The Real Effects of Liquidity: Evidence from a Quasi-Natural Experiment in Puerto Rico

Carlos D. Ramirez[1]
cramire2@gmu.edu

Department of Economics
George Mason University
Fairfax, VA 22030

February 2018

Abstract:

Research has found that negative liquidity shocks contract bank lending and amplify economic downturns. This paper investigates a reverse scenario—the effects of a flooding of liquidity on financial markets, using the case of Puerto Rico as a quasi-natural experiment. The U.S. Tax Reform Act of 1976 implemented tax incentives (through IRC Section 936) to stimulate economic development in Puerto Rico. In combination with local incentives, Section 936 corporations generated significant funds, most of which were deposited in local (PR) banks. The tax incentives were repealed in 1996, allowing for a 10-year phase-out period. I analyze the effect that the 936 funds had on Puerto Rico's banking industry between 1984 and 2016. I find that 936 funds did stimulate loan growth—in particular, C&I lending, and real estate loans. However, the stimulus appears to have been "too much"—the incidence of troubled loans (90 day past due) among banks that received 936 funds was significantly higher after Section 936 tax subsidy was repealed, indicating that a sizable portion of the projects those banks were financing were inefficient. The implementation and subsequent removal of these tax incentives introduced an extended boom-bust cycle that dislocated Puerto Rico's economic structure, contributing to the ongoing economic crisis.

Keywords: Section 936 tax incentives, liquidity shocks, loan growth, problem loans

JEL Classification Codes: G21, H21, H25

I. Introduction

Over the last four decades, a significant amount of research has shown that contractionary liquidity shocks increase financial fragility, curtail bank lending, and contract real economic activity.[2] The events surrounding the 2007-09 financial crisis have provided additional evidence corroborating those findings (Acharya and Mora, 2015; Ivashina and Scharfstein, 2010; Cornett et. al., 2011; Chodorow-Reich, 2014, etc).

Although these studies analyze different experiences and employ different methodologies for identification, one common thread is their focus on testing this relationship by studying episodes of liquidity contractions. Undoubtedly, such episodes offer valuable insights. However, studies that rely on contraction episodes have some limitations. For instance, episodes of liquidity contractions typically take place during adverse financial and economic conditions, and are therefore, endogenous. Unless careful identification strategies are employed, it is difficult to ascribe an effect. Investigating periods of liquidity expansions offer an opportunity for additional identification strategies, as well as additional insights into the liquidity-credit growth relationship. For example, the effects may not be symmetric. In particular, while liquidity contractions may amplify economic downturns, exogenous liquidity expansions may create a different problem—cheap credit may fuel an inefficient boom. Indeed, there is evidence suggesting that the 2001-2006 housing boom was driven by cheap credit and a savings glut (Glaeser, Gottlieb, and Gyourko, 2013; Favara and Imbs, 2015).

In this paper I analyze a largely exogenous and long-lasting liquidity infusion into Puerto Rico's banking system stemming from Section 936 Tax Code that was in effect from 1976 until

---

[2] Some of the earliest contributions include Bernanke (1983), Bernanke and Blinder (1992). However, this literature has grown dramatically since then.

1996. The Tax Reform Act of 1976 implemented tax incentives (through IRC Section 936) to stimulate economic development in Puerto Rico. In combination with local incentives, Section 936 corporations generated a substantial increase in liquidity, and most of it ended up in local (PR) banks. In 1996 U.S. Congress eliminated the 936 tax incentives without any additional provision that may have alleviated the impact of the repeal, except for a 10-year phase-out allowance period. I analyze the effect that the 936 funds had in Puerto Rico's banking industry between 1984 and 2016.

The identification strategy utilized in this paper is the structure of the tax incentive and the ensuing liquidity that it generated. Identification is achieved through an upward shift in the supply of liquidity that the tax incentive created, without a commensurate shift in demand for credit. It is important to explain the "commensurate" modifier. In general, tax incentive policies aim at stimulating investment as well as employment, and therefore, higher levels of economic activity—thereby shifting the demand for credit. Indeed, Section 936's tax incentives were aimed at those outcomes. However, in reality, Section 936's incentives primarily distorted U.S. corporations' incentive to shift their source of income away from the parent company and into its Puerto Rico's subsidiary. As I document below, the corporations that could benefit the most from this income-shifting strategy were those with a high value-added content in their production—primarily pharmaceuticals and high technology firms. While these companies (called 936 corporations), in their effort to extract the income-shifting incentives, generated (some) investment and employed local workers, the income-shifting benefits—and thus, the liquidity they generated—were significantly higher than the employment effects they produced.

The liquidity infusion into PR's banking system stemming for the 936 funds was large, peaking at over 75% of GDP in the mid-1980s. Thus, it was large enough to impart a measurable effect in the local loan market. Indeed, the main results indicate that banks that received 936 funds significantly expanded their loan portfolio. The two types of loan categories that expanded the most were commercial and industrial (C&I) loans, and real estate loans.

A natural question is whether the liquidity infusions into Puerto Rico's banking system were welfare enhancing. From a theoretical standpoint the answer is not clear. As Allen and Gale (2004) point out, when markets are incomplete, the laisse-fair equilibrium may entail "too little" or "too much" liquidity, depending on the degree of risk aversion. Too little liquidity would imply underinvestment in equilibrium, as asymmetric information introduces frictions in financial markets (Stein 1998). From that perspective, an exogenous infusion of liquidity would be socially beneficial since it would ease a bank's constraint for financing profitable investment opportunities. However, an alternative hypothesis maintains that financial frictions are constrained-efficient, and thus, liquidity infusions may create, instead, "free cash flow"-like problems, with banks financing uneconomical or inefficient projects. Hence, whether or not liquidity infusions are welfare enhancing is an empirical question.

As I elaborate further below, the magnitude of the 936 funds-induced liquidity infusions into the local banking system were very substantial and long-lasting. Thus even if the underinvestment hypothesis holds for some range of liquidity injections, the size of such injections, in the Puerto Rico case, was likely more that the "optimal" amount. To confirm that result, I evaluate the quality of the loan portfolio of banks that took in 936 funds, once Section 936 incentives were repealed, and compare it to a carefully selected matched sample of banks

that did not received such funds. The regressions indicate that the incidence of troubled loans (90 days past due) was significantly higher among banks that received 936 funds. This result supports the view that the excess liquidity in the banking system ended up financing inefficient projects. Thus, Section 936 tax incentives appear to have been too much of a good thing.

This paper contributes to different research strands. First, it adds to the literature that investigates the effects of liquidity shocks on loan supply, using natural experiments as an identification strategy. Recent examples of this line of research include Paravisini (2008), Khwaja and Mian (2008), and Gilje, Loutskina, and Strahan (2016). Paravisini (2008) investigates the allocation of government funds for banks in Argentina and finds that those infusions amplified the supply of credit. Khwaja and Mian (2008) utilizes unanticipated nuclear tests in Pakistan to show that negative liquidity shocks contract bank lending. More recently Gilje, Loutskina, and Strahan (2016) exploits unexpected liquidity gains from oil and natural gas shale discoveries, finding that banks exposed to those infusions increase mortgage lending through their branch network.

