Considering Bank Age and Performance for De Novo Status

By Stephen Jones, Forest Myers, and Jim Wilkinson

Newly formed or "de novo" banks promote vitality and competition in their local markets and may provide access to banking services for underserved communities and groups. However, as with any newly formed business, de novo banks are likely to be more financially fragile than more established banks, especially during periods of economic stress. A central challenge for federal banking regulators is mitigating this risk through supervisory attention without discouraging new bank formation.

Currently, federal banking agencies use several strategies to mitigate de novo bank risk, including application requirements and more stringent operating and examination standards. For example, when de novo banks begin operations, they are subject to more frequent examinations, more intensive surveillance, higher standards for capital levels, and limits on capital distributions for at least three years. However, whether this three-year period effectively balances risk mitigation with regulatory burden is an open question.

One way to evaluate the suitability of this threshold is to examine de novo banks' performance as they mature. If a de novo bank's financial performance is comparable to the performance of established banks, enhanced regulatory treatment may not be needed. In this article, we evaluate the appropriate length of the enhanced supervisory period by

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analyzing de novo bank financial performance over time. We find that the typical de novo bank's financial performance differs substantially from that of established banks during their first three years. By the end of three years, the financial performance of de novo banks more closely resembles older and more mature banks. Our results indicate the three-year enhanced supervisory period is likely appropriate.

Section I provides background information on de novo bank activity. Section II summarizes supervisory policy pertaining to de novo banks. Section III presents our research approach. Section IV summarizes study results.

## I.   De Novo Bank Formation and Economic Conditions

De novo banks are an important feature of the U.S. banking system. Their entry into local banking markets helps maintain banking competition (Adams and Gramlich 2014). They also help provide financial and credit services to underserved communities with limited access to banking products (Bowman 2021). Furthermore, de novo banks can be an especially important source of small business lending because, relative to larger banks, they are more likely to rely on relationship banking—that is, they are more likely to use a more personalized touch in their customer dealings and give weight to intangibles in credit requests as well as financial factors.

De novo bank formation has always been cyclical, increasing in economic expansions and declining during recessions. The number of new bank charters increases when interest rates rise because higher interest rates increase banks' net interest margins, the primary earnings component for small banks; the number of charters declines when interest rates fall and net interest margins are compressed (Adams and Gramlich 2014; Lee and Yom 2016).[1] Indeed, Chart 1 shows that new charter activity has largely moved with the federal funds rate.

From 1985 to 2009, there were 3,870 new bank charters issued in the United States. Following the Great Recession, the number of new bank charters remained low even as economic growth strengthened and bank profitability improved starting in 2010.[2] One potential explanation for the paucity of new banks after the Great Recession is an increase in regulatory burden, as new and changing laws, supervisory policies, and regulations can all affect operating costs and shareholder returns.

Chart 1

New Bank Charters and Annual Federal Funds Rate by Year, 1985–2020
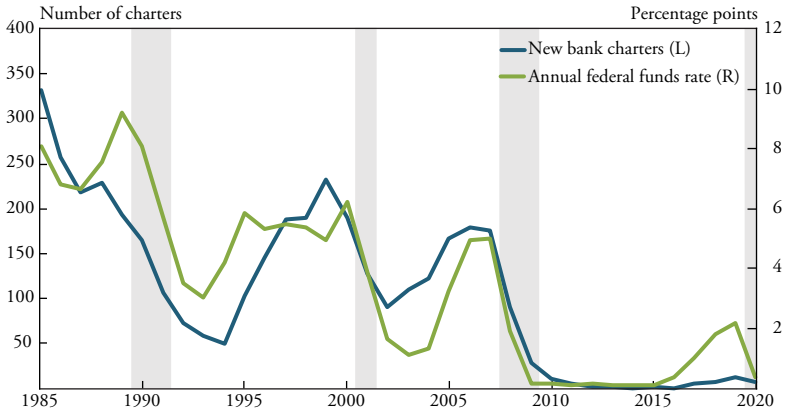
Note: Gray bars indicate National Bureau of Economic Research (NBER)-defined recessions.
Sources: FDIC, Board of Governors of the Federal Reserve System, and NBER.

The Dodd-Frank Act, passed in 2010, led to a substantial increase in new regulations. Moreover, a Federal Deposit Insurance Corporation (FDIC) count of substantive regulatory changes applicable to smaller banks or community banks found 157 changes, or one every 28 days from 2008 to 2019 (FDIC 2020).[3]

Although the goal of these regulatory changes is to mitigate financial risks, at the margin, they may also discourage new bank formation. Regulatory burden has been a long-running concern for banks. Most recently, the dearth of new bank charters has called attention to supervisory policy pertaining to bank charters and de novo banks. Whether enhanced supervision of de novo banks is appropriate or overly stringent is a question critical to both regulators and banks.

