The Performance of Internet-based Business Models: Evidence from the Banking Industry

汇报人：赵静艺

作者：

Robert DeYoung

Federal Reserve Bank of Chicago
University of Kansas School of Business
Capitol Federal Professor in Financial Institutions and Markets

Introduction

① Internet websites are playing a more central role in most companies' business plans. "Internet-only" business model in the banking industry.

② Nearly half of all U.S. banks and thrifts were operating transactional Internet websites at the beginning of 2002.

③ Dozen Internet-only banks and thrifts that started up between 1997 and 2001 ; 644 branching banks and thrifts that also started up between 1997 and 2001 are used as a performance benchmark.

④ Intuitive framework for analyzing the performance of start-up firms : *general experience effects ; general scale effects ; technology-based experience effects* and *technology-based scale effects*

⑤ Empirical analysis: quarterly time-series cross-section financial data

1.The Internet Banking Environment

① The strategic core of the click-and-mortar banking model is to route standardized, low-value-added transactions through the inexpensive Internet channel, while routing specialized, high value-added transactions through the more expensive branch channel.

② The strategic core of the Internet-only business model is to reduce overhead expenses by completely eliminating the physical branch channel.

③ Internet website can impact a bank's production function and alter its product mix. Internet-only banks are poorly suited for "relationship lending" and are better suited for "transactions lending". Low ratio variable costs-to-fixed costs, Internet-only banks may have access to greater scale economies than traditional branching banks.

④ Most Internet-only banking franchises in the U.S. have struggled for profitability.

⑤ Government regulators have increasingly paid close attention to Internet-only banks, because these banks tend to be young, tend to grow rapidly, and tend to have lower than average earnings.

2. Relevant Literature

- 2a. Learning and Experience Effects
- 2b. Bank Scale Economies
- 2c. Internet Banking

2a. Learning and Experience Effects

① Asher (1956), Arrow (1962), Alchian (1963), Hartley and Corcoran (1978) and others developed the idea of experience effects.

② Ghemawat (1985) found that a doubling of experience was typically associated with between a 10% to 25% decline in unit costs.

③ Griliches (1979), accumulated production/accumulated time.

2b. Bank Scale Economies

① Gilbert 1984; Clark 1988; Humphrey 1990; Evanoff and Israilevich 1991; Berger,Hunter, and Timme 1993; Berger, Demsetz, and Strahan 1999, the current debate focuses on whether the very largest banks enjoy increasing returns to scale.

② Hughes, Lang, Mester, and Moon 2001, attempt to find that scale economies exist for even the largest banks.

③ Rossi (1998) found that mortgage banks (which rely heavily on automated lending technologies) have access to much larger scale economies.

2c. Internet Banking

① Lang, and Nolle (2002); Courchane, Nickerson, and Sullivan(2002):which banks are more likely to offer Internet banking/adopt new technology.

② Three previous studies have examined the financial performance of Internet banks:Sullivan (2000); Furst, Lang, and Nolle (2002); DeYoung (2001).

3. Experience effects and scale effects

3a.general experience effects & general scale effects

3b.technology-based experience effects & technology-based scale effects

3a.general experience effects & general scale effects

① common to all newly chartered banks, regardless of their business Models

② *General experience effects* occur as a new bank ages. Improving financial performance through learning-based improvements in pricing, marketing, cost control, risk management, employee relations, competitive strategy, etc.

③ *General scale effects* occur as a new bank grows larger. lower per unit costs, revenue efficiencies as a new bank gains access to new product markets.

④ Age and size are positively correlated at young banks, experience effects and scale effects are unavoidably intertwined.

3b.technology-based experience effects & technology-based scale effects

① only at start-up banks with business models based on new or nontraditional technologies: in this study, newly chartered Internet-only banks.

② *Technology-based experience effects* occur as a new Internet-only bank ages If technology-based experience effects exist, they are additive to general experience effects.

③ Similarly, Internet-only banks may experience *technology-based scale effects* that are additive to general scale effects.