In addition to its contribution to the liquidity shocks and loan supply literature, this paper's findings may be helpful for understanding the protracted and unfortunately, still ongoing economic crisis in Puerto Rico. The enactment and subsequent repealing of (large) tax incentives introduced an extended boom-bust cycle that dislocated Puerto Rico's economic structure, contributing to the present economic and debt crisis.[3]

---

[3] For a background on Puerto Rico's current economic and debt crisis see Krueger, Teja, and Wolfe (2015).

The rest of the paper is organized as follows: the next section provides a background of IRC Section 936 tax incentives. Section III describes the empirical methodology. Section IV provides a discussion of the results. Section V offers some concluding remarks.

II. IRC Section 936 Tax Incentives

Since the early 1920s, the federal government has provided U.S. corporations a variety of incentives to locate and invest outside of the U.S., including Puerto Rico (Shultz and Scott, 2014; Mendez-Torres, 2004; Grubert and Slemrod, 1998). Section 936 of the Tax Reform Act of 1976 became the most prominent incentive for attracting investment and capital to Puerto Rico. Although the IRC code was amended in 1982 and 1986, the basic provisions stipulated that the subsidiary of a U.S. company established in Puerto Rico under Section 936 (typically identified as "936 corporations"), could offset its U.S. income taxes on earnings generated by its subsidiary while it was conducting business in Puerto Rico, as applicable. Hence the parent company obtained a full tax credit from the income it generated in Puerto Rico. Even financial income stemming from retained earnings reinvested in the island was exempt, if maintained in Puerto Rico. Therefore, in effect, income generated in Puerto Rico was practically exempt from U.S. taxes. There were certain rules that U.S. companies had to abide to qualify for this credit, such as the requirement that at least 80% of its gross income over the previous three years was coming from U.S. possessions, and that at least 75% was from active business conduct. Additional limitations and rules were introduced through various amendments and regulations

over these years, but in 1996 the possession tax credit was ultimately repealed with the enactment of the Small Business Job Protection Act of 1996.

The 936 tax exemption created an enormous incentive for U.S. companies to report large income in Puerto Rico, while allocating to the U.S. parent company costs associated with R&D as well as other intangibles (Grubert and Slemrod, 1998). While these incentives applied to all U.S. companies, manufacturing companies with a high profit margin stood to benefit the most. Although the 1982 and 19[4]86 amendments were implemented in part to limit the income-shifting incentives (by imposing, for instance, different types of cost-sharing agreements), high profit margin industries (primarily pharmaceuticals and high technology firms) continued to benefit the most from the tax incentives. Grubert and Slemrod (1998) report that in 1987, for example, the operating rate of return of Puerto Rican possessions corporations was 138.6% for drug companies and 114% for electronic equipment companies. At the lower end of the spectrum were apparel companies (56.4%) and "other" companies (46.4%).

The tax exemption incentives did indeed end up shifting the composition of industrial employment in Puerto Rico. To see that, Table 1 presents the establishments and employment shares for four industries in Puerto Rico from 1967 to 2002.[5] The shift in the composition of employment is very clear: in 1967, for instance, the employment share in the apparel industry was 28.4%, while in the food industry was 17.4%. In the same year, the employment share in drug manufacturing was less than 1%. By 2002, the employment shares had dramatically shifted away from the apparel industry and into drug manufacturing (with an employment

---

[4]

[5] Source: Census of Manufactures for Puerto Rico and outlying areas, various years.

share of nearly 20%). The figures for establishment shares reflect a similar pattern: the establishment share in the apparel industry declined form 17% to 5.5%, while for the drug manufacturing industry it almost trebles.

The tax benefits that Section 936 generated were substantial, ranging from $2 billion in 1983 to $4.6 billion in 1993. To get an idea of that magnitude, several studies have computed those benefits per employee in various industries. For instance, based on a study conducted using IRS returns for 936 companies, Shultz and Scott (2014) find that for every dollar drug companies spent on gross employee compensation, the companies reported tax benefits of $2.11 in 1993. (The average compensation for employees in drug companies was $36,867, while the reported tax benefit per employee was $77,699). The same ratio for electrical and electronic equipment was $2.31. Across all manufacturing industries that ratio stood at $1.50.

Income generated by 936 corporations was subject to taxes in Puerto Rico—the general corporate tax and the "tollgate" tax U.S. companies had to pay on repatriated income. However, the Puerto Rican government offered many exemptions that mitigated local tax liabilities. The exemptions were indeed quite substantial. For instance, Gruber and Slemrod (1998) report that in 1989 Puerto Rico collected only 4% of total possessions corporate net income.

One of the most significant local exemptions was the incentive the Puerto Rican government created for 936 companies to avoid paying the "tollgate" tax. 936 companies that invested their retained earnings locally in "eligible activities" for five years would see a reduction of 50 percent in their tollgate tax. And indeed, if the company invested for ten years, the earnings would be completely exempt of tollgate taxes. The "eligible activities" for

investment included: investment in local banks (via deposits), investment in Puerto Rico's Government Development Bank (GDB) (an institution created for facilitating the financing of government debt), investment in approved Caribbean Basin Initiative projects, and investment in some types of Repurchase Agreements.

Approximately 60 to 70% of those "936 funds" ended up in the local banking sector. The multi-year requirement of the "tollgate" avoidance benefit was successful in the sense that it generated a substantial amount of liquidity. To get a sense of that magnitude, Figure 1 presents a graph of the 936 funds in local banks as a fraction of PR's GDP. That fraction peaked at 75.8% in 1985 ($11.6 billion of 936 funds relative to $15.3 billion nominal GDP in Puerto Rico), before steadily declining to 0 in 2006, after the 10-year phase out concluded.[6]

Banks that accepted 936 funds were required by the Office of the Commissioner of Financial Institutions of Puerto Rico (OCIF, as known for its Spanish acronym) to report in their balance sheet statements the amount of 936 funds received every period. In addition, OCIF rules and regulations established guidelines pertaining how those funds could be invested. A small portion of those funds were to be used to finance GDB bonds and government (Puerto Rico) debt. The rest of the funds was to invested in "allowable investments," which included: (i) commercial and industrial loans for companies operating in Puerto Rico; (ii) commerical or residential real estate loans in Puerto Rico; (iii) loans for financing the acquisition of business assets of a company operating in Puerto Rico; (iv) other miscellaneous loans, such as loans for financing education tuition or books. The rules explicitly excluded consumer loans. They

---

[6] 936 funds data is from the Oficina del Comisionado de Instituciones Financieras, Puerto Rico (OCIF). The data were adjusted to harmonize the series with the figures reported by the Governor of Puerto Rico in 1990. Those figures are reported in Hernandez Colon (1990).

allowed for exceptions, but these exceptions had to be approved by the OCIF Commissioner as well as the Economic Development Administration of Puerto Rico.[7]

According to OCIF reports, all but a handful of very small trust companies ended up accepting 936 deposits. This observation is worth highlighting since it implies no selection bias pertaining to bank participation in the 936 fund market.

The next section evaluates empirically the extent to which 936 funds impacted Puerto Rico's banking market.

---

[7] See Reglamento No. 5105 from OCIF, approved on July 24, 1994.

III. Empirical Methodology

This section describes the empirical tests conducted. The tests comprise three different regression specifications: (1) a model of loan growth; (2) a model to evaluate financing restrictions based on loan growth-fund sensitivity tests; and (3) a model that analyzes loan portfolio quality.

