\cdot\overline{\text{PFDEP}}^2,\beta_{dF}+\gamma_F+2\cdot\gamma_{dF}\cdot\overline{\text{PFDEP}}\right)=\widehat{\text{Cov}}(\beta_F,\beta_{dF})+\widehat{\text{Cov}}(\beta_F,\gamma_F)+\overline{\text{PFDEP}}\cdot\widehat{\text{Cov}}(\beta_F,\gamma_{dF})$

$$-\overline{\text{PFDEP}}^2\cdot\left[\widehat{\text{Cov}}(\gamma_{dF},\beta_{dF})+\widehat{\text{Cov}}(\gamma_{dF},\gamma_F)\right]-\overline{\text{PFDEP}}^3\cdot\hat{\sigma}^2_{\gamma_{dF}}.$$

PI Functions for Analysis of Banks' Connection to the Pension Fund Industry:

Confidence intervals for the PI functions of pension fund depositors on connected banks $\left(CONNECT_i=1\right)$ are given by:

$$\text{CI}=\left[\left(\widehat{\beta_F}+\widehat{\beta_{dF}}+\widehat{\phi_{dF}}\right)+\left(\widehat{\gamma_F}+\widehat{\gamma_{dF}}+\widehat{\tau_{dF}}\right)\cdot\text{PFDEP}_{i,t-l}\right]$$
$$\pm t_{\alpha/2}\cdot\sqrt{\hat{\sigma}^2_{(\beta_F+\beta_{dF}+\phi_{dF})}+2\cdot\widehat{\text{Cov}}(\beta_F+\beta_{dF}+\phi_{dF},\gamma_F+\gamma_{dF}+\tau_{dF})\cdot\text{PFDEP}_{i,t-l}+\text{PFDEP}^2_{i,t-l}\cdot\hat{\sigma}^2_{(\gamma_F+\gamma_{dF}+\tau_{dF})}}\quad.$$

Confidence intervals for the PI functions of pension fund depositors on unconnected banks are obtained as before.

Table 1. Summary Statistics

	Mean	SD	Min	Max	25%	50%	75%
Deposit Growth							
ΔDEP (l=6)	0.5276	9.9250	-0.9981	383.3161	-0.1008	0.0107	0.0997
Bank-specific Fundamentals							
CAPR	0.1624	0.1402	0.0123	0.9841	0.0785	0.1146	0.1836
LIQ	0.0712	0.0479	0.0002	0.3360	0.0343	0.0626	0.0986
PROFIT	-0.0005	0.0073	-0.1705	0.0356	-0.0008	0.0003	0.0013
NPLL	0.1388	0.1597	0.0000	0.9218	0.0248	0.0907	0.1875
NGOVB	0.0599	0.0982	-0.2636	0.6974	0.0015	0.0353	0.0863
Size							
SIZE	0.0114	0.0217	0.0001	0.1363	0.0009	0.0026	0.0094
Pension Fund Deposits							
PFDEP	0.0608	0.1728	0.0000	0.9997	0.0000	0.0000	0.0225
PFDEP (>0)	0.1690	0.2544	0.0002	0.9997	0.0157	0.0576	0.1636
Macroeconomic Variables							
CURISK	239.2	327.2	21.3	2073.0	85.0	142.3	253.0
FISCAL	-0.0003	0.0001	-0.0004	-0.0001	-0.0003	-0.0002	-0.0002
MERVALNB	123.1	25.6	62.9	173.9	104.5	128.6	138.8
PRODUCTION	82.1	5.0	66.0	91.7	80.0	81.7	85.1
DUM							
CONNECT	0.1333						
FOREIGN	0.3998						
PRIVATE	0.8860						

Sources: Central Bank of Argentina; IMF, International Financial Statistics; SAFJP; and authors' calculations.

Table 2. Deposit Growth from Pension Funds and Other Depositors: Pooled and Fixed Effects Regressions (Equation 1)