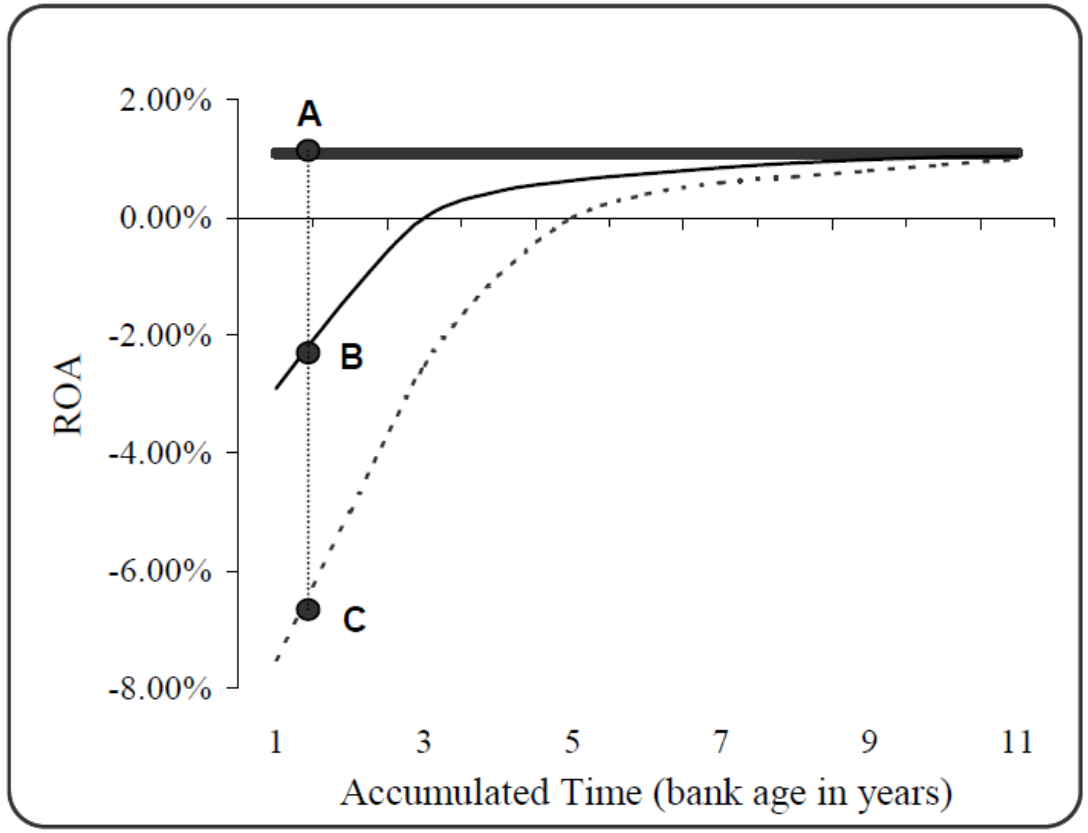
the slope of the performance time path for branching banks (i.e., general experience effects);

the relative slopes of the two performance time paths(i.e.,technology-based experience effects).

assets on the horizontal axis,general scale effects.

Figure 1

Hypothetical Time Paths for Return-on-Assets (ROA) at Newly-chartered Banks.



The thick solid line :the average ROA for small established banks.

The thin solid line is a time path for ROA at newly chartered branching banks.

The dashed line is an hypothetical time path for ROA at newly chartered Internet-only banks.

4. The Data

① The Internet-only sample: 12 banks and thrifts newly chartered in the U.S. between 1997 and 2000.The benchmark performance sample: 644 banks and thrifts newly chartered in the U.S. between 1997 and 2000. Both of these samples are quarterly data panels.

② The combined data set is an unbalanced panel of 4,742 quarterly observations of 656 banks and thrifts observed over a 17-quarter window from 1997:Q2 through 2001:Q2.

③ Bank age (*AGE*) is set equal to 1 at the end of each bank's first full quarter of operations, banks are included in the sample only up to their 10th full quarter of operation.

④ 3 of the 12 banks in the Internet-only sample banks ceased to exist as Internet-only banks. A fourth abandoned the Internet-only strategy in late 2000.

5. Initial Analysis of the Data

- 5a. Branching start-ups [2] relative to small established banks [1]
- 5b. Internet-only start-ups [3] relative to branching start-ups [2]
- 5c. “Surviving” Internet-only start-ups [4] relative to branching start-ups [2]
- 5d. Preliminary evidence of experience effects and scale effects

endogenous variables (18 financial performance ratios)

Table 2
Summary Statistics for Quarterly Data, 1997:Q2–2001:Q2.

	[1] Established Banks N=48,146, K=3,777		[2] Benchmark Banks N=4667, K=644		[3] Internet-Only Banks (full sample) N=75, K=12		[4] Internet-Only Banks (survivor sample) N=49, K=8	
Dependent Variables in Regressions								
	Mean	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Mean**	**Std Dev**
ROA	0.0109	0.0098	-0.0134 ***	0.0269	-0.0431 ***	0.0469	-0.0240	0.0347
ROE	0.1187	0.0967	-0.0467 ***	0.1234	-0.1842 ***	0.2014	-0.1111 ***	0.1599
SPREAD	0.0548	0.0140	0.0424 ***	0.0163	0.0178 ***	0.0178	0.0125 ***	0.0170
LOANRATE	0.0906	0.0115	0.0807 ***	0.0159	0.0629 ***	0.0181	0.0586 ***	0.0174
DEPRATE	0.0358	0.0081	0.0383 ***	0.0101	0.0451 ***	0.0123	0.0461 ***	0.0121
LOANS	0.6141	0.1460	0.5740 ***	0.1927	0.4718 *	0.2574	0.5594	0.2511
DEPOSITS	0.8450	0.0843	0.7750 ***	0.1301	0.6958 *	0.1620	0.7124	0.1739
FEES	0.0108	0.0157	0.0071 ***	0.0169	0.0035	0.0035	0.0031	0.0036
NIEXP	0.0349	0.0193	0.0520 ***	0.0323	0.0801 ***	0.0663	0.0530	0.0461
LABOREXP	0.0181	0.0096	0.0259 ***	0.0161	0.0293	0.0253	0.0219	0.0250
FTES	0.0004	0.0002	0.0005 ***	0.0003	0.0004	0.0003	0.0003 **	0.0003
WAGE ($1,000)	$43.54	$13.41	$54.87 ***	$16.83	$73.05 ***	$19.56	$70.90 ***	$15.17
PREMEXP	0.0053	0.0031	0.0085 ***	0.0060	0.0134 ***	0.0130	0.0089	0.0107
OTHEREXP	0.0029	0.0029	0.0044 ***	0.0042	0.0091 ***	0.0094	0.0055	0.0048
OVERHEAD	0.0198	0.0133	0.0356 ***	0.0300	0.0213	0.0245	0.0143	0.0238
EQUITY	0.0979	0.0408	0.1909 ***	0.1232	0.2329	0.1549	0.2144	0.1575
GROWTH	0.0426	0.3927	0.5339 ***	0.8371	1.0539 ***	1.5525	1.2357 ***	1.7416
BADLOANS	0.0096	0.0116	0.0017 ***	0.0067	0.0028	0.0085	0.0007	0.0016