III.1. Loan growth model

To evaluate the effect of 936 funds on Puerto Rico's banking system I regress the growth of loans on the change of 936 funds that banks received, controlling for other bank-specific characteristics. Specifically, I fit the following regression:

$$\frac{\Delta ln_{c,i,t}}{a_{i,t-1}} = \alpha_0 + \alpha_1 \frac{\Delta 936_{i,t}}{a_{i,t-1}} + \boldsymbol{\beta X}_{i,t} + \gamma_i + \theta_t + \varepsilon_{i,t}$$

Where $\Delta ln_{c,i,t}$ stands for the change in loan category c (total loans, commercial and industrial (C&I) loans, real estate loans, or consumer loans), for bank i, at quarter t. The key independent variable is $\Delta 936_{i,t}$, which measures the change in 936 funds for bank i in quarter t. Both of these variables are normalized by bank i's stock of total assets at the beginning of the period— hence, they are measured at time t-1. The vector $\boldsymbol{X}_{i,t}$ captures a variety of bank-specific characteristics, including size, return on assets, and existing stock of liquid assets normalized by total assets. The coefficient of interest is α_1. A positive (and statistically significant) point estimate of this coefficient would be indicative that bank i's loan growth is increasing in liquidity infusions stemming from 936 funds.

The chosen regression specification is an econometrically valid way of investigating the effects of 936 funds as long as: (i) the liquidity infusions can be considered as exogenous, and (ii) they did not impact the cost of funds for banks in Puerto Rico.

The case for exogeneity rests on the structure of the 936 tax incentives. As discussed in the introduction and in the previous section, the liquidity generated by the 936 funds stemmed from the design of Section 936 tax code in combination with local (PR) tax incentives. Although the original purpose of the tax credit was to stimulate economic activity in Puerto Rico, the first-order effect was the income-shifting incentive it generated. The liquidity it ensued was substantial—whether measured on a per employee compensation basis, or as a fraction of GDP. From that perspective, the infusion of 936 funds were largely orthogonal to changes in the demand for credit—triggered instead by an overly generous tax policy. This characteristic facilitates identification from an econometric perspective, as it allows treating movements in 936 funds as exogenous in a standard loan growth regression.

The claim that the infusion of 936 funds impacted the overall cost of funds for banks in Puerto Rico is hard to sustain in a world of full capital mobility, particularly between Puerto Rico and the rest of the U.S. As confirmation, I compare the ratio of interest expense on domestic deposits relative to total domestic deposits for banks in Puerto Rico with the same ratio for banks in the US. This comparison offers a direct way of measuring a differential effect on the cost of funds. If the infusion of 936 funds into Puerto Rico's banking system impacted the overall cost of funds, and the Puerto Rico and U.S. financial markets were segmented, we would expect to observe a lower ratio among banks in Puerto Rico, relative to banks in the US.

Figure 2 depicts those two ratios. The figure does not support the claim that 936 funds resulted in a lower cost of funds for banks in Puerto Rico. The ratio for banks in Puerto Rico was very close to the one for U.S. banks between the late 1970s and early 1990s, which is the period that spans the heyday of the 936 tax incentive program.

III.2. Sensitivity tests and financing frictions

The next model evaluates whether the infusion of 936 funds eased financing frictions for banks in Puerto Rico. A common and straightforward way of evaluating this hypothesis is by estimating loans to total financing sensitivities and testing whether those sensitivities are larger for banks that are more likely to be constrained, based on some ex-ante exogenous characteristic (Kashyap and Stein (2000), Kishan and Opiela (2000), Paravisini (2008)). In the context of this paper, that exogenous characteristic is the infusion of 936 funds. Thus, the test entails estimating loan-total funds sensitivities for the group of banks that received 936 funds, and compare those sensitivities to the ones obtained from an appropriate control group (described in more detail in the data section). Formally, I fit the following regression for the two samples of banks:

$$\frac{\Delta ln_{i,t}}{a_{i,t-1}} = \alpha'_0 + \alpha'_1 \frac{\Delta funds_{i,t}}{a_{i,t-1}} + \boldsymbol{\beta'X}_{i,t} + \gamma'_i + \theta'_t + \varepsilon'_{i,t}$$

Where the variables are defined as before, with the exception of $\Delta funds_{i,t}$, which is defined as the change in total sources of funds relative to bank assets at the beginning of the period.

The test entails comparing the value of α'_1 across the two different samples of banks— for institutions that received 936 funds prior to 2006, and for the control group.

III.3. Evaluation of Loan Quality Portfolio

The final regression specification is designed to evaluate whether the portfolio of loans

issued by 936 banks (banks that accepted 936 funds) was riskier than those from the control

group, particularly after the 936 tax program was repealed. The focus on the post-936 program

is straightforward to understand. As indicated above, while the 936 incentive program was in

effect, it generated a credit boom fueled by the liquidity infusion into the banking system.

During such prosperous periods, the relative riskiness of different projects may be difficult to

ascertain as during good times "rising tides lift all boats." However, after the tax incentive

program is repealed and liquidity becomes scarcer, the viability of riskier projects falters

significantly more rapidly. This reasoning implies that poor or inefficient projects financed

during the boom period are likely to be more readily observed after the boom is over.

One common way of ascertaining the quality of loan portfolios is by looking at loan

performance measures such as the proportion of loans that are 90 or more days past due,

nonaccrual loans, etc. (Berger and Udell, 1990; Berger and DeYoung, 199). Following that

literature, I estimate the following regression:

$$\frac{90 \; Past \; Due_{c,i,t}}{a_{i,t-1}} = \theta_0 + \theta_1 \big(936 \; Bank_{i,t}\big) + \boldsymbol{\rho} \boldsymbol{X}_{i,t} + \delta_t + u_{i,t}$$

Where "90 Past Due" is the total quantity of 90-day or more past due loans in loan category *c*

(C&I loans, consumer loans, real estate loans) for bank *i*, in quarter *t* (for t ≥ 2001q1), "936

bank" is an indicator variable equal to 1 if bank *i* received 936 funds prior to 2001,[8] and $\boldsymbol{X}_{i,t}$ is a

vector of bank-specific characteristics. Note that since "936 bank" is an indicator variable, it is

---

[8] Section 936 tax incentive program was completely phased out in 2006. However, those funds began dwindling
significantly in the banking sector after 2001. For that reason, the cutoff date of 2001q1 for post-936 program was
chosen. Nonetheless, the regression results are nearly identical if the 2006q1 cutoff date is chosen instead.

not possible to also include bank fixed effects in the regression, since they would completely absorb the variation of the indicator variable.

IV. Data

The dataset used in this study includes all Puerto Rico banks from 1984q1 to 2016q4. The panel dataset is from quarterly Call Reports (FFIEC) available from the FDIC website. This dataset was then supplemented with a carefully matched sample of banks operating elsewhere in the U.S. To obtain a comprehensive set of control banks, a minimum of two matches were manually identified for every bank in Puerto Rico. The matching was done on the basis of: (i) size and (ii) bank longevity. Hence, at least two equally sized institutions, alive for approximately the same period as the bank in Puerto Rico, were selected. Using size as a matching attribute is straightforward to explain. Size is generally taken as a proxy for cost of external finance, efficiency, etc., and thus, it is an important characteristic to take into account. The length of time an institution is in alive an indication of the likelihood of failure, merger, or absorption. Thus, this particular attribute ameliorate concerns pertaining to survivability or attrition biases.