Dependent variable: real growth rate of deposits (ΔDEP), 6 months (l = 6)		Pooled		Fixed Effects	
		(1) Time Effects	(2) Macroeconomic Variables	(3) Time Effects	(4) Macroeconomic Variables
Explanatory variables:					
FUND	*CAPR (-1)*	0.028	0.030	0.476	0.597
		(0.82)	(0.88)	(3.84) ***	(4.81) ***
	LIQ (-1)	0.059	-0.072	-0.236	-0.462
		(0.88)	(-1.02)	(-2.12) **	(-4.13) ***
	PROFIT (-1)	1.076	0.617	0.362	-0.050
		(1.54)	(0.90)	(0.54)	(-0.08)
	NPLL (-1)	-0.075	-0.079	-0.035	-0.043
		(-3.63) ***	(-3.60) ***	(-1.26)	(-1.47)
	NGOVB (-1)	-0.020	-0.046	-0.197	-0.214
		(-0.49)	(-1.10)	(-2.45) **	(-2.70) ***
d^j **X FUND**	d^j *X CAPR (-1)*	0.184	0.264	0.323	0.378
		(0.68)	(0.98)	(1.01)	(1.18)
	d^j *X LIQ (-1)*	-1.045	-1.039	-1.345	-1.344
		(-3.67) ***	(-3.65) ***	(-3.80) ***	(-3.76) ***
	d^j *X PROFIT (-1)*	16.752	15.209	14.413	13.492
		(1.92) *	(1.84) *	(1.80) *	(1.76) *
	d^j *X NPLL (-1)*	0.343	0.312	0.204	0.180
		(1.45)	(1.38)	(0.87)	(0.80)
	d^j *X NGOVB (-1)*	0.472	0.391	0.589	0.511
		(2.38) **	(2.03) **	(2.99) ***	(2.61) *
FUND X PFDEP	*CAPR (-l) X PFDEP (-1)*	-0.854	-0.472	0.284	0.631
		(-2.06) **	(-1.08)	(0.45)	(0.97)
	LIQ (-l) X PFDEP (-1)	2.501	1.983	1.031	0.387
		(2.22) **	(1.72) *	(0.71)	(0.26)
	PROFIT (-l) X PFDEP (-1)	-4.284	-4.147	0.316	0.749
		(-1.69) *	(-1.60)	(0.12)	(0.27)
	NPLL (-l) X PFDEP (-1)	1.398	0.897	-0.154	-0.541
		(2.36) **	(1.40)	(-0.20)	(-0.63)
	NGOVB (-l) X PFDEP (-1)	-0.067	-0.099	0.041	-0.096
		(-0.24)	(-0.37)	(0.10)	(-0.23)
d^j **X FUND X PFDEP**	d^j *X CAPR (-l) X PFDEP (-1)*	0.518	0.155	-0.453	-0.670
		(0.52)	(0.16)	(-0.41)	(-0.61)
	d^j *X LIQ (-l) X PFDEP (-1)*	-4.773	-4.786	-3.507	-3.346
		(-2.33) **	(-2.31) **	(-1.64) *	(-1.54)
	d^j *X PROFIT (-l) X PFDEP (-1)*	-21.131	-21.305	-19.374	-19.483
		(-1.95) *	(-2.05) **	(-1.87) *	(-1.94) *
	d^j *X NPLL (-l) X PFDEP (-1)*	-3.047	-2.727	-1.797	-1.624
		(-2.11) **	(-1.98) **	(-1.23)	(-1.14)
	d^j *X NGOVB (-l) X PFDEP (-1)*	-0.839	-0.702	-1.134	-0.988
		(-2.03) **	(-1.73) ***	(-2.57) ***	(-2.25) **
SIZE	*SIZE (-1)*	0.005	0.152	-1.269	-1.380
		(0.03)	(0.83)	(-1.07)	(-1.15)
d^j **X SIZE**	d^j *X SIZE (-1)*	-0.348	-0.369	-0.242	-0.315
		(-0.72)	(-0.77)	(-0.41)	(-0.52)
SIZE X PFDEP	*SIZE (-l) X PFDEP (-1)*	6.293	3.655	8.364	6.491
		(1.86) *	(1.08)	(1.42)	(1.09)
d^j **X SIZE X PFDEP**	d^j *X SIZE (-l) X PFDEP (-1)*	-6.018	-5.766	-7.082	-6.443
		(-0.93)	(-0.91)	(-1.00)	(-0.90)
PFDEP	*PFDEP (-1)*	-0.210	-0.195	-0.203	-0.244
		(-2.67) ***	(-2.56) **	(-1.48)	(-1.81) *
d^j **X PFDEP**	d^j *X PFDEP (-1)*	0.233	0.232	0.303	0.284
		(1.80) *	(1.81) *	(1.93) *	(1.82) *
DUM	*CONNECT*	0.034	0.036		
		(3.23) ***	(3.33) ***		
	FOREIGN	-0.036	-0.037		
		(-4.68) ***	(-4.76) ***		
	PRIVATE	-0.005	-0.008		
		(-0.51)	(-0.80)		
MACRO	*CURISK*		0.000		0.000
			(-1.36)		(-1.00)
	FISCAL		221.8		266.7
			(4.07) ***		(4.96) ***
	MERVALNB		0.0004		0.0005
			(2.36) **		(3.04) ***
	PRODUCTION		0.004		0.005
			(3.47) ***		(4.49) ***
Number of observations		3,194	3,194	3,200	3,200
F-test for DUM and fixed effects (p-value)		8.85 (0.00)	9.57 (0.00)	4.73 (0.00)	4.68 (0.00)
R^2		0.165	0.109	0.271	0.220

Note: This table reports OLS and fixed effects regressions with robust standard errors of real growth of time deposits held by pension funds and other depositors on bank-specific factors and macroeconomic risk indicators. Regressions (1) and (3) include time effects (not reported); regressions (3) and (4) include fixed effects for banks and depositor types (not reported). In all regressions a constant is estimated but not reported. The table is based on monthly data. Deposit growth rates are calculated over 6 month periods and regressors are measured at the beginning of the periods. *t*-statistics are indicated in parentheses, with 10% (*), 5% (**), and 1% (***) significance levels. The table also reports *F*-tests on the significance of DUM variables in pooled regressions and bank and depositor dummies in fixed effects regressions (which are compared against "restricted" regressions that include the variables DUM), with *p*-values in parentheses.

Table 3. Fixed Effects Regressions to Assess the Effects of Bank Connection to the Pension Fund Industry on Deposit Growth (Equation 2)

Dependent variable: real growth rate of deposits (ΔDEP), 6 months (l = 6)					
Explanatory variables:			**Explanatory variables:**		
FUND	*CAPR (-l)*	0.484	**FUND X PFDEP**	*CAPR (-l) X PFDEP (-l)*	0.173
		(3.88) ***			(0.27)
	LIQ (-l)	-0.189		*LIQ (-l) X PFDEP (-l)*	0.961
		(-1.70) *			(0.67)
	PROFIT (-l)	0.404		*PROFIT (-l) X PFDEP (-l)*	-0.122
		(0.60)			(-0.05)
	NPLL (-l)	-0.032		*NPLL (-l) X PFDEP (-l)*	0.078
		(-1.15)			(0.10)
	NGOVB (-l)	-0.205		*NGOVB (-l) X PFDEP (-l)*	0.115
		(-2.55) **			(0.28)
d^j X FUND	*d^j X CAPR (-l)*	0.222	**d^j X FUND X PFDEP**	*d^j X CAPR (-l) X PFDEP (-l)*	0.697
		(0.64)			(0.66)
	d^j X LIQ (-l)	-0.951		*d^j X LIQ (-l) X PFDEP (-l)*	-3.165
		(-2.11) **			(-1.36)
	d^j X PROFIT (-l)	12.716		*d^j X PROFIT (-l) X PFDEP (-l)*	-15.171
		(1.27)			(-1.30)
	d^j X NPLL (-l)	0.513		*d^j X NPLL (-l) X PFDEP (-l)*	-4.785
		(2.12) **			(-3.63) ***
	d^j X NGOVB (-l)	0.523		*d^j X NGOVB (-l) X PFDEP (-l)*	-0.972
		(2.04) **			(-2.00) **
SIZE	*SIZE (-l)*	-2.265	**SIZE X PFDEP**	*SIZE (-l) X PFDEP (-l)*	9.773
		(-1.86) *			(1.65) *
d^j X SIZE	*d^j X SIZE (-l)*	0.328	**d^j X SIZE X PFDEP**	*d^j X SIZE (-l) X PFDEP (-l)*	5.783
		(0.39)			(0.64)
PFDEP	*PFDEP (-l)*	-0.229			
		(-1.65) *			
d^j X PFDEP	*d^j X PFDEP (-l)*	0.112			
		(0.67)			
d^j X FUND X CONNECT	*d^j X CAPR (-l) X CONNECT*	0.441	**d^j X FUND X PFDEP X CONNECT**	*d^j X CAPR (-l) X PFDEP (-l) X CONNECT*	-46.159
		(0.37)			(-2.94) ***
	d^j X LIQ (-l) X CONNECT	-2.096		*d^j X LIQ (-l) X PFDEP (-l) X CONNECT*	15.697
		(-2.14) **			(1.66) *
	d^j X PROFIT (-l) X CONNECT	6.957		*d^j X PROFIT (-l) X PFDEP (-l) X CONNECT*	-82.763
		(0.22)			(-0.28)
	d^j X NPLL (-l) X CONNECT	-0.945		*d^j X NPLL (-l) X PFDEP (-l) X CONNECT*	14.713
		(-2.74) ***			(2.59) ***
	d^j X NGOVB (-l) X CONNECT	0.568		*d^j X NGOVB (-l) X PFDEP (-l) X CONNECT*	-12.558
		(0.96)			(-1.76) *
d^j X SIZE X CONNECT	*d^j X SIZE (-l)) X CONNECT*	2.372	**d^j X SIZE X PFDEP X CONNECT**	*d^j X SIZE (-l) X PFDEP (-l) X CONNECT*	-88.871
		(1.95) *			(-4.65) ***
d^j X PFDEP X CONNECT	*d^j X PFDEP (-l) X CONNECT*	5.699			
		(3.19) ***			
Number of observations		3,200			
F-test for fixed effects (p-value)		4.43 (0.00)			
R^2		0.293			

