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For How Long Are Newly Chartered Banks Financially Fragile?

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Abstract: We examine the financial performance of 1,664 commercial banks chartered between 1980 and 1985, a period of intense chartering activity just preceding the banking recession of the late-1980s. We compare new banks to a benchmark sample of 2,047 small established banks. Using a split population duration model, we estimate the probability distribution of long-run failure for both sets of banks over a 14 year period, and assess how regulatory, environmental, and bank specific conditions affect that probability distribution.

We find that the fragility of a new bank varies over time in a fairly regular 'life cycle' pattern, but that how this basic life cycle pattern is positioned *vis a vis* the business cycle also matters. On average, new banks are initially less likely to fail than established banks; after about four years they become more likely to fail than established banks; and as time passes and new banks mature they fail at rates similar to established banks. But banks chartered just prior to the banking recession failed at the highest rates, and their estimated hazard functions followed an extreme life cycle shape.

State laws restricting the acquisition of de novo banks are associated with higher rates of new bank failure, but easy-entry chartering policies are not. We find that de novo failure is more sensitive to capital levels than established bank failure, evidence that justifies recent increases in minimum capital requirements for de novo banks. Finally, our results suggest that early warning signals may be easier to identify for de novo banks than for established banks, perhaps because banks in the early stages of their life cycles are less heterogeneous and hence simpler to model than mature banks.

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Introduction

As the U.S. commercial banking industry continues to consolidate, the number of new, or *de novo*, commercial banks in the U.S. has continued to grow. In each of the past five years the number of new charters issued by state and federal bank regulators has been larger than in the previous year. In all, over 800 new charters were issued between 1995 and 1999, or roughly one new charter for every three existing charters that disappeared due to mergers and acquisitions. Indeed, recent studies find a causal link between bank mergers and de novo bank charters (Berger, Bonime, Goldberg, and White 1999, Keeton 2000), supporting the anecdotal wisdom that new banks spring up when depositors, small business borrowers, and loan officers become disgruntled, displaced, or dismissed in the aftermath of a bank merger. In addition to preserving retail competition in markets where existing community banks have been acquired, de novo banks are potentially important for ensuring access to credit for small businesses (DeYoung, Goldberg, and White 2000).

Like most new business ventures, de novo banks can be financially fragile at first. Hence, a newly chartered bank cannot be counted on as a reliable source of credit or competitive rivalry until it establishes a strong financial footing. Government regulators recognize this financial fragility in a number of ways; for example, new banks are examined more frequently and are required to hold higher amounts of equity capital than established banks. It is important to understand whether and how these special de novo bank regulations have affected de novo bank performance. But in order to evaluate the efficacy of these regulations, we must first understand how the performance of newly chartered banks evolves over time and how it differs from the performance of small established banks.

This study examines the financial performance of 1,664 commercial banks chartered in the U.S. between 1980 and 1985, a period of especially intense chartering activity. We study this earlier de novo banking wave (as opposed to the more recent wave of de novos in the late 1990s) because this allows us to observe new banks passing through all the stages of their life cycles, from birth to financial maturity; because these banks' exposure to the turbulent conditions of the late 1980s and early 1990s allows us to test how 'newness' affects banks' ability to withstand economic pressure; and because this time frame allows us to test the impact of changes in state and federal regulations on de novo banks over the past 20 years.[1] For each of these new banks, we observe key financial ratios at the end of its first year of life, the environmental conditions under which it operated (e.g., regulatory, economic, competitive), and whether and when the bank dropped out of the data set during the first 14 years of its life due to failure or acquisition. We then analyze these data within the context of a 'split population duration model.' This model allows us to estimate the probability that de novo banks will survive or fail during the first 14 years of their lives; how de novo bank failures are distributed across this time period; and which financial and environmental conditions are associated with higher/lower probabilities of failure and faster/slower times to failure. We also estimate a separate, benchmark duration model for 2,047 small, established commercial banks located in the same geographic markets as the de novo banks, and then compare the estimated parameters of the two models.

Our tests produce a rich set of empirical results. First, our results both reinforce and sharpen earlier research on de novo bank life cycles. Similar to earlier research (DeYoung 1999), we find that the average de novo bank was initially less likely to fail than the average established bank (due to high levels of initial start-up capital); after about four years had become just as likely to fail as the average established bank (as capital cushions declined due to fast growth and low earnings); and after about eight years had become twice as likely to fail as the average established bank. However, the fragility of a new bank also depends on how its life cycle is positioned *vis a vis* the business cycle. De novos chartered in 1984-85 (just four years prior to the peak of the banking recession) failed at relatively high rates and have estimated hazard functions that follow an extreme version of this life cycle pattern. In contrast, de novos chartered in 1980-81 failed at rates quite similar to small established banks and have relatively flat estimated hazard functions. Second, we are able to evaluate the impact of three important regulatory policies toward de novo banks. We find that state laws that prohibit or limit

1. Although one might argue that an analysis of banks chartered during the 1980s cannot be prescriptive for banks chartered

acquisition of newly chartered banks tend to increase the likelihood of failure for new banks that start up in these states. We find no difference in the failure rates of new national banks and new state-chartered banks, which suggests that the OCC's historically 'market-based' chartering policy eased entry for new banks without causing a higher failure rate (ceteris paribus). And our finding that low initial capital levels are a long-run predictor of de novo bank failure (but not established bank failure) provides *ex post* support for the increased capital requirements for de novo banks imposed by bank supervisors during the 1990s. Finally, we find that the long-run determinants of de novo bank and established bank failure are not the same. Although it is always difficult to predict long-run failure, our results suggest it should be *relatively* easy to develop a useful early warning model for de novo bank distress, perhaps because these banks are less heterogeneous and hence easier to model than established banks.

1. Chartering trends and the regulation of new banks

Over 6,000 new commercial banks have been chartered by U.S. banking authorities since the mid-1960s. As shown in Figure 1, these start-ups have occurred in a series of three waves in the early 1970s, in the mid-1980s, and in the late-1990s. These periodic increases and decreases in chartering activity are associated with changes in economic conditions, financial regulations, and industry structure over time. The chartering waves in the 1980s and 1990s correspond roughly with general economic expansions, while the trough in between these two waves corresponds with a banking crisis in the late-1980s (bank failures are also shown in Figure 1) and a national recession in the early 1990s. The 1980s chartering wave corresponds roughly with the repeal or relaxation of state-level unit banking laws during that decade, changes that allowed banking companies in those states to expand geographically either by starting a new bank or by acquiring an existing bank. Furthermore, the mergers that resulted from these state-level deregulations (as well as from the inter-state banking compacts of the 1980s and from the Riegle-Neal Act of 1994) have had an indirect effect of encouraging de novo entry.

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during the 1990s or early 2000s, we provide evidence that the rate of financial development of newly chartered banks is in

During the cost-cutting and reorganization that generally follow an acquisition, experienced bank employees often lose their jobs, some small business accounts are not renewed, and some retail depositors become dissatisfied with the larger post-merger bank. These disruptions provide a ready supply of depositors, borrowers, and managerial expertise for de novo banks.

De novo national banks are chartered by the Office of the Comptroller of the Currency (OCC), while de novo state banks are chartered by the banking commissions of their home states. Historically, the OCC has been more liberal in granting charters than most of the state chartering authorities; its policy has been that market forces, not the chartering authority, should determine which local markets need and can support new commercial banks. In contrast, many state chartering authorities have historically used ‘convenience and needs’ tests when ruling on applications for new bank charters, denying applications when the authorities believe that the convenience and needs of the banking public are already adequately served by existing banks. A possible consequence of these historical differences in chartering policies is that the average national bank chartered during the 1980s may have been less likely to survive than the average newly chartered state bank. State and federal chartering policies have tended to converge over time. One important factor was the Federal Deposit Insurance Corporation Improvements Act of 1991 (FDICIA), which required the FDIC to approve all new federal and state bank charters.[2]

Regulatory policies regarding de novo banks also differ across the various states. For example, some states prohibit the acquisition of de novo banks until they are five or more years old, while other states allow de novos to be acquired soon after they are chartered. The supposed purpose of these restrictions is to prevent speculators from applying for bank charters; in practice, these restrictions likely have other effects, such as

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many ways invariant to the era in which they start up.

2. See DeYoung and Hasan (1998) for a detailed discussion of the historical differences in state and federal chartering philosophies. Despite the recent convergence in chartering policies, Seelig and Critchfield (1999) find some evidence that state chartering authorities continue to weigh local banking conditions more heavily than does the OCC. They find that income per capita per bank branch was a stronger predictor of de novo state bank entry than of de novo national bank entry between 1995 and 1997.

supporting the price of existing banks in the acquisition market, discouraging investment in start-up banks, and increasing the number of de novo bank failures (i.e., because financially weak de novos cannot be purchased).

A primary concern of both state and federal chartering authorities is that new banks start out with enough equity capital to absorb the negative earnings and rapid asset growth typical of new banks' first few years of operation. Chartering authorities might require as little as $3 million start-up financial capital, or as much as $20 million, depending on the proposed location and business plan of the prospective bank. Larger amounts of start-up capital are generally required for urban banks, for banks locating in vibrant economic markets, and for banks with business strategies that feature fast growth (e.g., a new Internet bank).

Once a new bank opens its doors for business, regulatory scrutiny shifts from the applications staff to the examination staff. Bank supervisors pay closer attention to newly chartered banks than to similarly situated established banks. Federal Reserve supervisors conduct full scope examinations for safety and soundness at a newly chartered state member banks at 6 months intervals (established banks are examined every 12 to 18 months) and will continue to schedule exams at this frequency until the bank receives a strong composite CAMEL ratings (i.e., a rating of 1 or 2) in two consecutive exams. The FDIC requires all newly chartered state and national banks to maintain an 8% Tier 1 equity capital-to-risk based assets ratio for their first three years, while the Federal Reserve requires newly chartered state member banks to hold this ratio above 9% for three years. These temporary capital requirements -- which exceed the 4% Tier 1 ratio required for established banks to be considered 'adequately capitalized' -- are a relatively recent supervisory response to the large number of de novo bank failures that occurred during the late-1980s. In addition, bank supervisors typically place restrictions on dividend payouts by new banks, limit the amount of debt that new bank holding companies can issue, and require new banks to maintain minimum levels of loan loss reserves.

2. Recent research on de novo banks

Most of the recent research on de novo banks focuses on one of two issues: the locational choice of newly chartered banks, and the post-entry performance of newly chartered banks. Moore and Skelton (1998) show that de novo banks are more likely to start up in markets where economic growth is high, in markets where competition among existing banks is weak, and in markets where small banks are under-represented. This is consistent with anecdotal reports that new banks tend to start up in the aftermath of mergers in which small, locally controlled banks are purchased by larger, out-of-market banks. Berger, Bonime, Goldberg and White (1999) examine de novo bank formation in urban and rural banking markets between 1980 and 1998, and find that entry is more likely in local markets that have recently experienced mergers or acquisitions, especially acquisitions involving large banking organizations. Seelig and Critchfield (1998) examine de novo bank and thrift formation in urban markets between 1995 and 1997 -- a shorter, post-deregulation time period during which banking conditions were uniformly good -- and in contrast they conclude that de novo entry is less likely in the aftermath of bank mergers. Keeton (2000) identifies the strengths and weaknesses of these two studies, and performs new statistical tests on de novo bank formation in urban markets between 1995 and 1999. He finds that mergers that shift local market deposits from small banks to large banks, or from local banks to out-of-market banks, are catalysts for de novo bank entry, but that other types of mergers (e.g., combinations of two small banks in the same market) are unrelated to de novo bank entry.

Once de novo banks enter a market and begin operating, their financial performance tends to lag that of established banks by a considerable margin. DeYoung and Hasan (1998) measured the profit efficiency of over a thousand de novo banks during the 1980s and early 1990s, and compared these estimates to established bank efficiency levels. They find that the typical de novo bank was only about 25% as efficient as the typical established bank after one year of operation; about 50% as efficient after two years; about 75% as efficient after 5 years; and did not become 100% efficient until its ninth year of operation. These results are roughly consistent with earlier studies (e.g., Huyser 1986, Hunter and Srinivasan 1990) that used accounting ratios to measure de novo bank performance.