Banks in Puerto Rico that received 936 funds reported them as a liability in their balance sheet. Unfortunately, the Call Reports do not include a separate liability entry that identified those funds for banks in Puerto Rico. However, as noted above, because banks that received 936 funds were required by OCIF to report those funds in their balance sheet, I was able to use OCIF statements to identify 936 deposits received by banks on an annual basis going back to

1984.[9] Thus, the Call Report data were complemented with data from OCIF statements for banks in Puerto Rico.

V. Results

This section present the regression results based on the models described in Section III.

V.1 Loan growth model results

Table 3 presents the regression results based on the loan growth model described in Section III.1. The table presents four regressions—the first one for total loans, while the other three are for different loan categories: C&I, real estate, and consumer loans. The results indicate that the contemporaneous change in 936 funds (relative to assets) imparts a positive and significant effect on three of the four regressions. In regression 1, for instance, the coefficient of 0.275 implies that a one-standard deviation increase in 936 funds (approximately 0.024) is associated with approximately a 30 percent increase in loan growth (starting from the mean of 0.022). The equivalent magnitude for C&I loan growth is 132 percent, and for real estate loans, 55 percent. Thus, at least for these two loan categories, and for total loan growth, 936 fund infusions were associated with significant increases in loans as a fraction of total assets.[10]

---

[9] Inspection of both OCIF statements and the Call Reports revealed that the 936 funds were included as "time deposits over the insurance limit" in the Call Reports, and not as a separate liability as in the OCIF statements. But because this Call Report liability category is broader (and includes items other than 936 deposits), it is not possible to back out the exact amount of those funds from the Call Reports directly.

[10] The regressions in Table 3 also report the sum of four lags of the change in 936 funds. These lags were included in the specification because, for most banks, OCIF statements report 936 fund data on an annual basis, rather that quarterly basis. In order to ensure that the regressions include a full cycle of changes in those funds, the four lags were added to these regressions. I report the sum, as opposed to the coefficients individually, to limit cluttering.

The results in column 4 report the results for consumer loans. In this regression, the coefficient of interest is negative and statistically significant. At first, this result seems puzzling. However, a careful investigation of the data revealed that one bank in Puerto Rico reported an anomalous increase in consumer loans during the sample period.[11] The coefficient becomes statistically insignificant after that observation is removed from the sample. Additional sensitivity analyses reveal that the effect of an increase in 936 funds is not significantly different from zero for this loan category.

The fact that the 936 coefficient in the consumer loan regression is not statistically significant (when eliminating the outlier observation) is consistent with expecations. As noted in Section II, OCIF Rule No. 5105 explicitly disallowed banks that received 936 funds from using them for financing consumer loans.

V.2 Sensitivity tests results

Table 4 presents the main regression results of the sensitivity test described in Section III.2. The table presents three regressions. Regression 1 shows the result for the control sample of banks. The α'_1 coefficient for this regression is 0.864, and it is statistically significant at the 1 percent level. This result indicates that there is a tight association between changes in funds and loan growth. Such a tight association is consistent with the financial frictions hypothesis— banks can expand their loan portfolio only when additional resources become available.

Regression (2) estimates the same specification but for banks that received 936 funds in Puerto Rico. The same coefficient is still positive and statistically significant (0.561), but it is

---

[11] It is likely that this anomalous entry is the result of a data entry error as this bank did not undergo any merger or acquisition during the sample period and none of the other loan categories display anomalous changes.

much smaller than the one obtained for the control group. A t-test analysis indicates that the difference in these two coefficients (0.864 vs 0.561) is significant at the 5 percent level. This result indicates that the dependency of loan growth on increments in the sources of funds was smaller for banks that received 936 funds. It suggests that financing constraints were not as binding for banks with access to 936 funds.

The results in regression (3) offer further confirmation of that result. In particular, this last regression fits the same specification, but using the increments in 936 funds as an instrument of changes in sources of funds. Thus, this regression estimates the sensitivity of loan growth to sources of funds stemming only from 936 fund infusions. The coefficient is even smaller (0.265) and barely significant (at standard levels). This result suggests that banks that received 936 funds had less of a financing constraint relative to the control group. The fact that 936 banks were less constrained supports the hypothesis that the loan market in Puerto Rico was overly saturated. However, before reaching that conclusion more analysis is required.

V.3. Loan quality portfolio results

The sensitivity of loan growth to sources of funds results suggests that the liquidity infusion of 936 funds did alleviate financing frictions. In combination with the loan growth regression results from Table 3, they suggest that the infusion of 936 funds may have stimulated loan growth "too much" from a social welfare perspective. However, a careful analysis of the loan quality portfolio is necessary to confirm that assertion.

The evaluation of the loan quality portfolio begins with a graphical analysis of two of the most commonly used loan performance ratios: (i) 90-day or more past due loans as a fraction of

total net loan and leases, and (ii) nonaccrual loans to total net loan and leases. These ratios are displayed in Figure 4 and 5, beginning in 1984. Each figure displays the ratio for all banks in Puerto Rico (black solid line) as well as for all banks in the U.S. (dashed line).[12] Both figures reveal a clear gap in loan performance—banks in Puerto Rico held, on average, a riskier loan portfolio than banks in the U.S. This gap in loan performance becomes particularly more discernable after 2006, when the 936 tax incentive program was finally phased out. Although the effect of the 2007-09 financial crisis are clearly observable (as the quality loan portfolio for banks in the U.S. deteriorates between 2007 and 2009), the deterioration in loan quality for banks in Puerto Rico far exceeds that of banks in the U.S.

The regression specification delineated in Section III.3 complements the loan portfolio analysis. The results from estimating this regression are presented in Table 5. The table presents three regressions, one for each of the following loan categories: C&I lending (regression 1), consumer loans (regression 2), and real estate loans (regression 3). The regressions reveal that, for every loan category, the share of troubled loans (90 day or more past due) in total bank assets was significantly higher for 936 banks, relative to the control group. For instance, in regression 1, the coefficient of 0.507 indicates that, all else constant, the share of problem C&I loans in total assets among 936 banks was nearly 2.8 times higher (=0.507/0.181, where 0.181 is the share of troubled C&I loans in total assets among non-936 banks) relative to the control group of banks. The equivalent magnitudes for the other two loan categories are 15 times for consumer loans, and nearly 45% higher for real estate loans. Thus, this set of regressions show that the loan portfolio of 936 banks was significantly riskier than

---

[12] Data for the ratios are from the FDIC's Historical Statistics on Banking, Commercial Banks, balance sheet tables CB11, and CB17. https://www5.fdic.gov/hsob/SelectRpt.asp?EntryTyp=10&Header=1.

that of the control group. This result supports the claim that 936 banks ended up financing inefficient projects.

IV. Conclusion

Between 1976 and 1996, IRC's Section 936 tax exemptions offered U.S. corporations with a Puerto Rican subsidiary a very profitable opportunity to shield income from the parent company through its Puerto Rican subsidiary. The tax shield, in combination with local tax exemptions, generated a substantial amount of liquidity, most of which ended up in local (PR) banks. I exploit this event as a natural experiment to investigate the effect of exogenous increases in liquidity on loan supply.

