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Do small bank deposits run more than large ones? Three event studies of contagion and financial inclusion

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Abstract

How susceptible to contagion are bank deposits associated with financial inclusion? To shed light on this question, we analyze the behavior of deposits of different account sizes around three significant bank closures in the Philippines. When we look at the three events by applying difference-in-difference regressions to a dataset that distinguishes between small and large deposits at the town level, we find no evidence that the closure of a large bank leads to withdrawals by depositors at other banks nearby, whether the deposits are large or small. For two of the events, we do find some evidence that depositors, both large and small, anticipate that their bank is about to fail, and they start to withdraw before the bank is closed. With more comprehensive branch-level data for one of the events, we find that the bank closure does lead to reduced deposits at bank branches nearby. All this suggests that, while a bank failure can lead to contagion, the behavior of small depositors is no different from that of large depositors, and thus financial inclusion is unlikely to add to financial instability.

JEL classification: G21, G28, C21, O35.

Keywords: Financial inclusion, financial stability, contagion, bank run, event study, selection bias.

[1] Dante Canlas is with the University of the Philippines, Johnny Ravalo with the Bangko Sentral ng Pilipinas (BSP) and Eli Remolona with the Bank for International Settlements (BIS). We thank Governor Amando Tetangco for encouraging this research. We also thank for helpful comments Prasanna Gai, Dean Karlan, Aaron Mehrotra, Cristina Orbeta, Pia Roman-Tayag, Christopher Siguitan, James Yetman and participants at the BIS Asian Research Network Workshop in Auckland, New Zealand, on 1–2 March 2018. We also thank Vicente de Villa III, Agne Subelyte, Am Dizon, Alvin Fama and Shirra De Guia for indispensable statistical help. The views expressed in this paper are those of the authors and should not be interpreted as reflecting the views of either the BSP or the BIS.

1. Introduction

Financial inclusion involves the pursuit of both financial and social objectives. To what extent are these objectives at odds with each other? To what extent are they complementary? More specifically, when a banking system expands to provide services to segments of society that traditionally lack access to such services, does the system as a whole become more resilient to adverse shocks or less so? Does it matter what regulatory measures are in place?

In July 2015, the Philippine government launched its National Strategy for Financial Inclusion with the Bangko Sentral ng Pilipinas (BSP) as the lead agency.[2] The strategy seeks to make various products and services offered by financial institutions accessible to all citizens. It rests on four pillars: policy and regulation, financial education and consumer protection, advocacy, and data and measurement. This study is relevant to the first pillar, that of policy and regulation. The appropriate regulation of institutions involved in financial inclusion requires an understanding of the special risks that such institutions face. This study is an effort to contribute to that understanding by looking at the Philippine experience.

In general, the risks that banks face may be grouped into two types. One is intrinsic to the bank: unexpected changes in the behavior of economic agents in the fundamental processes of deposit-taking and loan extension. The other is extrinsic: unexpected changes in beliefs of economic agents arising from adverse shocks to the banking sector or the economy at large. These beliefs include the possibility that those outside shocks have a bearing on the safety and liquidity of a bank. It is extrinsic risk that leads to financial contagion and systemic risk.

When it comes to financial inclusion, the literature on these risks is in its infancy, and most of it focuses on intrinsic risk. In a study that does consider extrinsic risk, Han and Melecky (2013) look at 95 countries to determine the relationship between a measure of access to deposits and the maximum decline in deposit growth in 2007–2010. They find that higher access tends to lead to a smaller drop in deposit growth. In the case of lending services, Morgan and Pontines (2014) rely on country-level panel data from

[2] In a global survey of 59 jurisdictions, the Basel Committee (2015) finds that 37 percent have a national financial inclusion strategy, including 63 percent of low-income respondents.

the World Bank and IMF for 2005–2011 and construct two indicators of bank risk, the "bank z-score" and non-performing loans. They find that a greater share of lending to small firms tends to reduce both indicators of bank risk.

In this paper, we focus on extrinsic risk with the advantage of disaggregated data. Unlike previous studies, our data allow us to address selection biases, in which the governments that tend to promote financial inclusion may happen to be also those that tend to succeed in fostering financial stability for a host of other reasons. The risk we consider is the risk of contagion in the form of deposit runs in the wake of the failure of a large bank nearby. We analyze quarterly data on deposits of different size cohorts at the level of towns and municipalities in the Philippines.

The analysis consists of event studies of the behavior of such deposits around the three biggest bank closures in the country since 2007. These are the closure of the ABC Banks in Q4 2008, the closure of Bank 123 in Q3 2011 and the closure of the Bank XYZ in Q2 2013.[3] We focus on the behavior of deposits in towns that are in the same province as that of the failing bank. If there is any contagion from the closure of a bank, we expect to find deposits of other banks in these towns to be affected.[4] For a given town, the deposits data are available only for banks with head offices in that town, but these data have the advantage of breaking down deposits into account-size cohorts. We take the deposits in the smallest size cohort to be deposits associated with financial inclusion, and we compare their behavior to that of larger deposits. The event studies are carried out by means of difference-in-difference (DD) regressions. To test for robustness of results, different model specifications of generalized DD are also estimated for Bank XYZ. For the same bank, we also have data on deposits at bank branches that include banks with head offices outside the province. These additional data cover deposits more comprehensively and thus offer us many times more observations than do the head-office data. However, they do not come with a breakdown by deposit size. With such branch-level data, we run time fixed-effects regressions to further explore the possibility of contagion from a bank failure.

When we conduct three event studies by analyzing datasets that distinguish between

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[3] These are not the banks' real names. For technical legal reasons, we are unable to identify the three banks by their real names. Hence, we will call them the ABC Banks, Bank 123 and Bank XYZ

[4] Note that we specify the econometric model without setting *a priori* whether the contagion is a positive externality (i.e., deposits migrate from affected banks to other banks in the area) or a negative externality (i.e., there are withdrawals from the other banks).

small and large deposits at the town level, we find no evidence that the closure of a large bank leads to withdrawals by depositors at other banks with head offices in the vicinity, whether the depositors are large or small. However, for the two more recent events, we are hobbled by a relatively small number of observations. Nonetheless, we do find some evidence that depositors, both large and small, anticipate that their bank is about to fail and start to withdraw before the bank is closed. With more comprehensive branch-level data for the most recent event, we find that bank failure does lead to reduced deposits at bank branches nearby.

The study is organized as follows: Section 2 explains the theory of bank deposit runs and describes the institutions and regulations that are aimed at mitigating the risk of such runs. Section 3 provides narratives of the events we will analyze. Section 4 describes the data we will analyze and the empirical approaches we will implement. Section 5 reports our empirical results for the event studies relying on data that distinguish between small and large deposits. Section 6 reports our results for one of the events with more comprehensive branch-level data. Section 7 makes concluding remarks.

