

Supplementary Online Appendix to

Product and Geographic Market Diversification in U.S. Banking*

JINGFANG ZHANG¹

VALENTINA HARTARSKA¹

EMIR MALIKOV²

¹Auburn University

²University of Nevada, Las Vegas

November 9, 2020

Abstract

Prior literature either estimates economies of product diversification or evaluates the effects of market expansion on bank performance, but few studies look at the intersection of product and geographic diversification. We examine if the market expansion opportunities resulting from deregulation helped improve diversification/scope economies exhibited by banks. We leverage spatiotemporal variation in the implementation of deregulation laws across states to identify this relationship using a difference-in-differences framework. We find that the inter/intrastate deregulation accounts for a modest but statistically significant decrease in diversification diseconomies, and these gains were long-lasting. The findings suggest that geographic and product diversification are complementary.

Keywords: banks, deregulation, market diversification, product diversification, scope economies

JEL Classification: G21, L25, D24

*Email: jzz0080@auburn.edu (Zhang), hartavm@auburn.edu (Hartarska) and emir.malikov@unlv.edu (Malikov).

A Data

Our data come from the Reports of Condition and Income (Call Reports). The sample covers all FDIC-insured banks during the 1977–2018 period. Most banks (75.26%) provide all five outputs (the “FD” type). The rest are partially specialized: 0.21% are of type PS_1 and do not offer commercial loans and 23.49% are the PS_2 -type banks that do not offer agricultural loans.¹ We omit the remaining banks that may have one other output not produced because they are very few. We also drop banks that have just one observation. The operationable sample consists of 379,921 bank-year observations.

Consistent with the “intermediation approach,” variable inputs are conventionally specified to include physical capital, borrowed funds and labor, with the respectively corresponding input prices w_1 , w_2 and w_3 . Price of fixed assets w_1 is defined as expenditures on fixed assets divided by premises and fixed assets. Price of labor w_2 is defined as salaries divided by full-time equivalent employees. Price of borrowed funds w_3 is defined as interest expenses on deposits and federal funds divided by the sum of total deposits and fed funds purchased. Operating costs C is the sum of interest expenses on deposits, interest expenses on fed funds, loan-loss provisions, expenditures on fixed assets and salaries. Along the lines of Hughes & Mester (1998), we include equity capital e as a quasi-fixed netput to proxy for the risk (or quality) of loans. The time variable is included to accommodate temporal shifts in the cost frontiers. All monetary volumes are deflated to the 2005 values using the consumer price index.

Table A.1 reports summary of the data. Evidently, banks offering different product mixes are also notably different in their characteristics, and it is reasonable to allow banks of different types to have heterogeneous production technologies (cost structures) which we accomplish by separately estimating bank-type-specific cost functions.² Table A.2 summarizes temporal and spatial variation in the two key deregulation variables; these data come from Koetter et al. (2012).

¹While the PS_1 category is the smallest of all, it still includes 810 observations allowing us to estimate the corresponding cost function with reasonable precision.

²In each case, the linear homogeneity in input prices is imposed using w_2 as a normalizing price.