The main findings are threefold: 1. 936 funds (funds generated by 936 corporations) significantly stimulated overall loan growth. The two loan categories that were impacted the most were C&I lending (with an increment of 132%) and real estate lending (with an increment of 55%). 2. 936 funds eased financing frictions for Puerto Rican banks—the sensitivity of loan growth to increments in sources of funds is significantly lower for banks that took in funds from 936 corporations, all else constant. 3. 936 banks (banks that took in funds from 936 corporations) were shown to have a worse loan quality portfolio—they display a significantly higher proportion of troubled loans—relative to a carefully-matched control group.

Undoubtedly, Sections 936 tax incentives were implemented with the intention of stimulating economic development in Puerto Rico. But as is often the case with the implementation of such policies, there were significant and long-lasting negative side effects. The findings in this paper suggest that consequences went beyond the tax shielding incentives

it generated—it also stimulated an excessive increase in loan growth that fueled an inefficient lending boom prior to 2006. The repeal of these incentives ended up undermining Puerto Rico's ability to withstand the 2007-09 financial crisis, setting the stage for its ongoing economic calamity and subsequent default.

Table 1
Shift in Employment in Puerto Rico

	1967	1987	1992	2002
Num. Establishments (all industries)	**2,367**	**2,328**	**2,258**	**2,195**
Food etc establishments share	18.72%	19.80%	14.66%	20.32%
Apparel establishment share	17.11%	11.77%	12.62%	5.56%
Furniture etc establishments share	8.79%	7.22%	6.33%	3.37%
Drugs Manf establishment share	1.18%	3.31%	3.90%	3.37%
Num. Employees (all industries)	**121,537**	**149,968**	**158,181**	**126,707**
Food etc employment share	17.43%	15.34%	12.77%	11.45%
Apparel employment share	28.37%	17.75%	19.80%	7.68%
Furniture etc employment share	2.85%	1.49%	1.46%	1.19%
Drugs Manf employment share	0.88%	10.67%	15.74%	19.76%

Source: Census of Manufacturing for Puerto Rico and Outlying Areas, various years.

Figure 1
936 Funds in Puerto Rico's Banking System as a Fraction of GDP

936 Funds to GDP
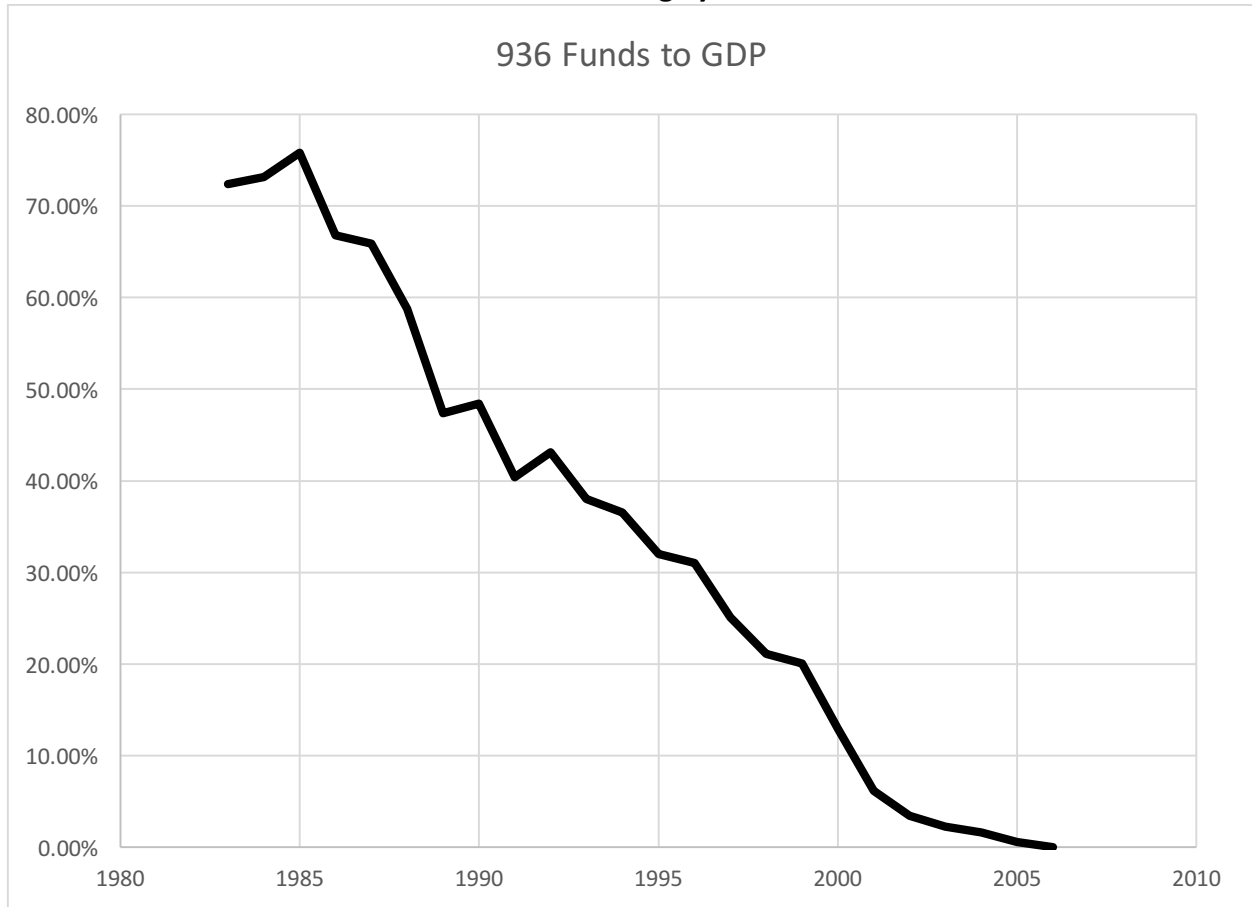
Source: Oficina del Comisionado de Instituciones Financieras, Puerto Rico, and Junta De Planificacion de Puerto Rico (Puerto Rico Planning Board).