2. Theory and institutions

2.1 The theory of bank runs and the role of deposit insurance

The theory of bank runs is well understood. These runs are risks that naturally arise in equilibrium as a result of a bank's fundamental functions, uncertainty in the minds of depositors and the nature of the deposit contract. Diamond and Dybvig (1983) gave us the canonical model of how all this works. At root, banks do two things. They take deposits and they extend loans. Hence, managing a bank is essentially about keeping deposits safe and liquid while making loans less risky and illiquid. In the face of uncertainty, however, it is not enough that deposits are safe and liquid. It is no less important that at all times the bank's depositors are convinced that this is so. Once there is the slightest perception that something may be amiss, depositors will want to withdraw. With a deposit contract that must be paid on demand, in full and on a first-come-first-serve basis, a deposit run will ensue. Even if the bank had enough good loans to ultimately cover all deposits, the illiquidity of those loans means the bank will run out of funds well before it can meet all deposit withdrawals.

The informational features associated with the risk and uncertainty that can trigger bank runs are similar to those of some general-equilibrium models of contagion in financial markets (see, for example, Allen and Gale, 2000). A representative bank depositor who values commodity consumption across time faces limited and asymmetric information. A representative firm with access to a production technology taps banks for possible loan financing. Identical banks investigate credit risks, store, monitor, and verify information about the viability of projects. Amid multiple equilibria, paths with the probability of financial contagion and bank runs exist. Bank runs can occur in an environment whereby each bank is better informed than its depositors about the bank's true financial state. Moreover, depositors are heterogeneous, differing in their withdrawal risks. In this risky and uncertain financial setting, a critical mass of depositors may be induced into withdrawing their funds, particularly, if rumors of a bank failure shape their belief that a bank run is imminent in the future.

The theory of how to deal with bank runs is also well understood. Diamond and Dybvig proposed deposit insurance as an effective instrument against the risk of bank runs, and wide experience has proven this to be the case. Even in the presence of such insurance, however, a limited run may ensue if some depositors are unsure about how quickly they would be paid. If a run does ensue, the central bank can step in and inject enough liquidity to reassure depositors and stem the run. Cooper and Ross (1998) show that the Diamond-Dybvig model can be extended to one in which deposit insurance leads to issues of moral hazard. With such insurance, people may lose the incentive to monitor a bank's management. Goldberg and Hudgins (2002), however, find that a threshold in deposit insurance coverage fosters such monitoring by the larger depositors. In practice, bank supervisory authorities perform much of this monitoring role. These authorities also impose capital and liquidity standards to reduce the risk of bank failure and thus maintain confidence in the banking system.[5]

Of added interest to government regulators is whether regulation beyond deposit insurance and risk-adjusted capital adequacy ratios is essential in mitigating the risk of a bank run. Iyer and Puri (2012), for example, investigate whether bank-depositor relationships and social networks can start and propagate bank runs. The authors find that the length of bank-depositor relationships is inversely proportional to the probability of a bank run during a crisis. Moreover, social networks affect the

[5] In practice, bank regulators assist an individual bank by providing a liquidity injection only to the extent that the bank has acceptable assets such as marketable securities as collateral. This prevents moral hazard. However, the interesting case is when the need for such emergency liquidity facility is of systemic proportions or the classic too-big-to-fail scenario.

likelihood of a bank run. That is, if other people in a given depositor's network run, that depositor is likely to run, too. Our paper, however, does not pursue the roles of the factors that Iyer and Puri studied, on account of data limitations. We have discussed only the above-mentioned role of deposit insurance in mitigating the risk of a bank run.

This paper focuses on events in which the uncertainty is extrinsic. The source of uncertainty is the closure of another bank, an event that may cause depositors to infer possible problems with their own bank and thus to run. As Kaufman (1994) explains, "Bank (depository institution) contagion is of particular concern if adverse shocks, such as the failure or near-failure of one or more banks, are transmitted in domino fashion not only to other banks and the banking system as a whole, but beyond to the entire financial system and macroeconomy." The question we ask is whether the kind of deposit that is fostered by financial inclusion would make such contagion more likely.

2.2 Bank supervision, deposit insurance and the banking system in the Philippines

The Bangko Sentral ng Pilipinas (BSP) regulates banking and supervises bank operations in the Philippines. The existing legal framework is the General Banking Law of 2000. It mandates the BSP's supervision of the various types of bank, including universal banks, commercial banks, thrift banks and rural and cooperative banks. Under this supervision mandate, the BSP also sets minimum capital adequacy ratios that are sensitive to banks' risk profiles. The calculation of risk-sensitive weights underlying the capital ratios is consistent with the standards specified by the Basel Committee on Bank Supervision (see Espenilla, 2005). In addition, the BSP likewise sets the regulatory capital threshold required for each bank type i.e., for universal, commercial, thrift, rural banks. These thresholds have recently been modified to calibrate minimum capital requirements vis-à-vis the bank's branch network.

The Philippines has had a deposit insurance system in place since 1963, when the Philippine Deposit Insurance Corporation (PDIC) was created. Besides providing deposit insurance, the PDIC works closely with the BSP in conducting bank examination and resolution and serves as the statutory receiver and liquidator of closed banks. Membership of the PDIC is required of all banks operating in the country, for which they are assessed 20 basis points of total deposit liabilities. Deposit insurance covers up to PHP 500,000 (about USD 10,600 at January 2015 exchange rates) per depositor per bank. This means that over 95 percent of deposit accounts are fully insured. This coverage threshold was raised in June 2009, before which it was PHP 250,000. Once a bank is closed, the PDIC has a policy of settling depositor claims within six months.[6] While the fact of deposit insurance may suggest that depositors would have no incentive to run at signs of trouble, the possibility of a six-month wait would be more than an inconvenience for the liquidity-constrained and a run could still ensue.[7]

In the Philippine banking system, the burden for achieving the goal of financial inclusion falls largely on thrift banks and rural and cooperative banks. These are the banks that tend to offer deposit accounts to small savers and to lend to small firms that would ordinarily have limited or no access to the services of larger universal banks and commercial banks. Thrift banks include savings and mortgage banks, private development banks, stock savings and loans associations and microfinance thrift banks. Rural and cooperative banks are the banks that focus on the rural areas. Their role is to provide people in those communities with basic financial services. While rural banks are privately owned, cooperative banks are owned by cooperatives or federations of cooperatives. As of September 2016, there were 64 thrift banks in the Philippines, holding a total of PHP 1,038.22 billion in assets. There were also 513 rural and cooperative banks holding a total of PHP 206.54 billion in assets. For their microfinance operations, many rural banks have received incentives for opening branches and exemptions from some of the documentary requirements for loans.