II.   De Novo Bank Formation and Supervisory Policy

De novo banks are subject to additional supervisory requirements because they are considered more financially fragile than established banks for several reasons (Lee and Yom 2016). First, de novo banks may be organized by investor groups with limited familiarity or experience with bank operations, resulting in a weaker governance chain for management than that of more established banks. Second, even when

management teams are experienced, that experience may be at established banks and may not directly translate to managing a newly formed bank. Third, the customer composition may differ between mature and de novo banks. For example, some loan customers denied credit by established banks may seek credit at de novos, believing these institutions will be more driven to build a customer base to achieve profitability. In other instances, new banks may be established to capture presumed market opportunities within a particular sector. However, the banks may develop sectoral concentrations, creating greater credit risk should these sectors experience economic hardship. Fourth, new banks may not have the same financial wherewithal as established institutions. De novos are likely to have lower earnings while building out their loan portfolio and may have lower margins by making loan rate concessions to attract borrowers while paying out higher deposit rates or relying on wholesale funding.[4] Fifth, de novo banks may not have settled risk management practices, and bank managers may have to refine policies, procedures, and risk limits over time, especially if the business model changes.

Because of these risk factors, regulatory agencies—specifically, the Office of the Comptroller of Currency (OCC), the FDIC, and the Federal Reserve System—view de novo banks as riskier than established banks. The agencies mitigate these risks by instituting requirements in the application process for new bank charters and imposing higher initial operating and examination standards.[5]

Organizers of de novo banks must complete applications for both chartering and deposit insurance. The applications request similar information from the organizers about financial and management resources and ask how the proposed bank will meet the credit needs of the community served. In addition, organizers must meet certain requirements set by the agencies—for example, including experienced senior managers in their leadership group and having a board of directors with diverse and relevant backgrounds, including two outside directors with banking experience. Bank organizers must also include with their applications a sound and comprehensive business plan that covers the first three years of operation and demonstrates that the bank will be able to meet supervisory expectations for capital levels over this period.

Once the application is approved, newly chartered banks are subject to more intensive supervision by banking agencies. De novo banks

receive more frequent safety and soundness examinations than established banks. Typically, healthy community banks receive an examination every 18 months.[6] Newly chartered banks, however, are subject to a targeted examination within six months and a full-scope examination within 12 months of their opening. These banks will continue to receive full-scope examinations every 12 months until they have had three full-scope examinations and been in operation for at least three years. In addition, regulatory agencies encourage de novo banks to engage an independent public accountant to audit their annual financial statements during the first three years of operation. Newly chartered banks are also expected to maintain capital ratios well above regulatory minimums. To help achieve these ratios, banking agencies limit de novo banks' capital distributions.

Currently, banking agencies impose these higher supervisory standards for a three-year period. However, this period has varied over time and across agencies. In 2009, for example, the FDIC extended its heightened supervisory period for de novo banks to seven years in response to a high failure rate after the Great Recession for banks younger than eight years. In 2016, the FDIC returned to a three-year de novo period. In contrast, the Federal Reserve maintained a five-year de novo period until 2020, when it moved to a three-year de novo period.

Whether the enhanced supervisory period for de novo banks is an appropriate length is an important question, as it influences supervisory costs for both banks and banking supervisors. Furthermore, application costs and associated supervisory requirements may play a role in the slowdown in de novo bank formations to the detriment of an innovative, competitive banking system.

III. Measuring the Financial Performance of De Novo Banks

Currently, banking agencies consider a de novo bank an established bank after three years of operations. The appropriateness of this period depends on whether the financial performance of most de novo banks has sufficiently "matured" within three years so that their risk profiles are comparable to established banks.

To test the appropriateness of the three-year period, we use a statistical model to estimate the probability of a bank being a de novo

bank. Specifically, we use a probit model to predict the likelihood that a bank is three years old or less based on their financial characteristics and performance.[7] This approach allows us to observe how banks' probabilities of being de novo change over time and identify when banks "mature" into established banks. The model's dependent variable, de novo status, is based on the three-year regulatory de novo period. The explanatory variables are financial performance measures aligned with the capital, asset quality, earnings, and liquidity components from the regulatory agencies' CAMELS examination rating systems.[8] We include growth rates as well as levels of these financial variables given that the financial composition and performance of de novo banks is expected to change significantly in their early years of operation. In addition, we control for bank operating conditions including market characteristics (such as local economic health and whether a bank is urban or rural) and corporate structure (specifically, whether a bank is part of a bank holding company). Table 1 provides a complete categorization of these independent variables.

Data on bank financial performance are from annual (year-end) Call Report data for domestic commercial U.S. banks from 1995 to 2018. The economic health index is constructed at the Federal Reserve Bank of Kansas City and estimated from various measures of economic activity available at the county level. Appendix A contains more complete information on the sample of banks and the variable definitions and calculations, and Appendix C provides further information on the economic health index.

We divide the data into two groups using randomly selected bank identification numbers. We use half of the observations to estimate model parameters and the other half to predict de novo status. In the parameter estimation process, we use banks with three or fewer years of operation and banks with 14 or more years of operation. This ensures that non-de novo banks are clearly "established" banks.[9] We then use the estimated parameters to predict de novo status for banks of all ages in the second half of the observations and analyze the distribution of de novo probabilities by bank age.