Figure 2
Interest Expense as a Fraction of Deposits: Puerto Rico vs US Banks
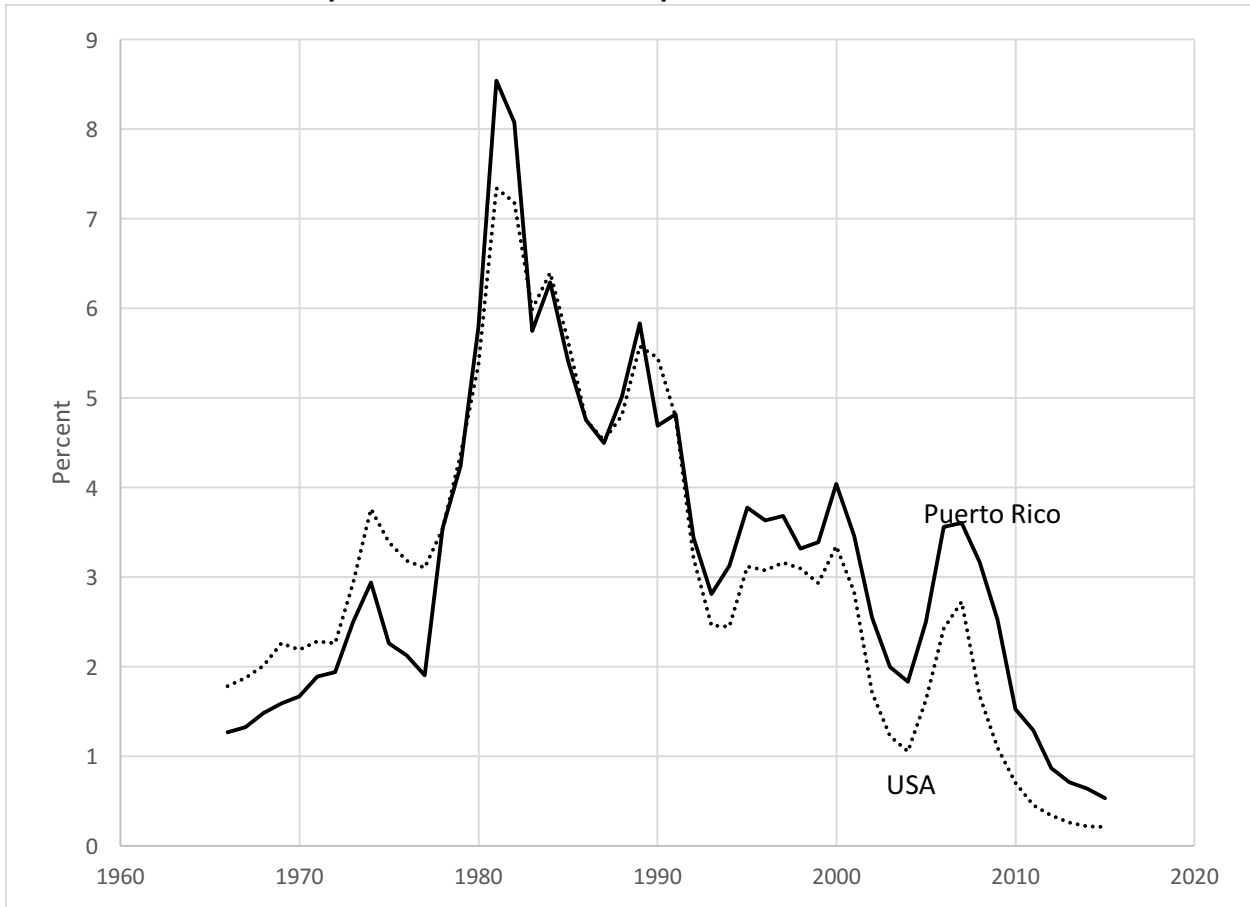
This figure displays the ratio of interest expense on domestic deposits relative to total domestic deposits at FDIC-insured commercial banks, for both banks in Puerto Rico (solid line) and all banks in the U.S. (dashed line). Source: FDIC Historical Statistics On Banking, Tables CB06 and CB15.

Table 2
Summary Statistics

	936 Banks			Control Group		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Num quarters "alive"	1,705	97	34	4,801	90	36
Average Assets	1,705	3,949,190	4,968,150	4,801	3,587,036	5,112,440
Average Loan/Assets	1,705	0.571	0.138	4,801	0.629	0.109
Average CI Loans/Assets	1,705	0.107	0.062	4,801	0.109	0.090

Notes: This table compares basic summary statistics for 936 banks and the control group. Data are from 1984q1 to 2016q4. Source: Call Reports, FDIC.

Table 3
Effect of 936 Funds on Loan Growth

| VARIABLES	(1) ΔTotal Loans	(2) Δ C&I Loans	(3) Δ RE Loans	(4) Δ Consu. Loans
$\Delta 936_{i,t}/a_{i,t-1}$	0.275*	0.173***	0.236***	-0.133**
	(0.134)	(0.059)	(0.081)	(0.047)
$\sum_{k=1}^{4}\Delta 936_{i,t-k}/a_{i,t-k-1}$	-0.555	0.066	-0.184	-0.438*
	(0.500)	(0.058)	(0.276)	(0.228)
$liquidity_{i,t}/a_{i,t-1}$	0.039	0.016	0.002	0.020
	(0.067)	(0.011)	(0.043)	(0.025)
$capital_{i,t}/a_{i,t-1}$	0.341	0.019	-0.047	0.368*
	(0.576)	(0.145)	(0.319)	(0.204)
$roa_{i,t}$	2.626	0.703*	1.337	0.587
	(1.577)	(0.354)	(0.871)	(0.470)
$size_{i,t}$	0.002	-0.000	-0.001	0.004
	(0.005)	(0.001)	(0.003)	(0.003)
constant	-0.194***	-0.052***	-0.090**	-0.052**
	(0.059)	(0.013)	(0.036)	(0.021)
Observations	337	337	337	337
R-squared	0.190	0.204	0.202	0.208
Bank FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES

Notes: This table presents regression results of the model described in Section III.1. Dependent variable: change in loans (each column for a different loan category). Independent variables: Change in 936 funds for bank i in quarter t as a fraction of assets at $t-1$; the sum of lags 1 through 4 of the change in 936 funds; liquidity (defined as the sum of: (i) interest bearing cash and due, (ii) noninterest bearing cash and due, and (iii) securities available for sale at fair value) as a fraction of assets at t-1; total equity capital as a fraction of assets at $t-1$; return on assets (roa), defined as total interest income relative to assets at t-1; and size, defined as total assets in US$ billions. Robust standard errors (clustered at the bank level) in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4
Effect of 936 Funds on Elasticities

| VARIABLES	(1) Chg loans Control	(2) Chg loans 936 banks	(3) Chg loans 936 banks IV
$\Delta funds_{i,t}/a_{i,t-1}$	0.864***	0.561***	0.265*
	(0.096)	(0.079)	(0.146)
$size_{i,t-1}$	0.002	-0.004	-0.006*
	(0.002)	(0.003)	(0.004)
$roa_{i,t-1}$	0.316	-0.052	0.220
	(0.327)	(0.369)	(0.496)
$liquidity_{i,t-1}/a_{i,t-2}$	-0.062	0.013	0.030
	(0.057)	(0.025)	(0.030)
constant	-0.017	0.001	-0.008
	(0.014)	(0.032)	(0.036)
Observations	986	380	355
R-squared	0.688	0.558	0.338
Bank FE	YES	YES	YES
Time FE	YES	YES	YES