Although numerous studies have estimated models of financial institution failure (e.g., Whalen 1991, Thomson 1992, Wheelock and Wilson 1995, Cole and Gunther 1996, Wheelock and Wilson 2000), only a few studies have modeled the failure of new financial institutions.[3] Hunter, Verbrugge, and Whidbee (1996) estimated a split-population duration model for de novo savings and loans, and found that credit risk, adverse economic conditions, low capital stocks, and cost inefficiencies all contributed to de novo thrift failure. In addition, they found that failing thrifts with large amounts of nonperforming assets and/or that were growing fast tended to fail more slowly, which they interpret as evidence of regulatory forbearance. DeYoung (1999) estimated a split-population duration model for de novo commercial banks chartered in 1985, and compared the results to a similar model estimated for established banks. His results support a life cycle theory of bank failure in which new banks initially have a low probability of failing, but eventually become substantially more likely to fail than established banks. Santarelli (2000) estimates a proportional hazard model for de novo financial institutions in Italy in 1989 and 1990, and finds that large start-ups and bank start-ups have lower risks of early exit than do small start-ups and nonbank start-ups.

3. Data and Variables

Our data set contains information on 1,664 de novo banks and a benchmark sample of 2,047 established banks. The 1,664 de novo banks represent all new commercial banks that opened their doors during the 24 quarters from 1980:Q1 through 1985:Q4.[4] As displayed in Figure 1, this time period contains the majority of the banks chartered during the 1980s de novo bank wave, and it is situated just ahead of the historically large episode of insolvencies that began in the mid-1980s. Thus, these data allow us to examine how the age of a new bank contributes to its ability to withstand difficult economic conditions. For example, banks that started in 1980 had several years to develop and mature before the onset of the failure wave, while banks that started in 1985 had

3. Although Wheelock and Wilson (2000) do not formally model new bank failure, they include the natural log of bank age as a covariate in a proportional hazards model of U.S. bank failure between 1983 and 1994. They find that bank age has a marginally negative effect on duration, which implies that de novo banks are more likely than established banks to fail.
4. We mark the beginning of a bank's life as the day it begins operating, which typically occurs several months or more after its charter is issued. Because chartering activity was heavier at the end of our sample period than at the beginning, and because some banks that receive charters never open for business, our data set includes fewer than the 1,800 new commercial bank charters granted from 1980 through 1985 (FDIC website). In addition, we excluded a small number of banks for which complete data was not available.

to develop and mature in the midst of the failure wave. Along these lines, it is useful to organize the de novo banks into three cohorts based on when they opened for business: a 1980-81 cohort of 394 de novo banks that started up in 1980 or 1981; a 1982-83 cohort of 617 de novo banks that started up in 1982 or 1983, and a 1984-85 cohort of 653 de novo banks that started up in 1984 or 1985.

The 2,047 established banks were selected to provide a good performance benchmark for the de novo banks in terms of bank size and location. We began by selecting three cohorts of established banks. The 1980-81 cohort of 1,342 established banks includes every commercial bank from year-end 1980 that met the following conditions: it was located in one of the geographic markets (urban MSAs or rural counties) represented in the 1980-81 de novo bank cohort; it had less than $100 million in assets (1985 dollars); it had at least a 6% capital-to-asset ratio; and it was at least 20 years old. The 1982-83 cohort of 1,462 established banks was similarly selected from year-end 1982 data, and the 1984-85 cohort of 1,279 established banks was similarly selected from year-end 1984 data. A substantial number of established banks appeared in more than one cohort; to avoid observing these overlapping banks more than once, we randomly assigned each of them to a single cohort, which resulted in the overall sample of 2,047 established banks.

We tracked each cohort of banks for 14 years. The 1980-81 cohorts were tracked each quarter through 1994:Q4, the 1982-83 cohorts were tracked each quarter through 1996:Q4, and the 1984-85 cohorts were tracked each quarter through 1998:Q4. A bank's *duration* is the number of quarters it remained in the data set. The minimum duration is t=1 for banks that failed or were acquired during their first full quarter in the data set. Failure refers to any of the following: a bank is declared insolvent by its regulator; a bank receives regulatory assistance (e.g., a capital injection) without which it would have become insolvent; or a bank is acquired soon after its net worth declined to less than 1% of its assets. The maximum duration (for banks that neither failed nor were acquired during the sample period) varies depending on when the bank entered the data set. The maximum duration is t=60 for de novo banks that opened during the first quarter of their cohort group, t=56 for de novo banks that opened during the final quarter of their cohort groups, and t=56 for established banks. We use *t* as the dependent variable in our duration model in section 6 below.

Summary statistics for the duration variable *t* and other variables are shown in Table 1. The variables in Panel A indicate that de novo banks tended to exit the market both more often and more quickly than established banks. Only 31% of the de novo banks survived until the end of the sample period (compared with 52% of the established banks), while 23% failed and 46% were acquired (compared to only 8% and 39% of the established banks). The average de novo bank had a duration of only 39 quarters (9: years), compared to 44 quarters (11 years) for the average established bank.

The variables in Panel B describe the sample banks' market environments and organizational structures. Compared to the established banks, de novo banks were more likely to be located in concentrated urban markets (*HHI*, *URBAN*) and in fast growing states in which bank acquisitions were relatively common (*STATEGROWTH*, *MERGE8098*). The latter result is consistent with the findings of Berger, Bonime, Goldberg, and White (1999) and Keeton (2000) that new banks are likely to start up in the wake of bank mergers. The typical de novo bank was prohibited from being acquired for about 3 years (*DELAY*). Roughly half of the established banks were located in states that in 1985 had legal branching limitations characterized by Calem (1994) as "severe" (*LIMITS*). Consistent with the market-based chartering policy of the OCC during the sample period, de novo banks were more than twice as likely as established banks to hold national bank charters (*OCC*). De novo and established banks were equally likely to be affiliated with multibank holding companies (*MBHC*). We use these environmental variables as explanatory variables in our duration model in section 6 below.

The variables in Panel C describe the business strategies and financial performance of the sample banks. For the established banks these variables are taken from year-end 1980, year-end 1982, or year-end 1984 financial statements (depending on the cohort), and for de novo banks they are taken from financial statements at the close of each bank's fourth full quarter of operation. Not surprisingly, at one-year old the typical de novo bank was smaller, better capitalized, less profitable, and was growing faster than the typical established bank (*ASSETS*, *EQASS*, *ROA*, *ASSGROW*). The data suggest that the swift de novo grow rates were financed in part with large deposits (*BIGDEP*). Although the typical de novo bank invested a larger portion of its assets in loans, the unseasoned nature of these loan portfolios kept nonperforming loans low (*LOAN*, *NPL*). De novo banks tended to spend proportionately more on salaries and overhead than established banks (*SPEND*); while this is consistent with inefficient management at de novo banks, it more likely reflects excess capacity in salaried workers and physical plant at these new banks.[5] We use these financial variables as explanatory variables in our duration model in section 6 below.

4. Performance trends

The banking industry provides a unique opportunity to examine the early stages of firm life cycles. It provides a large number of new start-up firms from the same industry (which eliminates noisy cross-industry effects), and government regulators collect and disseminate uniform and highly detailed financial data for each of these new firms. Figures 2 through 5 use some of this data to document the speed at which de novo banks grow to resemble established banks over time. Each figure chronicles the quarterly movements of a different de novo bank financial ratio (profitability, capitalization, asset growth, and loan quality) and compares those movements to the established bank benchmark.

The figures represent the passage of time two different ways. For example, in Figure 2A the horizontal axis measures 72 quarters of chronological time, starting in 1981:Q1 and ending in 1998:Q4. The bold line shows the quarterly median values of *ROA* for the banks in our established bank sample, while the three other lines trace the movements in median *ROA* for the three de novo bank cohorts.[6] The rate at which de novo banks mature financially is measured by the shrinking gap between the de novo bank lines and the established bank line,

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5. See DeYoung and Hasan (1998) for a more detailed comparison of the financials of de novo and established banks during this time period.

6. The number of banks represented in each quarter of Figures 2 through 5 varies across time because (a) some banks drop out of the samples as they failed or were purchased, and (b) we observed the three cohorts of established banks over different time intervals (i.e., 1981:Q1 through 1994:Q4; 1983:Q1 through 1996:Q4; and 1985:Q1 through 1998:Q4). For each of the de novo bank cohorts, we calculated the quarterly medians using data from the eight-quarter window that surrounded the quarter in question. For example, to calculate the first quarterly median for the 1980-81 de novo bank cohort graph, we assumed that all the banks in that cohort were one-quarter old at 1981:Q1 (while in reality some were one-quarter old as

holding changes in economic and industry conditions roughly constant. In contrast, the horizontal axis in Figure 2B measures 56 quarters of 'time since chartering,' starting with *t*=1 and ending with *t*=56. By abstracting from chronological time this approach holds constant the ages of these banks, allowing us to directly compare the financial evolution of the three de novo bank cohorts. The degree to which these three lines converge with, or diverge from, each other indicates whether differences in economic or industry conditions at the time a new bank is chartered have an affect on the rate at which that bank matures.

We also add a dark line in Panel B which shows the median averages for a fourth cohort of 405 de novo banks chartered between 1994 and 1999.[7] These new banks started up under a different set of regulations (post-FDICIA, post-geographic deregulation), faced a different set of technological possibilities (e.g., credit scoring, loan securitization, the Internet), and enjoyed a much more favorable economic climate. Adding this information to the figures provides a test, albeit a crude one, of whether the basic features of de novo bank financial development are robust to different economic, regulatory, and technological regimes. Evidence that de novos banks chartered during different time periods have similar rates of financial development would suggest that our duration model, which we estimate below for 1980s de novos, may also be prescriptive for new banks chartered in the 1990s and beyond.

The data in Figures 2 through 5 reveal strongly similar financial ratio time paths for the three cohorts of 1980s de novo banks. Furthermore, the basic financial patterns observed for the 1980s de novos are echoed in the time paths of the 1990s de novos. In general, the data in these figures is consistent with a largely time-invariant life cycle that guides the financial evolution of banks in their early years. However, the figures also suggest that economic conditions during banks' early years (in our case, the banking recession that began in late

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early as 1980:Q1 and some were one-quarter old as late as 1981:Q4).

7. For the 1990s cohort we excluded de novo credit card banks and new charters granted to existing institutions in charter swaps. Because there were relatively fewer banks chartered annually during the late 1990s, and because the oldest of these banks was only 23 quarters old when we performed this study, we treated these banks as a single, six-year long cohort. To calculate the median quarterly financial ratios for this cohort, we grouped the banks together by age, regardless of when the banks were chartered during the 1994-1999 time period. That is, the first observation on the graph is the median value for

1980s) can alter the local trajectory of these time paths.

The patterns in Figure 2 are broadly consistent with previous studies of de novo bank profitability, i.e., that the typical new bank loses money at first, and then after it is profitable continues to underperform similar established banks for a decade or more. In addition, the path to profitability was slower for new banks that were very young when the banking recession started. The typical 1980-81 de novo became profitable after just 3 quarters, while the typical 1982-83 and 1984-85 de novos needed at least 5 quarters to become profitable, and recorded substantially lower earnings for the first 4 to 5 years of their lives. The 1990s cohort at first underperformed the 1980s de novos, but the *ROA* time paths for all four cohorts followed the same general pattern, and after a few years all of the cohorts were earning similar levels of *ROA* on average.

Figure 3 shows that de novo capital ratios start out very high but decline very quickly, reaching (and dipping just below) the established bank average after 3 to 5 years. Some of the start-up capital bleeds away with the losses of the early years, and what is left gets spread thin across a rapidly increasing asset base, as shown in Figure 4. The earlier 1980s de novos had more time to grow and mature prior to the banking recession, and compared to the later 1980s de novos they were able to sustain high asset growth and high capital ratios for a longer period time. The growth rates and capital ratios of the 1990s de novos followed similar overall patterns: asset growth similar to the 1980-81 cohort in most quarters, and the slightly higher capital ratios (about 9% instead of 8%) probably reflect the higher regulatory minimums imposed on new banks during the 1990s. (Note that the right-hand extreme of the 1990s time paths exhibit high quarter-to-quarter volatility, because only a handful of these banks were 6 years old at the time of our study.)