Additionally, we apply k-means clustering on the predicted de novo probabilities to determine an appropriate cutoff point for assigning each observation to either a de novo or an established bank group. The

Table 1
Variables Grouped by Financial Performance Categories

Capital	Asset quality	Earnings	Liquidity	Operating characteristics
Tier 1 capital ratio	Loans to asset ratio	Pre-tax net income as a percentage of average assets	Noncore funding percentage	Indicator for bank headquartered within a rural market
Annual Tier 1 capital ratio growth	Non-performing asset ratio	Efficiency ratio	Deposits to assets	Economic health index
Annual Tier 1 capital ratio growth squared	Annual loan growth	Annual efficiency ratio growth	Annual deposits to assets growth	Indicator for bank operating under a bank holding company
	Annual loan growth squared	Annual efficiency ratio growth squared	Annual deposits to assets growth squared	

k-means clustering algorithm works iteratively to assign observations into a prespecified number of groups—two groups, in this case. The algorithm minimizes the distance between each observation's predicted probability and the cluster centroids. In effect, our observations are optimally grouped into two categories in which the probabilities are nearest to the mean of their neighbors. Once grouped, we can analyze the composition of banks in the false positive and false negative categories.

IV. Results Support a Three-Year De Novo Period

Our results provide confidence that the regression model successfully reflects the behavior of de novo banks during their early operating years. Table 2 presents selected coefficients from our parameter estimation process. (Complete regression results, including each variable's average marginal effect, are provided in Appendix A.)

Overall, the table suggests that the results are consistent with the financial performance of de novo banks. Specifically, the results show that banks with lower income, lower efficiency, high but declining capital ratios, high loan growth, and fewer nonperforming assets are more likely to be within their first three operating years. The coefficients on these variables are statistically significant, indicating they are important in distinguishing between de novo and established banks.

Table 2
Regression Coefficients for Selected Variables

Variable	Level	Growth
Pre-tax net income to average assets	–24.45***	N/A
Efficiency ratio	0.56***	–3.48***
Capital + ALLL to total assets	6.62***	–1.57***
Loans to total assets	0.65***	3.10***
Nonperforming assets ratio	–8.28***	N/A

*** Significant at the 1 percent level

Note: "N/A" indicates the growth variable is not included in the model.

The negative coefficient on the first variable shown in the table, net income to average assets, indicates that banks with losses or low income are more likely to be de novo banks. De novo banks are expected to incur losses in their initial years because their asset base does not generate sufficient income to cover noninterest expenses.

The next variable shown in the table, the efficiency variable, is the ratio of noninterest expense to earnings. Informally, this ratio can be thought of as the cost of earning a dollar of income. Thus, a high ratio indicates a bank is less efficient in generating earnings. The positive coefficient on the efficiency variable suggests that less efficient banks are more likely to be de novo banks, consistent with de novo banks not yet reaching their planned asset size during their initial operating years. Furthermore, the negative coefficient on the efficiency ratio growth variable shows that banks with improving efficiency ratios are more likely to be de novo banks, which is consistent with de novo banks trying to grow into their planned asset size.

The positive capital ratio coefficient and negative capital growth coefficient suggest that banks with high but declining capital ratios have a higher probability of being de novo banks. This estimate is unsurprising: as discussed previously, de novo banks are required to hold capital ratios well above regulatory minimums, and these ratios tend to decline over time due to negative or low earnings and an increasing asset base.

The coefficients on the loans-to-total-assets level and growth variables are positive and significant, suggesting banks with high loan growth are more likely to be de novos. This result is in line with expectations, as de novo banks need to grow their loan portfolios to support their net interest margins.

Finally, the coefficient on the nonperforming assets variable is negative, indicating that banks with fewer nonperforming assets are more likely to be de novo banks. Although this parameter estimate might seem counterintuitive, it too is consistent with de novo banks. Initially, all new loans perform well. Repayment problems generally appear after loans have seasoned, which will occur after the de novo period for some loans.

The estimated parameters of the statistical model are consistent with expectations for de novo bank financial performance, suggesting our model can accurately predict which banks have the characteristics of de novo banks. Thus, we use the estimated model parameters to measure the likelihood that banks in the remainder of our sample are de novo banks. Specifically, we assess the distributions of de novo bank probabilities by bank age to determine when de novo banks mature sufficiently to be considered established banks.

The box-and-whisker plots in Chart 2 show the range of time it takes for de novos to reach an established state.[10] The boxes contain 50 percent of the predicted probabilities, or those banks with probabilities within the lower and upper quartiles, and the line within the box indicates the median value of the probabilities at each age. Thus, for banks with two to three years of operation, for example, the black horizontal line within the box at 0.6 indicates that the median bank in this age group has a 60 percent probability of being a de novo bank (based on financial performance), while 50 percent of banks in this age group had de novo probabilities between 22 and 93 percent. The dashed lines (or "whiskers") outside of the box represent probabilities as far out as 1.5 times the interquartile range, while data points outside of these whiskers, denoted as dots, are considered potential outliers.

To assess whether banks in each age group are de novo banks or established banks, we use a cluster analysis that divides banks into these two categories based on their projected de novo probabilities. The cluster analysis chooses a probability level to divide the banks so that each bank's probability is closer to its own group's average probability than to the other group's average probability. Our analysis includes banks with a probability of 42 percent or higher into the de novo bank cluster. Those with a lower probability are put in the established bank cluster. The green line in Chart 2 provides a visual reference for this dividing line.

