The Determinants of De Novo Bank Survival

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Abstract: The number of newly chartered, or 'de novo,' commercial banks in the U.S. has increased every year since 1994. These new banks are potentially important for preserving competition and providing credit in consolidating banking markets. However, like other new business ventures, newly chartered banks can be prone to failure. To investigate the long-run financial viability of newly chartered banks, we estimate a 'split-population' duration model for 656 commercial banks chartered in 1984 and 1985. To provide a benchmark, we estimate a similar model for 1,288 small established banks located in the same geographic markets.

Our results are consistent with a 'life-cycle' theory of bank failure. Because new banks are heavily capitalized and hold portfolios of unseasoned loans, they are initially less likely to fail than established banks. But rapid asset growth, subpar profitability, and declining loan quality gradually erode their capital stocks. De novo failure rates catch up with, and then surpass, established bank failure rates within five years. After seven years, de novo banks are twice as likely to fail as established banks.

We find similar determinants of failure for de novo and established banks, including adverse economic conditions, rapid asset growth, concentrations of risky and illiquid investments, large amounts of purchased funds, and excess overhead spending. For de novo banks that eventually fail, we find that failure is accelerated by concentrations of business loans, large amounts of purchased funds, low capital ratios, and excess overhead spending; failure was delayed by fast asset growth, holding company affiliation, and holding a federal charter.

We find no significant evidence that de novo national banks were more likely to fail than de novo state chartered banks, which suggests that the OCC's relatively lenient chartering policies increased local market competition without materially increasing new bank failure. We find that low capital ratios accelerate failure for de novo banks that do fail, but we find that capital ratios do not significantly predict which new banks will eventually fail. Thus, requiring higher levels of capital for young banks does not reduce their probability of failure, but rather serves as a buffer that provides extra time to resolve young banks should they become troubled institutions.

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Introduction

The number of newly chartered, or 'de novo,' commercial banks in the U.S. has increased in each of the past six years. These new banks can be an important source of credit for small business, and can help preserve competition in local banking markets in which established banks have merged or been acquired. However, like most other new business ventures, newly chartered banks can be financially fragile and prone to failure. Before a new bank can become a permanent source of competition and credit, it must first survive long enough to become financially viable itself. In this study, we estimate the likelihood that the typical de novo bank will survive that long, and we also explore the reasons why de novo banks fail.

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 occurred in a series of three waves: one that peaked in the early 1970s, one that peaked in the mid-1980s, and one that may be peaking now. We examine 656 de novo banks that were chartered near the peak of the second of these three waves, which occurred just before the largest episode of bank failures since the Great Depression. We observe the rates at which these new banks failed, the timing of those failures, and the determinants of those failures. To serve as a benchmark, we perform parallel tests for 1,288 banks that were already well established at the time.

Our results are consistent with a 'life-cycle' theory of bank failure. Because newly chartered banks are heavily capitalized and hold portfolios of unseasoned loans, they are initially less likely to fail than established banks. But rapid asset growth, subpar profitability, and declining loan quality gradually erode these capital stocks. After about five years the de novo banks are just as likely to fail as established banks, and after about seven years de novo banks are twice as likely to fail as established banks. Despite this relatively high failure rate, de novo banks tend to fail for the same reasons as established banks. We find that adverse economic conditions, rapid asset growth, concentrations of risky and illiquid investments, large amounts of purchased funds, and excess overhead spending reduce the likelihood of survival for both types of banks. Thus, even though the risk drivers are similar at new and established banks, market forces tend to punish these risks more severely at young banks.

Our results should help inform bank regulators charged with a number of tasks related to de novo banks, including: approving new bank charters; establishing capital levels for de novo banks; determining the frequency de novo bank safety and soundness exams; performing antitrust analysis in markets recently entered by de novo banks; and watching for early signals of de novo bank failure. Because the root of our investigation is the financial health and success of newly chartered banks, our findings should also be useful for managers of newly chartered banks, and for prospective investors in new bank start-up ventures.

The paper begins in section 1 by summarizing current and past U.S. regulatory policy toward de novo banks. Section 2 is a short review of recent research on de novo banks. In section 3 we describe our de novo bank and established bank data sets. We apply two different analytic frameworks to these data. In section 4 we compare the time trends of several financial ratios for the de novo banks and the established banks. Based on these comparisons, we form expectations about the comparative rates at which new banks and established banks will fail over time. In section 5 we develop a 'split-population' duration model, and in section 6 we apply this model to the data. The results of these models largely conform to our expectations. In section 7 we summarize our results and draw policy conclusions based on those results.