Note: This table reports a fixed-effects regression with robust standard errors of real growth of time deposits held by pension funds and other depositors on bank-specific factors. The regression includes time effects and fixed effects for banks and depositor types (not reported). The table is based on monthly data. Deposit growth rates are calculated over 6 month periods and regressors are measured at the beginning of the corresponding periods. t-statistics are indicated in parentheses, with 10% (*), 5% (**), and 1% (***) significance levels. The table also reports the result of an F-test on joint significance of bank and depositor dummies (compared against "restricted" regressions that include the variables DUM), with p-values in parentheses.

Table 4. Pension Fund Deposits and Bank Fundamentals at the Beginning of the Banking Crisis, January of 2001

(in percent)

	Banks with Large Pension Fund Deposits (9 banks)	Banks Receiving 90 Percent of Pension Fund Deposits (15 banks)	All Banks with Pension Fund Deposits (29 banks)	Banks with No Pension Fund Deposits (57 banks)	All Banks (86 banks)
Pension Fund Deposits					
PFDEP	52.6 **(32.7)**	32.1 **(8.5)**	19.0 **(6.7)**	---- ----	7.2 **(5.7)**
Bank-specific Fundamentals					
CAPR	15.1	9.6	10.9	20.1	16.6
LIQ	4.7	4.5	6.1	7.0	6.7
PROFIT	0.07	0.03	-0.01	0.03	0.01
NPLL	10.5	11.0	10.9	25.4	19.9
NGOVB	10.4	9.4	7.9	4.1	5.5
Size					
SIZE	1.4	4.0	2.7	0.4	1.3

Sources: Central Bank of Argentina; IMF, International Financial Statistics; SAFJP; and authors' calculations.
Notes: Numbers are calculated as simple averages across banks; numbers in parentheses in the upper panel indicate deposit-weighted averages across banks.

Table 5. Bank Deposit Changes During the Banking Crisis by Depositor Type, January-November 2001

(in percent)

	Banks with Large Pension Fund Deposits (9 banks)	Banks Receiving 90 Percent of Pension Fund Deposits (15 banks)	All Banks with Pension Fund Deposits (29 banks)	Banks with No Pension Fund Deposits (57 banks)	All Banks (86 banks)
All depositors	**-24.7**	**-25.7**	**-24.2**	**-10.1**	**-18.8**
Pension funds	**-24.8**	**-19.7**	**-17.7**	**. . .**	**19.0**
Other depositors	**-24.6**	**-26.2**	**-27.3**	**-10.1**	**-23.4**

Sources: Central Bank of Argentina; SAFJP; and authors' calculations.
Notes: Numbers are calculated as deposit-weighted averages across banks.

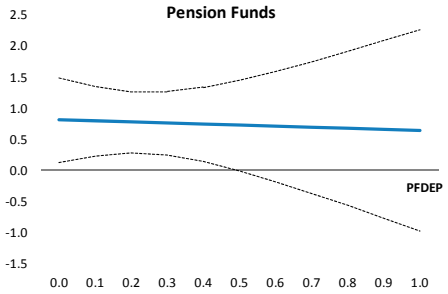
Table 6. Pension Fund Deposit Flows Across Banks during the Crisis, January-November 2001