Table A.1. Data Summary Statistics

Variable	1st Qu.	Median	Mean	3rd Qu.	1st Qu.	Median	Mean	3rd Qu.	1st Qu.	Median	Mean	3rd Qu.
	FD-type Banks				PS₁-type Banks				PS₂-type Banks			
C	2,012.15	3,914.25	22,685.32	8,117.22	770.68	1,332.09	1,999.17	2,184.78	3,547.64	6,711.99	18,061.51	13,951.17
y_0	8,904.73	19,150.14	80,224.58	41,561.31	3,266.16	6,725.42	11,344.58	12,166.26	9,876.39	24,770.88	82,299.27	60,861.44
y_1	2,238.45	5,160.74	35,156.12	12,156.93	989.73	2,140.25	5,284.45	4,590.73	2,172.56	5,838.74	43,349.49	14,936.98
y_2	6,704.14	18,277.23	116,541.80	51,483.13	1,363.83	3,951.12	9,405.85	9,067.55	17,268.14	44,870.25	156,782.70	118,549.80
y_3	626.25	2,423.82	6,890.93	6,609.46	652.94	1,656.14	2,574.97	3,554.44				
y_4	2,284.98	5,836.37	68,338.57	15,512.14					4,659.64	12,005.11	43,703.57	29,289.15
w_1	17.93	25.56	35.71	38.81	19.34	33.14	44.51	55.76	17.51	26.96	44.30	46.52
w_2	19.93	28.97	33.91	44.23	13.15	17.65	22.73	25.64	22.33	34.74	42.27	56.30
w_3	2.45	3.93	4.03	5.71	3.50	4.58	4.71	6.02	1.91	3.47	3.53	5.05
e	3,285.63	6,593.28	32,786.44	14,200.97	1,272.67	1,937.50	3,786.60	3,301.10	5,398.61	10,976.45	36,368.61	24,469.37
SIZE	36,172.88	71,525.77	411,344.80	153,525.40	11,944.59	20,933.23	33,798.18	35,063.02	63,929.13	126,677.70	387,153.50	276,906.50
LLP	25.89	122.49	1792.09	397.91	0.00	20.94	168.25	70.89	74.17	255.75	2186.45	764.65
ROA	1.83	2.31	2.27	2.80	1.81	2.33	2.33	2.85	1.62	2.24	2.19	2.86
ER	7.47	8.81	9.26	10.64	7.93	9.38	10.39	11.98	6.95	8.45	9.00	10.43
INTR			0.64				0.36				0.76	
INTER			0.66				0.30				0.74	

C – total variable costs; w_1 – price of physical capital; w_2 – price of labor; w_3 – price of borrowed funds; y_0 – securities, y_1 – individual loans, y_2 – real estate loans, y_3 – agricultural loans, y_4 – commercial and industrial loans; e – equity; SIZE – total assets; LLP – loan-loss provisions relative to total loans; ROA – return on asset; ER – equity to total assets ratio; INTRA – an indicator equal to 1 in the year and after a state implemented intrastate deregulation; INTER – an indicator equal to 1 in the year and after a state implemented interstate deregulation. C , y_0 , y_1 , y_2 , y_3 , y_4 , e , w_2 and SIZE are in thousands of real USD; w_1 , w_3 , LLP, ROA and ER are in %.

Table A.2. Deregulation Timing across U.S. States

State	Intrastate	Interstate
Alabama	1981	1987
Alaska	1960	1982
Arizona	1960	1986
Arkansas	1994	1989
California	1960	1987
Colorado	1991	1988
Connecticut	1980	1983
Delaware	1960	1988
Florida	1988	1985
Georgia	1983	1985
Hawaii	1986	1997
Idaho	1960	1985
Illinois	1988	1986
Indiana	1989	1986
Iowa	1999	1991
Kansas	1987	1992
Kentucky	1990	1984
Louisiana	1988	1987
Maine	1975	1978
Maryland	1960	1985
Massachusetts	1984	1983
Michigan	1987	1986
Minnesota	1993	1986
Mississippi	1986	1988
Missouri	1990	1986
Montana	1990	1993
Nebraska	1985	1990
Nevada	1960	1985
New Hampshire	1987	1987
New Jersey	1977	1986
New Mexico	1991	1989
New York	1976	1982
North Carolina	1960	1985
North Dakota	1987	1991
Ohio	1979	1985
Oklahoma	1988	1987
Oregon	1985	1986
Pennsylvania	1982	1986
Rhode Island	1960	1984
South Carolina	1960	1986
South Dakota	1960	1988
Tennessee	1985	1985
Texas	1988	1987
Utah	1981	1984
Vermont	1970	1988
Virginia	1978	1985
Washington	1985	1997
Washington, DC	1960	1985
West Virginia	1987	1988
Wisconsin	1990	1987
Wyoming	1988	1987

Reported are the years when a state began to deregulate the banking industry.