Figure 5 shows that the typical new bank has no problem loans on its books during the first year of its life. But these portfolios of new loans begin to season after a few years, and nonperforming loan ratios reach (and in some cases temporarily exceed) the established bank average after 3 to 4 years. Banks chartered well before

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all banks at the end of their first quarter of operation, which may have occurred as early as 1994:Q1 or as late as 1999:Q4.

the banking recession tended to have larger and longer lasting loan quality problems, while banks chartered right at the beginning of the banking recession had fewer problems. This may reflect differences in the geographic locations (and hence the local economic conditions) of the banks in the three 1980s cohorts, or it may indicate that banks chartered later had more information about the coming banking recession before putting their assets in place, and devised a less aggressive lending strategy. Loan quality for the 1990s cohort was substantially better, not surprising given that these banks started up during a strong economic expansion.

When considered together, the shapes of the time trends in Figures 2 through 5 are consistent with the three-part life cycle theory of de novo bank failure put forth by DeYoung (1999). First, these trends imply that de novo banks will initially be *less likely to fail* than established banks. Despite heavy losses and high asset growth during their initial years, de novo banks start out with very large capital cushions and very low levels of nonperforming loans. Second, these trends imply that de novo banks will become *more likely to fail* than established banks some time after their third or fourth year. By that time, de novo bank loan quality, asset growth, and capital reserves have reached or are approaching established bank levels, while de novo profitability still lags established bank levels. Third, the steady improvement in de novo bank profits, and the overall maturation of these banks over time, imply that de novo bank failure rates *will gradually converge* to those of established banks.[8] These relative patterns are present in the data not only for the three cohorts of 1980s de novo banks, but also for the 1990s de novos. However, note that the lengths of time that identify the beginning and end of the three failure states are unlikely to be constants; although the *general shapes* of the time trends in Figures 2 through 5 are quite regular across the four cohorts, the *exact shapes* of these time trends appear to vary somewhat with the economic and regulatory conditions present early in a new bank's life.

5. Estimation methodology

8. Because a substantial percentage of our sample banks either failed or were acquired prior to the end of the sample period, the time trends in Figures 2 through 5 exhibit survivor bias. For example, surviving banks tend to have higher than average *ROA*, higher than average *EQASS*, and lower than average *NPL*. In the duration models in section 6, we control for *exit via*

We use a 'split-population' duration framework to estimate the probability of failure, the expected survival time, and the determinants of each, for the banks in our de novo bank and established bank samples. Schmidt and Witte (1989) developed the split-population approach, and both Cole and Gunther (1995) and Hunter, Verbrugge, and Whidbee (1996) have estimated split population models of financial institution failure. The central failure concept in these models is the hazard rate, the probability that a bank will fail at time t given that it has survived through all of the previous time periods leading up to time t.

Assume a population of N banks which may fail over time period $(0,t)$ according to some probability distribution:

$$F(t) \;=\; \int_0^T f(t)dt \qquad (1)$$

where $f(t)$ is the associated probability density function and the duration t is the length of time between t=0 and the subsequent failure date T. The hazard function h(t) can be written as a function of F(t) and f(t) as follows:

$$h(t) \;=\; \frac{f(t)}{1-F(t)} \;=\; \frac{f(t)}{S(t)} \qquad (2)$$

where 1-F(t) = S(t) is the survival function, the probability that a bank has not failed as of time t. The function h(T) gives the probability that a bank will fail at T conditional on surviving until T. When estimated, the general shape of the hazard function is constrained by the functional form of the probability distribution F(t) imposed on the data. We use the log-logistic distribution in our tests, a relatively flexible form that yields a hazard function that is non-monotonic in t with up to two inflection points. This flexibility is essential to test whether de novo failure follows a non-monotonic, life cycle type pattern as suggested above. The log-logistic imposes the following functional forms on the hazard and survival functions:

$$S(t) \;=\; \frac{1}{1 \;+\; (\,lt\,)^{p}} \qquad (3)$$

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acquisition in order to estimate the probability and timing of *exit via failure*.

$$h(t) \;=\; \frac{lp(\,lt\,)^{p\text{-}1}}{1 \;+\; (\,lt\,)^{p}} \tag{4}$$

where the estimable parameters *p* and ? give the hazard function its exact shape. The parameter *p* determines the rate at which hazard rate increases or decreases across time, while the parameter ? determines the portion of the hazard rate that is time-invariant. We estimate these parameters using maximum likelihood techniques and the following likelihood function:

$$L \;=\; \prod_{i=1}^{N} \big[\, df(t_i|\,p,\; l)\big]^{Q_i} \big[(1\text{-}\; d) \;+\; dS(t_i|\,p,\; l)\big]^{1\text{-}Q_i} \tag{5}$$

where Q_i = 1 if bank *i* failed during the sample period (uncensored observations); Q_i = 0 if bank *i* survived the sample period or was acquired during the sample period (censored observations); and the estimable parameter d is the probability that a bank will eventually fail (either during or after the sample period). Including the latter term creates a more general likelihood function: for d=1 equation (5) collapses to a 'standard' duration model in which S(*t*) and f(*t*) are estimated assuming that all banks eventually fail, while for d<1 both S(*t*) and f(*t*) are estimated conditional on the probability of bank failure.

Of the three estimable parameters in the likelihood function (*, 8, and *p*), the probability of failure d and the cross-sectional parameter 8 can be made bank-specific as follows:

$$d_i \;=\; \frac{1}{1 \;+\; e^{a'X_i}} \tag{6}$$

$$l_i \;=\; e^{-b'X_i} \tag{7}$$

where X_i is a vector of bank-specific and time-invariant covariates, and the parameter vectors ∀ and ∃ are to be estimated. The estimated ∀'s measure the impact of the covariates on the probability that a bank will survive -- a negative ∀ indicates that the covariate is associated with a lower probability of survival (a higher probability of failure). The estimated ∃'s measure the impact of the covariates on a bank s duration -- given that a bank will eventually fail, a negative ∃ coefficient indicates that the covariate is associated with a shorter duration (a faster failure). Thus, we have a very flexible specification in which the shape of the hazard function, the probability of survival, and the time-to-failure all can vary from bank to bank.

Substituting (2), (3), (4), (6), and (7) into the likelihood function (5), and then performing a log transformation, produces the log-likelihood function to be maximized. Before estimation, we specify (6) and (7) to include the following covariates: *YEAR8283*, *YEAR8485*, *MERGE8098*, *STATEGROWTH*, *DELAY*, *LIMITS*, *URBAN*, *OCC*, *MBHC*, *HHI*, *lnASSETS*, *EQASS*, *ROA*, *ASSGROW*, *LOAN*, *NPL*, *BIGDEP*, and *SPEND*, each of with is defined Table 1. These covariates measure the economic, regulatory, organizational, and financial conditions present during each bank's initial year in the data set. (Note that *LIMITS*, *DELAY*, and *HHI* reflect state and local conditions as of 1985, and *MERGE8098* and *STATEGROWTH* are annual averages from 1980 through 1998.) Thus, we estimate a split population model that describes bank failure over the extreme long-run (i.e., 14 years), an approach that differs from most prior applications of this model which observe bank financial condition just a year prior to failure (e.g., Cole and Gunther 1995). We take a long-run approach because our main objective is to estimate a hazard function that captures the full financial life cycle of newly chartered banks -- which the data in Figures 2 through 5 suggest can last for a decade or more -- and to do so we must control for variation in local environment, organizational structure, and business strategies across de novo banks at the outset of their life cycles.

Note that we include the covariates *MERGE8098* and *DELAY* in our exit-by-failure models to control explicitly for the competing risk of exit-by-acquisition. This approach differs from so-called 'competing risk' models which estimate a separate duration model for each exit state (e.g., Wheelock and Wilson 2000).

5.1 Determinants of the probability of survival

We expect that the probability of survival will vary positively with the following variables: *MERGE8098*, *MBHC*, *HHI*, *STATEGROWTH*, *lnASSETS*, *EQASS*, and *ROA*. Banks located in markets with lots of acquisition activity will be more likely to exit the sample as a merger target, and thus will be less likely to fail. Banks that are affiliated with multibank holding companies may have access to greater financial resources and managerial expertise. Banks located in highly concentrated markets face less competitive rivalry, and hence may be less likely to fail during periods of financial distress. Banks that operate in states with robust economies may be less likely to fail. Large banks are typically better diversified, and *ceteris paribus* large size may indicate a better managed or otherwise more successful bank. High capital ratios allow banks to absorb losses without incurring financial distress, and high profitability indicates an ability to replenish bank capital internally.

We expect that the probability of survival will be negatively associated with the following variables: *DELAY*, *LIMITS*, *OCC*, *LOAN*, *NPL*, *BIGDEP*, and *SPEND*. De novo banks located in states that prohibit the acquisition of young banks will be less likely to exit the sample as a merger target, and thus will be more likely to fail. (We include *DELAY* only in the de novo bank regressions because there is no reason *a priori* to expect established bank survival to be related to these prohibitions.) Established banks located in states that limited branching may have been less well diversified, and thus more likely to fail. (We include *LIMITS* only in the established bank regressions because geographic expansion is a moderate- to long-run strategy, and hence these regulatory limits are less germane to newly chartered banks.) De novo national banks may be less likely to survive than de novo state banks due to the OCC's market-based chartering philosophy. (We include *OCC* only in the de novo bank regressions because although we have a good reason *a priori* to expect de novo national banks to fail more often than new state banks, we have no reason *a priori* to expect the same of established national banks.) A balance sheet heavy in loans is less liquid and hence may be more sensitive to economic downturns than a balance sheet heavy in marketable securities, cash, or cash equivalents. Nonperforming loans reduce a bank's return on investment and deplete its capital should they have to be written off as bad debt. Large CD financing is expensive, and these uninsured deposits are likely to run should the bank get into trouble. Above average expenditures on physical capital, premises, salaries and benefits may indicate inefficient management and/or agency problems. In addition, we expect the probability of de novo bank survival will be negatively associated with *YEAR8283* and *YEAR8485* because banks starting up in these years had less time to mature prior to the banking recession.

The impact of *URBAN* and *ASSGROW* on the probability of survival is not clear *a priori*. Banks in urban regions face greater competitive rivalry than do rural banks, which suggests a negative coefficient *URBAN*, but banks in urban regions may have greater opportunities for diversification, which suggests a positive coefficient on *URBAN*. Fast asset growth could indicate a successful business plan and/or healthy local economic conditions, which suggests a positive coefficient on *ASSGROW*. Alternatively, banks might achieve fast growth by relaxing their lending standards or purchasing expensive non-core financing, business practices that suggest a negative coefficient on *ASSGROW*. The latter scenario may be more likely for de novo banks than for established banks, given the high levels of *BIGDEP* and *ASSGROW* at young banks.

5.2 Determinants of survival time

In general, we expect that the determinants of survival duration (i.e., the number of quarters a bank survives before failing) will be similar to the determinants of survival probability. Accordingly, we expect survival time to vary positively with *MBHC*, *HHI*, *STATEGROWTH*, *lnASSETS*, *EQASS*, and *ROA*, and to vary negatively with *DELAY*, *LIMITS*, *LOAN*, *NPL*, *BIGDEP*, and *SPEND*.

The impact of *YEAR8283*, *YEAR8485*, *MERGE8098*, *URBAN*, *OCC*, and *ASSGROW* on survival time is not clear *a priori*. All else equal, we would expect failing banks in the *YEAR8283* and *YEAR8485* cohorts to have failed early, because they were chartered just a short time before the banking recession; however, the banking recession hit some geographic areas later than other areas, and if the banks in these two cohorts were disproportionately located in those geographic areas they may have failed more slowly. The sign on *MERGE8098* depends on the relative health of the target banks in states with heavy merger activity: for example, if the merger targets tended to be relatively healthy and/or more viable banks (leaving relatively unhealthy banks and/or less viable banks in the market) then we would expect a negative coefficient. As above, the sign on *URBAN* will reflect the balance of the negative effects of competitive rivalry on survival time and the positive effects of diversification opportunities on survival time. The time to failure for de novo national banks need not be any different than for de novo state chartered banks; however, if the OCC practiced a policy of forbearance with its troubled banks, or if troubled national banks were disproportionately located in states that suffered economic distress later in the sample period, then survival times for failed de novo national banks could be relatively long. These arguments suggest either a neutral or positive sign on the *OCC* coefficient for de novo banks. Finally, the coefficient on *ASSGROW* will be positive if fast asset growth temporarily delays the inevitable for banks that eventually do fail (perhaps by generating fee income from new loans of questionable quality), but will be negative if fast asset growth is a signal of failure due to a reckless growth strategy (as opposed to other causes of failure such as general managerial incompetence, poor local economic conditions, etc.).