exogenous regression variables & some additional descriptive variables

	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
AGE (quarters)	244.24	150.58	4.81 ***	2.75	4.29	2.72	4.37	2.83
ASSETS ($1,000)	$192,039	$193,254	$48,668 ***	$48,610	$221,661 ***	$256,278	$251,724 ***	$297,884
%REALESTATE	0.6580	0.1918	0.6245 ***	0.2100	0.7511 **	0.2210	0.8130 ***	0.1768
%BUSINESS	0.1994	0.1475	0.2744 ***	0.1803	0.0654 ***	0.0941	0.0415 ***	0.0582
%CONSUMER	0.1284	0.1217	0.0890 ***	0.1148	0.1408	0.1552	0.0927	0.1086
%CREDITCARD	0.0053	0.0136	0.0048 **	0.0164	0.0427 ***	0.0652	0.0140	0.0227
ALLOWANCE	0.0080	0.0045	0.0065 ***	0.0035	0.0033 ***	0.0032	0.0042 **	0.0033
MBHC	0.2413	0.4279	0.1727 ***	0.3780	0.0533	0.2262	0.0000	0.0000
THRIFT	0.1152	0.3193	0.0812 **	0.2732	0.6267 ***	0.4869	0.6122 ***	0.4923
OCC	0.2657	0.4417	0.2008 ***	0.4006	0.0667	0.2511	0.0000	0.0000
JOBGROWTH	0.0055	0.0039	0.0052 ***	0.0043	0.0180 ***	0.0076	0.0186 ***	0.0076

Definitions:

1.ROA = return on assets (annualized). 2.ROE = return on book equity (annualized).
3.SPREAD = LOANRATE - DEPRATE.
4.LOANRATE = interest and fees received on loans divided by total loans (annualized).
5.DEPRATE = interest paid on deposits divided by total deposits (annualized).
6.LOANS = total loans divided by total assets.
7.DEPOSITS = total deposits divided by total assets.
8.FEES = noninterest income divided by total assets (annualized).
9.NIEXP = total noninterest expense divided by total assets (annualized).
10.LABOREXP = salary and benefits expense divided by total assets (annualized).
11.FTES = number of full-time equivalent employees divided by total assets.
12.WAGE = salary and benefits expense divided by FTES (annualized).
13.PREMEXP = expense on premises and equipment divided by total assets (annualized).
14.OTHEREXP = all "other" (i.e., non-labor and non-premises) noninterest expenses divided by total assets (annualized).
15.OVERHEAD = book value of physical assets divided by total assets.
16.EQUITY = book value of equity divided by total assets.
17.GROWTH = asset growth rate (annualized).
18.BADLOANS = nonperforming loans divided by total assets.

1.AGE = number of full calendar quarters since the bank's ledger was opened.
2.ASSETS = total assets.
3.%REALESTATE = real estate loans divided by total loans.
4.%BUSINESS = commercial and industrial loans divided by total loans.
5.%CONSUMER = consumer loans divided by total loans.
6.%CREDITCARDS = credit card loans divided by total loans.
7.ALLOWANCE = allowance for loan and lease losses divided by total assets.
8.MBHC = 1 if bank is an affiliate in a multibank holding company; = 0 otherwise.
9.OCC = 1 if bank holds a national bank charter; = 0 otherwise.
10.THRIFT = 1 if bank holds a thrift charter; = 0 otherwise.
11.JOBGROWTH = growth rate of total employment in the bank's home state (annualized)

5a. Branching start-ups [2] relative to small established banks [1]

Table 2
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5b. Internet-only start-ups [3] relative to branching start-ups [2]

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5c. "Surviving" Internet-only start-ups [4] relative to branching start-ups [2]

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5d. Preliminary evidence of experience effects and scale effects

The thick solid line: median ROA for small established banks over 1997:Q2 to 2001:Q2.