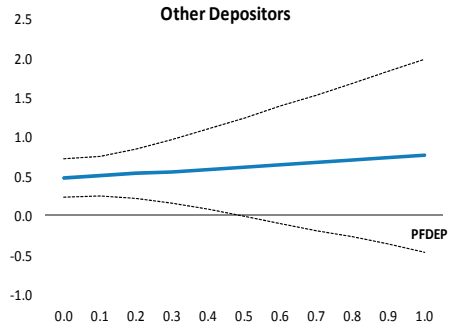
Bank Name	Pension Funds: Share of Bank Deposits January 2001 (%)	Pension Funds: Deposits January 2001 (thousands of pesos)	Pension Funds: Deposits November 2001 (thousands of pesos)	Pension Funds: Deposit Change January-November 2001 (thousands of pesos)	Pension Funds: Deposit Change January-November 2001 (%)	Banks: Size, Asset Market Share January 2001 (% of system)	Banks: Deposit Change January-November 2001 (%)	Banks: Ownership Type	Banks: Connection to Pension Fund Industry
Banks with Pension Fund Deposits in January 2001									
Foreign Banks									
CITIBANK N.A.	**7.6**	242,490	369,747	**127,256**	52.5	6.2	-23.6	**F**	**Y**
DEUTSCHE BANK ARGENTINA	**90.5**	111,814	178,491	**66,677**	59.6	1.5	37.6	**F**	
SCOTIABANK QUILMES S.A.	**6.6**	91,671	139,799	**48,127**	52.5	2.3	-6.5	**F**	**Y**
HSBC BANK ARGENTINA S.A.	**18.7**	396,166	422,938	**26,772**	6.8	4.3	-5.0	**F**	**Y**
BANKBOSTON, NATIONAL ASSOCIATION	**4.9**	166,533	173,811	**7,278**	4.4	6.7	-23.0	**F**	**Y**
BANCO SOCIETE GENERALE S.A.	**5.9**	31,169	36,558	**5,389**	17.3	0.6	-14.3	**F**	
LLOYDS TSB BANK PLC.	**6.2**	25,353	27,175	**1,823**	7.2	0.7	-31.0	**F**	
DEL SUQUIA S.A.	**0.3**	3,084	4,678	**1,595**	51.7	1.4	-7.8	**F**	
ABN AMRO BANK N.V.	**5.5**	22,801	21,917	**-884**	-3.9	1.0	-59.9	**F**	
B.I.CREDITANSTALT S.A.	**19.0**	29,552	26,864	**-2,689**	-9.1	0.2	-50.7	**F**	**Y**
BANSUD S.A.	**0.5**	4,757	-	**-4,757**	-100.0	1.3	-19.3	**F**	
BBVA BANCO FRANCES S.A.	**0.3**	12,448	6,791	**-5,657**	-45.4	7.3	-19.5	**F**	**Y**
BISEL SA	**6.2**	75,412	36,228	**-39,185**	-52.0	1.7	-26.6	**F**	
NAZIONALE DEL LAVORO S.A.	**5.6**	115,086	72,837	**-42,249**	-36.7	3.0	-20.9	**F**	
EUROPEO PARA AMER.LATINA	**99.7**	161,859	103,684	**-58,175**	-35.9	0.7	-39.2	**F**	
RIO DE LA PLATA S.A.	**4.2**	205,751	147,354	**-58,397**	-28.4	8.6	-22.3	**F**	**Y**
CAJA DE AHORRO S.A.	**6.4**	79,248	-	**-79,248**	-100.0	1.5	-11.0	**F**	
MORGAN GUARANTY TRUST CO OF NY	**98.7**	187,597	90,586	**-97,011**	-51.7	0.6	-54.2	**F**	
ING BANK N.V.	**80.0**	141,407	9,987	**-131,420**	-92.9	0.5	-85.8	**F**	
Domestic Public Banks									
DE LA CIUDAD DE BS. AS.	**2.8**	50,862	75,269	**24,407**	48.0	2.6	-10.9	**D-Pub**	
DE LA PCIA. DE BS. AS.	**2.3**	124,857	86,694	**-38,163**	-30.6	9.4	-30.2	**D-Pub**	**Y**
Domestic Private Banks									
CREDICOOP COOP.LTDO.	**0.2**	2,374	13,231	**10,857**	457.4	1.5	-12.6	**D-Priv**	
COMAFI S.A.	**1.3**	1,120	-	**-1,120**	-100.0	0.2	-50.0	**D-Priv**	
PATAGONIA S.A.	**1.1**	1,590	-	**-1,590**	-100.0	0.3	-36.9	**D-Priv**	
GENERAL DE NEGOCIOS S.A.	**10.0**	44,211	41,563	**-2,649**	-6.0	1.1	-52.3	**D-Priv**	
MACRO MISIONES S.A.	**0.8**	2,948	-	**-2,948**	-100.0	0.5	-25.6	**D-Priv**	
SAENZ S.A.	**15.1**	8,793	2,254	**-6,538**	-74.4	0.1	-48.0	**D-Priv**	
HIPOTECARIO S.A.	**41.8**	166,297	62,370	**-103,927**	-62.5	3.3	-56.9	**D-Priv**	
DE GALICIA Y BUENOS AIRES	**7.8**	540,903	358,557	**-182,346**	-33.7	9.3	-37.5	**D-Priv**	
Sub-total		**3,048,155**	**2,509,381**	**-538,774**	**-17.7**	**78.6**			
Banks that Attracted New Pension Fund Deposits in January-November 2001									
SUDAMERIS ARGENTINA S.A.	-	-	250,097			-	+	**F**	**Y**
ITAU BUEN AYRE S.A.	-	-	24,069			0.0	-7.5	**F**	
BANK OF AMERICA NA	-	-	280,257			0.8	+	**F**	
LINIERS SUDAMERICANO S.A.	-	-	1,024			0.1	82.5	**F**	
DE LA NACION ARGENTINA	-	-	563,021			11.1	-4.2	**D-Pub**	**Y**
Sub-total		-	**1,118,468**	**1,118,468**	**+**	**12.0**			
Total		**3,048,155**	**3,627,849**	**579,694**	**19.0**	**90.7**			

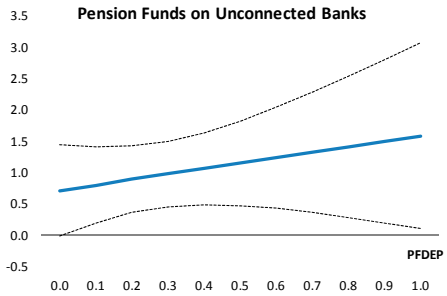
Sources: Central Bank of Argentina; SAFJP; and authors' calculations.
Notes: ownership of banks is indicated by F (foreign), D-pub (domestic public), and D-priv (domestic private). Y indicates that the bank has ownership stakes in a pension fund management company, as of April 2001.

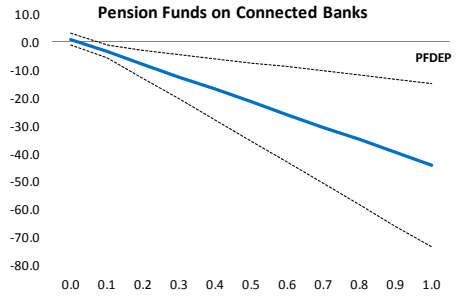
Figure 1. Partial Influence Functions by Type of Depositor (Equation 1) [1/]