Chart 2
Probability of De Novo-Like Financial Characteristics by Age
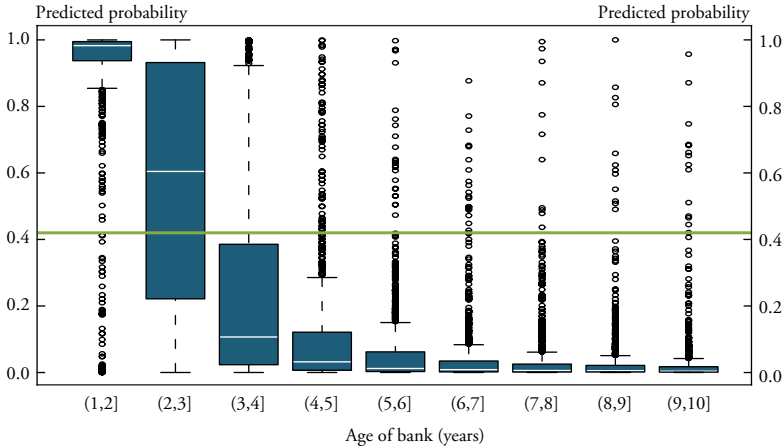
Source: Authors' calculations.

The results show that most banks in our sample reach maturity after three years of operation. As expected, during the first one to two years of operation, almost all banks have a high probability of being classified as a de novo bank. At the two- to three-year age range, however, de novo probabilities become widely dispersed, as evidenced by the large interquartile range. In other words, the financial maturity of banks in this age group varies widely. After three years of operation, most banks have become established—that is, they have a low probability of being a de novo. Thus, our results suggest that the three-year cutoff defined by current regulatory guidance is reasonable overall.

However, our results also show that some banks are maturing much faster than expected, and that some banks are taking much longer than anticipated to reach an established state. For example, the box for banks with two to three years of operation extends below the 42 percent level, indicating banks in that zone already have the performance of established banks. In contrast, the upper tail for the three- to four-year cohort shows that many banks are maturing more slowly and have not reached an established state after the three-year regulatory timeframe. The high probability outliers in the older cohorts are likely poorly performing established banks with low earnings and high loan growth, leading our

model to mistakenly classify them as de novo banks. Nevertheless, focusing on performance metrics in addition to age when determining de novo status may be beneficial, given that many banks appear to be reaching an established state before or after three years of operation,

To quantify the volume of banks that are reaching maturity within a shorter or longer timeframe than the three-year de novo period, we construct a confusion matrix that compares the actual and predicted de novo status of banks in our sample. Rather than arbitrarily setting a cutoff probability (or dividing line), we separate de novo and established banks using the cluster analysis, which gives us a cutoff value of 42 percent.

The results from the confusion matrix, shown in Table 3, suggest that nearly 99 percent of the banks in our sample were classified correctly. The 544 false positive observations represent banks that have not yet reached maturity (as measured by our financial performance variables) after three years. These observations may include both newer banks that are taking longer than expected to mature and established banks with risk characteristics that make their financial performance appear similar to de novo banks. The false positive observations account for less than 1 percent of the established banks in our sample. The 403 false negative observations represent banks that reached maturity in less than three years—that is, banks that have the financial characteristics of established banks but that are in their first three years of operation. Overall, 23 percent of de novo banks in our sample reached an established state sooner than the three-year regulatory period. If regulatory agencies included financial performance in their assessment of de novo status, the de novo period could be shortened for these banks, reducing costs for both the banks and the agencies. However, the period of reduced burden would be very short—less than one year for most of these banks. De novo banks achieved a greater reduction in regulatory burden when the FDIC shortened its de novo period from seven to three years in 2016 and when the Federal Reserve reduced its de novo period from five to three years in 2020.

Our results may depend on the three-year assumption used to assign banks to the de novo group. Although this choice mirrors banking agencies' current practice, it may bias the statistical results relative to using a longer assignment period. To account for this possibility, we

Table 3

Comparison of Actual and Predicted De Novo Status

	Actual classification	
Predicted classification	Established	De novo
Established	72,753	403
De novo	544	1,353

repeat the analysis using five-year and seven-year de novo periods. The longer period results have very similar probability distributions to our base three-year results. However, the five-year and seven-year confusion matrices show higher false positive and false negative rates, suggesting the three-year model performs better. The results for the alternatives are discussed in Appendix B.

Conclusion

De novo banks provide important benefits to the banking markets they enter. However, as with any new and growing entities, de novo banks are generally riskier than established banks. To mitigate these risks, banking agencies require a rigorous process for applying for a bank charter and deposit insurance and impose more stringent supervision on new banks for the first three years of operation. Whether this three-year duration is appropriate is an important question, as the enhanced supervision creates additional regulatory burden for de novos during their initial years of operation.

This paper attempts to assess the appropriate length of the enhanced supervisory period by estimating the probability that a bank is a de novo bank based on its financial performance. Our analysis shows that banks with weak earnings, high loan growth, and high capital ratios have a higher de novo probability. We observe the distribution of these probabilities by bank age and find the probabilities of being a de novo bank decline during the third year. Further, most banks have a low de novo probability in their fourth year. Our results support the regulatory agencies using a three-year trial period for de novo banks.