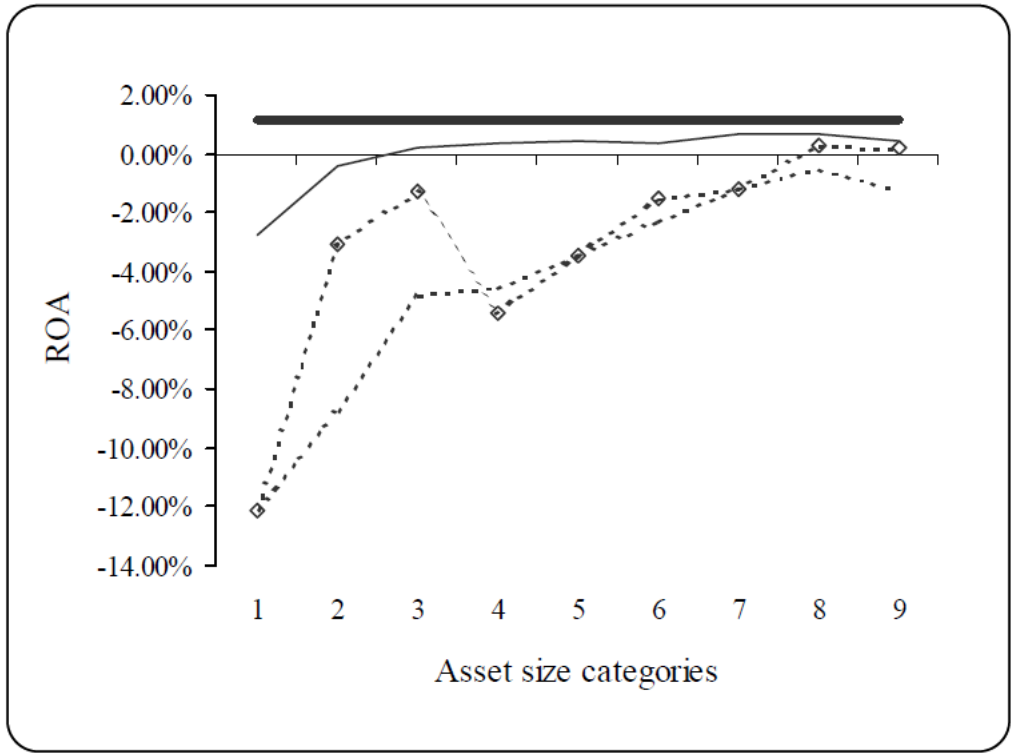
The thin solid: median quarterly ROA for the newly chartered branching bank sample.

The dashed line with diamonds: median quarterly ROA for the newly chartered Internet-only survivor bank sample.

The dashed line without diamonds: median quarterly ROA for the newly chartered Internet-only bank sample.

Figure 3
Size Paths for Return on Assets (ROA).

Quarterly data drawn from 1997:Q2–2001:Q2. All ROA numbers are annualized. Additional summary statistics for the four samples of banks are displayed in Table 2. The break points between the nine asset size categories are $25 million, $50 million, $75 million, $100 million, $150 million, $200 million, $250 million, and $300 million.



6. Regression Framework

6a. A *static regression analysis tests* for the existence and magnitude of cross-sectional financial performance gaps between the Internet-only start-up banks and the branching start-up banks.

6b. A *dynamic regression analysis tests* for the existence of general and technology-based experience and scale effects.

6a. *static regression analysis tests*

$$PERFORMANCE_{i,t} = \alpha + \beta * INTERNET_i + \delta * \ln AGE_{i,t} + \lambda * \ln ASSETS_{i,t} + \theta_1 * \%BUSINESS_{i,t} + \theta_2 * \%REALESTATE_{i,t} + \theta_3 * LOANS_i + \theta_4 * ALLOWANCE_{i,t} + \theta_5 * MBHC_i + \theta_6 * THRIFT_i + \theta_7 * OCC_i + \theta_8 * JOBGROWTH_{i,t} + \theta_9 * YEAR_t + \theta_{10} * QUARTER_t + \varepsilon_{i,t} \quad (1)$$

$$PERFORMANCE_{i,t} = \alpha + \sum_{j=1}^{12} \beta_j * INTERNET_{ij} + \delta * \ln AGE_{i,t} + \lambda * \ln ASSETS_{i,t} + \theta_1 * \%BUSINESS_{i,t} + \theta_2 * \%REALESTATE_{i,t} + \theta_3 * LOANS_i + \theta_4 * ALLOWANCE_{i,t} + \theta_5 * MBHC_i + \theta_6 * THRIFT_i + \theta_7 * OCC_i + \theta_8 * JOBGROWTH_{i,t} + \theta_9 * YEAR_t + \theta_{10} * QUARTER_t + \varepsilon_{i,t} \quad (2)$$

PERFORMANCE can be any one of the 18 financial performance ratios, *AGE* and *ASSETS* are control variables.
The subscript *i* indexes bank-level observations, and the subscript *t* indexes time in quarters.
INTERNET is a dummy variable equal to 1 for Internet-only start-up banks, and the coefficient β provides the main static test.