2.3 "Unsafe and unsound" banking practices and bank closures

The purview of the Philippine central bank over the behavior of regulated institutions that are construed to be "unsafe and unsound" dates back to 1948. The phrase "unsafe and unsound" has evolved to include specific practices that could be prejudicial to the stakeholders of the bank (i.e., depositors) without necessarily being explicitly prohibited by the language of any law. The list of such practices includes operating with capital and reserves "that are inadequate in relation to the kind and quality of the

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[6] See Frequently Asked Question: "How long does it take PDIC to settle a claim for insured deposit?" http://www.pdic.gov.ph/index.php?nid1=6&nid2=1&nid3=19.

[7] As discussed in the following section, there is a 2011 regulatory issuance from the PDIC to the effect that deposit accounts that arise from unsafe and/or unsound deposit-related practices may, under certain circumstances, not be eligible for deposit insurance. In the face of asymmetric information, this could be another reason for the expected preference to withdraw funds rather than wait for deposit insurance proceedings.

assets” of the covered institution. The list also includes relying excessively on “large, high-interest or volatile deposits/borrowings” as well as involvement in “speculative and hazardous investment policies”. Under the powers granted to the Monetary Board, covered entities found to be operating in an unsafe and unsound manner may be penalized with administrative sanctions, excluded from clearing, placed under receivership or closed down and liquidated.

Taking a look at broad numbers, the number of banks in the industry declined from 947 in 2000 to 648 between 2014, a decline of 31.6 percent over 15 years. This reflected the efforts of the banking regulator to instill a high standard of governance that includes the prohibition of unsafe and unsound practices. Nonetheless, there was also an effort to induce mergers and consolidations.

3. Developments leading up to the three events

In the years after the 2008 global crisis, both the Philippine economy and its banking system expanded briskly. The real economy grew by an average rate of 5.8 percent per annum between 2008 and 2017. In the banking industry, total assets rose from PHP 5.7 trillion at end-2008 to PHP 15.2 at end-2017, an annual growth rate of 11.5 percent. This expansion was in all major aspects of the banks’ balance sheets. Deposit accounts increased from PHP 4.2 trillion at end-2008 to PHP 11.7 trillion at end-2017.

This sustained expansion notwithstanding, some 168 banks were placed under receivership and subsequently underwent liquidation between 2008 and 2014, the period covered by the events of this study. This averages to roughly 24 bank closures a year. This may seem alarmingly high but given the total number of banks, these closures comprise only 3–4 percent of all banks annually.[8] Moreover, in terms of the assets and deposit balances of these closed banks versus the overall system, they actually only represent 0.98 percent and 0.94 percent, respectively.[9] This should not come as a great surprise, since the majority of the closures were community-type banks, 85 percent of which were rural banks and the rest thrift banks.

[8] The number of distinct banks in the Philippines for the said period declined from 818 to 648. Consolidation via the Strengthening Program for Rural Banks (and its subsequent iterations) was also one of the reasons for the decline in the number of banks during the period.

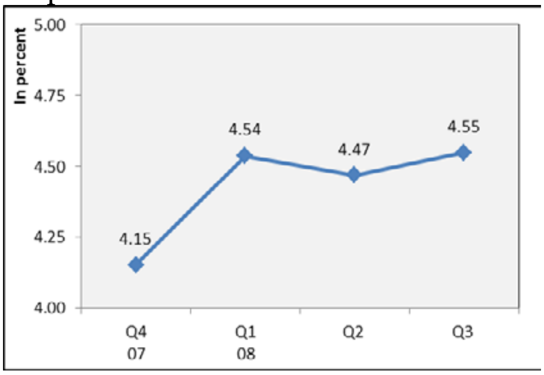
[9] For simplicity and convenience, the percentages were computed against December 2014 values.

Among the bank closures, three events stand out because of their size relative to their peers, and these are the events that form the basis of our analysis. Chart 1 shows that the share of the three closed banks, in terms of assets, with respect to other thrift and rural banks was relatively small when compared to all banks in the same province but increases when analyzed at the town level.

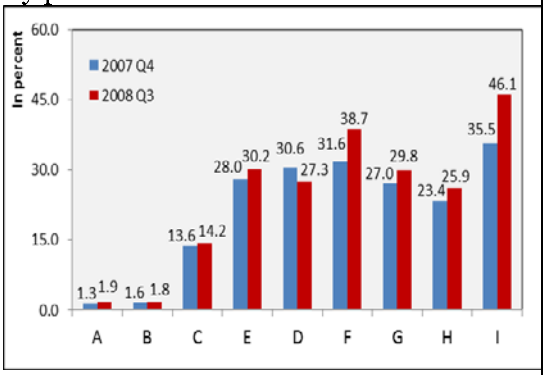
Chart 1: Asset shares of failing banks relative to nearby banks

Bank ABC

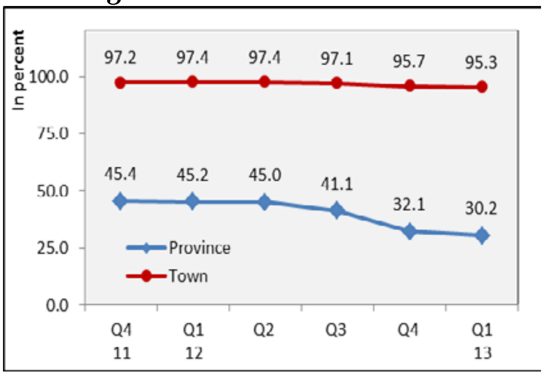
All provinces



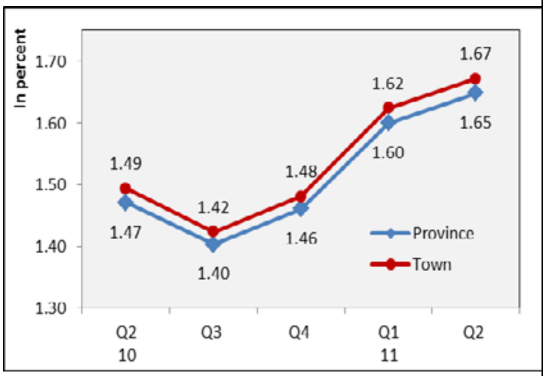
By province



Bank 123



Bank XYZ



While the three events arose from banking strategies that shared common elements of aggressive deposit-taking and egregious misuse of funds, they also had important differences. One involved a group of banks that formed a whole national network, one a bank that was closely connected to a remittance business and one a bank that was largely restricted to a single province. We provide below a brief narrative of how the banks in question got into trouble.

3.1 The ABC Banks

The most conspicuous of the three events is the closure of banks that belonged to the ABC Banks, which consisted of several rural banks belonging to a single conglomerate. From a systemic standpoint, this is potentially significant because the group's banks were scattered over several provinces. In addition, since the conglomerate itself included non-bank financial institutions (i.e., pre-need companies, affiliated credit card companies, investment house) and other non-bank non-financial corporations (i.e., realty companies and motor vehicle dealers), the extent of intra-group transactions added a large degree of complexity to the whole situation, including the efforts to supervise the banks.