Notes: This table presents regression results of the model described in Section III.2 for banks that received 936 funds and the control group. The results for the control group (benchmark results) are in column 1. The results for banks that received 936 funds are in column 2. Column 3 presents the same regression as in column 2, but using 936 funds as an instrument for the change in total funds. Dependent variable: change in total loans. Independent variables: "$\Delta funds_{i,t}$" is the change in total funding sources (defined as the sum of total domestic deposits and total equity capital) for bank *i* in quarter *t* as a fraction of assets at *t-1*; liquidity (defined as the sum of: (i) interest bearing cash and due, (ii) noninterest bearing cash and due, and (iii) securities available for sale at fair value) as a fraction of assets; total equity capital as a fraction of assets; return on assets (roa), defined as total interest income relative to assets; and size, defined as total assets in US$ billions. Size, roa, and liquidity are lagged since the model takes them as predetermined controls. Robust standard errors (clustered at the bank level) in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Figure 4
90 Day or More Past Due Loan and Leases: PR vs USA Banks
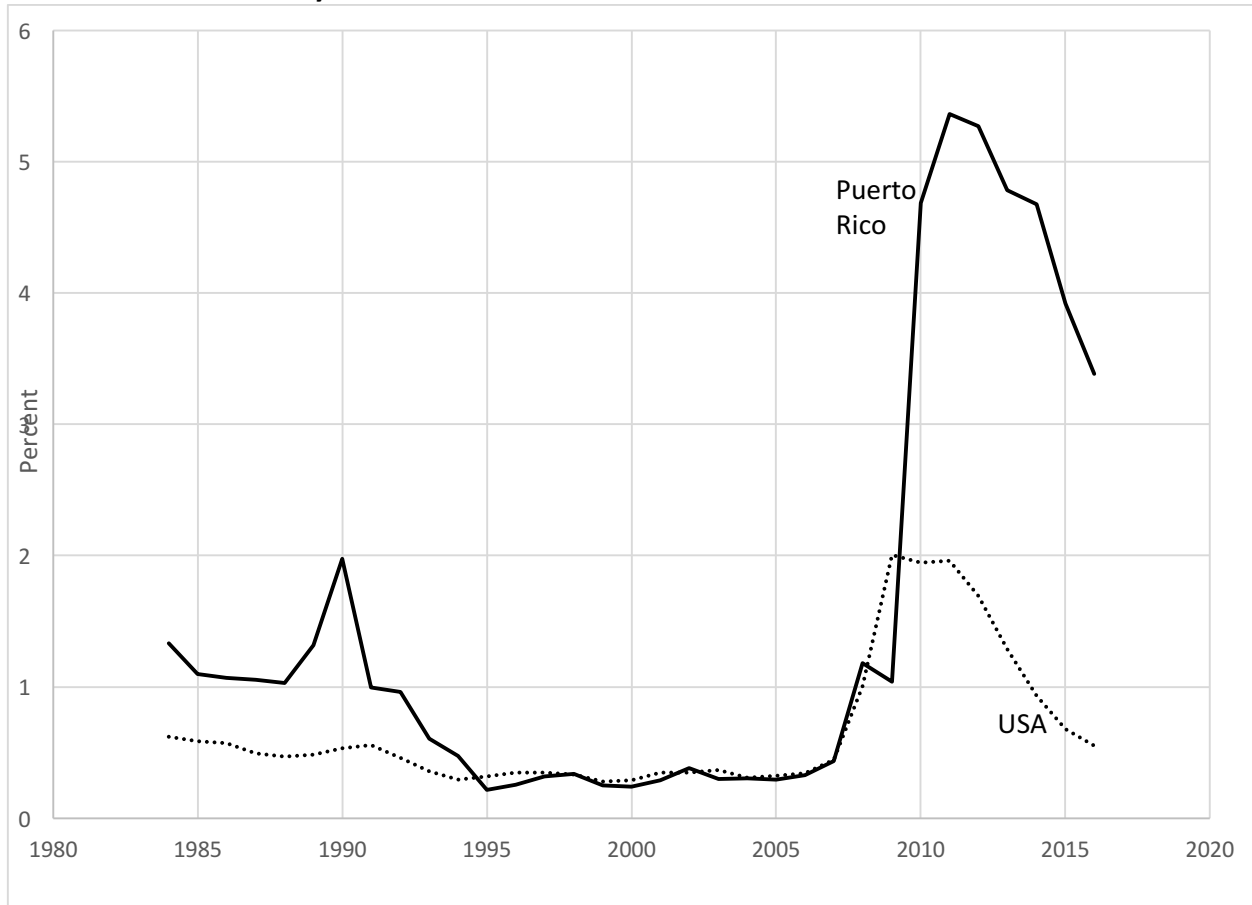
This figure displays the ratio of 90 day or more past due loans relative to total net loans at FDIC-insured commercial banks, for both banks in Puerto Rico (solid line) and all banks in the U.S. (dashed line). Source: FDIC Historical Statistics On Banking, Tables CB11 and CB17.

Figure 5:
Non-Accruals Relative to Total Loans: PR vs US Banks
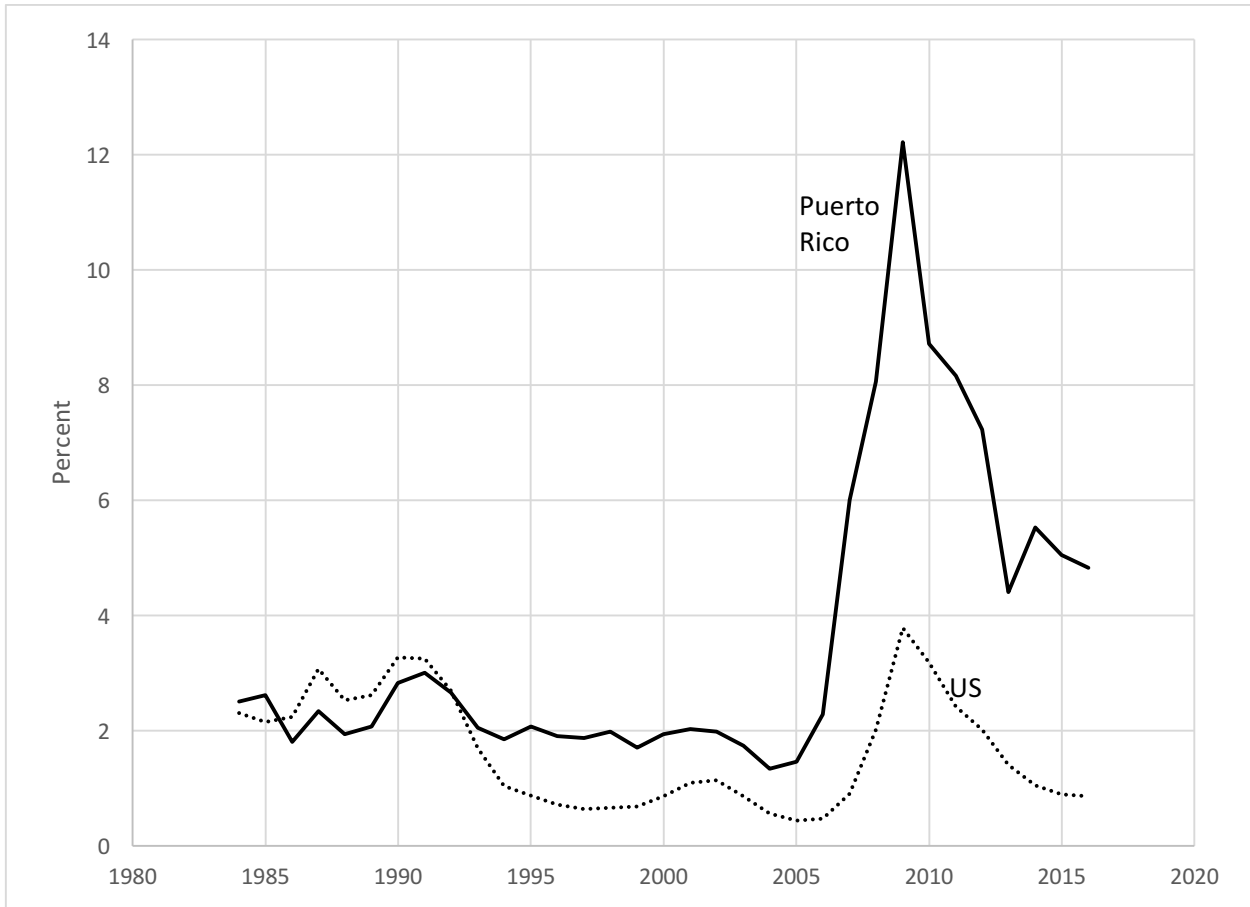
This figure displays the ratio of nonaccrual loans relative to total net loans at FDIC-insured commercial banks, for both banks in Puerto Rico (solid line) and all banks in the U.S. (dashed line). Source: FDIC Historical Statistics On Banking, Tables CB11 and CB17.