However, our results also suggest that considering financial performance in addition to age could lower regulatory burden for some de novos. Specifically, a cluster analysis shows that some banks older than three years had a high de novo probability, while a substantial

proportion of banks younger than three years had a low de novo probability, indicating they should be included in the established bank cluster. These outliers suggest that banking agencies may be able to use financial performance analysis to shorten the de novo window and reduce regulatory burden for some banks.

This research did not analyze the costs and benefits from the regulatory requirements of the application process. It may be possible to reduce regulatory burden associated with applying for a new charter and deposit insurance. However, banks that successfully complete the current application processes appear to be well poised to achieve the financial performance of established banks by the end of three years of operation.

Appendix A

Data and Banks Used in the Analysis

This study uses annual (year-end) data from the Reports of Income and Condition (Call Reports) for the years 1985–2018. We collect data only for U.S. commercial banks and exclude credit unions, savings and loans, savings banks, industrial loan companies, deposit national banks, and U.S. subsidiaries of foreign banking organizations.[11] The data are adjusted to reflect the effect of mergers to ensure the growth rate variables used in the analysis are calculated correctly (English and Nelson 1998). Because growth rate calculations in a given year require data from the previous year, we cannot use the initial annual observation for each bank in the analysis.

For this study, we consider de novo banks to be newly chartered banks up to three years of age, reflecting banking agencies' presumption of de novo status. We only include new entities with no previous operating experience. Thus, we exclude newly chartered banks that 1) result from an established bank changing its charter, 2) are the product of a merger between banks that results in a new charter, 3) facilitate an ownership change of an existing bank, or 4) are the second or subsequent subsidiary of multibank holding companies.

Table A-1 provides full definitions for each variable in our model. Table A-2 provides descriptive statistics for each of our bank samples. Table A-3 presents our complete probit regression results.

Table A-1
Variable Definitions

Variable	Definition
Loans to assets	The ratio of total loans to total assets
Pre-tax net income to average assets	Net income to average assets on a pre-tax basis
Efficiency ratio	The ratio of noninterest expenses to operating revenue, or the overhead required to generate a dollar of revenue
Tier 1 + ALLL to total assets	Tier 1 capital and loan loss reserve as a percentage of total assets
Brokered borrowings and fed funds purchased to average assets	The percentage of average assets funded by non-core funding including brokered deposits and federal funds purchased
Deposits to assets	The ratio of total customer deposits to total assets
Nonperforming assets ratio	The ratio of loans 90+ days past due or on nonaccrual to total assets
Annual loan growth	The simple annual growth rate of total loans
Annual loan growth squared	The square of annual loan growth
Deposits to assets growth	The simple annual growth rate of deposits to assets
Deposits to assets growth squared	The square of deposits to assets growth
Tier 1 + ALLL to total assets growth	Simple annual growth rate of Tier 1 + ALLL to total assets
Tier 1 + ALLL to total assets growth squared	The square of Tier 1 + ALLL to total assets growth
Efficiency ratio growth	Simple annual growth rate of the efficiency ratio
Efficiency ratio growth squared	The square of the efficiency ratio growth
Economic health index	A measure of the economic health of each county
BHC indicator	1 if bank operates under a holding company, 0 otherwise
Rural indicator	1 if bank is headquartered in a rural market, 0 otherwise

Table A-2
Descriptive Statistics

Variable	Overall		De novo		Established	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
De novo	0.023	0.150	1.000	0	0	0
Loans to assets	0.623	0.152	0.681	0.144	0.622	0.152
Pre-tax net income to average assets	0.012	0.012	−0.008	0.019	0.012	0.011
Efficiency ratio	0.693	0.202	1.068	0.424	0.685	0.184
Tier 1 ALLL to total assets	0.111	0.034	0.143	0.055	0.110	0.033
Brokered and FFP to total assets	0.063	0.083	0.076	0.101	0.063	0.083
Deposits to assets	0.002	0.071	0.818	0.085	0.841	0.070
NPA ratio	0.014	0.019	0.006	0.015	0.014	0.019
BHC_1	0.829	0.377	0.490	0.500	0.837	0.369
Rural_1	0.495	0.500	0.162	0.369	0.503	0.500
Loan growth	0.119	0.262	1.014	0.626	0.098	0.204
Loan growth squared	0.083	0.378	1.419	1.328	0.051	0.247
Deposits to assets growth	0.002	0.043	0.087	0.091	0.000	0.039
Deposit to assets growth squared	0.002	0.005	0.016	0.016	0.002	0.004
Tier 1 ALLL to total assets growth	−0.002	0.107	−0.232	0.178	0.008	0.098
Tier 1 ALLL to total assets growth squared	0.011	0.026	0.086	0.063	0.010	0.021
Efficiency ratio growth	0.002	0.124	−0.247	0.183	0.008	0.116
Efficiency ratio growth squared	0.015	0.038	0.095	0.071	0.013	0.035
Economic health index	0.002	0.892	0.599	0.754	0.289	0.893