The ABC Banks comprised 15 banks (i.e., 15 distinct head offices) with a total of 36 branches located across the three major island groups of the country, namely Luzon, Visayas and Mindanao. In Luzon, the bank group maintained a presence in Metro Manila and in the provinces of Rizal, Laguna, Batangas and Albay. In the Visayas, the bank group was present in the provinces of Cebu, Bohol, Leyte and Negros. The group also maintained a presence in Mindanao.

The ABC Banks engaged in an aggressive fund solicitation campaign, anchored on offering investment instruments with high returns. With tenors of three, five and six years, the effective annual returns on these schemes were well above market. The product offerings were designed to entice investors. These instruments fell into three categories: (a) double-your-money (DYM) schemes, (b) so-called hybrid instruments and (c) buy-backs. The DYM schemes offered a traditional end-of-term bullet payment. For investors with a need to generate periodic returns, the "hybrid five" scheme essentially provided a 20 percent return per annum. As a middle variant between the DYM and the "hybrid", a "3-year-buy-back" scheme provided investors with 12 post-dated checks dated quarterly that would effectively provide a DYM return.

It is then no surprise that the ABC Banks were able to raise funds at a pace much faster than their peers did. Once the Philippine regulators discovered the ABC Banks' unsafe and unsound banking practices, the various banks in the group were closed in quick succession in December 2008.

3.2 Bank 123

The second largest event in our study is the closure of Bank 123. The corporate history of Bank 123 dates back to 1956, when it was established as a rural bank. In 1985, it shifted its operations into a thrift bank. In 1995, the bank was acquired by a business group in 1995 and was renamed Bank 123. This new name gave the bank instant market recognition since its namesake affiliate was well known for door-to-door payments, remittance and courier services and cargo logistics, advertising a "network of 6,400 locations … in over 30 countries in Asia-Pacific, North America, the Middle East and Europe".[10]

Similar to the ABC Banks, Bank 123 operated in many parts of the Philippines. But unlike the ABC Banks, Bank 123 had its head office in Makati, the financial district where most of the large banks are headquartered. The 19 branches of Bank 123 were found largely in Luzon although it maintained a presence in strategic locations in the Visayas (i.e., in Cebu, Iloilo and Kalibo) and in Mindanao (i.e., Davao and Cagayan de Oro). This network of branches was a critical feature of the bank's business model. It was the paying agent of two entities, which were the primary remittance business units of the larger business group that owned it.

Also similar to the ABC Banks, Bank 123 was a component of a business strategy within a larger conglomerate. Unlike the ABC Banks, however, Bank 123 did not seem to overreach in raising funds. Instead, as payment agent for a large remittance business, Bank 123 extended advances to its affiliated companies so that the remittance payments could be delivered quickly. This business practice soon put a strain on the financial condition of the bank. At some point, regulators directed the bank to desist from this practice as well as to review its reliance on high-yielding time deposits. The bank failed to remedy its situation and at the time it was closed on September 9, 2011, the bank had PHP 6.1 billion in deposits on its books.

3.3 Bank XYZ

The last event we consider is the closure of Bank XYZ. Unlike the nation-wide exposures of both the ABC Banks and Bank 123, Bank XYZ was much more "localized" in nature and thus presents an interesting contrast. Furthermore, unlike the two other cases in this study, Bank XYZ was more akin to a traditional bank in the sense that it

[10] Taken from the website of the affiliate company.

mobilized savings to fund regular lending activities. Bank XYZ started operations in February 1978 and was based in a good-sized town in a province adjacent to Metro Manila. Aside from its head office, there were 13 branches located within this province plus four other branches located elsewhere in the island of Luzon.

Like the others, Bank XYZ funded itself predominantly by offering higher-than-market rates on various instruments. The bulk of these instruments were time deposits with short-term maturities (i.e., one year maximum) although maturities of up to five years were also offered. Although Bank XYZ was only one of 27 banks in its home province at the start of 2008 (and one of 22 banks as of June 2012), its share of the total deposit liabilities in the province was significant. That share rose steadily from about 23 percent in March 2008 to just below 40 percent by June 2012. The rapid growth in bank liabilities led to governance and risk-related issues for Bank XYZ. At the time the bank was closed in May 2013, deposits stood at PHP 2.2 billion.

4. Data and empirical approach

4.1 Data

Data on bank deposits by town for all the regions of the Philippines are obtained from the BSP on the condition that banks would not be identified by their real names. What makes the data especially useful for our purposes is the fact that they are disaggregated into size cohorts i.e., the data are broken down into outstanding balance categories. Data for deposits surrounding the first two events of bank failure are broken down into 16 cohorts of deposit account size, ranging from a cohort of accounts below PHP 15,000 in size to a cohort of accounts over PHP 2 million in size. Data for deposits surrounding the third event are disaggregated into 18 size cohorts, ranging from below PHP 5,000 to over PHP 2 million. One limitation of these data is that they include deposits only for banks with head offices in a given town. They do not include deposits at branches of banks with head offices outside the town. The data are structured such that all deposits are credited to the town of the bank's head office. The data also distinguish between towns classified as cities and towns classified as municipalities. The classification is based, among other criteria, on the average annual income of the locality over the past four years.[11] Separately, we also have data on the locations of all

[11] The average income of the locality is among the criteria for distinguishing a "city" from a "municipality." Under existing guidelines issued by the Department of Finance, sixth-class cities (the lowest category among cities) have an average annual income below PHP 80 million. On the other hand, first-class

the branches of the failing banks.

We assume that deposits in the bottom size cohort are those that can be associated with financial inclusion. To analyze contagion, we consider the behavior of deposits in towns that are in the same province as the failing bank. If there is contagion, we are most likely to find it in the same province. However, we exclude the town of the failing bank's head office, because for the most part, the data do not allow us to distinguish the deposits of the failing bank from those of other banks in the same town.

For one of the events, that of Bank XYZ, we also have data on deposits at bank branches in the same province as Bank XYZ, even when the head offices of those branches are located elsewhere. For this branch data, however, the deposits are not broken down into size cohorts.

4.2 An informal look at the events

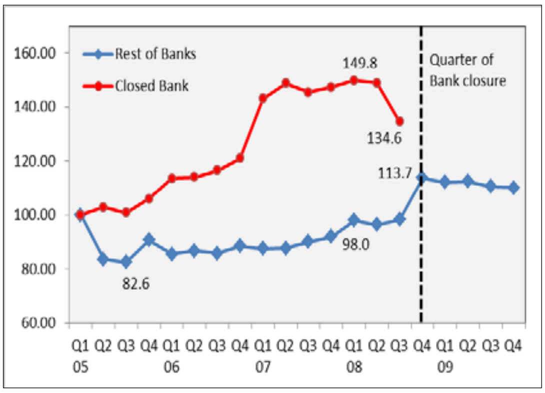
To get an initial sense of the events, it is instructive to look at how various deposits behaved around our events, specifically the smallest and largest deposit balances respectively.