5.3 Testable Policy Hypotheses

Our specification allows us to test three hypotheses regarding the effects of past and current government policies toward de novo banks discussed in section 1 above. First, a negative coefficient on *DELAY* in the de novo bank regression would indicate that state regulations prohibiting the acquisition of de novo banks had the unintended consequence of reducing the probability of new bank survival (by eliminating the possibility of exit-by-acquisition for these banks). Second, a positive coefficient on *EQASS* in the de novo bank regression, coupled with a smaller positive or zero coefficient on *EQASS* in the established bank regression, would indicate that the higher minimum capital levels imposed on de novo banks during the 1990s (i.e., after the bulk of our sample period) were justified prudential regulations. Third, a negative coefficient on *OCC* in the de novo bank regression would indicate that the benefits of relatively easy access to national bank charters during our sample period were at least partially offset by the costs of disruptions from increased failures of new national banks.

Our specification also allows us to test a policy hypothesis regarding the effects of past government policies toward established banks. A negative coefficient on *LIMITS* in the established bank regression would indicate that state laws which limit the ability of banks to diversify *via* geographic expansion reduce banks' abilities to survive economic downturns, and that the elimination of these branching restrictions during the 1980s and 1990s contributed to a more stable banking system.

As specified, our duration model does not include an exhaustive list of the potential determinants of bank failure; however, we stress that building a failure prediction model is not our main objective. We select this particular set of covariates for a number of reasons. First, the covariates *DELAY*, *LIMITS*, *EQASS*, and *OCC* allow us to test four important hypotheses about bank regulation and deregulation. Second, by including the covariates *lnASSETS*, *EQASS*, *ROA*, *ASSGROW*, *LOAN*, *NPL*, *BIGDEP*, and *SPEND* in both the de novo and established bank duration models, we can test in a general fashion whether early warning indicators of de novo bank distress and established bank distress are similar, and thus whether supervisory monitoring of new bank financial condition should be designed differently from supervisory monitoring of established bank financial condition. Third, the covariates *YEAR8283*, *YEAR8485*, *MERGE8098*, *DELAY*, *LIMITS*, *URBAN*, *OCC*, *MBHC*, *HHI*, and *STATEGROWTH* are included to control for exogenous conditions that might otherwise interfere with the tests of the policy hypotheses or with the clean estimation of de novo bank life cycle effects in the hazard functions.

6. Results

Tables 2 and 3 display the results of the de novo bank and established bank duration models. We specified each of the models three different ways: column [1] shows the results with no covariates on the right-hand-side; column [2] shows the results with just the market environment and bank structure covariates on the right-hand-side; and column [3] shows the results of the fully specified models. (As discussed above, *OCC* does not appear in the established bank model, and *LIMITS* replaces *DELAY*. In addition, we had to exclude *BIGDEP* from the established bank model in order to make the model converge.)

Consistent with the raw data in Table 1, the estimated probability of failure is higher for de novo banks than for established banks. The estimated probability that the average de novo bank will eventually fail ranges between 27% and 30%, compared to about 11% for the average established bank.[9] The intertemporal distribution of failure is also quite different for the two sets of banks. Consistent with the life cycle patterns discussed above,

9. Note the these estimated failure probabilities in Tables 2 and 3 are higher than the raw percentage of banks that failed during the sample period shown in Table 1. This is because the duration model allows for the possibility that additional banks (i.e., some of the censored observations) will fail in the years following the sample period.

the de novo banks at first fail more slowly, and then more quickly, than the established banks. Using the estimates from the column [3] models, it takes an estimated 21.68 quarters (about 52 years) for 25% of the eventually failing de novo banks to exit the sample, compared to only 17.47 quarters (about 43 years) for established banks. But after that the rate at which de novo banks fail speeds up considerably: 50% of the eventually failing de novo banks will have exited within an estimated 27.44 quarters (26.28 quarters for failing established banks), and 75% of the eventually failing de novo banks will have exited within an estimated 34.72 quarters (39.55 quarters for failing established banks).

These relative patterns of bank failure are represented graphically in Figure 6, which plots the estimated de novo bank and established bank hazard functions. These hazard functions are constructed by evaluating equation (4) for the estimated values of 8, *p*, and ∃ displayed in column [3] of Tables 2 and 3; for the mean values of the covariates *X* displayed in Table 1; and for the quarterly values of $t = (0,56)$. By construction, the log-logistic functional form forces both of the hazard functions through the origin at t=0. For larger values of *t*, the conditional probability of failure for established banks immediately increases; peaks at about 5% for established banks that survive for 32 quarters (8 years); and then slowly declines toward a lower long-run level as the effects of the banking recession subside.[10] In contrast, the conditional probability of failure for de novo banks remains at or near zero for about two years; stays below the established bank hazard rate for 19 quarters (4: years); peaks at 10% percent for de novo banks that have survived for 36 quarters (9 years); and then begins to decline toward the long-run established bank hazard rate. Because the probability that a bank still surviving at t=56 will eventually fail is non-zero, both estimated hazard functions remain positive at the end of 56 quarters, with the de novo bank hazard function declining faster than the established bank hazard function.

6.1 Results: determinants of the probability of survival

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10. Note that the hazard rate at time *t* is conditional on a bank surviving until time *t*, and is independent from the hazard rate at any time *s*, *s t*. Thus, the peak hazard rate for example for the established banks is interpreted as follows: of the set of established banks that survive until the 32[th] quarter, an estimated 5% are expected to fail during that quarter.

For the de novo banks, 10 of the 17 'probability of survival' coefficients (Table 2, Panel A) are statistically significant with expected signs. High levels of *LOAN* and *NPL* at one-year old banks significantly reduced the long-run probability of survival, while high levels of *lnASSETS*, *EQASS*, and *ROA* at one-year old banks significantly increased the long-run probability of survival. There is weak evidence that banks that started up in highly concentrated markets (*HHI*) and/or in urbanized markets (*URBAN*) are also more likely to survive in the long-run. The significant negative coefficients on *YEAR8283* and *YEAR8485* indicate that banks that started up later in the sample period (i.e., nearer to the banking recession) were less likely to survive.

There is also evidence regarding each of our three de novo bank policy hypotheses. The significant negative coefficient on *DELAY* indicates that laws prohibiting the acquisition of de novo banks tend to increase the likelihood that new banks will fail. The significant positive coefficient on *EQASS*, coupled with the non-significance of *EQASS* in the established bank regressions (see Table 3), provides *ex post* support for the extra-high minimum capital levels imposed on de novo banks in the 1990s. The non-significance of the coefficient on *OCC* suggests that the Comptroller's market based chartering policy did not contribute to a higher rate of de novo bank failures during the 1980s and early 1990s.

For the established banks, only 4 of the 15 probability of survival covariates carry statistically significant coefficients (Table 3, panel A). As expected, poor loan quality reduced the probability of established bank survival (*NPL*). Unexpectedly, high levels of overhead spending are positively related to long-run survival for these banks (*SPEND*). High levels of this covariate may be indicative of greater labor inputs devoted to risk management (e.g., more loan monitoring) or a more diversified product mix (e.g., labor-intensive fee-based activities). As we will see below, *SPEND* is negatively related to time-to-failure for established banks. The coefficients on *YEAR8283* and *YEAR8485* are also negative and significant, but this merely reflects the fact that the 1980-81 portion of the regression sample (we which constructed from the three established bank cohorts) contains a large number of banks guaranteed to survive for at least six years.

The paucity of significant probability of survival coefficients in Table 3 reinforces what we already know about predicting bank failure in the long-run: it is difficult to do. In contrast, the large percentage of significant probability of survival coefficients in Table 2 suggests that predicting the long-run failure of newly chartered banks may be *relatively* less difficult. This difference in results may occur because (a) new banks are less heterogeneous than established banks and hence easier to model and/or (b) during the early stages of bank life cycles the recipes for success (and failure) are far simpler.

6.2 Results: determinants of survival time

For the de novo banks, 11 of the 17 'survival time' coefficients were statistically significant (Table 2, Panel B), and none of these 11 coefficients have unexpected signs. De novo survival time was significantly and positively related to *MBHC*, *HHI*, *STATEGROWTH*, *lnASSETS*, and *ROA*, or was significantly and negatively related to *DELAY*, *LOAN*, and *BIGDEP*, in either column [2] or column [3]. The significant positive coefficient on *YEAR8485* indicates that a disproportionate number of de novo banks in this cohort happened to start up in geographic markets that were hit relatively late by the banking recession. Although Panel A indicates that de novo banks were less likely to fail in urban markets, the significant negative coefficient on *URBAN* in Panel B indicates that de novo banks that do fail in urban markets do so quickly. The significant and positive coefficient on *MERGE8098* indicates that banks that fail in high-merger states fail more slowly, consistent with merger activity that targets the least financially viable banks.

For the established banks, 7 of the 15 survival time coefficients were statistically significant (Table 3, Panel B). None of the significant coefficients have unexpected signs, and three are consistent with the significant coefficients from the de novo bank regression (*YEAR8485*, *MERGE8098*, and *LOAN*). In addition, and consistent with our expectations, survival time for failing established banks was significantly and negatively related to *ASSGROW*, *NPL*, and *SPEND*. Finally, there is some evidence regarding our established bank policy hypothesis. Although we find no evidence that banks in states that restricted branching were more likely to fail (see Panel A), the negative and significant coefficient on *LIMITS* in Panel B indicates that small established banks that did fail did so more quickly in branching restricted states.

6.3 Results: Comparing hazard functions across time cohorts

To more closely investigate the life cycle patterns of new banks, we estimated a separate duration model for each of the three de novo bank cohorts, and compared the results to separately estimated duration models for each of the three established bank cohorts. The resulting hazard functions for these six regressions are displayed in Figures 7 and 8, where panel A aligns the cohorts by chronological time and panel B aligns the cohorts by time-since-chartering.[11]

The established bank hazard functions in Figure 7 serve as a benchmark for evaluating the life cycle effects displayed in the de novo bank hazard functions in Figure 8. The three established bank hazard functions in Figure 7A are virtually coincident as they increase, peak, and decrease in step with the banking recession (bank failures peaked in 1988-89.) Even at the peaks of these hazard functions, the conditional probabilities of failure never diverge from each other by more than 2 percentage points, ranging tightly between 5% and 7%. There are no life cycle effects here, nor should there be: at the initial point on the hazard functions these banks were all at least 20 years old.

The three de novo hazard functions in Figure 8 display clear life cycle effects. All three of these de novo hazard functions equal zero for the first several years, reflecting the high initial capital cushions of very young banks. As time passes and capital cushions are drawn down, all three hazard functions begin to increase -- but importantly, the rate of increase depends on the age of the banks when the banking recession hit. The hazard function for the cohort of de novos most mature at the beginning of the banking recession (the 1980-81 cohort) closely resembles the established bank hazard functions in Figure 7, increasing at a gradual rate and peaking at only about 5%. In contrast, the hazard functions for the less mature de novos (the 1982-83 cohort, and especially the 1984-85 cohort) increase sharply with the approach of the banking recession, and peak at rates that are up

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11. The small number of observations in these cohort models made convergence difficult using the full right-hand-side specification. Hence, we specified these six regressions using only the covariates shown in Panel A in Tables 2 and 3. As can be seen in the first two rows of Tables 2 and 3, excluding the Panel B covariates has little effect on the estimated shapes of the hazard functions.

to twice as large (respectively, 10% and 14%) as the peak hazard rates for the established banks. These results illustrate the extent to which very young banks are financially fragile; underscore the marginal effect of a few additional years of financial development on the fragility of new banks; and suggest that by the time the typical new bank is about 7 years old (approximately the length of time between the 1980-81 start-ups and the peak of the bank failure wave in 1988-89) it is no more or less fragile than the typical small established bank. These life cycle effects are more directly illustrated in the three panels of Figure 9, which compare the de novo and established bank hazard functions for each of the three time cohorts.

7. Summary and conclusions

One of the more interesting, and perhaps unexpected, features of the consolidating U.S. commercial banking industry has been the large number of new commercial bank start-ups. These de novo banks can be an important source of new competition in local retail and small business banking markets, but they can also be financially fragile. Recognizing this, government agencies have from time to time imposed special regulations on de novo banks (e.g., stringent entry requirements, extra-high capital minimums, more frequent supervision, protection from acquisition) designed to help these new banks establish a firm financial footing and maximize their ability to enhance competitive rivalry. This study examines the efficacy of these special regulations, how newly chartered banks evolve over the first decade-and-a-half of their lives, and how the financial performance of de novo banks differs from that of small established banks.