1. A brief overview of de novo bank entry and regulation

There are a number of explanations for the periodic increases and decreases in new bank charters shown in Figure 1. Like all new business ventures, new banks are more likely to form when business conditions are good. The waves of chartering activity 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 and a national recession in the early 1990s. Regulatory changes can also have an impact. A number of states relaxed or repealed unit banking laws during the 1980s, which afforded banking companies in those states the opportunity to enter other geographic markets, either by starting a new bank or by acquiring an existing bank. Increased merger activity has also encouraged de novo entry. During the cost-cutting and reorganization that generally follow an acquisition, experienced bank employees often lose their jobs, and some small business and retail depositors become dissatisfied. 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.

Although this difference in federal-versus-state chartering philosophy has diminished over time, it implies that national banks chartered during the 1980s may have been less likely to survive than de novo state banks chartered at the same time.[1]

Beyond this difference in chartering philosophy, the policies of the various bank chartering and regulatory authorities toward de novo banks are quite similar. A primary concern is that newly chartered banks start out with enough equity capital to survive through the initial years of negative earnings and rapid asset growth that is typical of de novo banks. The dollar amount of start-up financial capital required for approval might be as low as $3 million, or as high 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, although the difference in treatment varies depending on the new bank=s primary regulator. Federal Reserve supervisors will conduct full scope examinations for safety and soundness at a newly chartered bank 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)

1. DeYoung and Hasan (1998) discuss the convergence of state and federal chartering philosophies. Despite this convergence, Seelig and Critchfield (1998) find that the states remain more likely to consider local banking conditions when evaluating a charter application. For example, 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.

in two consecutive exams. The FDIC requires all newly chartered state and national banks maintain an 8% Tier 1 equity capital-to-risk based assets ratio for their first three years, while the Federal Reserve requires new state chartered Fed member banks to hold this ratio above 9% for three years. These temporary extranormal capital requirements for new banks (the Tier 1 requirement for established banks to be considered >adequately capitalized= is only 4%) are a relatively recent supervisory response to de novo failure experience of the 1980s. Bank supervisors also restrict new banks from paying out dividends for several years, and in some cases require new banks to maintain minimum levels of loan loss reserves.

These entry barriers and regulatory covenants are severe compared to those faced by most non-bank start-ups, and this >selection bias= naturally leads to a higher survival rate for new banks. Bartholomew and Whalen (1996) provide evidence that 17 percent of the commercial banks that started up between 1980 and 1994 also failed during that time period. In our sample of de novo banks chartered in 1984 and 1985, about 23 percent had failed by the end of 1998 (see section 3). Although these may seem like high failure rates, they are lower than the failure rates typically reported for business start-ups in general, despite that fact that they occurred during the largest episode of bank failures since the Great Depression.[2]

2. Recent research on de novo banks

2. Raw data reported by the Small Business Administration (1992) suggests that at least 60% of new business ventures with less than 500 employees that started in 1977-78 failed within 6 years. Kirchhoff (1994, pp. 153-169) argues that this raw data overstates the small business failure rate, and after adjusting it he concludes that in a 'best case scenario' 18% of new business ventures will fail within 8 years of starting up. In comparison, the 23% failure rate over 14 years for our de novo banks is relatively low, considering that it occurred in a 'worst case scenario.'

Although Figure 1 shows that de novo entry has followed a cyclical pattern at the macro level, changing conditions in local banking markets have a strong influence on where newly chartered banks locate. 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. These results suggest that new banks will be more likely to start-up in local markets where mergers have reduced the number of competing banks and/or where existing banks are exercising market power.

One recent study provides support for this suggestion. Berger, Bonime, Goldberg and White (1999) examine de novo bank entry between 1980 and 1998, and find that entry is more likely in local markets that have experienced mergers or acquisitions during the previous 3 years, particularly when those acquisitions involved large banking organizations. In contrast, Seelig and Critchfield (1998) conclude that local market entry by acquisition deters de novo entry. The latter study includes both banks and thrifts, and examines a relatively short time period (1995-1997) during which banking conditions were uniformly excellent and restrictions on geographic mobility were virtually non-existent.[3]

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

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3. Studies of local market entry by *already established banks* find that entry is more likely in highly profitable markets, but less likely in highly concentrated local banking markets. See Amel and Liang (1997). Of course, the causes and consequences of a new bank start-up may be quite different from the causes and consequences of market entry by an already established bank.