In the case of the ABC Banks, Chart 2 compares the behavior of its deposits with that of other banks in the same provinces. The panel on the left makes the comparison for small deposits and the panel on the right for large deposits. The small deposits at ABC Banks grew by nearly 50 percent over a three-year period. At the same time, similar deposits in other banks in the same provinces registered a more subdued increase. In the final quarter of its existence, small deposits at the ABC Banks fell by 17 percent while no such decline can be seen in the other banks. It would seem that small depositors "knew" something, contrary to the usual assumption that they would be uninformed. This is in spite of deposit insurance. Once the banks were closed, there is no evidence of a run by small deposits at the other banks. Instead, there seems to have been an initial increase in these deposits.

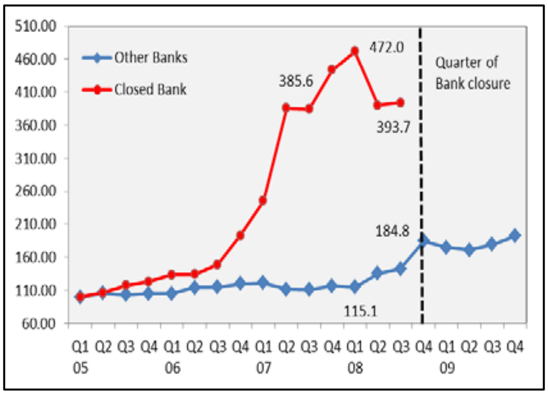
municipalities (the highest level for municipalities) are those with average annual income of at least PHP 55 million.

Chart 2: Behavior of deposits at ABC Banks versus at other banks nearby

Small deposits



Large deposits



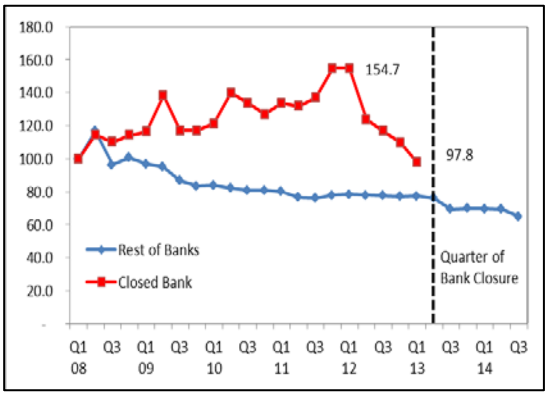
The red line indicates deposits at ABC Banks, the blue line deposits at other banks in the area.

In the case of large deposits, the panel on the right shows that, by 2007, ABC Banks had mobilized large deposits at a much faster pace than other banks did. During this period, large deposits held in ABC Banks as a percentage of similar deposits in other banks in the same areas in which the ABC Banks operated rose to over 200 percent from below 30 percent in previous quarters. There is also a noticeable decline in ABC Banks' large deposits two quarters before closure, suggesting that the large depositors also "knew" something, and they knew it before the small depositors did. Again there is no clear indication that the closure of the banks led to a run by large deposits at the other banks in the area.

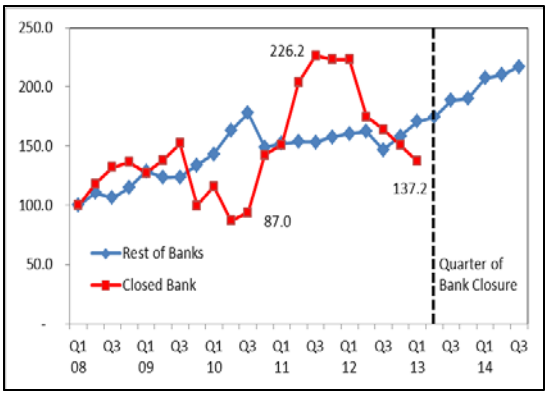
This deposit behavior is also evident in Bank XYZ. In this case, small deposits (left panel, Chart 3) grew by 54 percent from Q1 2008 to Q1 2012 while large deposits (right panel, Chart 3) nearly tripled between 2010 and early 2012. In the latter case, the growth was significantly higher than the comparable growth in other banks while the growth of small deposits was made all the more significant because small deposits elsewhere were actually declining.

Chart 3: Behavior of deposits at Bank XYZ versus at other banks nearby

Small deposits



Large deposits



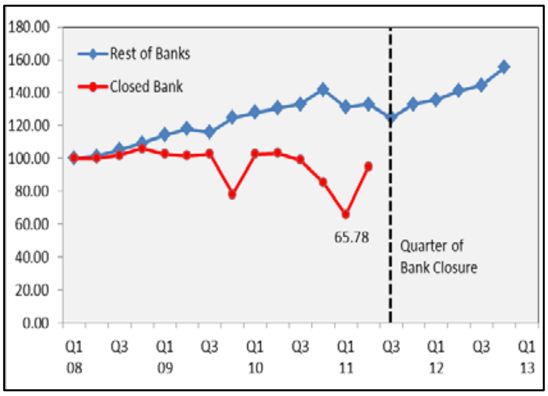
The red line indicates deposits at Bank XYZ, the blue line deposits at other banks in the area.

And, as in the case of the ABC Banks, we also find small and large deposit balances in Bank XYZ declining after a rapid rise. This decline is particularly significant because it begins from Q2 2012, a full year before the bank is closed. This again suggests that these depositors had information about the poor health of Bank XYZ and they acted on that information. The small depositors apparently withdrew their funds, even in the knowledge that they were covered by deposit insurance. After the bank's closure, there is no strong indication of contagion in that deposits at other banks in the area were not withdrawn in large amounts. In fact, large deposits at the other banks in the area rose strongly. While small deposits in these other banks seem to have declined, it was not a sharper decline than those before the Bank XYZ's closure.