6b. *dynamic regression analysis tests*

$$PERFORMANCE_{i,t} = \alpha + \beta*INTERNET_i + \delta*\ln AGE_{i,t} + \lambda*\ln ASSETS_{i,t}$$
$$+ \gamma*INTERNET_i*\ln AGE_{i,t} + \eta*INTERNET_i*\ln ASSETS_{i,t}$$
$$+ \theta_1*\%BUSINESS_{i,t} + \theta_2*\%REALESTATE_{i,t}$$
$$+ \theta_3*LOANS_i + \theta_4*ALLOWANCE_{i,t}$$
$$+ \theta_5*MBHC_i + \theta_6*THRIFT_i + \theta_7*OCC_i + \theta_8*JOBGROWTH_{i,t}$$
$$+ \theta_9*YEAR_t + \theta_{10}*QUARTER_t + \varepsilon_{i,t} \quad (3)$$

δ gives the slope of the performance time path for branching start-ups (general experience effects);
δ + γ gives the slope of the performance time path for Internet-only start-ups (general experience effects plus technology-based experience effects);
γ indicates the importance of any technology-based experience effects.
Similarly, λ : general scale effects;
λ + η: general scale effects plus technology-based scale effects;
η: the importance of any technology-based scale effects.

7. Regression Results

7a. Static tests of performance

7b. Dynamic tests of performance

7a. Static tests of performance

The estimated values of β from 180 separate regressions of equation (1). 18 different dependent variables (listed in the first column of Table 3), 2 different Internet-only banking data samples (the full sample of 12 banks and the survivor sample of 8 banks), 5 different estimation procedures (OLS and four random effects approaches).

The last column in Table 3 displays the simple average for the five estimated values of β in each row.

Table 3

Estimates of β from 180 separate regressions of equation (1).

Dependent Variable	Data Set	OLS	Random Effects Models				Average
			Model 1	Model 2	Model 3	Model 4	
ROA	full	-0.0399 ***	-0.0423 ***	-0.0468 ***	-0.0474 ***	-0.0293 ***	-0.0411
	survivors	-0.0251 ***	-0.0312 ***	-0.0319 ***	-0.0339 ***	-0.0163 ***	-0.0277
ROE	full	-0.1904 ***	-0.1960 ***	-0.1960 ***	-0.2004 ***	-0.1929 ***	-0.1951
	survivors	-0.1317 ***	-0.1520 ***	-0.1321 ***	-0.1351 ***	-0.1299 ***	-0.1362
SPREAD	full	-0.0187 ***	-0.0177 ***	-0.0162 ***	-0.0165 ***	-0.0169 ***	-0.0172
	survivors	-0.0245 ***	-0.0230 ***	-0.0204 ***	-0.0214 ***	-0.0210 ***	-0.0221
DEPRATE	full	0.0079 ***	0.0047 **	0.0061 ***	0.0057 **	0.0058 **	0.0060
	survivors	0.0068 ***	0.0051 *	0.0059 **	0.0055 **	0.0059 **	0.0058
LOANRATE	full	-0.0121 ***	-0.0124 ***	-0.0111 ***	-0.0112 ***	-0.0099 ***	-0.0113
	survivors	-0.0177 ***	-0.0174 ***	-0.0160 ***	-0.0162 ***	-0.0145 ***	-0.0164
DEPOSITS	full	-0.0854 ***	-0.1317 ***	-0.1474 ***	-0.1473 ***	-0.1667 ***	-0.1357
	survivors	-0.0878 ***	-0.1357 ***	-0.1608 ***	-0.1637 ***	-0.1648 ***	-0.1426
LOANS	full	-0.0699 ***	-0.0261	0.0726	0.0702	0.0941 **	0.0282
	survivors	-0.0081	0.0364	0.1436 ***	0.1410 ***	0.1897 ***	0.1005
FEES	full	-0.0092 ***	-0.0051	-0.0057	-0.0058	-0.0027	-0.0057
	survivors	-0.0098 ***	-0.0056	-0.0059	-0.0061	-0.0024	-0.0060
NIEXP	full	0.0336 ***	0.0500 ***	0.0576 ***	0.0569 ***	0.0370 ***	0.0470
	survivors	0.0118 ***	0.0363 ***	0.0399 ***	0.0420 ***	0.0305 ***	0.0321
PREMEXP	full	0.0067 ***	0.0088 ***	0.0091 ***	0.0095 ***	0.0091 ***	0.0086
	survivors	0.0029 ***	0.0068 ***	0.0064 ***	0.0073 ***	0.0046 ***	0.0056
LABOREXP	full	0.0084 ***	0.0189 ***	0.0212 ***	0.0216 ***	0.0143 ***	0.0169
	survivors	0.0025	0.0166 ***	0.0179 ***	0.0189 ***	0.0109 **	0.0134
OTHEREXP	full	0.0042 ***	0.0048 ***	0.0053 ***	0.0051 ***	0.0025 ***	0.0044
	survivors	0.0015 **	0.0026 **	0.0027 ***	0.0028 **	0.0019 **	0.0023
FTES	full	0.00007 **	0.00025 ***	0.00029 ***	0.00028 ***	0.00024 ***	0.00023
	survivors	0.00000	0.00024 ***	0.00029 ***	0.00029 ***	0.00027 **	0.00022
WAGE	full	8.9940 ***	12.7257 ***	12.3029 ***	12.9293 ***	12.3018 ***	11.8507
	survivors	8.1357 ***	11.2089 **	10.8547 **	11.4685 **	9.3700 *	10.2076
GROWTH	full	0.3347 ***	0.2464 **	0.2984 ***	0.2531 **	0.0915	0.2448
	survivors	0.6585 ***	0.6858 ***	0.6550 ***	0.7835 ***	0.5307 **	0.6627
EQUITY	full	0.0840 ***	0.1550 ***	0.1828 ***	0.1866 ***	0.1468 ***	0.1510
	survivors	0.0854 ***	0.1652 ***	0.2078 ***	0.2212 ***	0.1719 ***	0.1703
OVERHEAD	full	0.00101	0.01744 **	0.02498 ***	0.02556 ***	0.02382 ***	0.01856
	survivors	-0.00240	0.02010 **	0.02810 ***	0.02840 ***	0.02900 ***	0.02064
BADLOANS	full	0.0009	0.0000	0.0009	0.0008	-0.0015	0.0002
	survivors	-0.0013	-0.0024	-0.0018	-0.0018	-0.0016	-0.0018