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 consistent with earlier studies (e.g., Huyser 1986, Hunter and Srinivasan 1990) that used accounting ratios to measure de novo bank performance.[4]

Although numerous studies have estimated models of financial institution failure (e.g., Whalen 1991, Thomson 1992, Wheelock and Wilson 1995, Cole and Gunther 1996), only a few studies have modeled the failure of new financial institutions. Bartholomew and Whalen (1996) estimated a binomial logit model of de novo bank failure, and found that poor asset quality, reliance on purchased funds financing, low profitability, low capital stocks, and adverse economic conditions all contributed to de novo bank failure. Hunter, Verbrugge, and Whidbee (1996) found similar results for de novo savings and loans using a split-population duration model. They 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.

4. See DeYoung and Hasan (1998) for a more complete review of this literature.

This study takes an approach similar to that of DeYoung (1999), but we make a number of methodological improvements. First, our regression specifications are richer. This allows us to test a large variety of hypotheses about the determinants of de novo bank failure. Second, because we estimate these richly specified models for both de novo and established banks, we can test whether the determinants of failure are different for these two sets of banks. Third, we do not limit our investigation to a single year of de novo banks. This improves our ability to draw statistical inferences, and it eliminates the possibility that the results are driven by phenomena from a single year.[5]

3. Data

Our data set contains information on 656 de novo banks and 1,288 established banks. The de novo bank sample is essentially the population of new commercial banks that opened their doors during the eight quarters from 1984:Q1 through 1985:Q4. We observe bank start-ups centering around 1984-85 for two reasons. As shown in Figure 1, this is the peak of the 1980s bank chartering wave (so we have lots of de novo banks to observe), and it occurred just ahead of an historically large episode of failures among both established and newly chartered banks (so we have a statistically meaningful number of failures for our survival modeling).

All of the established banks had been in operation for at least 25 years as of the beginning of 1985. We constrained the established bank sample across three additional parameters so that it

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5. We observe roughly twice as many de novo banks as the study by DeYoung (1999). In the next draft of this study, we plan to re-double both the number of de novo bank observations and the years in which these banks were chartered. In addition, the next draft of this study will include an expanded list of exogenous variables in the durations models.

would provide a good benchmark for the de novo banks. Each of the established banks held less than $100 million in assets (because de novo banks are small), had at least a 6% capital-to-asset ratio (because de novo banks are initially well capitalized), and was located in an MSA or county included in the de novo bank sample (to neutralize differences in economic and regulatory conditions).

We tracked each of the de novo banks and established banks quarterly across time, beginning with the first quarter of operation for de novo banks (1985:Q1 for the established banks), and ending with 1998:Q4. We define each bank's 'duration' as the number of quarters it remained in the data set. Duration ranges from t=1 (for banks that either failed or were acquired after just one quarter) to as high as t=60 (for banks chartered in 1984:Q1 that survived for the entire sample period). For the purposes of this study, we define 'failure' as any one of the following: (a) a bank was declared insolvent by its regulator; (b) a bank received regulatory assistance (e.g., a capital injection) without which it would have become insolvent; or (c) a bank was acquired soon after its net worth had declined to less than 1% of its assets.

We compiled financial data for the de novo banks and the established banks from the *Reports of Condition and Income* (call reports), and data on new charters and bank failures from the *National Information Center* database. Summary statistics for these data are displayed in Figure 1. These raw data suggest that de novo banks exited the market more often and more quickly than established banks. Only about a third of the de novo banks survived until the end of the sample period, while 23.48% of the de novo banks failed and 43.45% were acquired. In contrast, over half of the established banks survived until the end of the sample period, while only 6.60% of the established banks failed and only 37.73% were acquired. On average, de novo banks lasted only 37 quarters (about 9 years), compared to about 43 quarters (about 11 years) for the average established bank.

Although we selected the both sets of banks from the same geographic markets, we did not draw identical numbers of de novo and established banks from each market. Thus, the two samples have different geographic characteristics. A relatively high percentage of the de novo banks were located in the ‘energy’ states of Texas, Louisiana, Oklahoma, and Colorado (49% vs. 30%) and in urban areas (78% vs. 73%). On average, de novo banks operated in more highly concentrated local markets than established banks (*HHI*=1597 vs. 1369). A greater percentage of de novo banks held national bank charters (62% vs. 28%), and a smaller percentage of de novo banks were affiliates of multibank holding companies (12% vs. 17%).