Table A-3
Complete Probit Regression Results

Independent variables	Probit model	Average marginal effect
(Intercept)	−5.28***	
	(0.50)	
Loans to assets	0.65***	0.010
	(0.15)	
Pre-tax net income to average assets	−24.45***	−0.396
	(3.15)	
Efficiency ratio	0.56***	0.009
	(0.14)	
Tier 1 + ALLL to total assets	6.62***	0.107
	(0.69)	
Brokered borrowings and fed funds purchased to average assets	1.41***	0.023
	(0.30)	
Deposits to assets	1.60***	0.026
	(0.49)	
Nonperforming assets ratio	−8.28***	−0.134
	(2.33)	
Annual loan growth	3.10***	0.050
	(0.16)	
Annual loan growth squared	−1.50***	−0.024
	(0.09)	
Deposits to assets growth	0.61	0.010
	(0.52)	
Deposits to assets growth squared	6.63	0.011
	(3.99)	
Tier 1 + ALLL to total assets growth	−1.57***	−0.025
	(0.20)	
Tier 1 + ALLL to total assets growth squared	3.05***	0.049
	(0.73)	
Efficiency ratio growth	−3.48***	−0.056
	(0.17)	
Efficiency ratio growth squared	3.80***	0.062
	(0.51)	
Economic health index	0.05*	0.001
	(0.02)	
BHC indicator	−0.51***	−0.010
	(0.04)	
Rural indicator	−0.33***	−0.005
	(0.05)	
N	64677	
AIC	4037.59	
BIC	4210.05	
Pseudo R^2	0.77	

  * Significant at the 10 percent level
 ** Significant at the 5 percent level
*** Significant at the 1 percent level

Appendix B

Sensitivity to Alternative Measurement of De Novo Status (Five-Year and Seven-Year Results)

Our main results show that most de novo banks have a low probability of being de novo (or a high probability of being an established bank) in three to four years. However, this result may depend on the decision to define de novo banks as banks up to three years in age. Defining a longer period for de novo banks might produce different results. To test this sensitivity, we rerun the analysis using assigned de novo periods of five and seven years. Below are the de novo probability distributions using the three-year, five-year, and seven-year de novo periods.

Comparing the three panels of Chart B-1 shows that the probability distributions are higher in the five-year (Panel B) and seven-year (Panel C) periods. However, the three panels show a similar pattern over time, with the distributions of the probability of being a de novo bank declining in the third, fourth, and fifth years.

We then use cluster analysis to assign banks to de novo and established bank clusters. The cutoff level is similar in each case: 42 percent, 40 percent, and 38 percent for the three-year, five-year, and seven-year scenarios. When these cutoff levels are applied to the probability distributions, the median de novo probability is below the cutoff levels by the end of the fourth year for the five-year and seven-year analyses. This means the majority of banks are in the established bank cluster by this time, which is before the end of the de novo window.

Table B-1 shows the confusion matrices for the three scenarios. The three-year confusion matrix shows that the model projects a higher percentage of true established banks and a higher percentage of true de novo banks. With a longer de novo period, the model assigns more of the true de novos to the established bank cluster. In the three-year analysis, 23 percent of de novo banks are shown as established banks (403 out of 1,756), while the corresponding percentages for the five-year and seven-year analyses are 42 percent and 49 percent. This result supports the idea that longer periods are "too long," because a much higher percentage of banks become established before the end of the de novo period.