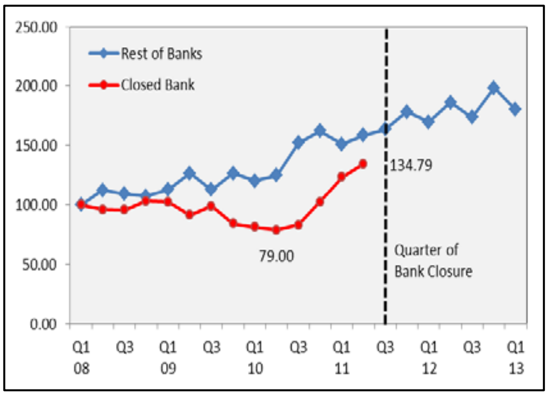
In contrast to deposits in the banks at the center of the two other events, deposits in Bank 123 generally did not outpace the deposits in the other banks in the province in the period before closure. Small deposits (left panel, Chart 4) saw two quarters of increase but generally the pattern remained that of a decline. Large deposits (right panel, Chart 4), on the other hand, were actually rising just before the bank was closed. As in the case of the two other events, there is no indication here of contagion from the closure of Bank 123. Both small and large deposits at other banks in the area actually rose.

Chart 4: Behavior of deposits at Bank 123 versus at other banks nearby

Small deposits



Large deposits



The red line indicates deposits at Bank 123, the blue line deposits at other banks in the area.

4.3 Formal empirical approaches

While our graphs are suggestive, a more formal analysis allows us to control for other variables and to test for statistical significance. For each of the three events, we conduct our formal analysis using difference-in-difference (DD) analysis. For the third event, the availability of data on deposits at branches allows us to look further at deposit behavior. In this case, we turn to time fixed-effects (TFE) regressions.

Difference-in-difference (DD) estimation is frequently used to capture the effect of a shock or policy change on the variable of interest, distinguishing between a treatment group and a control group. Dummy variables are used to capture the effects of the policy change and to capture factors that could cause changes over time in the variable of interest even in the absence of a policy change (see, e.g., Wooldridge, 2002).

DD estimation is widely used in estimating effects of a variety of specific economic and social policy legislation, including, unemployment insurance, minimum legislation, and raising excise taxes on alcoholic beverages. In the microfinance literature, selection biases have been addressed by applying a method similar to the DD approach to disaggregated data from randomized control trials. Karlan and Zinman (2009a and 2009b), for example, use randomized supply decisions to estimate the effect on individual borrowers in Manila of expanded access to credit. Similarly, Banerjee et al (2013) applied the DD approach to estimate the impact on household behavior in Hyderabad of micro-credit group-based lending.

Some writers though have noted a few possible statistical weaknesses. Bertrand, Duflo, and Mullainathan (2002) note possible bias in estimated standard errors for DD papers relying on many years of data and focus on serially correlated outcomes. Meanwhile, Mora and Reggio (2012) show how trend specification affects the significance of the results for generalized DD estimates. To account for this, Mora and Reggio (2017) formally extend the DD model to a general family with parallel assumptions valid for higher-order differencing, such as a difference of double-differencing. They further develop a general additive regression model with fully flexible dynamics, which has the advantage of being able to test for possible restrictions on the dynamics rather than simply positing a particular parametric form.

In our case, we utilize a classic two-period DD model that is not subject to the issues raised by Bertrand, Duflo, and Mullainathan. The treatment group consists of deposits in the smallest size cohort (less than PHP 15,000) in the towns belonging to the same province as the failing bank, while the control group comprises deposits in the largest size cohort (more than PHP 2 million) in those same towns. Deposit data of the town where the head office of the failing bank resides are excluded because the data do not allow a separation of the deposits of the failing bank from those of other banks in the same town. The closure of a bank is assumed to be the external shock or intervention in the model. This test of contagion is, of course, also a test of the perceived effectiveness of deposit insurance.

The general form of our DD regression is

$$ln(DEP_i) = \beta_0 + \beta_1 treatment_i + \beta_2 period_i + \beta_3 (period_i * treatment_i) + \sum c\, LOC_i + u_i$$

where DEP_i is the stock of deposits of both smallest and largest size cohort in the affected town i; $treatment_i$ is the dummy variable for the treatment group (*1* for smallest size cohort, *0* otherwise); $period_i$ is the dummy variable for the period (*1* for after bank closure, *0* otherwise); and, LOC_i are the variables that characterize the town where the deposits are located, such as presence of a branch of the defaulting bank and whether the town is a city or a municipality. Geographical distance of the town to the head office of the failing bank is also included, following Petersen and Rajan (2002) and Agarwal and Hauswald (2010), which found that distance is a useful inverse indicator of the availability of soft information.

For the case of Bank XYZ, we also run different model specifications for generalized DD regressions, following Mora and Reggio (2017), using 670 observations from Q2 2008 to Q3 2014 for 14 towns. This model allows for fully flexible pre-treatment trend differentials between the treated and control groups, while also allowing for a comparison of any two consecutive parallel assumptions such as paths versus growths.

The availability of more comprehensive data on deposits at branches of other banks in the province where one of the events took place allows us to look more closely at deposit behavior surrounding a bank closure. For this purpose, we turn to a time fixed-effects (TFE) model of the form

$$ln(DEP_{it}) = \beta_0 + \beta_1 T + \beta_2 D_{it>T_B} + \beta_3 (T \times D_{it>T_B}) + \alpha X + \mu_{it}$$

where DEP_{it} is deposit levels of bank i at period t; T is a linear time trend; $D_{t>T_B}$ is a dummy variable for the period after the closure; $T \times D_{it>T_B}$ is the interaction between the dummy variable and time; and X is a vector of control variables.

5. Empirical results

Our DD regressions allow us to consider contagion effects that distinguish between deposits of different sizes. Specifically, we would like to determine whether small deposits behave differently from large deposits in the face of a shock. In this paper, we consider each of three shocks, which are events of bank failures in the neighborhood. We run our regressions for two different windows. In a narrow window, we look at one quarter before a bank closure to one quarter after the closure. In a wide window, we look at two quarters before and two quarters after the closure. The model was also specified with and without covariates.

5.1 Event 1: Closure of the ABC Group of Banks in Q4 2008

The closure of the ABC Group of Banks in December 2008 involved a number of banks with head offices situated in seven different provinces and branches scattered in several towns/municipalities all over the country. The DD regression for the first event is as follow:

$$ln(DEP_i) = \beta_0 + \beta_1 DSMAL_i + \beta_2 DPERIOD_i + \beta_3 (DPERIOD_i * DSMAL_i) + \beta_4 DBRCH_i + \beta_5 DCITY_i + \beta_6\, ln(1 + DIST_i) + u_i$$

where DEP_i is the dependent variable represented by the deposit levels in the affected town i. Among the explanatory variables, $DSMAL_i$ is the treatment variable represented by a dummy for the smallest deposit size cohort, $DPERIOD_i$ is the time dummy variable time, $DBRCH_i$ is a dummy variable for the presence in the town of a branch of the failing bank, $DCITY_i$ is a dummy variable for whether the town is classified as a city rather than a municipality and $DIST_i$ is the distance of the town to the town where the head office of the failing bank is located. The regression is estimated for the narrow window of Q3 2008 to Q1 2009 and the wide window of Q2 2008 to Q2 2009.