CAPR

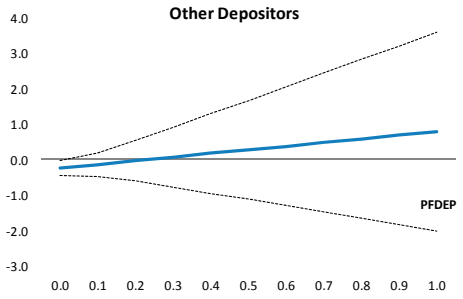


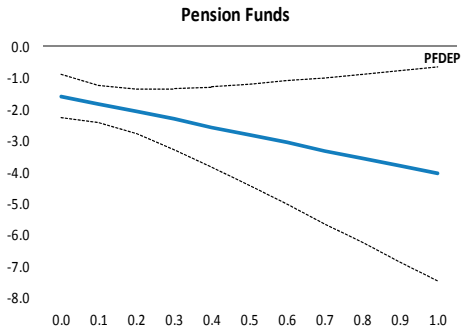


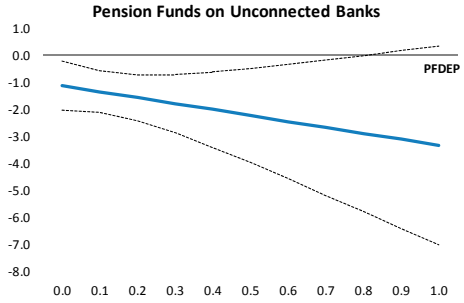


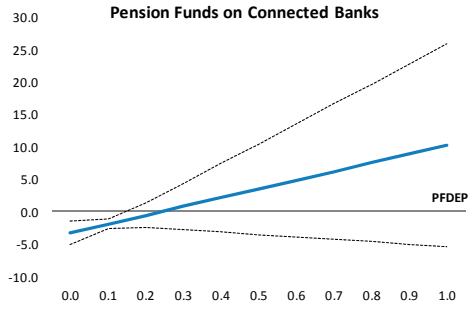


LIQ





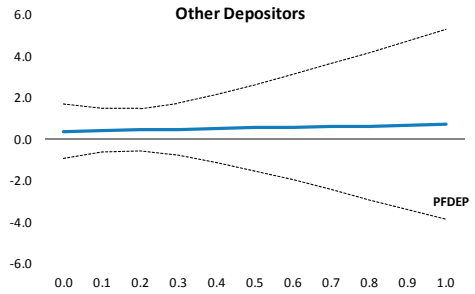


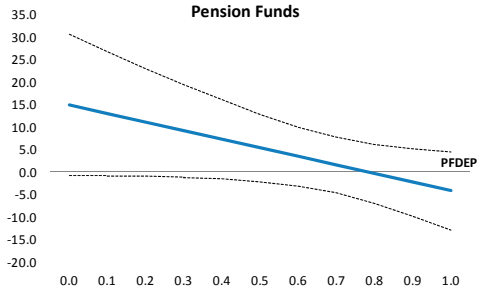


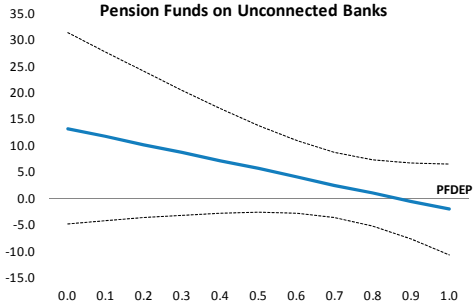
Note: 1/ For each fundamental, the PI functions shown in the upper panels, corresponding to 'other depositors' and 'pension funds', are obtained from regression (3) in Table 2. The PI functions shown in the lower panels, corresponding to 'pension funds on connected and unconnected banks,' are obtained from the regression presented in Table 3.

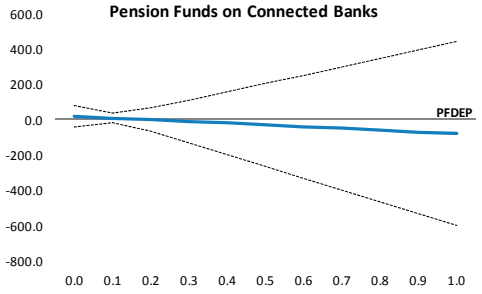
Figure 1. (cont.) Partial Influence Functions by Type of Depositor (Equation 1)

PROFIT

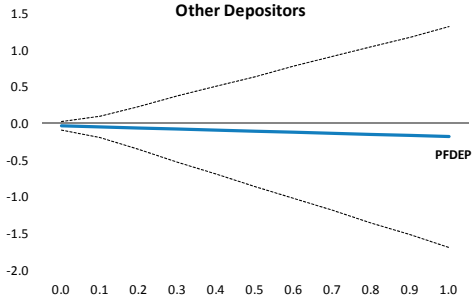


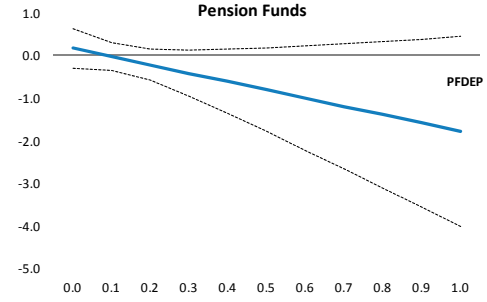


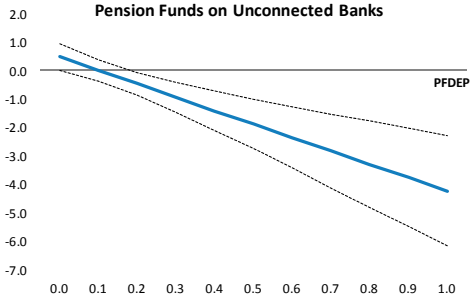




NPLL







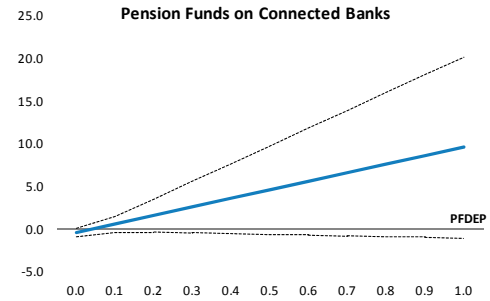
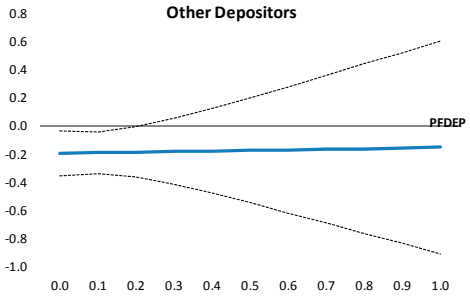
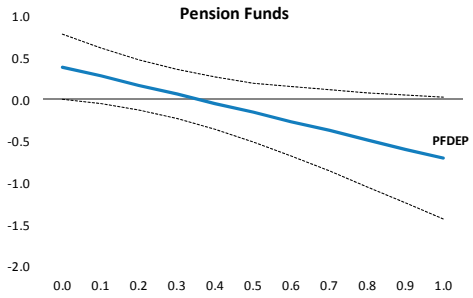
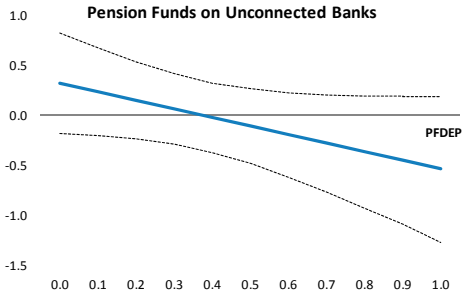