The financial ratios in Table 1 were measured at the beginning of 1985 for the established banks, and after four full quarters of operations for the de novo banks. These ratios reveal substantial differences between newly chartered and more seasoned banks. The de novo banks were smaller (assets of $11 million vs. $42 million for the established banks), better capitalized (13 percent equity ratio vs. 9 percent), less profitable (-1.22 percent return on assets vs. 0.99 percent), and faster growing (182% annual growth rate vs. 8 percent). The evidence suggests that de novo banks financed this fast growth with large deposits (24% of assets vs. only 10% for the established banks). The de novo banks invested a smaller portion of their assets in liquid assets (36% to 45%), especially marketable securities (12% to 32%), but they invested a larger portion of their assets in loans (59% to 52%), especially in business loans (23% to 18%). Because their loan portfolios were comprised of new credits, de novo bank nonperforming loan ratios were extremely low (0.36% of assets vs. 1.34%). Finally, de novo banks spent relatively more on salaries (1.86% of assets vs. 1.66%) and on premises and equipment (0.85% of assets vs. 0.47%) than established banks.

4. Performance trends

The descriptive statistics in Table 1 establish that de novo banks are initially quite different from established banks. But of course, these differences do not last forever. Previous studies have documented how de novo banks gradually come to resemble established banks as they age and mature (e.g., Hunter and Srinivasan 1990, DeYoung 1999, and DeYoung, Goldberg, and White 1999). In Figure 2, we chart this evolution for the 656 de novo banks in our data set.

Figures 2A through 2D display quarterly time trends of four important financial ratios -- return on assets, equity-to-assets, annual asset growth, and nonperforming loans to assets -- for both the de novo bank and the established bank samples. In each of the figures the horizontal axis has 56 increments. For the established banks, these increments correspond to 56 consecutive calendar quarters (from 1985:Q1 to 1998:Q4). For the de novo banks, these increments correspond to age in quarters (from t=1 to t=56).

For example, in Figure 2A the light-colored solid line indicates that the median return on assets for the established banks during the first quarter of our sample period (1985:Q1) was about 1.25%, while the dark-colored solid line indicates that the median return on assets for the de novo banks during their first quarter of operation (t=1) was about -1.60%. (Note that although t=1 occurs as early as 1984:Q1 for some de novo banks, and as late as 1985:Q4 for others, this eight-quarter window is centered around 1985:Q1.) The relative positions of these two solid lines reveals the rate at which the gap in return on assets between de novo banks and established banks closes over time, holding economic and industry conditions roughly constant.

Each of the figures also includes a pair of dashed lines which plot the median financial ratios for the subsets of 217 (out of 656) de novo banks and 717 (out of 1,288) established banks that survived until the end of the sample period. Failed banks typically have lower than average return on assets, lower than average capital ratios, and higher than average nonperforming loan ratios. The dashed lines allow us to assess the financial progress of de novo banks after eliminating any systematic impact of failure (and acquisition) on the financial ratio averages.

The return on assets graph confirms the results of existing studies of de novo bank profitability: the typical new bank loses money until it is about 18 months old, and it continues to materially underperform the average established bank for almost a decade. Our adjustments for survivor bias shift each of the graphs in the expected direction (i.e., median return on assets is higher for the subset of survivors than for the entire sample), and this shift is substantial for some banks in some years (e.g., about 25 basis points for 2-year old banks). However, these shifts do not materially alter the general shapes, or the relative shapes, of the trends in profitability.

Interpreting the profitability trends in Figure 2A within the context of the performance trends in the other three figures (asset growth , equity-to-assets, and nonperforming loans) provides insight into why and when de novo banks fail. De novo banks grow their assets extraordinarily fast during the first two years of their lives (Figure 2B). This fast growth rate increases the amount of assets against which new banks need to hold equity capital. At the same time, the negative profits generated during the first and second years of these banks= lives are depleting their equity capital. So despite its initially high capital levels, the capital-to-asset ratio of the typical new bank declines very quickly, dipping just below the capital level of the median established bank after about three years (Figure 2C). Note that adjusting for survivor bias has no appreciable affect on either the equity-to-assets trends or the asset growth trends.

Although newly chartered banks start out without any nonperforming loans, their loan portfolios immediately begin to 'season,' causing their nonperforming loan ratios to reach the median level for established banks after just three years (Figure 2D). Note that adjusting for survivor bias shifts the trend line for de novo nonperforming loans downward; this shift is substantial (as much as 0.5% in some quarters) and delays the convergence of de novo bank and established bank loan quality for several years.

These four sets of performance trends suggest a 'life-cycle' explanation of de novo bank failure.[6] First, the performance 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, the performance trends imply that de novo banks should become *more likely to fail* than established banks some time after their third year of operations. By that time, de novo bank loan quality, asset growth, and (most importantly) capital reserves have reached or are approaching established bank levels -- but de novo profitability still lags below established bank levels. Finally, 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.

In the analysis that follows, we estimate failure time paths for de novo banks and established banks, and test whether they correspond to the failure patterns implied by Figure 2.