We observe 1,664 commercial banks chartered in the U.S. between 1980 and 1985, a period of especially intense chartering activity just preceding the turbulent economic conditions and bank failure wave of the late 1980s and early 1990s. As a benchmark for comparison, we observe a sample of 2,047 small, established commercial banks located in the same geographic markets as the de novo banks. We track both sets of banks quarterly over a 14 year time period, and use a split population duration model to estimate the probability of de novo and established bank failure during those 14 years; the timing of those failures; and whether environmental conditions, regulatory conditions, and bank-specific characteristics present at the beginning of the time period influence failure.

Our results indicate that the financial performance of the typical de novo bank follows a rough life cycle pattern. New banks are extremely unlikely to fail during the first few years of their lives. As fast growth and early losses erode its initial capital cushion, the typical de novo bank becomes just as likely, and eventually more likely, to fail than the typical small established bank. As time passes and (surviving) de novo banks become financially mature, their failure rates descend toward those of small established banks. Importantly, the intertemporal parameters of this life cycle pattern vary with the economic conditions present when the new bank starts up. De novos chartered just prior to the bank failure wave have hazard functions that follow an extreme version of this life cycle pattern, and that peak at conditional failure rates that are twice as high as those of small established banks. In contrast, de novos chartered around seven years prior to the peak of the bank failure wave have hazard functions that are much flatter, and that peak at levels similar to those of small established banks. Hence, the fragility of a newly chartered bank depends not only on its age, but also on how its life cycle is positioned *vis a vis* the business cycle.

Our results also shed light on three special regulatory policies toward de novo banks. We find that laws restricting the acquisition of newly chartered banks tend to increase the likelihood that these banks will fail. We find no significance evidence that the OCC's historically market-based (i.e., easy entry) chartering policy caused de novo national banks to fail at high rates than de novo state banks. And we find that low initial capital levels are a *long-run* predictor of de novo bank failure, but not established bank failure, a result that provides *ex post* support for higher minimum capital requirements for de novo banks.

Although predicting bank failure is not a main objective of this study, the results of the duration models suggest that the determinants of long-run failure are different for de novo banks and established banks. A high percentage (10 out of 17) of the covariates in the de novo model were significantly related to increased long-run failure rates, including restrictive state regulations, small initial asset size, illiquid assets (high loan-to-asset ratios), poor loan quality, low initial capital cushions, low initial profitability, a rural location, and a competitive market structure. In contrast, only 4 of the 15 covariates in the established bank model were significantly related to increased long-run failure rates, and only one of these (poor loan quality) was also significant in the de novo bank model. Based on these results, it would appear to be easier to identify early warning indicators for de novo banks than for established banks, perhaps because new banks are on a common portion of their life cycles and hence are less heterogeneous than established banks.

Are our results for banks chartered in the 1980s prescriptive for banks chartered in the 1990s and beyond? Government regulation, industry structure, and banking technology have all changed substantially over the past decade, but it is not clear how these changes have affected the rate at which new banks mature or the degree to which new banks are more fragile than established banks. The data displayed in the second panels of Tables 2 through 5 suggest that the financial fundamentals of new bank life cycles (profitability, capital ratios, asset growth) have not changed much in the past decade. At the margin, the elimination of branching, interest rate, and product line restrictions may have increased the fragility of new banks by allowing (or requiring) them to grow faster, to take more risk, and by increasing the general level of competitive rivalry in the industry. On the other hand, newly chartered banks are now examined more frequently than before, regulators now require new banks to hold larger capital cushions, and new technology (e.g., loan securitization and derivatives markets) allows well-managed banks to better control risk, all of which should reduce the fragility of new banks. We will not be able to fully address this question until the banks chartered during the late 1990s pass through the final stages of their financial life cycles, and perhaps are exposed to less sanguine economic conditions than they have so far experienced.

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Table 1

Descriptive statistics.

De novo banks: Began operations between 1980:Q1 and 1985:Q4. Financial variables measured beginning at the conclusion of fourth full quarter of operations.

Established banks: Were at least 20 years old, had less than $100 million in assets (in 1985 dollars), and had at least 6% equity/assets. Located in the same geographic markets as the de novo banks. Financial variables measured at year-end 1980, year-end 1982, or year-end 1984, depending on the cohort.

	1664 de novo banks		**2047 established banks**	
	mean	**std. dev.**	**mean**	**std. dev.**
YEAR8081 = 1 if bank in the 1980-81 cohort	0.2368	--	0.3239	--
YEAR8283 = 1 if bank in the 1982-83 cohort	0.3708	--	0.3551	--
YEAR8485 = 1 if bank in the 1984-85 cohort	0.3924	--	0.3210	--
A. Outcomes:				
% failed prior to 1999	22.84%	--	8.10%	--
% acquired prior to 1999	46.15%	--	39.43%	--
% survived until 1999	31.01%	--	52.47%	--
t = duration	38.8449***	17.2755	43.8633	17.3197
B. Market environment and bank structure:				
STATEGROWTH = annual job growth in state, 1980-98	0.0194***	0.0150	0.0174	0.0137
MERGE8098 = mergers in state/banks in state, 1980-98	0.2657***	0.0937	0.2765	0.0760
DELAY = state prohibition on acquiring de novos, in years	3.2224	2.3505	--	--
LIMITS = 1 if in state with severe branching limits	--	--	0.5369	0.4988
HHI = Herfindahl Index in bank's home city or county	0.1704**	0.1417	0.1595	0.1218
URBAN = 1 if in MSA	0.7614***	0.4263	0.6761	0.4679
OCC = 1 if national bank	0.5859***	0.4927	0.2746	0.4496
MBHC = 1 if affiliate in multi-bank holding company	0.1412	0.3484	0.1455	0.3503
ASSETS (1985, $thousands)	47.0137***	28.2065	72.9447	38.2773
C. Financial ratios:				
EQASS (equity/assets)	0.1501***	0.0724	0.0912	0.0287
ROA (net income/assets)	-0.0071***	0.0186	0.0110	0.0078
ASSGROW (asset growth rate, first observed year)	185.87%***	161.26%	11.06%	19.97%
BIGDEP (deposits larger than $100,000/assets)	0.2408***	0.1413	0.0889	0.0747
LOAN (loans/assets)	0.5727***	0.1639	0.5126	0.1290
NPL (nonperforming loans/assets)	0.0051***	0.0125	0.0125	0.0150
SPEND (expenses on salaries, benefits, premises/assets)	0.0269***	0.0143	0.0210	0.0117

Note: The de novo bank means are significantly different from the established bank means at the 1%, 5%, 10% levels, respectively, as indicated by the superscripts ***, **, and *. The data in the table are taken from the *Reports of Condition and Income* (call reports); the *National Information Center* database; the Federal Deposit Insurance Corporation; Amel (1993); and Calem (1994).

Table 2

Split-population duration model for 1,664 de novo banks, 1980-1985. For coefficient estimates in Panels A and B, the superscripts ***, **, and * indicate significant difference from zero at the 1%, 5%, 10% levels, respectively.

	[1]		[2]		[3]	
	estimate	**std. error**	**estimate**	**std. error**	**estimate**	**std. error**
8	0.0396	0.0011	0.0379	0.0011	0.0365	0.0011
p	3.5751	0.2023	4.3001	0.2128	4.6636	0.2292
∗ (probability of failure)	0.2767	0.0158	0.2981	0.0153	0.2946	0.0158
quarters until 25% fail	18.57	--	20.46	--	21.68	--
quarters until 50% fail	25.25	0.7019	26.42	0.7659	27.44	0.8238
quarters until 75% fail	34.34	--	34.11	--	34.72	--
Log Likelihood	-1026.69	--	-909.40	--	-819.07	--
A. Probability of survival coefficient estimates:						
constant	3.2290***	0.0278	3.6600***	0.2996	0.0738***	0.3888
YEAR8283			-0.3405***	0.0729	-0.2794***	0.0724
YEAR8485			-0.5443***	0.0721	-0.4335***	0.0725
DELAY			-0.0568***	0.0121	-0.0431***	0.0111
MERGE8098			-00673	0.2462	-0.1170	0.2314
STATEGROWTH			0.6821	1.9848	0.9823	1.7986
URBAN			0.1787**	0.0814	0.0971	0.0828
OCC			0.0327	0.0538	0.0463	0.0490
MBHC			0.0235	0.0998	0.0670	0.0929
HHI			0.5480*	0.2886	0.2856	0.2785
lnASSETS			-0.0152	0.0698	0.2016**	0.0823
ASSGROW					0.0254	0.0157
LOAN					-0.3059*	0.1687
NPL					-4.6763***	1.2201
SPEND					1.1053	1.6234
BIGDEP					-0.2250	0.1674
EQASS					1.8526***	0.4608
ROA					2.9140***	1.0641
B. Survival time coefficient estimates:						
constant	0.5428***	0.0400	-0.7380	0.5619	1.0622	0.8746
YEAR8283			-0.0950	0.1286	0.0155	0.1482
YEAR8485			0.1042	0.1236	0.2582*	0.1519
DELAY			-0.0419**	0.0212	-0.0255	0.0228
MERGE8098			1.6169***	0.4407	1.3237***	0.4674
STATEGROWTH			13.7360***	3.2681	8.6854**	3.5213
URBAN			-0.3903***	0.1399	-0.2107	0.1507
OCC			-0.0045	0.0926	0.0637	0.0998
MBHC			0.3976**	0.1668	0.3255**	0.1695
HHI			1.2039***	0.4557	1.1942***	0.4725
lnASSETS			0.2102*	0.1275	0.1594	0.1808
ASSGROW					-0.0026	0.0409
LOAN					-1.4645***	0.3248
NPL					-2.8446	3.7520
SPEND					-5.6861	4.2628
BIGDEP					-2.2741***	0.3591
EQASS					-0.5883	0.9617
ROA					5.2105**	2.6221

Table 3

Split-population duration model for 2,047 established banks, 1980-1985. For coefficient estimates in Panels A and B, the superscripts ***, **, and * indicate significant difference from zero at the 1%, 5%, 10% levels, respectively.

	[1]		[2]		[3]	
	estimate	**std. error**	**estimate**	**std. error**	**estimate**	**std. error**
8	0.0300	0.0040	0.0365	0.0047	0.0380	0.0048
p	2.0914	0.1634	2.3741	0.2183	2.6885	0.2361
∗ (probability of failure)	0.1078	0.0138	0.1116	0.0119	0.1098	0.0100
quarters until 25% fail	19.66	--	17.26	--	17.47	--
quarters until 50% fail	33.25	4.4672	27.41	3.5622	26.28	3.3703
quarters until 75% fail	56.23	--	43.54	--	39.55	--
Log Likelihood	-703.17	--	-639.54	--	-572.57	--
A. Probability of survival coefficient estimates:						
constant	3.5041***	0.1343	2.8368***	0.6339	2.4659***	0.9664
YEAR8283			-0.4436	0.2957	-0.4294*	0.2561
YEAR8485			-0.8264***	0.2907	-0.8054***	0.2655
LIMITS			-0.1006	0.2125	0.0092	0.1898
MERGE8098			-0.5062	1.2436	-0.5205	1.1700
STATEGROWTH			10.2370	6.4675	3.7831	5.8855
URBAN			0.2831	0.2059	0.0722	0.2035
OCC			--	--	--	--
MBHC			0.1938	0.2884	0.0942	0.2374
HHI			0.3954	0.7605	0.3450	0.7224
lnASSETS			0.1533	0.1544	0.2316	0.1489
ASSGROW					0.2579	0.4528
LOAN					-0.7059	0.6638
NPL					-7.5919**	3.7559
SPEND					23.2490***	9.1808
BIGDEP					--	--
EQASS					0.8298	4.1421
ROA					7.7825	5.0364
B. Survival time coefficient estimates:						
constant	1.2380***	0.0747	0.3811	0.4147	2.8070***	0.7209
YEAR8283			0.1259	0.2172	0.1848	0.2167
YEAR8485			0.2084	0.2097	0.4064*	0.2163
LIMITS			-0.4978***	0.1375	-0.7167***	0.1493
MERGE8098			3.5295***	0.5702	4.1528***	0.6317
STATEGROWTH			6.5167	4.9076	5.4206	5.2716
URBAN			-0.1059	0.1445	0.0597	0.1582
OCC			--	--	--	--
MBHC			-0.3781	0.2368	-0.2543	0.2063
HHI			-0.6975	0.5478	-0.9690	0.6333
lnASSETS			0.0604	0.1042	-0.0385	0.1028
ASSGROW					-1.1921***	0.4251
LOAN					-2.2311***	0.5819
NPL					-11.1950***	3.4335
SPEND					-34.2750***	9.6283
BIGDEP					--	--
EQASS					-0.1661	2.7425
ROA					9.7447	7.1608