7a. Static tests of performance

The estimated vectors of βj coefficients from 90 separate regressions of equation (2).

These results demonstrate that the estimated performance gaps reported in Table 3 for the average Internet-only start-up are not being driven by a few poorly performing outliers.

Only one of the results from equation (1) was driven by outliers: there is no evidence in Table 4 that the growth rates (*GROWTH*) of the Internet-only start-ups differed systematically from the growth rates of the branching start-up banks.

Table 4

Summary of estimates of $\sum_{j=1}^{12} \beta_j$ from 90 separate regressions of equation (2).

Dependent Variable		OLS	Random Effects Models			
			Model 1	Model 2	Model 3	Model 4
ROA	# positive and significant	0	0	0	0	0
	# negative and significant	9	8	8	8	6
	most frequent sign	12 neg ***	12 neg ***	12 neg ***	12 neg ***	11 neg ***
ROE	# positive and significant	0	0	0	0	0
	# negative and significant	9	8	8	7	7
	most frequent sign	12 neg ***	11 neg ***	12 neg ***	12 neg ***	12 neg ***
SPREAD	# positive and significant	0	0	0	0	0
	# negative and significant	10	3	3	3	5
	most frequent sign	11 neg ***	11 neg ***	11 neg ***	11 neg ***	10 neg ***
DEPRATE	# positive and significant	7	2	2	2	2
	# negative and significant	0	0	0	0	1
	most frequent sign	10 pos ***	8 pos *	10 pos ***	10 pos ***	10 pos ***
LOANRATE	# positive and significant	0	0	0	0	0
	# negative and significant	7	4	4	4	4
	most frequent sign	10 neg ***	9 neg **	9 neg **	9 neg **	10 neg ***
DEPOSITS	# positive and significant	1	0	0	0	0
	# negative and significant	7	3	3	5	6
	most frequent sign	10 neg ***	10 neg ***	10 neg ***	10 neg ***	10 neg ***
LOANS	# positive and significant	3	1	2	2	4
	# negative and significant	5	3	1	1	2
	most frequent sign	7 neg	7 neg	8 pos *	8 pos *	9 pos **
FEES	# positive and significant	0	0	0	0	0
	# negative and significant	4	0	0	0	0
	most frequent sign	11 neg ***	11 neg ***	11 neg ***	11 neg ***	10 neg ***
NIEXP	# positive and significant	6	6	8	8	7
	# negative and significant	1	0	0	0	0
	most frequent sign	9 pos **	11 pos ***	11 pos ***	11 pos ***	10 pos ***
PREMEXP	# positive and significant	5	3	5	5	3
	# negative and significant	1	0	0	0	0
	most frequent sign	10 pos ***	10 pos ***	10 pos ***	10 pos ***	10 pos ***
LABOREXP	# positive and significant	4	4	3	3	2
	# negative and significant	1	0	0	0	0
	most frequent sign	7 pos	11 pos ***	11 pos ***	11 pos ***	10 pos ***
OTHEREXP	# positive and significant	5	4	4	4	3
	# negative and significant	0	0	0	0	0
	most frequent sign	8 pos *	11 pos ***	10 pos ***	10 pos ***	9 pos **
FTES	# positive and significant	3	2	4	4	2
	# negative and significant	1	0	0	0	0
	most frequent sign	8 pos *	11 pos ***	11 pos ***	11 pos ***	10 pos ***
WAGE	# positive and significant	6	2	2	2	2
	# negative and significant	0	0	0	0	0
	most frequent sign	8 pos *	9 pos **	8 pos *	9 pos **	8 pos *
GROWTH	# positive and significant	4	4	4	3	2
	# negative and significant	2	3	3	3	1
	most frequent sign	6 pos	6 pos	6 pos	6 pos	7 neg
EQUITY	# positive and significant	6	6	6	5	4
	# negative and significant	2	0	0	0	0
	most frequent sign	9 pos **	10 pos ***	10 pos ***	11 pos ***	10 pos ***
OVERHEAD	# positive and significant	2	2	2	4	3
	# negative and significant	3	0	0	0	0
	most frequent sign	7 neg	8 pos *	9 pos **	9 pos **	11 pos ***
BADLOANS	# positive and significant	1	1	1	1	0
	# negative and significant	1	0	0	0	0
	most frequent sign	7 neg	9 neg **	8 neg *	8 neg *	11 neg ***

7a. Static tests of performance

General experience effects & General scale effects : There is strong evidence of general experience effects in the data.