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6. This concept was introduced by DeYoung (1999).

5. Estimation methodology

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 that a population of *N* banks will fail over time period (0,*t*) according to some probability distribution:

$$F(t) = \int_0^T f(t)dt \tag{1}$$

where *f*(*t*) is the associated probability density function and *t*, or 'duration,' is the length of time between *t*=0 and the subsequent failure date *T*. (For de novo banks *t*=0 is the start-up quarter. For established banks *t*=0 is 1985:Q1.) The hazard function h(*t*) can then be written as a function of F(*t*) and f(*t*) as follows:

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

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 form of the probability distribution F(t) imposed on the data. We use the log-logistic distribution, a fairly flexible functional form that yields a hazard function that is non-monotonic in t. The log-logistic imposes the following functional forms on the hazard and survival functions:

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

$$h(t) \;=\; \frac{l\,p(\,l\,t\,)^{p\text{-}1}}{1 \;+\; (\,l\,t\,)^{p}} \qquad (4)$$

where the estimable parameters p and ë 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 ë determines the portion of the hazard rate that is time-invariant. We estimate these parameters using maximum likelihood techniques and the following likelihood function:

$$L \;=\; \prod_{i=1}^{N} \left[d\, f(t_i \,|\, p,\, l\,)\right]^{Q_i} \left[(1\text{-}d\,) \;+\; d\, S(t_i \,|\, p,\, l\,)\right]^{1\text{-}Q_i} \qquad (5)$$

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 ä is the probability that a bank will eventually fail (either during or after the sample period). The likelihood function collapses to the ‘standard’ duration model framework for ä=1, but for ä<1 both S(t) and f(t) become conditional on the bank eventually failing.

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

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

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

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: *URBAN*, *ENERGY*, *OCC*, *MBHC*, *HHI*, *ASSETS*, *EQASS*, *ASSGROW*, *C&I*, *REL*, *CON*, *NPL*, *BIGDEP*, *SAL*, and *PREM*. These covariates were defined above in section 3 and in Table 1.[7] In addition, we include a dummy variable *YEAR84* in the de novo bank model to control for possible differences in the conditions facing banks chartered in 1984 versus 1985. The remainder of this section discusses the expected impact of these covariates on the probability of bank survival and on bank survival time.

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7. Several of the variables (*ROA*, *EQUITY*, *LOAN*, *LIQUID*, *SEC*) defined in Table 1 are not included as covariates in the regressions we report here. We account for *EQUITY* by including both *lnASSETS* and *EQASS* in the regressions. We account for *LOAN* by including its components *REL*, *CON*, and *C&I* in the regressions. We exclude both *LIQUID* and *SEC*, because adding them to the regressions reported here resulted in symptoms of multicolinearity. When we replaced the loan variables *REL*, *CON*, and *C&I* with either *LIQUID* or *SEC*, the symptoms disappeared and these variables carried significant coefficients which were (as expected) the opposite sign from the coefficients on the loan variables that they replaced. We exclude *ROA* because most of its major drivers (asset mix, loan quality, financing mix, spending levels, competition) are already included in the regressions. Again, adding *ROA* to the regressions reported
(continued...)

5.1 Determinants of the probability of survival

We expect that the probability of survival will vary positively with the following variables: *MBHC*, *ASSETS*, *EQASS*, and *HHI*. Banks that are affiliated with multibank holding companies may have access to greater financial resources and managerial expertise. Large banks are typically better diversified, and *ceteris paribus* large size may indicate a better managed or otherwise more successful bank. (We use *lnASSETS* = the natural log of *ASSETS* in our regressions.) High capital ratios allow banks to absorb losses without incurring financial distress. Banks located in highly concentrated markets face less competitive rivalry, and hence may be less likely to fail during periods of financial distress.

We expect that the probability of survival will be negatively associated with the following variables: *ENERGY*, *LOANRAT*, *NPLRAT*, *SAL*, *PREM*, *BIGDEP*, and *OCC*. There were a large number bank failures in the 'energy' states during our sample period due to disruptions in energy-related industries, land price deflation, and relatively undiversified regional economies (exacerbated by unit banking restrictions in some of these states). A balance sheet heavy in loans is less liquid and 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 bank capital if they have to be written off as bad debt. Above average expenditures on physical capital, premises, salaries and benefits may indicate inefficient management and/or agency problems. (In the regressions reported below, we combine these expenditures to create a single covariate *SPEND* = *SAL* + *PREM*.) Large CD financing is expensive, and these deposits are likely to run should the bank get into trouble. As discussed above, a disproportionate

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here resulted in symptoms of multicolinearity.

percentage of newly chartered national banks failed in the 1980s and early 1990s, perhaps reflecting the OCC's market-based chartering philosophy. (We have no *a priori* reason to expect that established national banks would be less likely to survive than established state chartered banks, so we exclude *OCC* from the established bank regressions.)