Figure 1

Failures and New Charters for U.S. Commercial Banks

(expressed as a percent of total banks at end of same year)

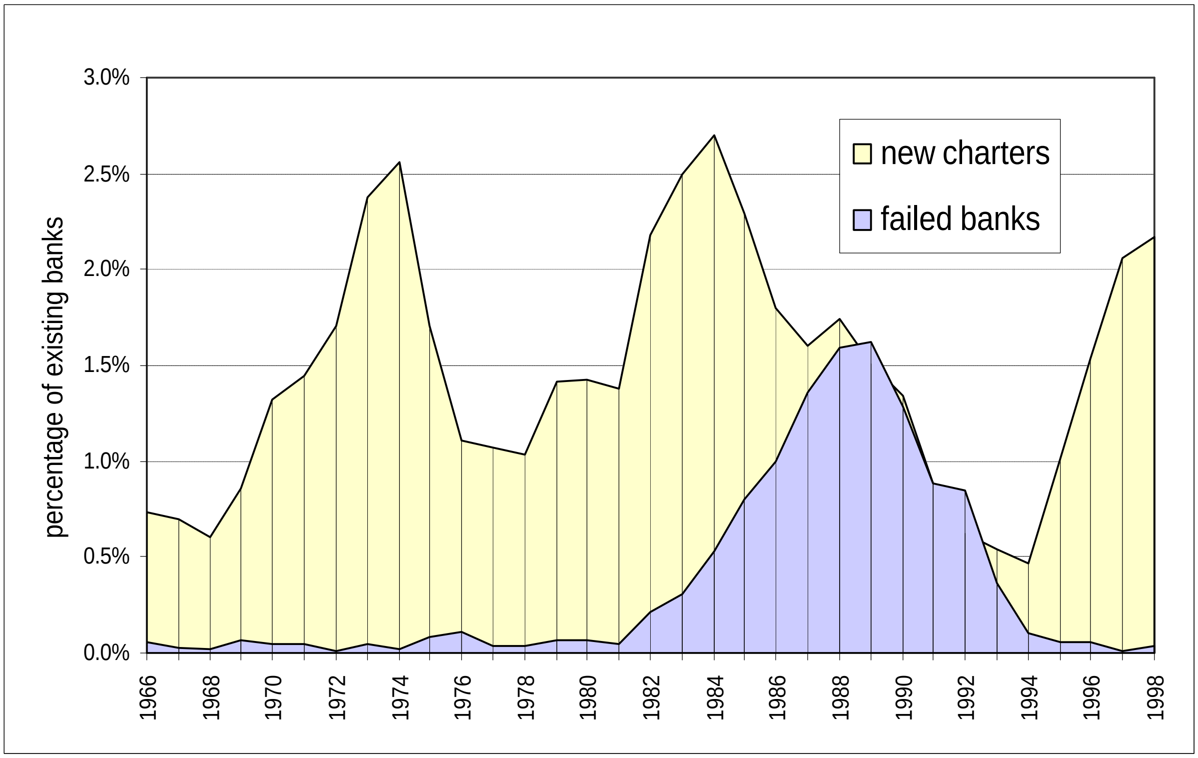
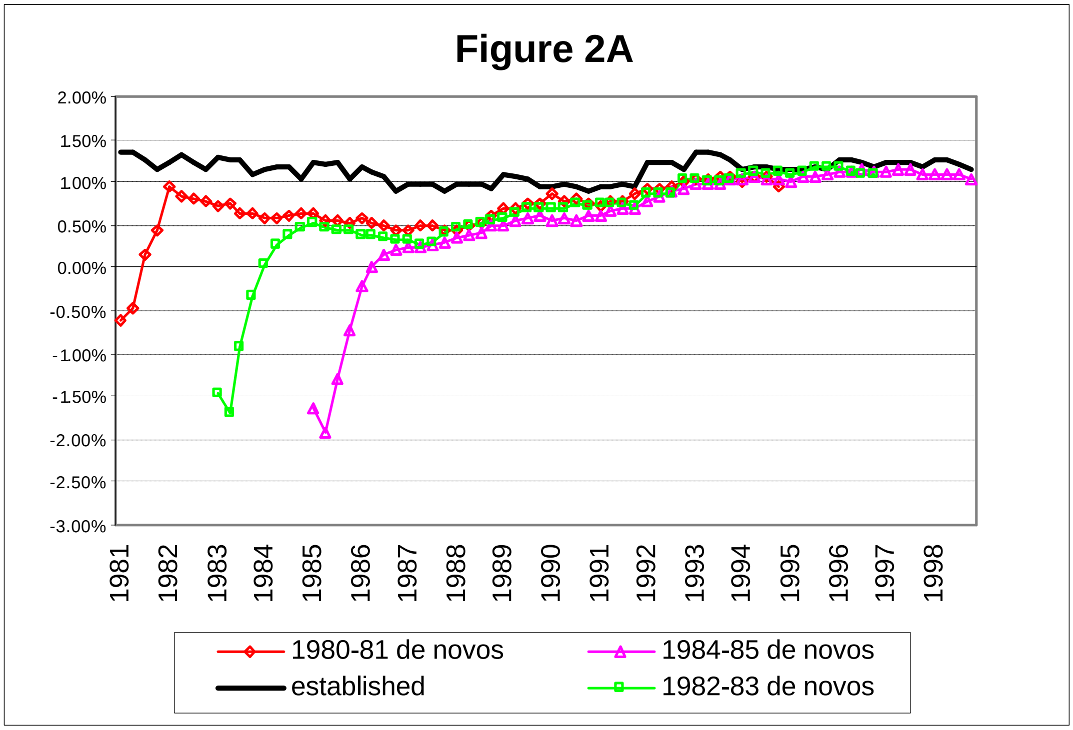


Figure 2

Median Return on Assets, by quarter (annualized)



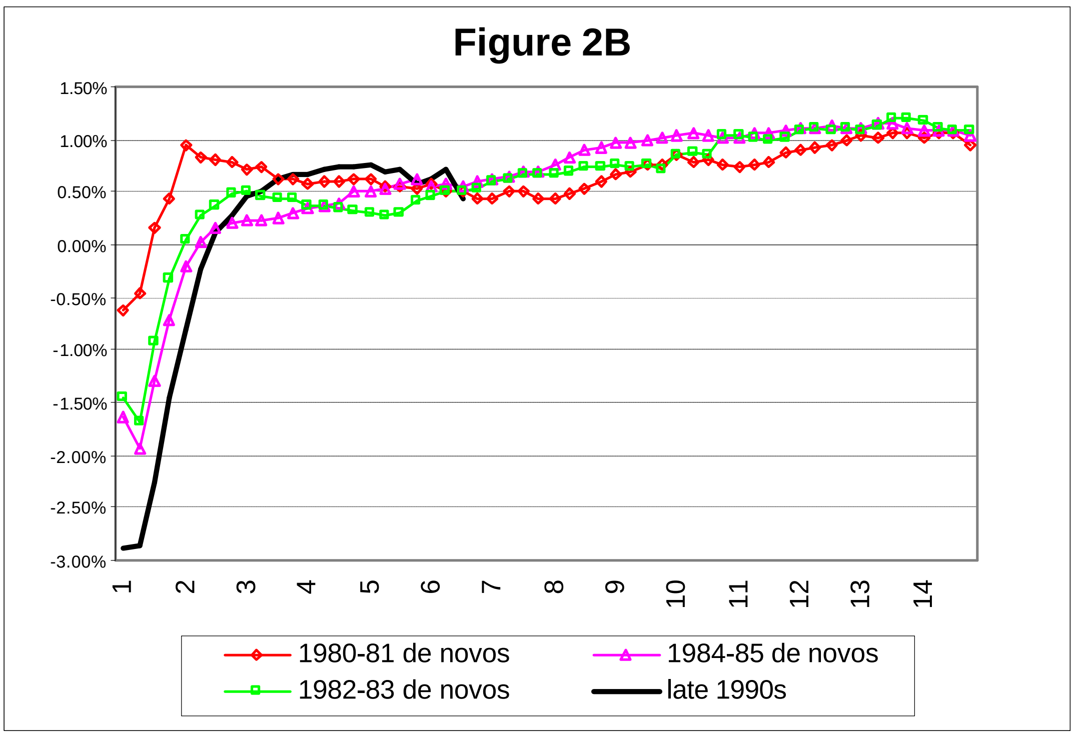
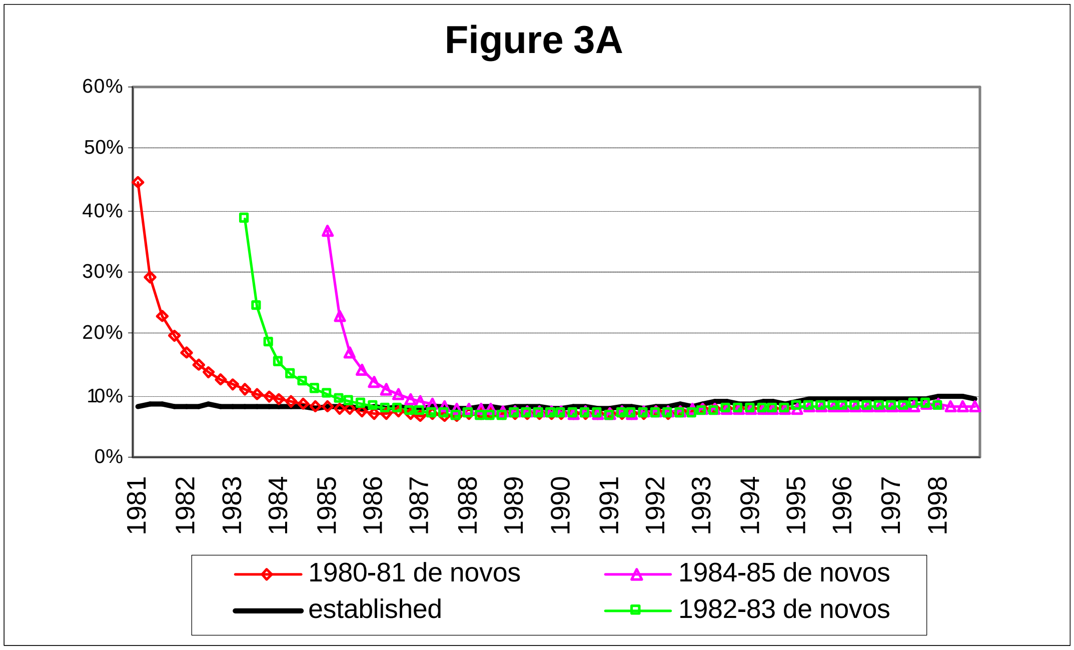