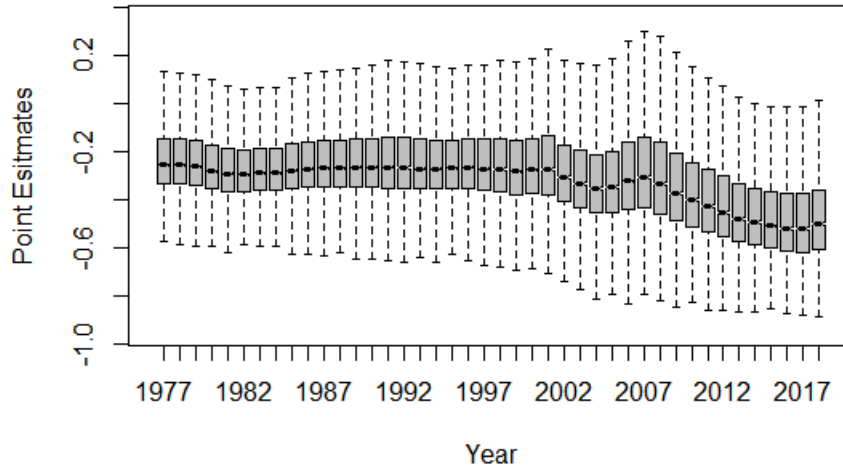


Figure B.1. Yearly Distribution of the Degree of Diversification Diseconomies

B Additional Results

To examine the evolution of diseconomies of diversification over time, we first plot yearly distributions of the (pooled) ED^* estimates for *all* banks in Figure B.1. It shows that until 2008 banks experienced stable scope diseconomies but, after the global financial crisis of 2008, the degree of diseconomies has grown. Next, we breakdown banks into two groups based on if they exhibit statistically significant economies or diseconomies of diversification. Table B.3 tabulates the sample shares of banks in each of these categories by year along with their corresponding mean ED^* estimates. The share of banks showing significantly positive economies of diversification has been fairly stable around 5%, while the average magnitude of these cost economies has been steadily increasing from 23% in 1977 to 38% in 2018. As noted earlier, the majority of diversified banks face product scope *diseconomies*, and their prevalence has also been fairly stable over time, staying between 82 and 93%. The average magnitude of (significantly negative) diseconomies of diversification has however been increasing over time from 27% in 1977 to 49% in 2018.

The banking literature has documented that bank size plays an important role in bank performance and risk-taking strategy (e.g., Milbourn et al., 1999; Berger & Black, 2011; Laeven et al., 2016). To investigate the role of bank size for the product diversification economies, we plot distributions of the ED^* point estimates across sample quintiles of the bank size. Figure B.2 suggests an inverse relationship: larger banks face higher diseconomies of product diversification.