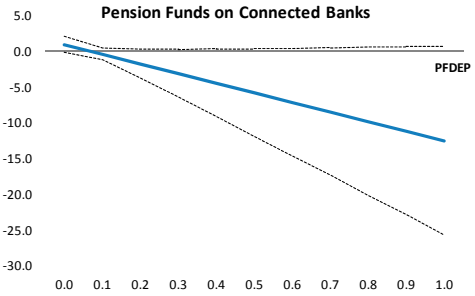
Figure 1. (cont.) Partial Influence Functions by Type of Depositor (Equation 1)

NGOV

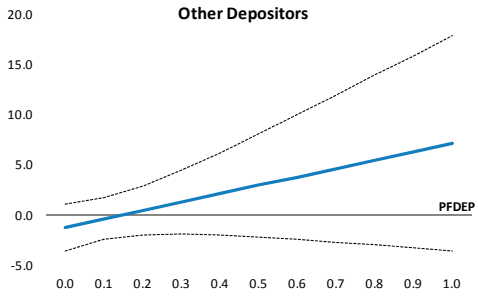


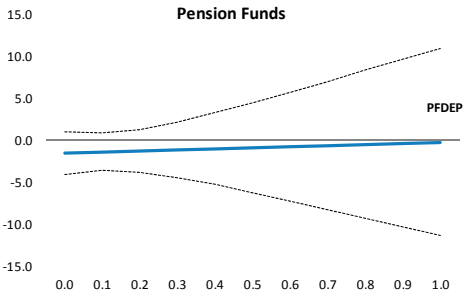


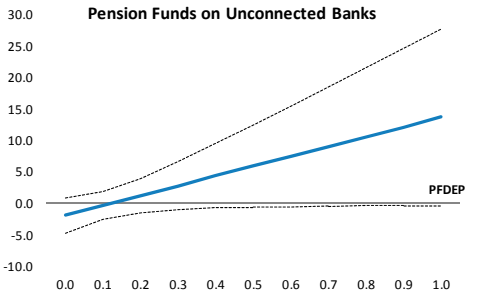




SIZE







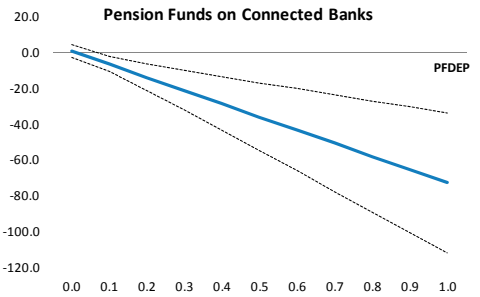


Figure 2. Aggregate Partial Influence Functions

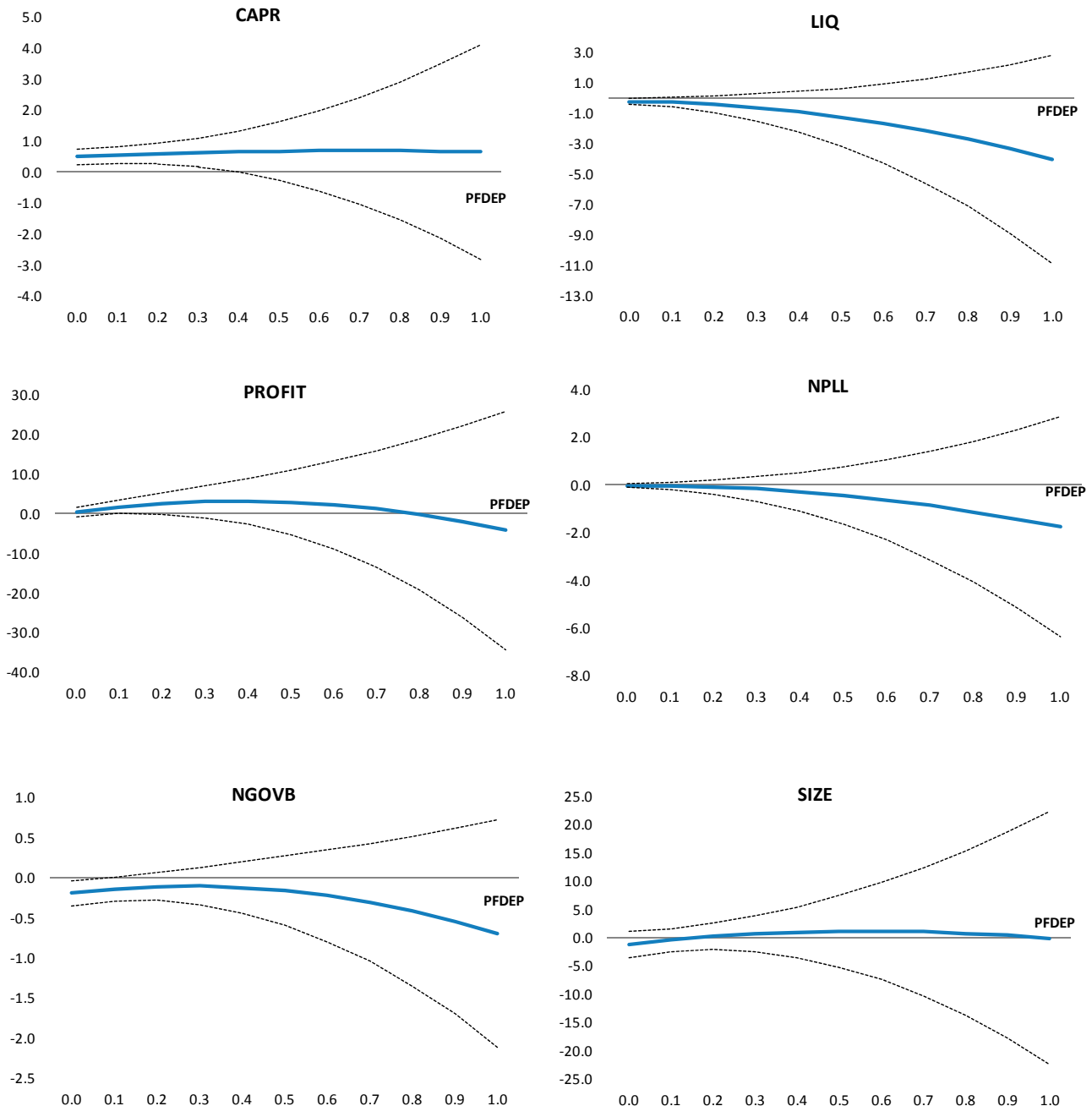


Figure 3: Time Deposits of Pension Funds in the Argentine Banking System (January 2000- November 2001)