Figure 3
Median Equity-to-Assets, by quarter



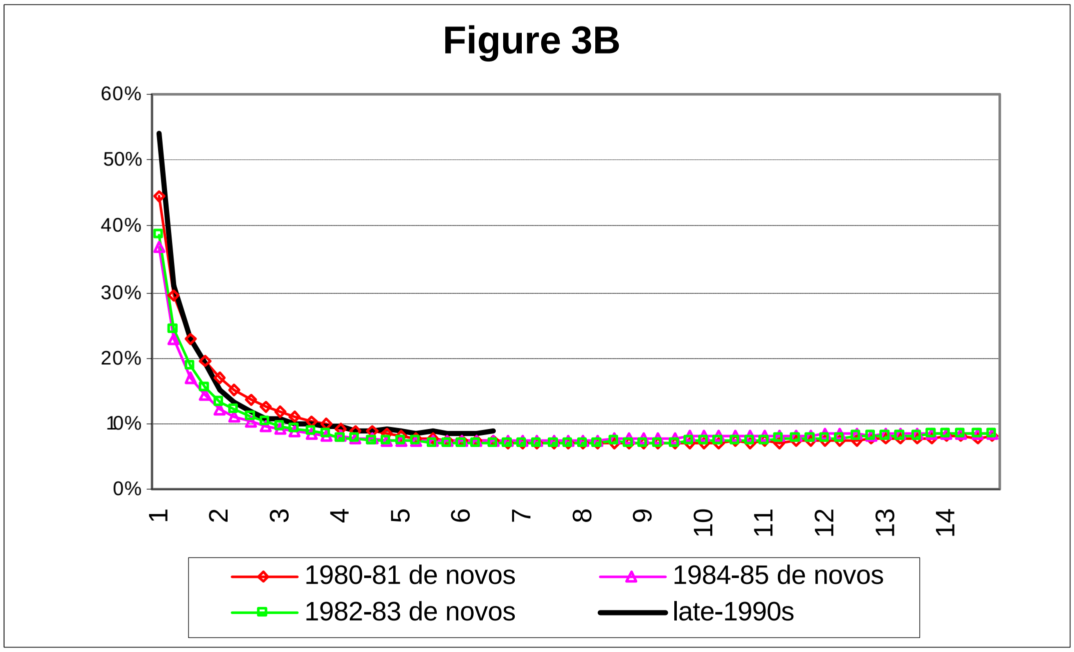
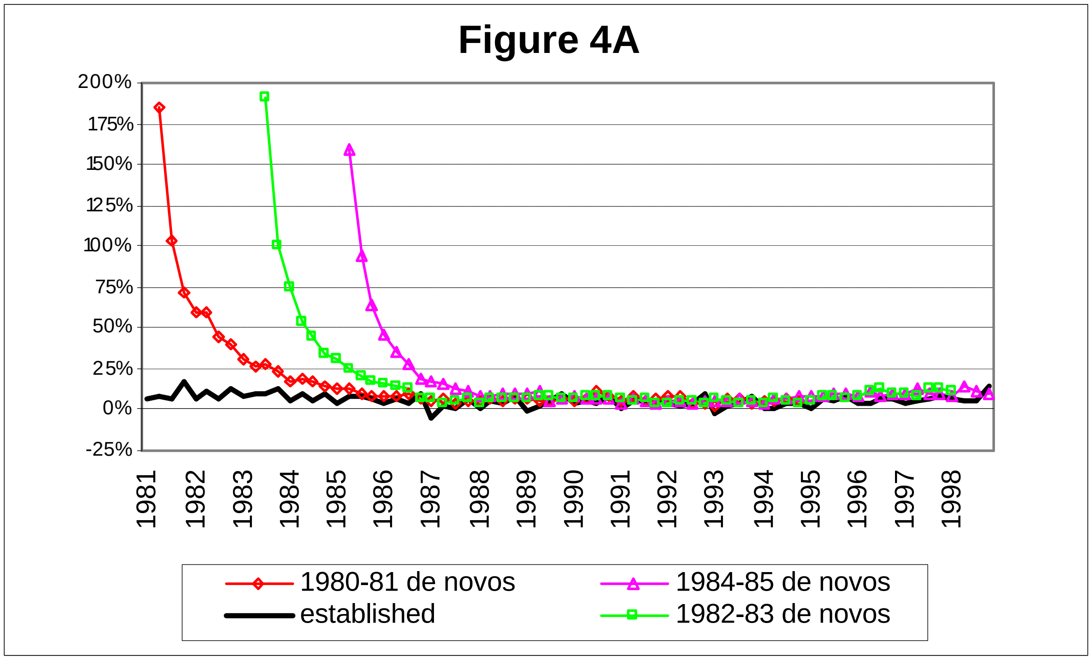


Figure 4
Median Asset Growth Rate, by quarter (annualized)



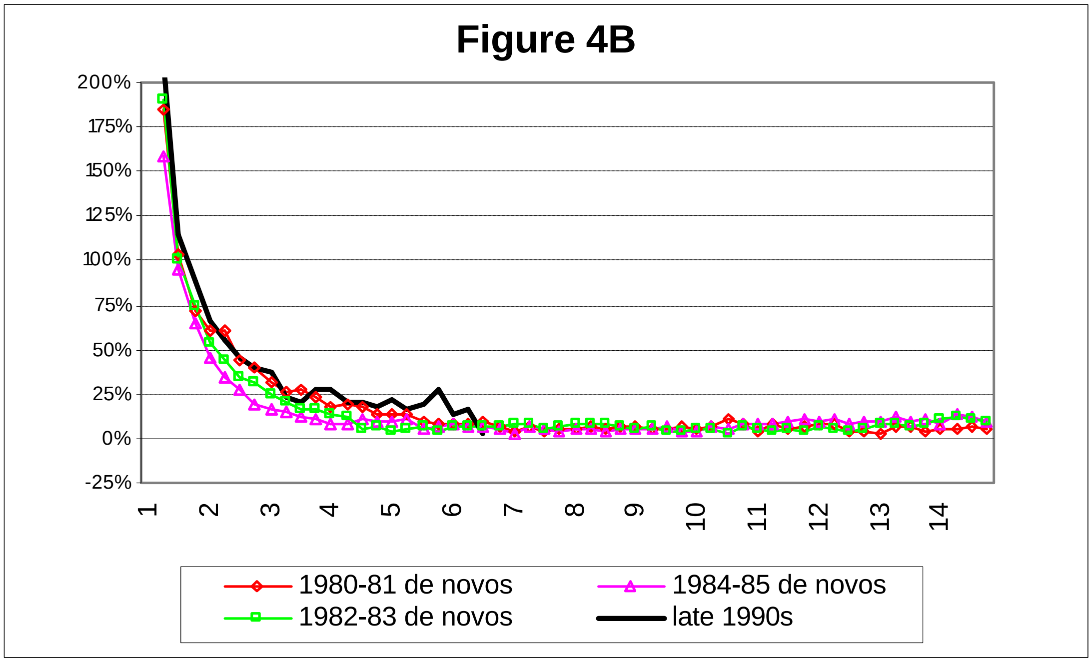
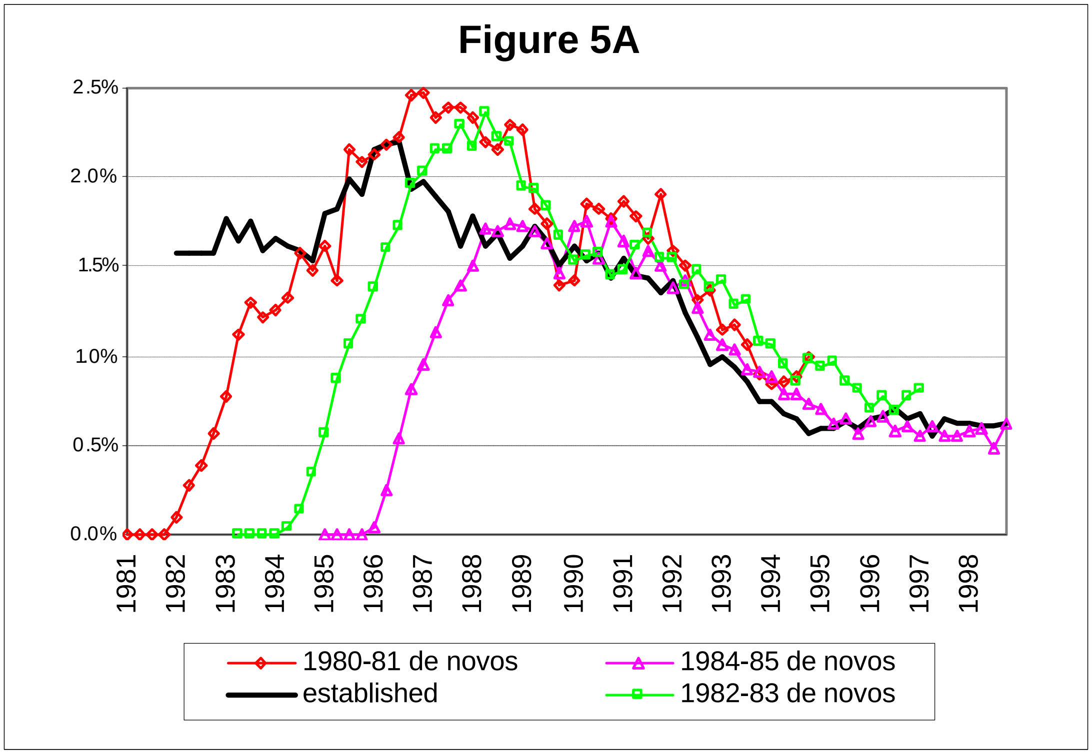


Figure 5
Median Nonperforming Loans-to-Assets, by quarter



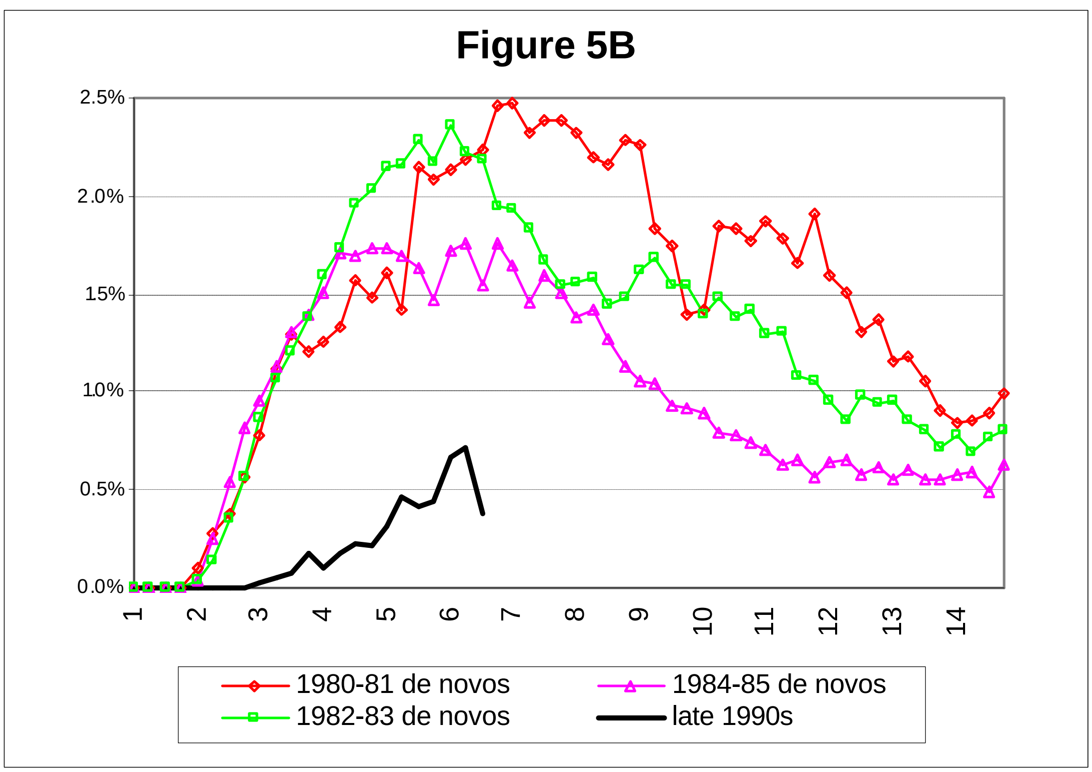


Figure 6

Split-population Hazard Functions.
Combined samples of all de novo and established banks.
RHS = full specification.