Table 1: DD Estimates for ABC Group of Banks

	Window 1: Narrow		**Window 2: Wide**	
Covariates	without	with	without	with
Pre-Treatment Difference (T-C) (p-value)	-1.272 (0.002)**	-0.990 (0.004)**	-1.222 (0.002)**	-0.898 (0.007)**
Post-Treatment Difference (T-C) (p-value)	-1.301 (0.001)**	-0.975 (0.005)**	-1.446 (0.000)**	-1.166 (0.001)**
Difference-in-Difference (p-value)	-0.029 (0.959)	0.015 (0.975)	-0.224 (0.689)	-0.268 (0.566)
R-squared	0.08	0.35	0.09	0.37
Total No. of Observations	249		251	

Sources: Bangko Sentral ng Pilipinas staff calculations. Stars indicate statistical significance, with ** indicating significance at the 5 percent level and * indicating significance at the 10 percent level.

The DD estimates provide consistent results for all specifications of the model, i.e., with or without covariates and for both narrow and wide windows. In both pre-treatment and post-treatment periods, the difference in size between small and large deposits is statistically significant. However the difference in the behavior of either deposit size after the closures of the ABC Banks is found to be statistically insignificant (Table 1). The results indicate that although small deposits are different from large deposits, the difference in the behavior of these two types of deposit does not significantly change over time after the closure of a nearby bank.

5.2 Event 2: Closure of Bank 123 in Q3 2011

The DD regression for the closure of Bank 123 was simpler considering that the province in which its head office was located only had cities so that the location of its other branches need not be considered. The specific DD regression in this case is:

$$ln(DEP_i) = \beta_0 + \beta_1 DSMAL_i + \beta_2 DPERIOD_i + \beta_3 (DPERIOD_i * DSMAL_i) + \beta_4\, ln(1 + DIST_i) + u_i$$

where again $DSMAL_i$ is the treatment dummy variable for the smallest deposit size cohort, $DPERIOD_i$ is the dummy variable time, and $DIST_i$ is distance of the city to Makati, the town where the head office of the failing bank was located. In this case, five cities in the same metropolitan district as Makati are considered and the regression is estimated for the narrow window of Q2 2011 to Q4 2011 and the wide window of Q1 2011 to Q1 2012.

Table 2: DD Estimates for Bank 123

	Window 1: Narrow		**Window 2: Wide**	
Covariates	without	with	without	with
Pre-Treatment Difference (T-C)	-5.181	-5.113	-3.797	-3.797
(p-value)	(0.032)**	(0.000)**	(0.104)*	(0.014)**
Post-Treatment Difference (T-C)	-5.070	-5.003	-6.052	-5.988
(p-value)	(0.035)**	(0.000)**	(0.020)**	(0.001)**
Difference-in-Difference	0.111	0.111	-2.255	-2.191
(p-value)	(0.972)	(0.924)	(0.491)	(0.283)
R-squared	0.44	0.93	0.39	0.79
Total No. of Observations[12]	18		19	

Sources: Bangko Sentral ng Pilipinas staff calculations. Stars indicate statistical significance, with ** indicating significance at the 5 percent level and * indicating significance at the 10 percent level.

Again, results in all model specifications show that the difference in size of small and large deposits is statistically significant but there is no discernible difference between the behavior of the small deposits and large deposits across time (Table 2).

5.3 Event 3: Closure of Bank XYZ in Q2 2013

The same DD model for event 1 was used for Bank XYZ:

$$ln(DEP_i) = \beta_0 + \beta_1 DSMAL_i + \beta_2 DPERIOD_i + \beta_3 (DPERIOD_i * DSMAL_i) + \beta_4 DBRCH_i + \beta_5 DCITY_i + \beta_6\, ln(1 + DIST_i) + u_i$$

where the variables are defined as in the previous regressions. Similar to the other events, the regression is run for the narrow window of Q1 2013 to Q3 2013 and the wide window of Q4 2012 to Q4 2013.

The DD regression for this event yields the same results as for the two other events.

[12] We recognize that the limited number of observations for Bank 123 weakens the accuracy of the estimated coefficients and the strength of the established relationship.

The difference in the size of small and large deposits is statistically significant but there is no statistical difference between the behavior of the smallest deposits and the largest deposits (Table 3).

Table 3: DD Estimates for Bank XYZ

	Window 1: Narrow		**Window 2: Wide**	
Covariates	Without	With	Without	With
Pre-Treatment Difference (T-C) (p-value)	-1.752 (0.005)**	-1.660 (0.005)**	-1.635 (0.008)**	-1.538 (0.008)**
Post-Treatment Difference (T-C) (p-value)	-2.535 (0.000)**	-2.385 (0.000)**	-2.565 (0.000)**	-2.345 (0.000)**
Difference-in-Difference (p-value)	-0.783 (0.380)	-0.725 (0.379)	-0.930 (0.290)	-0.807 (0.328)
R-squared	0.35	0.48	0.35	0.47
Total No. of Observations	49		49	

Sources: Bangko Sentral ng Pilipinas staff calculations. Stars indicate statistical significance, with ** indicating significance at the 5 percent level and * indicating significance at the 10 percent level.

Estimating the fully flexible generalized DD model of Mora and Reggio (2017), deposit data of Bank XYZ yield the same results as the classic DD regression, i.e., the difference in size of small and large deposits are not statistically significant even when different trend specifications are used (Table 4). The results are the same whether the contagion effects are considered as a "pulse", or one-time event (Q2 2013), or as a step function, or one that has lingering effects (Q2 2013–Q3 2014).

Table 4: Generalized DD Estimates for Bank XYZ						
Model[13]	**Standard**		**Linear**		**Quadratic**	
Length of Pre-Treatment	20	10	20	10	20	10
Difference-in-Difference	-0.435	-0.354	-0.284	-0.287	-0.285	-0.284
Standard Error (Robust)	-0.621	-0.63	-0.638	-0.642	-0.638	-0.652
Total No. of Observations	670	407	670	407	670	407

Sources: Bangko Sentral ng Pilipinas staff calculations. Stars indicate statistical significance, with ** indicating significance at the 5 percent level and * indicating significance at the 10 percent level.

6. A further test of contagion with data on bank branches

In the case of Bank XYZ, we were able to obtain data on other banks' branches that were located in the failing bank's home province. In our previous analyses, we relied only on head-office data, which would not capture the behavior of deposits at branches of a bank whose head office happened to be outside the province. These branch-level data, however, come with the limitation that they do not distinguish between small deposits and large ones. Moreover, these data are available only at a half-yearly frequency. We accept these limitations so that we can examine the possibility that the effects of contagion show up in deposits at bank branches of banks whose head offices are outside the province.