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*. (Because urban markets tend to have much lower concentration levels than rural markets, we interact *URBAN* with *HHI* in the regressions.) Fast asset growth may simply indicate good economic conditions, which suggests a positive coefficient on *ASSGROW*, but banks might be achieving fast growth by relaxing their lending standards or by purchasing expensive non-core financing, sensitive business practices that suggest a negative coefficient on *ASSGROW*. The latter scenario may be more likely for de novo banks than established banks, given the high levels of *BIGDEP* and *ASSGROW* at young banks.

5.2 Determinants of survival time

For the most part, we expect that the determinants of survival time (for banks that eventually fail) will be similar to the determinants of the probability of survival. However, the following covariates are exceptions: *ENERGY*, *OCC*, and *ASSGROW*. While there is no doubt that banks located in the 'energy' states were less likely to survive to the end of the sample period, the economic disruptions that caused them to fail may have occurred relatively later in the sample period. If this is the case, then the survival times for failed energy state banks could be longer than for failed banks in other states, and the coefficient on *ENERGY* will have a positive sign.

While the OCC's market-based chartering policy may have resulted in a higher rate of failure for de novo national banks, the time to failure for failed de novo national banks need not be any different than for failed de novo state chartered banks. Moreover, 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 a neutral or positive sign on the *OCC* coefficient. Finally, although fast asset growth could increase the probability of failure during times of economic distress, fast asset growth could temporarily delay the inevitable for banks that do fail (e.g., by generating fee revenue from new loans of questionable quality). This suggests a positive sign for the coefficient on *ASSGROW*.

6. Results

Table 2 displays the results of the duration models estimated separately for newly chartered banks and established banks. The estimated probability that the average bank will eventually fail is 28.27% for de novo banks and 8.91% for established banks. Note that these estimated failure probabilities are somewhat higher than the raw failure percentages shown in Table 1 (respectively, 23.48% and 6.60%) because some of the censored observations may eventually fail in the future.

Although established banks are less likely to fail, those that do fail have relatively short durations. Of the established banks that are expected to eventually fail, half of them will fail within an estimated 17.64 quarters (about 42 years) after the beginning of the sample period. Consistent with the 'life-cycle' explanation of de novo bank failure, newly chartered banks fail more slowly than established banks. It takes an estimated 24.19 quarters (about 6 years) for half of the de novo banks that are expected to fail to do so.

The differences in failure rates and duration times can be seen clearly in estimated hazard functions displayed in Figure 3. These hazard functions are constructed by evaluating equation (4) for the coefficient estimates from Table 2 and the covariate means from Table 1. The estimated probability of failure for established banks starts out near zero but immediately increases; peaks at about 8 percent for banks that survive for about 5 years; and then declines toward a lower long-run level as the bank failure wave (see Figure 1) dissipates. The estimated probability of failure for de novo banks is near zero for about two years, and although it increases rapidly after about three years, it remains below the established bank hazard rate for five years. The de novo hazard rate peaks at nearly 15 percent for banks that have survived for seven years, and then gradually declines toward the established bank hazard rate. Although both of the hazard functions in Figure 3 are in decline at the end of the sample period, they remain positive, which reflects the estimated non-zero probability of failure for the censored observations.

6.1 Results: determinants of the probability of survival

For both de novo banks and established banks, the probability of survival is strongly correlated with bank financial condition. All of the following caused a statistically significant reduction in the probability of de novo and established bank survival: high asset growth rates, high levels of loans-to-assets, reliance on purchased deposit funding, and heavy expenditures on overhead. Neither bank size nor capitalization was a significant indicator of future bank failure, and poor loan quality was a significant predictor of failure only for established banks. (Note: *NPL* would likely have been significantly negative for de novo banks, and *EQASS* would likely have been significantly positive for both sets of banks, had we observed our covariate vector X_i a year prior to failure, as did Cole and Gunther 1995, rather than at the beginning of the sample period.)

In contrast, very few of the non-financial covariates had a substantial influence on the probability of survival. As expected, being located in an energy state reduced the probability of survival for both de novo and established banks. Established urban banks were more likely to survive than established rural banks, perhaps due to the diversification opportunities available in these areas. Aside from *URBAN* and *ENERGY*, however, none of the locational, regulatory, or organizational covariates were significantly correlated with the probability of survival. The non-significance of *OCC* suggests that the Comptroller's market based chartering policy did not contribute to the high rate of de novo bank failures during the 1980s and early 1990s.