Technology-based experience effects : There is little evidence of technology-based experience effects in the data.

Technology-based scale effect : There is somewhat stronger evidence of technology-based scale effects in the data, especially among the "survivor" Internet-only start-ups.

Table 5

Estimated coefficients for the terms δ*ln$AGE_{i,t}$ (general experience effects), λ*ln$ASSETS_{i,t}$ (general scale effects), γ*$INTERNET_i$*ln$AGE_{i,t}$ (technology-based experience effects), and η*$INTERNET_i$*ln$ASSETS_{i,t}$ (technology-based scale effects) from 90 regressions of equation (3) for the full data set.

Dependent Variable		OLS	Random Effects Models				Average
			Model 1	Model 2	Model 3	Model 4	
ROA	lnAGE	0.0139 ***	0.0122 ***	0.0147 ***	0.0146 ***	0.0159 ***	0.0143
	lnAGE*INB	-0.0040	-0.0062	-0.0080	-0.0079	-0.0007	-0.0053
	lnASSETS	0.0111 ***	0.0160 ***	0.0150 ***	0.0160 ***	0.0087 ***	0.0134
	lnASSETS*INB	0.0027	0.0064	0.0082 *	0.0089 *	0.0050	0.0062
ROE	lnAGE	0.0489 ***	0.0447 ***	0.0465 ***	0.0470 ***	0.0493 ***	0.0473
	lnAGE*INB	0.0268	0.0141	0.0068	0.0118	0.0120	0.0143
	lnASSETS	0.0419 ***	0.0438 ***	0.0414 ***	0.0408 ***	0.0382 ***	0.0412
	lnASSETS*INB	-0.0462 ***	-0.0449 **	-0.0350	-0.0365	-0.0325	-0.0390
SPREAD	lnAGE	0.0073 ***	0.0082 ***	0.0099 ***	0.0093 ***	0.0104 ***	0.0090
	lnAGE*INB	0.0020	-0.0022	0.0000	0.0004	-0.0002	0.0000
	lnASSETS	-0.0022 ***	-0.0015 **	-0.0007	-0.0011	-0.0012 *	-0.0013
	lnASSETS*INB	-0.0007	0.0009	-0.0011	-0.0020	-0.0004	-0.0007
DEPRATE	lnAGE	0.0023 ***	0.0037 ***	0.0038 ***	0.0040 ***	0.0038 ***	0.0035
	lnAGE*INB	-0.0023	0.0041 **	-0.0008	0.0000	-0.0002	0.0001
	lnASSETS	0.0011 ***	0.0022 ***	-0.0007 *	0.0002	0.0000	0.0006
	lnASSETS*INB	0.0043 ***	-0.0018	0.0062 ***	0.0054 ***	0.0050 ***	0.0038
LOANRATE	lnAGE	0.0096 ***	0.0112 ***	0.0117 ***	0.0121 ***	0.0120 ***	0.0113
	lnAGE*INB	-0.0003	0.0011	-0.0007	0.0010	0.0018	0.0006
	lnASSETS	-0.0011 ***	0.0002	-0.0007	-0.0003	-0.0013 **	-0.0006
	lnASSETS*INB	0.0036 **	0.0004	0.0041	0.0019	0.0007	0.0021
DEPOSITS	lnAGE	0.0614 ***	0.0528 ***	0.0657 ***	0.0660 ***	0.0772 ***	0.0646
	lnAGE*INB	-0.0697 ***	-0.0904 ***	-0.0090	-0.0020	0.0398	-0.0262
	lnASSETS	0.0511 ***	0.1188 ***	0.1201 ***	0.1189 ***	0.0794 ***	0.0977
	lnASSETS*INB	-0.0014	0.0023	-0.0606 ***	-0.0649 ***	-0.1356 ***	-0.0520
LOANS	lnAGE	0.0742 ***	0.1034 ***	0.1254 ***	0.1254 ***	0.1325 ***	0.1122
	lnAGE*INB	-0.0012	0.0459 *	0.0672 **	0.0679 **	0.0531	0.0466
	lnASSETS	0.0176 ***	-0.0006	-0.0540 ***	-0.0539 ***	-0.0681 ***	-0.0318
	lnASSETS*INB	-0.0132	-0.0254	-0.0613 **	-0.0613 **	-0.0161	-0.0355
FEES	lnAGE	0.0009 **	0.0008 *	0.0009	0.0009 *	0.0012 **	0.0009
	lnAGE*INB	-0.0004	-0.0012	0.0007	0.0001	-0.0011	-0.0004
	lnASSETS	0.0009 **	0.0001	0.0001	0.0003	-0.0008 *	0.0001
	lnASSETS*INB	-0.0017	0.0006	-0.0018	-0.0011	0.0009	-0.0006

7a. Static tests of performance

General experience effects & General scale effects : There is strong evidence of general experience effects in the data.

Technology-based experience effects : There is little evidence of technology-based experience effects in the data.

Technology-based scale effect : There is somewhat stronger evidence of technology-based scale effects in the data, especially among the "survivor" Internet-only start-ups.