In the case of the Bank XYZ event, our branch data cover 113 banks with 446 branches in the province where the event took place. This gives us 2,843 observations as opposed to only 49 when we consider only head-office data. We look at the period from 31

[13] The standard model assumes that all Parallel-q's are equivalent while the linear and quadratic model assumes that Parallel-2 to Parallel-t and Parallel-3 to Parallel-t are equivalent, respectively, where t is the number of pre-treatment periods. Test for common pre-treatment dynamics show that the standard model is appropriate for the data.

December 2008 to 30 September 2014. Our data allow us to distinguish between three types of bank. Of the 113 banks present in the 24 towns of the province, 55 are rural banks (RBs), 37 thrift banks (TBs) and 21 universal and commercial banks (UKBs). We formally test whether there is a change in the deposit behavior of the bank branches in the province from before the closure of Bank XYZ to after the closure.

We estimate a time fixed-effects (TFE) model. We also considered a random-effects model. However, the Hausman (1978) specification test favored the TFE model. The general form of the TFE regression is

$$ln(DEP_{it}) = \beta_0 + \beta_1 T + \beta_2 D_{it>T_B} + \beta_3 (T \times D_{it>T_B}) + \alpha X + \mu_{it}$$

where DEP_{it} is the deposit levels of bank i at period t; T is a linear time trend; $D_{t>T_B}$ is a dummy variable for the whole period after the closure, defined as 1 from June 2013 onwards and 0 otherwise; $T \times D_{it>T_B}$ is the interaction between the dummy variable and time; and, X is a vector of control variables, such as bank size and seasonal variation.[14]

The results reported in Table 5 show that there was indeed a change in deposit behavior at the branches of other banks. The negative coefficients on the Bank XYZ dummy variable suggest that this change was an adverse one. In other words, deposits at neighboring bank branches were lower in the period after closure. This result appears to be robust.[15] The results tend to remain the same when branches are clustered according to bank type (i.e., separate regressions for RBs, TBs and UKBs). The one case where statistical significance is not obtained is when the branches belonged to a rural bank.

[14] A significant indicator variable denotes a change in deposit behavior. The intervention point was measured as a step function (or a persistent change starting time of default onwards).

[15] We also tested for the significance of the indicator variable using the following specifications: (1) only using bank data from towns with Bank XYZ presence; (2) assuming heteroskedastic panels and AR(1) disturbances; and (3) when the indicator variable is defined as a pulse function. The results remain.

Table 5: TFE Estimates for Bank XYZ

Bank Type	**All**	**Rural Banks (RB)**	**Thrift Banks (TB)**	**Universal/ commercial Banks (UKB)**
Post-closure dummy	-0.565	-0.264	-0.615	-0.603
(p-value)	(0.000)**	(0.117)	(0.000)**	(0.000)**
Interaction term	0.065	0.022	0.070	0.075
(p-value)	(0.000)**	(0.221)	(0.000)**	(0.000)**
Time trend	0.022	0.020	-0.002	0.034
(p-value)	(0.000)**	(0.038)	(0.779)	(0.000)**
Within R-squared	0.350	0.386	0.262	0.471
Between R-squared	0.649	0.646	0.391	0.611
Overall R-squared	0.470	0.572	0.166	0.389
No. of Observations	2,843	608	836	1,399

Sources: Bangko Sentral ng Pilipinas staff calculations. Stars indicate statistical significance, with ** indicating significance at the 5 percent level and * indicating significance at the 10 percent level.

When it comes to the interaction term, we obtain positive and significant coefficients. This suggests that deposits grew at a faster pace after Bank XYZ's default. This suggests that, even though deposits left the branches of other banks in the wake of the bank failure, they seemed to come back over time.

7. Conclusions

Would financial inclusion lead to a less stable banking system? To shed light on this question, we analyze the behavior of bank deposits of the size that is likely to be associated with financial inclusion. We compare this behavior to the behavior of large deposits around three significant events of bank failure in the Philippines. Here we focus on a narrow question: In the wake of a bank failure, do small deposits at other banks in the vicinity tend to run more than do large deposits? When we look at the three events by applying DD regressions to a dataset that distinguishes between small and large deposits at the town level, we find no evidence that any of the events leads to significant withdrawals by depositors, whether large or small, at other banks in the vicinity.

Unfortunately, for our two more recent events – the failure of Bank 123 in 2011 and the failure of Bank XYZ in 2013 – our analysis is hobbled by small sample sizes. For the Bank XYZ event, however, we are able to partially rectify the situation by turning to a more comprehensive dataset. This dataset covers deposits at bank branches at the town level, including branches of banks with head offices that are outside the province. By including these branches, our sample size rises from 49 to 2,843. We then apply a time fixed-effects regression to the data. This time we find that the bank failure does have a statistically significant effect on deposits at other banks. There is now some evidence of contagion in that deposits at these other banks fall in the wake of the bank closure. In this analysis, however, the data do not allow us to distinguish between small and large deposits.

In interpreting all these results together, we suggest that, while a large bank failure can lead to contagion, small and large depositors do not behave differently. Indeed, in our informal look at the events, we find that both small and large depositors tend to anticipate that their bank is about to fail and thus start to withdraw their funds before the bank is closed. This is quite telling, because it runs counter to the view that small depositors are less informed than large depositors. If, in general, small depositors were as well informed as large depositors, then they would likely not behave differently. We find that this is the case in our analysis of head-office data at the town level, in which depositors, whether large or small, do not seem to react to a bank failure nearby. When we turn to branch-level data, we do find some reaction by depositors in general. We would hazard a guess that even in this case, small and large depositors do not behave differently, although we do not have the data to show that directly. What all this means is that financial inclusion is unlikely to add to instability to the banking system.

When it comes to bank regulation, a Basel Committee (2015) global survey of 59 jurisdictions finds that the lower-income respondents tend to require higher capital adequacy ratios of their banks, including those banks that are involved in financial inclusion. Our results have implications for a different area of regulation, that of liquidity standards. At this stage of financial inclusion, micro-deposits should be regarded as relatively stable in the setting of these standards.[16] In general, the responsible course of action seems to be to heed Dittus and Klein (2011). They study the provision of banking services through mobile money and branchless banking, looking in detail at one such business, M-PESA, in Kenya. They argue that while regulation should initially allow experimentation with different business models, it can be tightened when viable businesses grow to the point where they have the potential to threaten financial stability.

[16] Under the liquidity coverage ratio (LCR), most liabilities are subject to some degree of runoff in the 30-day test window, which combines idiosyncratic and market-wide stress. “Stable” deposits are those which are insured and are part of a broader relationship with the bank. These are assigned the lowest minimum runoff rate of 3 percent. Under the Net Stable Funding Ratio (NSFR), which is a longer-term structural measure that does not assume a stress event, the same category of “stable” deposits are considered the most stable form of funding over a one-year horizon and are assigned the highest stable funding factor of 95 percent.

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