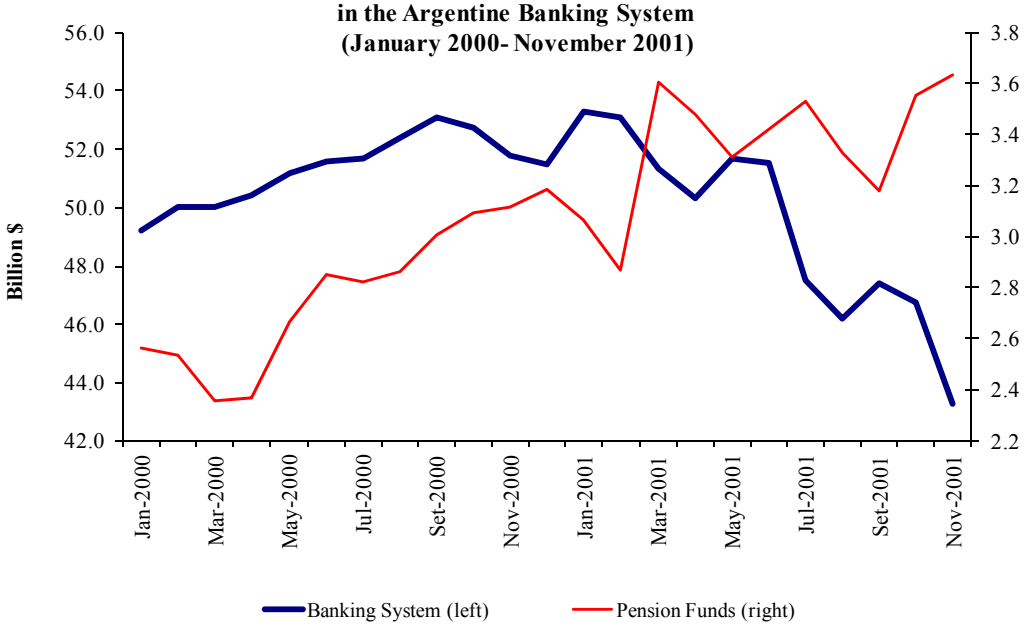


Figure 4: Histogram of Change in Deposits During the Crisis All Banks and Banks with Large Pension Fund Deposits (January-November 2001)

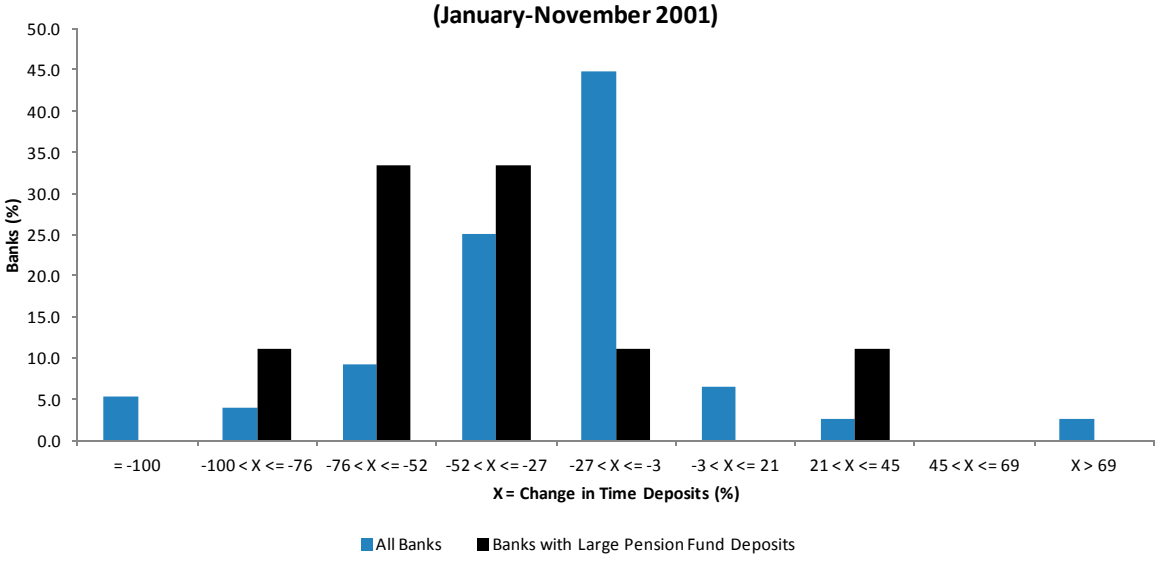
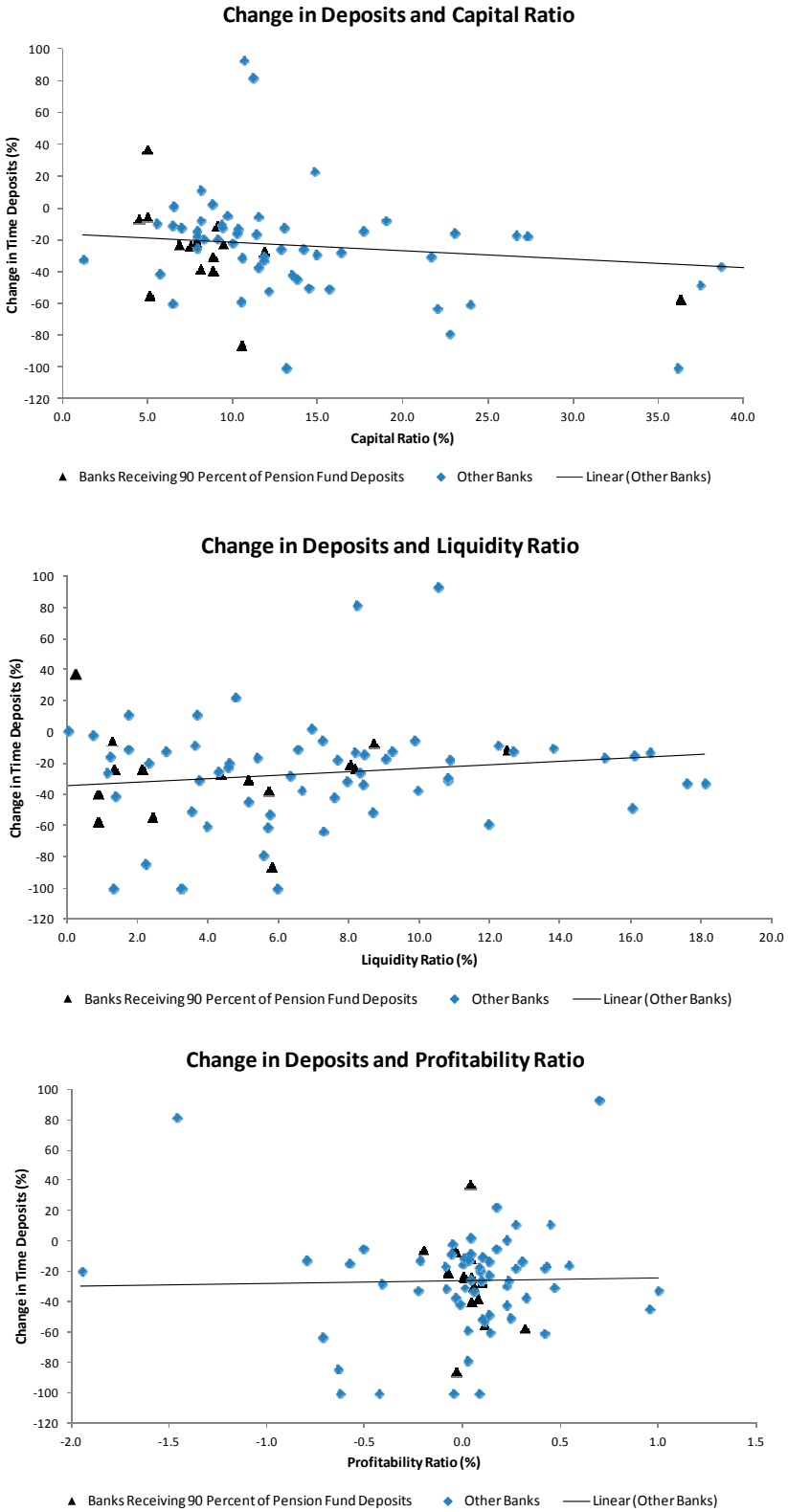
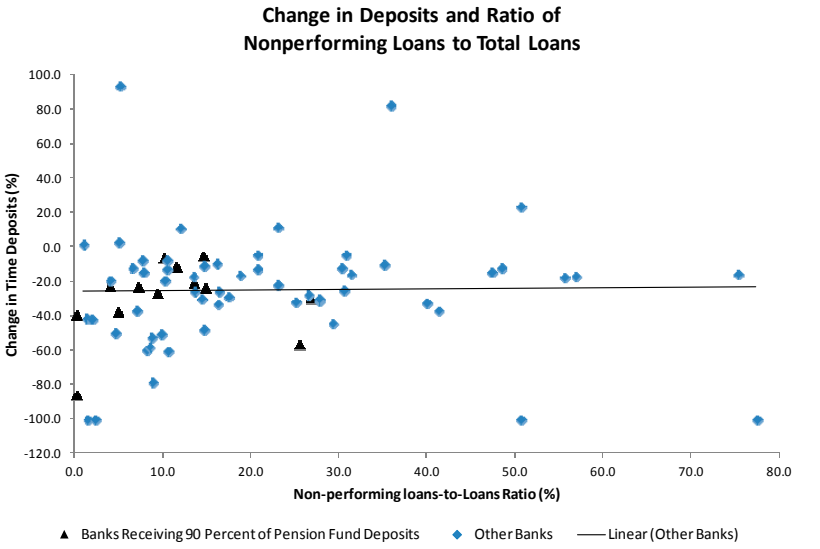