6.2 Results: determinants of survival time

The determinants of survival time differed for de novo banks and established banks. Only *CON* and *NPL* had significant coefficients for the established banks. The estimates indicate that a higher level of consumer lending increased survival time, and a higher level of nonperforming loans reduced survival time, for established banks that eventually failed. Note that neither of these two covariates were significant determinants of survival time for de novo banks.

For failing de novo banks, having a large capital cushion, growing fast, holding a national charter, and affiliation with a multibank holding company all delayed failure, while high levels of large deposit financing and overhead spending both hastened time to failure. Note that none of these covariates were significant determinants of survival time for established banks. The significant positive coefficient on *OCC* is consistent with forbearance, or may simply indicate that the OCC happened to charter new banks in areas that experienced economic disruptions later than the rest of the country. The significant positive sign on *ASSGROW* is consistent with new banks attempting to delay the inevitable by fast growth. Additional research would be necessary to confirm these interpretations.

The lack of uniformity in significant coefficients across the two models indicates that there are substantial differences in new and established banks. Moreover, the dearth of significant coefficients in the established bank model suggests that predicting the time to failure for established banks is simply more difficult than making this prediction for de novo banks. Perhaps timing the failure of a cohort of newly chartered banks is easier because they are all the same age and/or because they are on a more predictable portion of their life cycles.

7. Summary and conclusions

Like most new business ventures, newly chartered banks are financially fragile and prone to failure during economic disruptions. Although it is generally believed that the recent explosion in the number of new bank charters will have beneficial competitive effects in local markets, any benefits will be permanent only if these new banks can survive long enough to become financially viable. In this study, we explore the probability and the determinants of new bank failure.

We examine 656 de novo banks that were chartered in 1984 and 1985, just prior to a period of intense financial distress for the banking industry. We also observe 1,288 small established banks at the beginning of 1985 that were operating in the same geographic markets as the de novo banks. By estimating 'split-population' duration models for each of these samples, we can test whether the probability of failure, the timing of failure, and the determinants of failure differed for new banks and established banks during this stressful period.

The results of our tests are consistent with the 'life-cycle' theory of bank failure introduced by DeYoung (1999). Because newly chartered banks are heavily capitalized and hold portfolios of unseasoned loans, they are initially less likely to fail than established banks. But rapid asset growth, subpar profitability, and declining loan quality gradually erode de novo capital stocks. Our models indicate that the de novo bank failure rate catches up with the established bank failure rate after about five years, and after about seven years de novo banks are twice as likely to fail as established banks. Thus, one of the primary determinants of de novo bank failure is the 'newness= of the newly chartered bank.

Aside from the age of the bank, the determinants of failure are quite similar for de novo and established banks. Adverse economic conditions, rapid asset growth, concentrations of risky and illiquid investments, large amounts of purchased funds, and excess overhead spending reduce the likelihood of survival for both sets of banks. For new banks that eventually failed, concentrations of business loans, large amounts of purchased funds, low capital ratios, and excess overhead spending accelerated failure, while fast asset growth, affiliation with a multibank holding company, and holding a federal charter delayed failure. In contrast, none of these conditions had a significant effect on the time-to-failure for established banks.

These results have implications for bank chartering policy. We find no significant evidence that national banks were more likely to fail than state chartered banks. This suggests that the relatively lenient, market-based chartering policy practiced by the Comptroller of the Currency during the 1980s increased the number of competitors in local banking markets without causing disproportionate numbers of new bank failures. Our results also have implications for capital regulation of young banks. We find no evidence that low capital ratios predict de novo bank failure, but we do find that low capital ratios accelerate failure for banks that eventually fail. This suggests that the higher required levels of capital imposed on young banks in the 1990s likely have not reduced the probability of new bank failure, but rather serve as a buffer that provides extra time to resolve young banks should they become troubled institutions. Finally, our results should be instructive for de novo bank owners and managers. We find that the risk drivers at new banks and established banks are fundamentally similar. However, the market appears to punish mistakes more quickly and more severely at young banks.

Table 1
Descriptive statistics.

De novo banks: Began operations between 1984:Q1 and 1985:Q4. Financial ratios are measured at end of fourth full quarter of operations.

Established banks: Were at least 25 years old, had less than $100 million in assets, and had at least 6% equity/assets as of 1985:Q1. Located in the same geographic markets as the de novo banks. Financial ratios measured at beginning of 1985.