Chart B-1

Probability of De Novo-Like Financial Characteristics by Age

Panel A: Using Three-Year De Novo Period and 42 Percent Cutoff
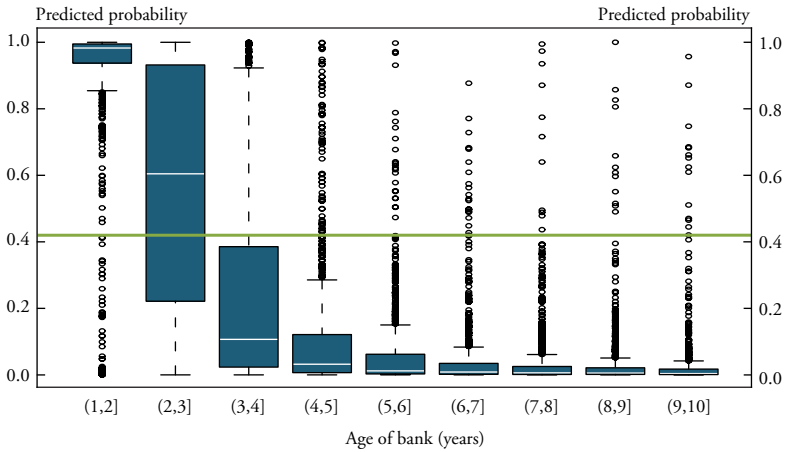
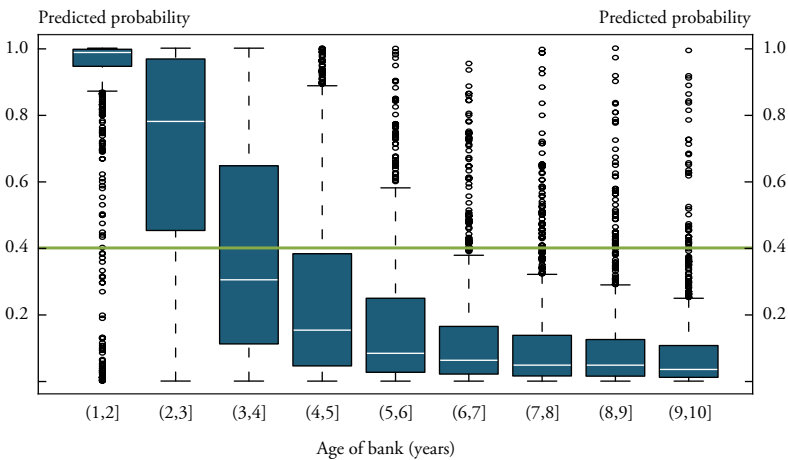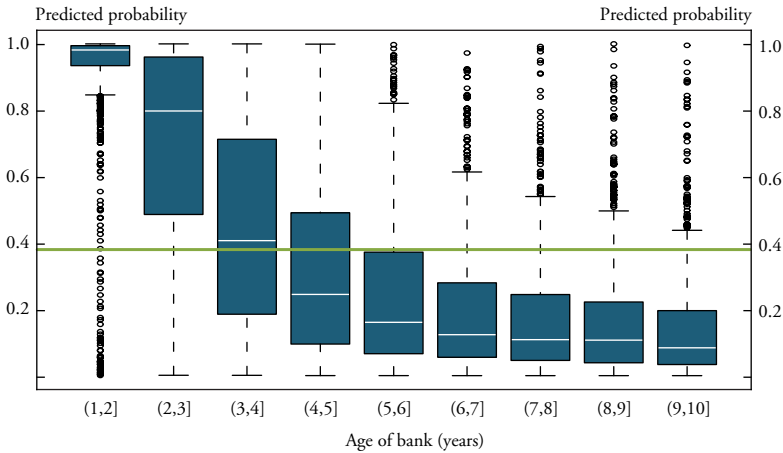**Panel B: Using Five-Year De Novo Period and 40 Percent Cutoff**

Chart B-1 (continued)

Panel C: Using Seven-Year De Novo Period and 38 Percent Cutoff

Predicted probability   Predicted probability

Age of bank (years)

Source: Authors' calculations.

In addition, when there is a longer time period for de novo status (five years or seven years), the model assigns a broader range of banks to the de novo bank cluster, including a higher proportion of established banks. Of the banks where the model projects a high de novo probability, 28.7 percent (544 of 1,897) are established banks in the three-year analysis, while 29.4 percent (882 of 2,999) and 32.9 percent (1,332 of 4,047) are established banks in the five-year and seven-year analyses, respectively. Using the longer period for de novos causes the model to cast too wide a net looking for de novo banks.
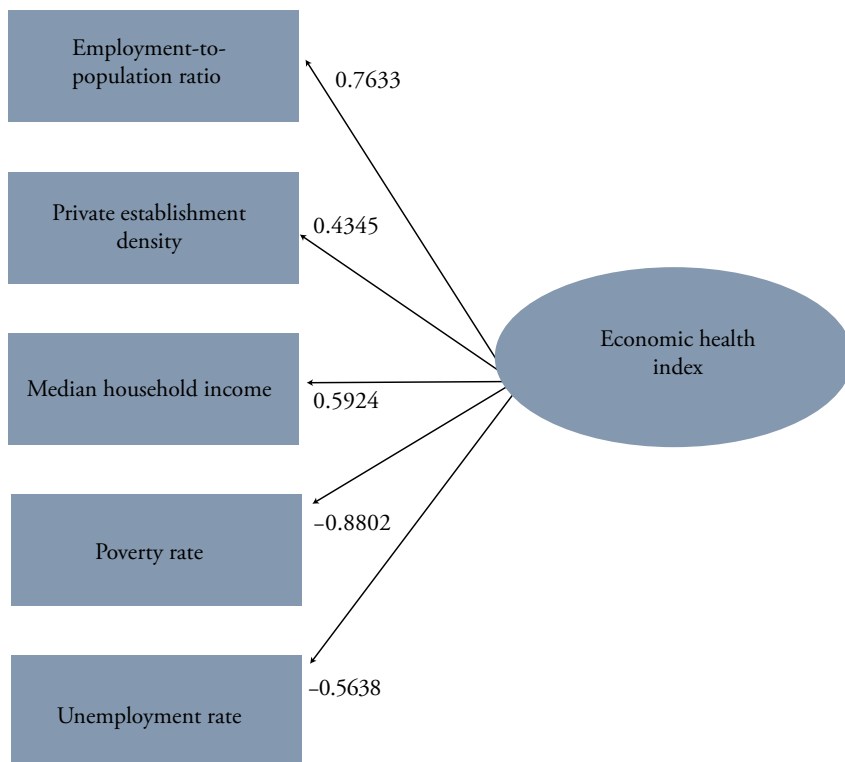
Table B-1
De Novo Period Sensitivity Analysis