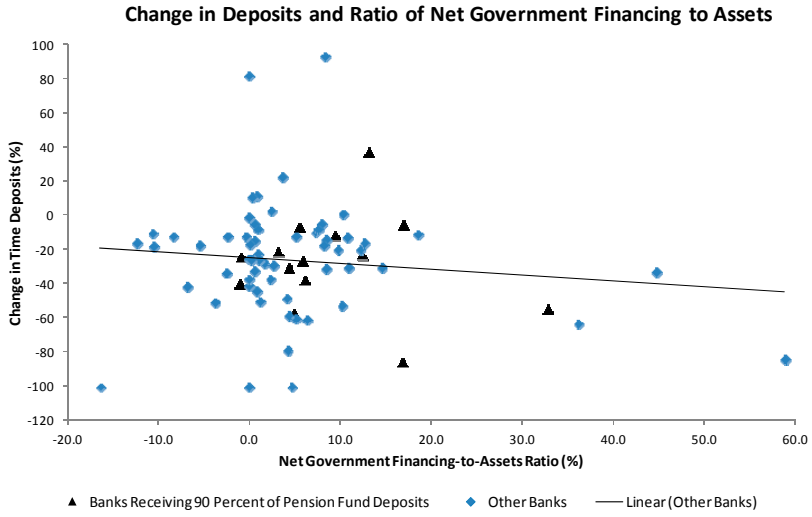
Figure 5. Deposit Growth and Bank Fundamentals and Size During the Banking Crisis[1/]

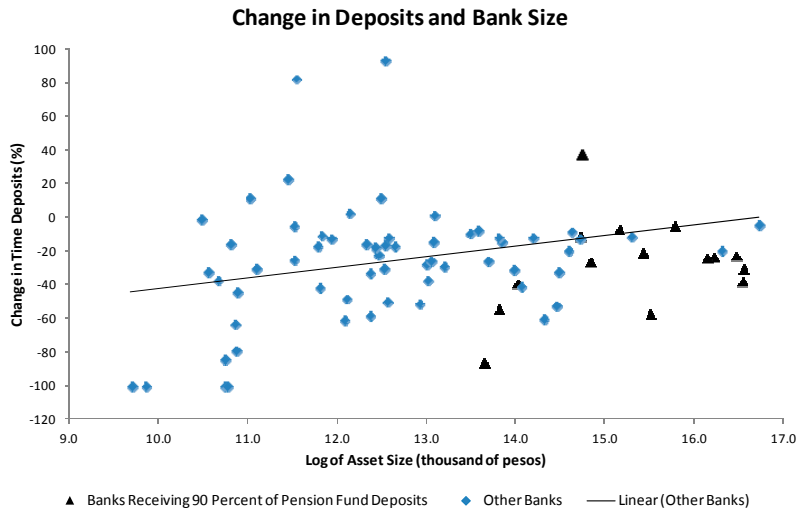


Note: 1/ Bank fundamentals and size are measured as of January of 2001. Deposit changes correspond to January-November 2001.

Figure 5. Deposit Growth and Bank Fundamentals and Size During the Banking Crisis (cont.)







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