	656 de novo banks		**1288 established banks**	
	mean	**std. dev.**	**mean**	**std. dev.**
Outcome:				
% failed before 1999	23.48%	--	6.60%	--
% acquired before 1999	43.45%	--	37.73%	--
% survived until 1999	33.07%	--	55.67%	--
t = duration	36.98 qtrs.	18.28	43.26 qtrs.	17.67
Structure variables:				
URBAN = 1 if in MSA	.7774	--	.7298	--
ENERGY = 1 if in energy state	.4878	--	.3036	--
OCC = 1 if national bank	.6189	--	.2756	--
MBHC = 1 if a mbhc affiliate	.1219	--	.1685	--
HHI = Herfindahl Index	1597	1339	1369	1075
Financial ratios:				
ASSETS (1985 $000)	$11,141	23,328	$42,401	25,429
EQUITY (1985 $000)	$2,689	6,159	$3,687	2,292
EQASS (equity/assets)	.1345	.0598	.0904	.0283
ROA (net income/assets)	-.0122	.0209	.0099	.0079
ASSGROW (% annual growth)	182.79%	210.41	8.28%	22.73
BIGDEP (CDs>$100K/assets)	.2441	.1437	.0963	.0767
LIQUID (cash+equivalents+securities/assets)	.3622	.1569	.4505	.1402
SEC (securities/assets)	.1203	.1333	.3209	.1383
LOAN (loans/assets)	.5917	.1597	.5243	.1396
REL (real estate loans/assets)	.2167	.1299	.1962	.1014
CON (consumer loans/assets)	.1308	.1032	.1337	.0835
C&I (C&I loans/assets)	.2293	.1288	.1773	.1127
NPL (nonperforming loans/assets)	.0036	.0078	.0134	.0156
SAL (salary expense/assets)	.0186	.0090	.0166	.0109
PREM (premises expense/assets)	.0085	.0061	.0047	.0037

Table 2

Results from split-population duration models. Slope coefficients that are significantly different from zero at the 1% and 5% levels are indicated by * and **, respectively.

	656 de novo banks		1288 established banks	
	estimate	**std. error**	**estimate**	**std. error**
8	0.0413	0.0018	0.0567	0.0138
p	5.8076	0.5462	2.6237	0.3065
* (probability of failure)	0.2827	0.0259	0.0891	0.0085
median quarters until failure	24.1879	1.0565	17.6432	4.2920
Log Likelihood	-272.03	--	-293.39	--
	probability of survival parameter estimates			
constant	3.3704	1.7671	5.7387**	1.8306
YEAR84	-0.2263	0.1487	--	--
OCC	0.2689	0.1759	--	--
ENERGY	-0.7036**	0.2072	-1.0322**	0.2038
MBHC	0.0611	0.3187	-0.3389	0.2539
URBAN	-2.6306	2.6418	0.9294*	0.4685
HHI	3.1200	1.9807	2.4681	1.7149
URBAN*HHI	-2.6306	2.6418	-4.4250	2.7398
lnASSETS	-0.0549	0.1597	-0.1503	0.1484
ASSGROW	-0.1686*	0.0877	-1.8188**	0.7449
EQASS	0.4736	1.7933	2.4482	3.1913
REL	-2.3691**	0.7489	-1.4918	1.2873
CON	-1.8882*	0.8727	-4.2449**	1.3823
C&I	-2.7432**	0.7559	-3.2825**	0.9124
NPL	-8.3958	8.0018	-14.5960**	4.7782
BIGDEP	-1.9585**	0.6479	-2.5908*	1.1801
SPEND	-21.8980**	7.0518	-37.7520**	14.3190
	survival time parameter estimates			
constant	2.2246**	0.5638	0.3718	1.9407
YEAR84	0.1033	0.0695	--	--
OCC	0.1615**	0.0652	--	--
ENERGY	-0.1229	0.0677	0.0911	0.2924
MBHC	0.2310*	0.1069	0.0986	0.3048
URBAN	0.3449	0.2398	-0.6803	0.5251
HHI	1.5060	0.8995	-2.1435	1.5862
URBAN*HHI	-0.6007	1.0391	4.1046	3.7353
lnASSETS	0.0654	0.0509	0.2482	0.1687
ASSGROW	0.0381*	0.0170	0.3953	0.6223
EQASS	2.3601**	0.6078	0.8857	5.5615
REL	-0.0858	0.3002	-0.3383	1.4653
CON	-0.3353	0.4080	2.7518*	1.2985
C&I	-0.5995*	0.2943	-0.9506	1.0708
NPL	-5.2410	3.1945	-10.2270*	4.7279
BIGDEP	-0.8947**	0.2204	0.1515	1.2945
SPEND	-5.4879**	2.3599	11.8090	15.1220

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