Table 5
936 Funds and Overinvestment

VARIABLES	(1) Past Due C&I	(2) Past Due Cons.	(3) Past Due RE
$Yes\ 936_i$	0.507***	0.240***	0.013*
	(0.069)	(0.033)	(0.008)
$size_{i,t}$	-0.003	0.004***	-0.001***
	(0.003)	(0.001)	(0.000)
$liquidity_{i,t}/a_{i,t-1}$	-0.444***	0.084	-0.042*
	(0.169)	(0.103)	(0.023)
$roa_{i,t}$	14.227**	7.912***	1.563**
	(6.560)	(1.926)	(0.705)
$capital_{i,t}/a_{i,t-1}$	0.607	0.146	0.042
	(0.863)	(0.207)	(0.083)
constant	-0.321	-0.328***	-0.008
	(0.322)	(0.103)	(0.034)
Observations	1,925	496	1,925
R-squared	0.136	0.389	0.096
Time FE	YES	YES	YES

Notes: This table presents regression results of the model described in Section III.3. Dependent variable: loans in category *c* (*c* = C&I, consumer (cons.), and real estate (RE)) that are 90 or more days past due relative to total loans in category *c* (each column for a different loan category). Independent variables: "Yes 936" is an indicator variable equal to 1 if bank *i* took in 936 funds, it is 0 otherwise; size, defined as total assets in US\$ billions; liquidity (defined as the sum of: (i) interest bearing cash and due, (ii) noninterest bearing cash and due, and (iii) securities available for sale at fair value) as a fraction of assets at *t-1*; return on assets (roa), defined as total interest income relative to assets at *t-1*; and, total equity capital as a fraction of assets at *t-1*. Robust standard errors (clustered at the bank level) in parentheses *** p<0.01, ** p<0.05, * p<0.1.

References

Acharya, Viral V. and Mora, Nada. 2015. A crisis of banks as liquidity providers. Journal of Finance. Vol. 70, No. 1, pp. 1-43.

Allen, Franklin and Gale, Douglas. 2004. Financial intermediaries and markets. Econometrica. Vol. 72, No. , pp. 1023-1061.

Ashcraft, Adam B. 2005. Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks. American Economic Review 95, no. 5:1712–30.

Berger, Allen N. and Gregory F. Udell. 1990. Collateral, loan quality and bank risk. Journal of Monetary Economics, Volume 25, Issue 1, Pages 21-42.

Berger, Allen N. and Robert DeYoung. 1997. Problem loans and cost efficiency in commercial banks. Journal of Banking & Finance, Volume 21, Issue 6. Pages 849-870.

Bernanke, Ben S. 1983. Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression. American Economic Review 73, no. 3:257–76.

Chava, Sudheer, and Purnanandam, Amiyatosh. 2011. The effect of banking crises on bank-dependent borrowers. Journal of Financial Economics, Vol. 99, No. 1, pp. 116-135.

Cornett, Marcia Millon; McNutt, Jamie John; Strahan, Philip E.; and Tehranian, Hassan. 2011. Liquidity risk management and credit supply in the financial crisis. Journal of Financial Economics, Vol. 101, pp. 297-312.

Chodorow-Reich, Gabriel. The employment effects of credit market disruptions: Firm-level evidence from the 2008-9 financial crisis. Quarterly Journal of Economics, Vol. 129, No. 1, pp. 1-59.

Favara, Giovanni and Imbs, Jean. 2015. Credit supply and the price of housing. American Economic Review, Vol. 105, No. 3, pp. 958-992.

Glaeser, Edward L., Gottlieb, Joshua D. and Gyourko, Joseph. 2013. Can cheap credit explain the housing boom? In Edward L. Glaeser and Todd Sinai (eds.) Housing and the Financial Crisis. Chicago, IL: University of Chicago Press.

Gilje, Erik; Loutskina, Elena; and Strahan, Philip E. 2016. Exporting liquidity: Branch banking and financial integration. Journal of Finance. Vol. 71, No. 3, pp. 1159-1184.

Grubert, Harry and Joel Slemrod. 1998. The Effect of Taxes on Investment and Income Shifting to Puerto Rico. Review of Economics and Statistics. Vol. 80, No. 3, pp. 365-373.

Hernandez Colon, Rafael (1990). Mensaje del gobernador del Estado Libre Asociado de Puerto Rico Hon. Rafael Hernandez Colon con motivo de las primeras jornadas universitarias Puertorriqueña sobre la Comunidad Europea e Iberoamericana. Speech at Condado Beach Hotel, October 11, 1990. http://www.rafaelhernandezcolon.org/MENSAJESTOMOS/1990_II/DOC031910%20Fri%20Mar%2019%202 02010%2011-22-57.140.pdf

Krueger, Anne O., Ranjit Teja, and Andrew Wolfe. 2015. Puerto Rico: A way forward. Manuscript. http://www.bgfpr.com/documents/puertoricoawayforward.pdf.

Mendez-Torres, Juan C. 2004. Internal Revenue Code's Role in Puerto Rico's Economic Development. Journal of International Taxation, Vol. 15, No. 2, pp. 22- 35.

Ivashina, V. and D. Scharfstein. 2010. Bank lending during the financial crisis of 2008. Journal of Financial Economics, Vol. 97, pp. 319-338.

Kashyap, Anil and Stein, Jeremy. 2000. What do one million observations on banks have to say about the transmission of monetary policy? American Economic Review, Vol. 90, No. , pp. 407-428.

Khwaja, A.I. and Mian, A. 2008. Tracing the impact of bank liquidity shocks: Evidence from an emerging market. American Economic Review. Vol. 98, pp. 1413-1442.

Kishan, Ruby and Opiela, Timothy. 2000. Bank size, bank capital, and the bank lending channel. Journal of Money, Credit, and Banking, Vol. 32, No. , pp. 121-141.

Paravisini, Daniel. 2008. Local bank financial constraints and firm access to external finance. Journal of Finance, Vol. 63, No. 5, pp. 2161-2193.

Schultz, Thomas D. and Kyle Scott. 2014. Puerto Rico: The Evolution of America's Corporate Tax Haven. The ATA Journal of Legal Tax Research, Vol. 12, No. 1, pp. 17-40.

Stein, Jeremy. 1998. An adverse selection model of bank asset and liability management with implications for the transmission of monetary policy. Rand Journal of Economics, Vol. 29, No., pp. 466-486.