	Three-year de novo period		
	Actual classification		
Predicted classification	Established	De novo	Total
Established	72,753	403	73,156
De novo	544	1,353	1,897
Total	73,297	1,756	75,053
	Five-year de novo period		
	Actual classification		
Predicted classification	Established	De novo	Total
Established	70,550	1,504	72,054
De novo	882	2,117	2,999
Total	71,432	3,621	75,053
	Seven-year de novo period		
	Actual classification		
Predicted classification	Established	De novo	Total
Established	68,389	2,617	71,006
De novo	1,332	2,715	4,047
Total	69,721	5,332	75,053

Appendix C

### Economic Health Index Variable

The economic health index variable is a latent construct produced through factor analysis intended to track the economic well-being of U.S. counties over the timespan of our data. The approach was modeled after The Hamilton Project's Economic Vitality Index presented in Nunn, Parsons, and Shambaugh (2018). The index considers the employment-to-population ratio, private establishment density, median household income, poverty rate, and unemployment rate, which were obtained from the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. Figure C-1 shows the applicable factor loadings. Much like linear regression coefficients, variables with positive factor loadings have a positive correlation with economic health, while variables with negative factor loadings have a negative correlation with economic health. We limit variables incorporated in the construct to those that can capture small counties and that have a data history that spans the length of our study.

Chart C-1 shows the distribution of the economic health index variable. Resulting index values have been normalized to a mean of 0 and a standard deviation of 1 so that the average county in an average year over the time horizon will have an index value of 0. The 1st and 99th percentile values of the index are –2.70 and 2.13, respectively; however, minimum and maximum values range as low as –5.54 and as high as 5.30.

Figure C-1
Economic Health Index Factor Loadings

Employment-to-population ratio — 0.7633

Private establishment density — 0.4345

Median household income — 0.5924

Poverty rate — −0.8802

Unemployment rate — −0.5638

Economic health index

Sources: U.S. Census Bureau and U.S. Bureau of Labor Statistics.

Chart C-1
Distribution of Economic Health Index
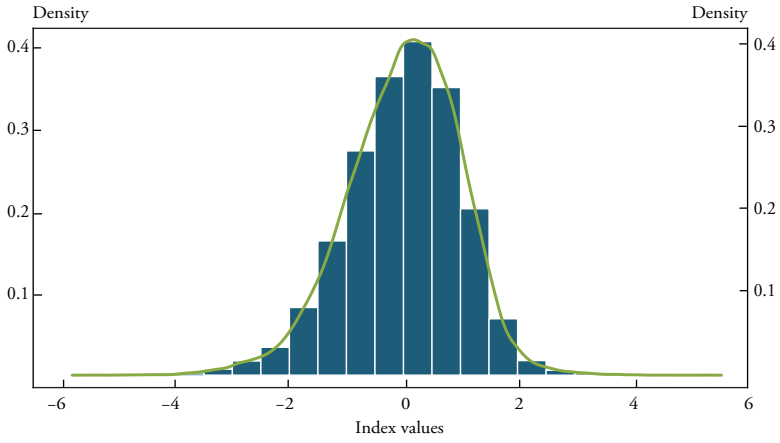
Source: Authors' calculations.

Endnotes

[1]Net interest margins (interest income minus interest expenses) are generally higher when the yield curve is steeper. However, net interest margins also increase or widen as interest rates rise, due primarily to the interest on earning assets rising faster than the interest rates paid on retail deposits, the primary liabilities for new and smaller banks.

[2]Only 18 new bank charters were issued from 2010 through 2015 and only 32 were issued from 2016 through 2020. The process for chartering a bank may take over a year to complete (Board of Governors of the Federal Reserve System 2013). Therefore, there may be some delay before increased profit opportunities in banking translate into new charters.

[3]Substantive changes included final rules and federal programs of the FDIC, Board of Governors of the Federal Reserve System, Office of the Comptroller of the Currency, Consumer Financial Protection Bureau, and the Department of the Treasury (FDIC 2020). The changes did not include accounting standards, tax laws, supervisory guidance, statements of policy, and state laws or regulations.

[4]Wholesale funds include brokered deposits, federal funds purchased, Federal Home Loan Bank advances, and other borrowings. These deposits usually have higher interest rates than retail deposits (FDIC 2019).

[5]The OCC charters and supervises national banks. The FDIC administers the Deposit Insurance Fund and jointly supervises state nonmember banks with state banking agencies. The Federal Reserve is the nation's central bank: it acts as the federal government's bank, is responsible for monetary policy, and is supervisor of state member banks along with state banking agencies and bank holding companies.

[6]Banks that are not in satisfactory condition are subject to more intensive oversight. For example, the banking agencies may examine banks in weak condition as frequently as every six months.

[7]Probit regressions are especially suitable for estimating probabilities because they use a mathematical transformation that keeps the estimated probabilities in the range of zero to one (which is not the case with ordinary least squares regressions).

[8]CAMELS is a summary rating given to banks after a commercial bank examination and stands for Capital, Asset quality, Management, Earning, Liquidity, and Sensitivity to market risk.

[9]DeYoung (1999) finds that de novo bank financial performance lagged more established banks for up to 14 years. We also estimate parameters using banks four years and older as established banks. The resulting probability distributions are very similar to results reported here.

[10]The chart only includes banks 10 years of age or younger.

[11]Deposit national banks are special-purpose banks established by the FDIC to resolve failed banks that could not be sold to or merged with an existing bank.

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