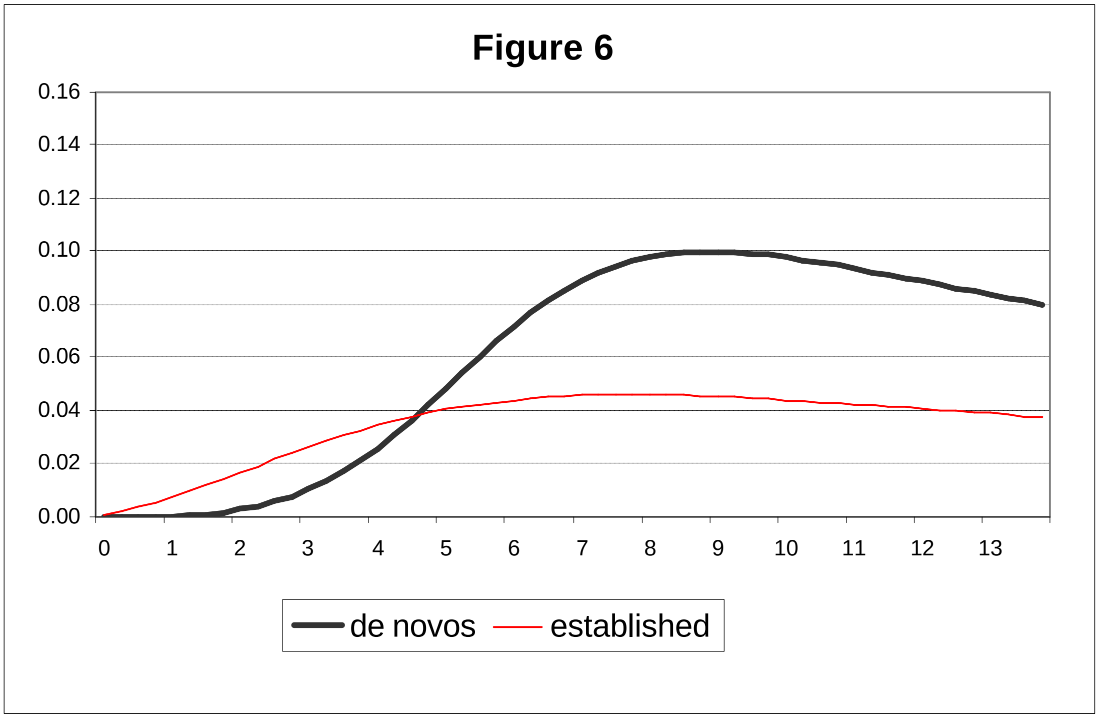
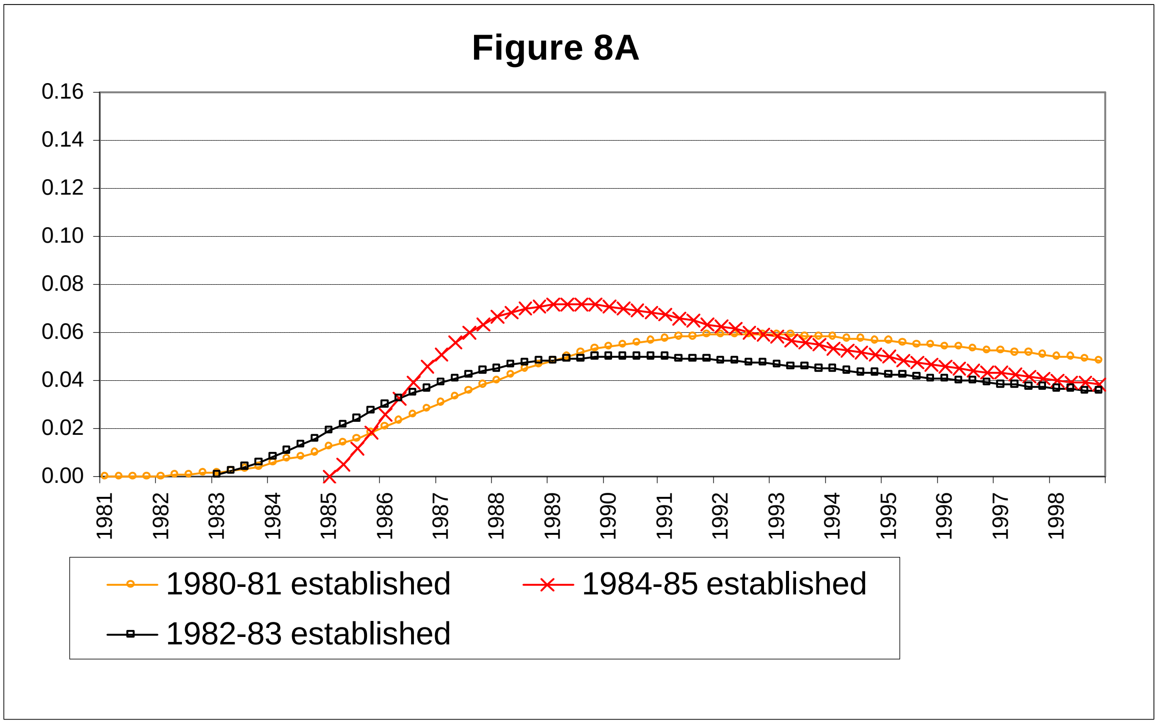


Figure 7

Split-population Hazard Functions

Established bank cohorts. RHS = structure variables only.



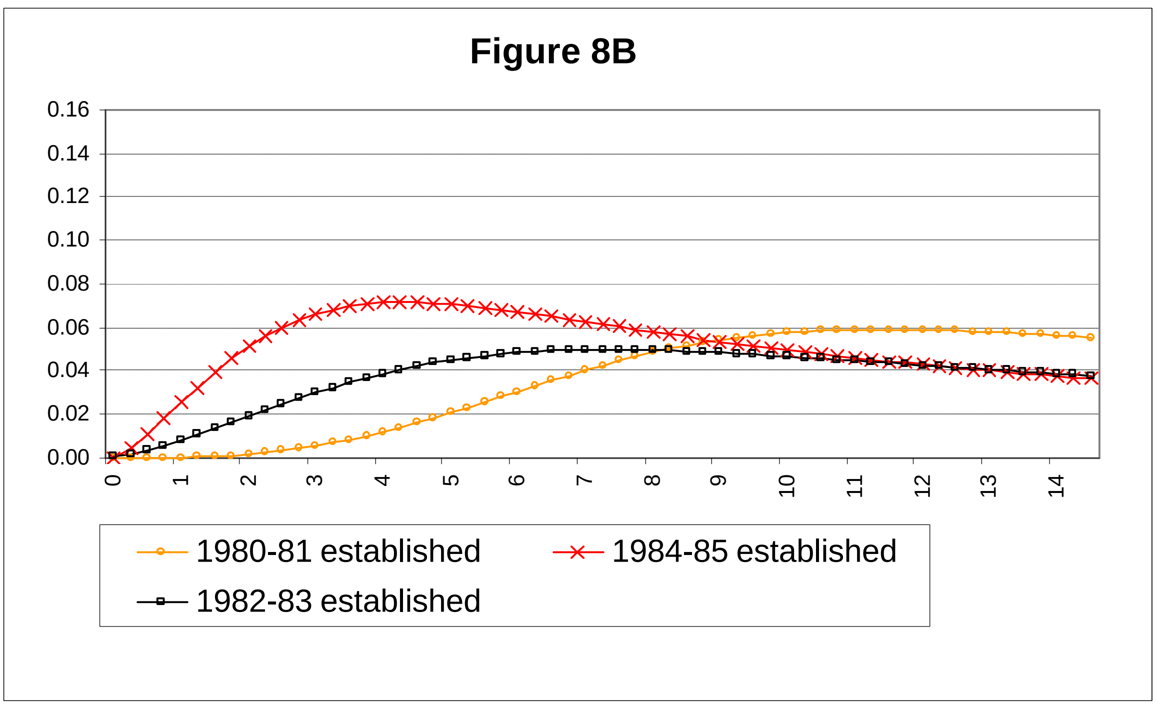
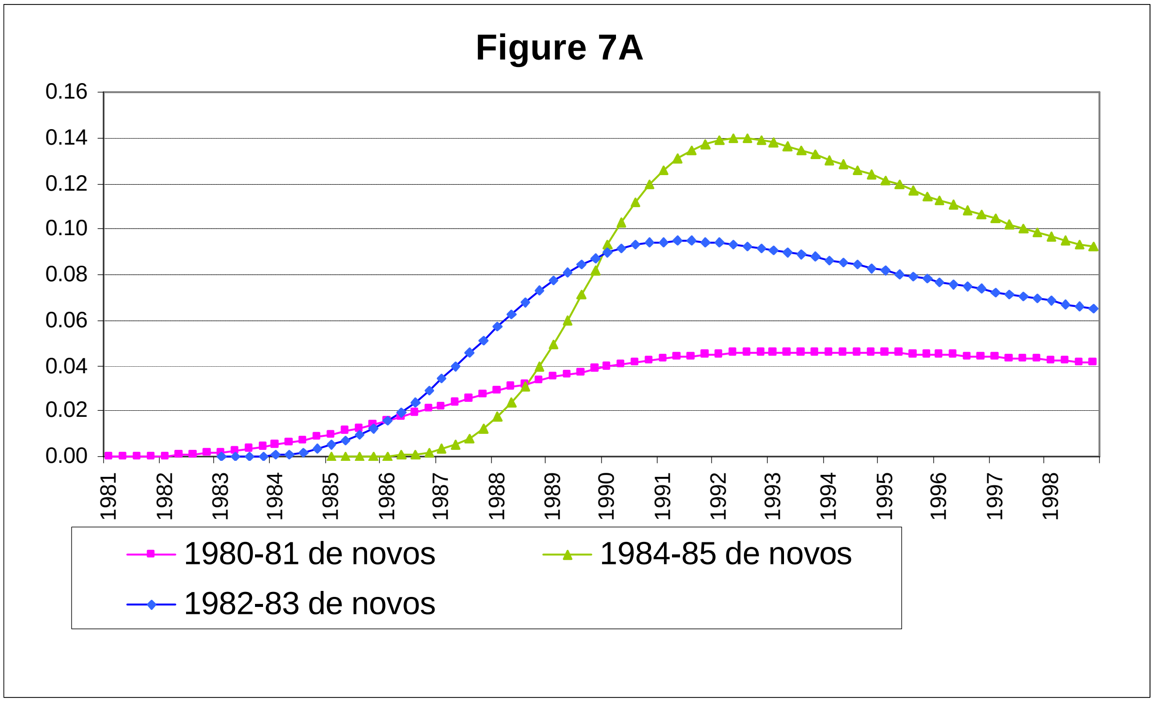


Figure 8
Split-population Hazard Functions
De novo bank cohorts. RHS = structure variables only.



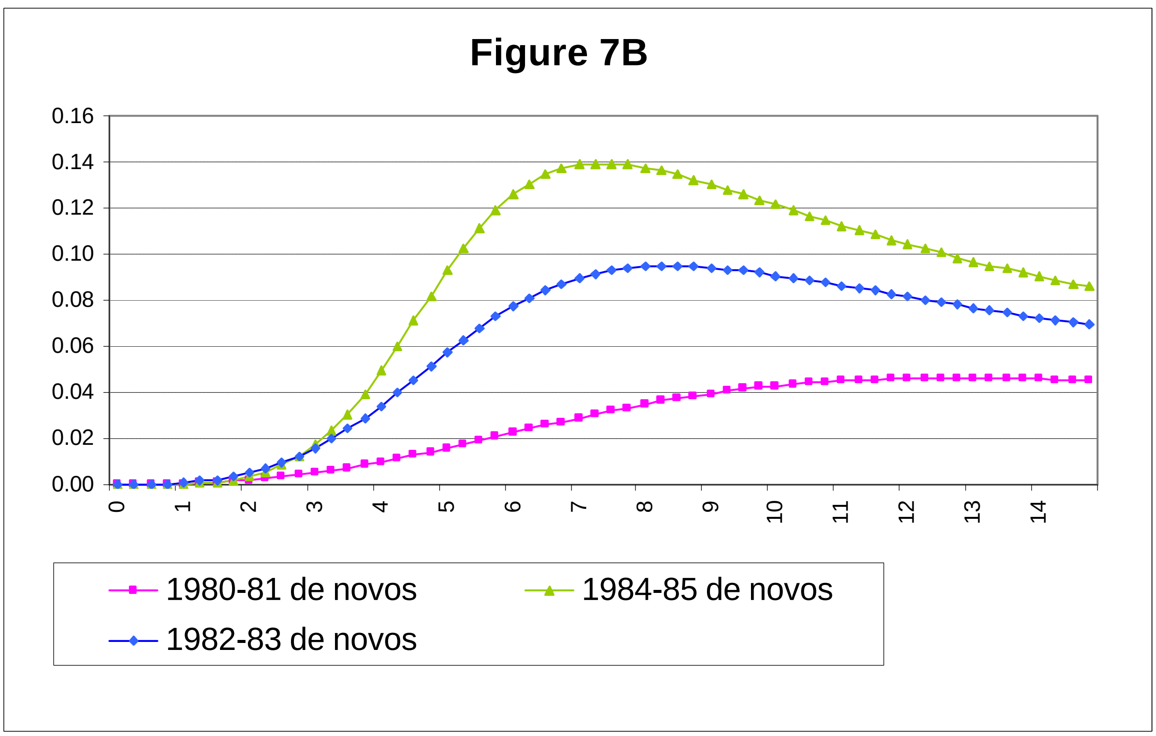


Figure 9

Split-population Hazard Functions

Comparing de novo banks and established banks by cohorts. RHS = structure variables only.