Table 6

Estimated coefficients for the terms δ*ln$AGE_{i,t}$ (general experience effects), λ*ln$ASSETS_{i,t}$ (general scale effects), γ*$INTERNET_i$*ln$AGE_{i,t}$ (technology-based experience effects), and η*$INTERNET_i$*ln$ASSETS_{i,t}$ (technology-based scale effects) from 90 regressions of equation (3) for the survivor data set.

Dependent Variable		OLS	Random Effects Models				Average
			Model 1	Model 2	Model 3	Model 4	
ROA	lnAGE	0.0140 ***	0.0122 ***	0.0148 ***	0.0147 ***	0.0154 ***	0.0142
	lnAGE*INB	-0.0019	-0.0059	-0.0073	-0.0082	0.0017	-0.0043
	lnASS	0.0112 ***	0.0160 ***	0.0150 ***	0.0159 ***	0.0082 ***	0.0133
	lnASS*INB	0.0076 **	0.0073	0.0116 **	0.0126 **	0.0012	0.0081
ROE	lnAGE	0.0495 ***	0.0449 ***	0.0469 ***	0.0473 ***	0.0495 ***	0.0476
	lnAGE*INB	0.0335	0.0236	0.0111	0.0164	0.0174	0.0204
	lnASS	0.0421 ***	0.0438 ***	0.0415 ***	0.0403 ***	0.0379 ***	0.0411
	lnASS*INB	-0.0168	-0.0443 *	-0.0171	-0.0256	-0.0247	-0.0257
SPREAD	lnAGE	0.0072 ***	0.0081 ***	0.0099 ***	0.0093 ***	0.0104 ***	0.0090
	lnAGE*INB	0.0013	-0.0010	-0.0006	0.0005	-0.0021	-0.0004
	lnASS	-0.0022 ***	-0.0015 **	-0.0007	-0.0011	-0.0012 *	-0.0013
	lnASS*INB	0.0019	0.0014	0.0008	-0.0004	0.0032	0.0014
DEPRATE	lnAGE	0.0023 ***	0.0038 ***	0.0038 ***	0.0041 ***	0.0038 ***	0.0035
	lnAGE*INB	-0.0041 **	0.0014	-0.0041	-0.0030	-0.0037	-0.0027
	lnASS	0.0012 ***	0.0022 ***	-0.0007 **	0.0002	0.0000	0.0006
	lnASS*INB	0.0044 ***	-0.0007	0.0071 ***	0.0064 ***	0.0058 ***	0.0046
LOANRATE	lnAGE	0.0095 ***	0.0111 ***	0.0116 ***	0.0120 ***	0.0120 ***	0.0112
	lnAGE*INB	-0.0028	-0.0010	-0.0042	-0.0021	-0.0046	-0.0029
	lnASS	-0.0011 ***	0.0002	-0.0007	-0.0003	-0.0013 **	-0.0006
	lnASS*INB	0.0063 ***	0.0024	0.0068 **	0.0046	0.0059 *	0.0052
DEPOSITS	lnAGE	0.0612 ***	0.0528 ***	0.0665 ***	0.0667 ***	0.0780 ***	0.0650
	lnAGE*INB	-0.0677 ***	-0.0637 **	0.0332	0.0439 *	0.0799 **	0.0051
	lnASS	0.0511 ***	0.1197 ***	0.1208 ***	0.1197 ***	0.0787 ***	0.0980
	lnASS*INB	-0.0090	-0.0163	-0.0738 ***	-0.0788 ***	-0.1553 ***	-0.0666
LOANS	lnAGE	0.0745 ***	0.1039 ***	0.1255 ***	0.1253 ***	0.1323 ***	0.1123
	lnAGE*INB	0.0302	0.0962 ***	0.1406 ***	0.1420 ***	0.1207 ***	0.1059
	lnASS	0.0174 ***	-0.0005	-0.0536 ***	-0.0533 ***	-0.0673 ***	-0.0315
	lnASS*INB	-0.0444	-0.0554 **	-0.0889 ***	-0.0903 ***	-0.0483	-0.0655
FEES	lnAGE	0.0009 **	0.0008 *	0.0009	0.0009 *	0.0012 **	0.0010
	lnAGE*INB	-0.0003	-0.0013	0.0000	-0.0002	-0.0013	-0.0006
	lnASS	0.0009 **	0.0001	0.0001	0.0003	-0.0008 *	0.0001
	lnASS*INB	-0.0010	0.0009	-0.0008	-0.0005	0.0015	0.0000

8. Conclusions

① As the Internet becomes more important for commerce, Internet websites become a more integral part of companies' business plans.

② There is strong evidence of general experience effects that are available to all new start-ups, but there is little evidence that technology-based learning accelerates the financial performance of Internet-only start-ups.On the other hand, there is evidence that increased scale yields a differentially greater improvement in financial performance for Internet-only start-ups relative to branching bank start-ups.

③ To date, most Internet-only banks and thrifts have struggled for profitability, and a substantial percentage of the firms that have tried this business model have abandoned it.

④ Internet-only banking model is potentially viable under current conditions, if they do exist in the future their market share is likely to be limited.

THANKS!