Table B.3. (Dis)Economies of Product Diversification over Time

Year	<i>Economies</i>		<i>Diseconomies</i>	
	% Obs	Mean Est.	% Obs	Mean Est.
1977	5.02	0.229	85.65	-0.270
1978	4.83	0.221	86.04	-0.270
1979	4.50	0.225	86.72	-0.275
1980	3.76	0.233	88.80	-0.288
1981	3.24	0.238	90.12	-0.296
1982	3.24	0.253	90.59	-0.297
1983	3.12	0.219	90.68	-0.293
1984	3.38	0.229	90.23	-0.294
1985	4.19	0.241	88.76	-0.286
1986	5.02	0.233	87.11	-0.283
1987	5.33	0.237	86.37	-0.284
1988	5.62	0.233	85.90	-0.285
1989	5.72	0.242	85.15	-0.284
1990	5.64	0.245	85.29	-0.284
1991	6.29	0.254	84.39	-0.285
1992	6.16	0.237	84.74	-0.287
1993	6.14	0.250	84.50	-0.290
1994	6.21	0.243	85.16	-0.293
1995	6.01	0.246	84.90	-0.290
1996	6.28	0.245	84.63	-0.290
1997	6.26	0.251	84.68	-0.296
1998	6.72	0.267	84.27	-0.299
1999	6.78	0.264	84.99	-0.309
2000	7.10	0.265	84.28	-0.305
2001	8.11	0.301	82.95	-0.310
2002	7.08	0.312	85.38	-0.332
2003	6.32	0.332	87.19	-0.353
2004	6.11	0.337	88.36	-0.368
2005	6.49	0.331	87.21	-0.367
2006	8.02	0.313	83.97	-0.357
2007	9.51	0.301	82.11	-0.350
2008	8.61	0.320	83.72	-0.370
2009	7.42	0.323	86.52	-0.393
2010	6.26	0.628	88.29	-0.412
2011	5.52	0.365	90.13	-0.428
2012	4.81	0.370	91.26	-0.449
2013	4.37	0.364	92.41	-0.468
2014	3.98	0.398	93.37	-0.480
2015	3.69	0.368	93.44	-0.494
2016	3.82	0.359	93.47	-0.503
2017	4.00	0.373	93.29	-0.507
2018	4.64	0.381	92.44	-0.495
1977–2018	5.42	0.278	87.13	-0.323

The “Economies” and “Diseconomies” of product diversification categories are respectively based on whether the ED^* point estimates are statistically greater or less than zero.

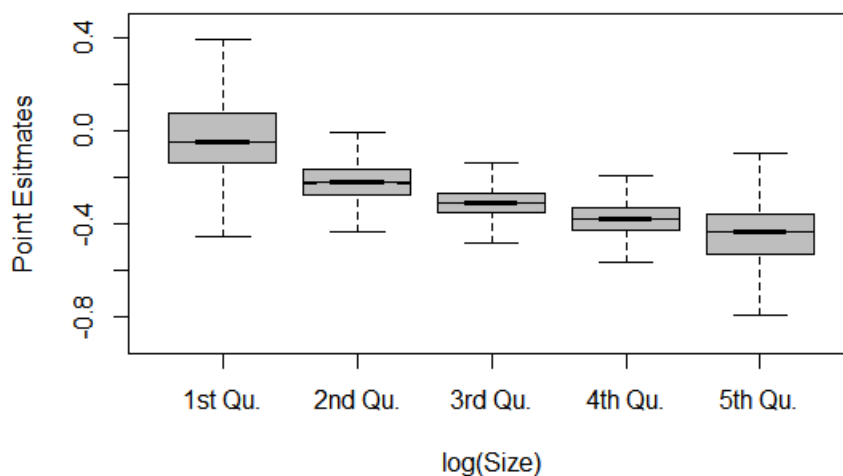


Figure B.2. (Dis)Economies of Product Diversification by (log) Size Quintiles

References

- Berger, A. N. & Black, L. K. (2011). Bank size, lending technologies, and small business finance. *Journal of Banking & Finance*, 35(3), 724–735.
- Hughes, J. P. & Mester, L. J. (1998). Bank capitalization and cost: Evidence of scale economies in risk management and signaling. *Review of Economics and Statistics*, 80(2), 314–325.
- Koetter, M., Kolari, J. W., & Spierdijk, L. (2012). Enjoying the quiet life under deregulation? Evidence from adjusted lerner indices for US banks. *Review of Economics and Statistics*, 94(2), 462–480.
- Laeven, L., Ratnovski, L., & Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance*, 69, S25–S34.
- Milbourn, T. T., Boot, A. W., & Thakor, A. V. (1999). Megamergers and expanded scope: Theories of bank size and activity diversity. *Journal of Banking & Finance*, 23(2-4), 195–214.