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

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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

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1 Introduction

The majority of U.S. banks provide a full menu of financial services, and only a small share focus on a subset of the banking products (say, agricultural lending) that they offer to their customers (e.g., DeYoung et al., 2015; Shen & Hartarska, 2018). While some banks cover large regional or national markets, most operate in smaller markets within one or several states. 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. In this paper, we first compute economies of product diversification in U.S. banking using a recently developed method, which accounts for partial specialization of banks, and then provide evidence on how opportunities for geographic market expansion affect such diversification economies.

Our analysis of the interaction between product and geographical market expansion is motivated by trade-offs that such a two-way diversification entails. On the one hand, geographic expansion improves access to more and different clients, with the modern technology presumably decreasing the cost of screening, monitoring and contract enforcement costs (back office work) for a larger geographic area with different products. On the other hand, a bank may lack local client-specific knowledge relevant for the new geographic markets thus impeding it from capitalizing on cost economies derived from offering diverse products to the new clients.

Evidence shows that the interstate and intrastate deregulation is associated with increased competition, reduced local monopolies and improved scale-driven efficiency in the U.S. banking sector (e.g., Jayaratne & Strahan, 1998). The passage of the Riegel–Neal Act of 1994, which allowed consolidations beyond the home state, was associated with benefits from a reduction in credit and deposit risk (Akhigbe & Whyte, 2003; Aguirregabiria et al., 2016). However, for bank holding companies, geographic market diversification entails trade-offs between value enhancement and risk reduction (Deng & Elyasiani, 2008). Thus, the evidence is not fully aligned with the portfolio theory highlighting the benefits from diversification across regions. Diversification can have a negative impact on bank performance if it becomes difficult to monitor remote operations, consistent with insights from the agency theory. Geographic market expansion increases the complexity of bank operations, and the headquarters may be less able to monitor loans and control risk (Acharya et al., 2006; Wheelock & Wilson, 2001).

A number of studies have examined scope-driven cost savings due to the joint production of outputs within one bank over their production by separate banks in the U.S. (e.g., Gilligan et al., 1984; Pulley & Braunstein, 1992; Pulley & Humphrey, 1993). However, the existing evidence of product scope economies is relatively dated and ambiguous (e.g., Mester, 1987; Hughes & Mester, 1993; Clark & Speaker, 1994; Jagtiani & Khanthavit, 1996), with few studies finding limited scope economies (e.g., Pulley & Braunstein, 1992; Wheelock & Wilson, 2001) and others documenting negative diseconomies (see Berger et al., 1987; Mester, 1992; Ferrier et al., 1993).[1]

[1]The relationship between diversification and bank performance has also been studied from a different perspective. This other strand of literature measures diversification using the revenue shares of bank activities (or the Herfindahl index thereof) and focuses on the reduced–form relationships between revenue diversification and financial perfor-

Our work differs from prior studies of scope economies in that we identify partially specialized banks and use this information to greatly minimize the "excessive extrapolation" problem from which the direct measurement of scope economies inherently suffers. Our approach is more robust because it accounts for the possibility that banks with different product mixes may be technologically heterogeneous and thus have significantly different cost structures. We apply it to examine product diversification economies in U.S. banking between 1977 and 2018.

Next, we contribute to the literature by examining if the market expansion opportunities resulting from industry deregulation championed by individual states and enactment of the 1994 Riegle-Neal Act at the federal level were associated with improvements in the product 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 estimate the average impact of the removal of intra- and interstate bank restrictions and follow this impact in time to capture dynamic effects.

2 Measuring economies of product diversification

Following the literature, we adopt Sealey & Lindley's (1977) "intermediation approach" whereby we treat revenue-generating assets (loans and trading securities) as bank outputs. We consider five main outputs, first of which are the securities (y_0) and the rest are the four types of loans: individual (y_1), real estate (y_2), agricultural (y_3) and commercial and industrial (y_4). Berger & Mester (2003) essentially consider the same product categories.

Economies of product diversification exist if the firm's average cost decreases with the expansion of its product scope as measured by the number of outputs (Panzar & Willig, 1981). Following Baumol et al. (1982), bank is then traditionally said to enjoy economies of diversification if the cost of providing five products jointly is less than the cost of producing them separately: $C(y_0,0,0,0,0) + C(0,y_1,0,0,0) + C(0,0,y_2,0,0) + C(0,0,0,y_3,0) + C(0,0,0,0,y_4) > C(y_0,y_1,y_2,y_3,y_4)$, where we have suppressed all other arguments of the cost function besides outputs. This definition essentially requires that one finds a group of fully specialized uni-product banks in order to measure scope economies. In reality however, no bank provides only one of the five products. Therefore, the above definition relies on the computation of counterfactual costs of producing each of the five outputs separately by projecting the estimated multi-product cost function to the five non-existent cases of full specialization. Such a counterfactual computation inherently suffers from the "excessive extrapolation" problem (see Evans & Heckman, 1984; Hughes & Mester, 1993) as well as restrictively implies that the fully specialized banks all share the same production technology and cost structure with the fully diversified integrated bank. This is unrealistic.

Evans & Heckman (1984) note that data may not be available to evaluate cost under complete

mance indicators such as risk viability, return on assets or market-to-book ratios (e.g., Hayden et al., 2007; Elsas et al., 2010; Saghi-Zedek, 2016; Shim, 2019) without attempting to directly measure cost savings due to product diversification like we do in this paper.

specialization schemes and to avoid extrapolation beyond the range of the observed data, the analysis ought to be limited to the partial specialization schemes. The U.S. data contain no banks producing only one output but have operationable information on partial specialization with two types of banks specializing in all but one output (in addition to banks offering all types of products). Thus, we differentiate *fully diversified* banks offering all five products FD $= \{y_0, y_1, y_2, y_3, y_4\}$ from the two types of *partially specialized* banks: producing all outputs but commercial and industrial loans $\text{PS}_1 = \{y_0, y_1, y_2, y_3\}$ and those offering all outputs except agricultural loans $\text{PS}_2 = \{y_0, y_1, y_2, y_4\}$.

The observed heterogeneity in full/partial specialization across banks calls for an approach that accounts for these data characteristics. We build on Malikov et al.'s (2017) approach where, instead of relying on the extreme extrapolation of $C_{\text{FD}}(\cdot)$ to the non-existent counterfactual full-specialization cases, we compare the fitted cost of fuly diversified banks providing all five outputs (the "FD" type) with the cost of producing the same outputs by the separate partially specialized banks of types "PS_1" and "PS_2" (keeping the total output quantities fixed, of course). These two types of "specialist" banks have a higher degree of specialization in agricultural loans y_3 and commercial loans y_4, respectively. Then, economies of product diversification exist if

$$C_{\text{PS}_1}\big(\varpi_0 y_0, \varpi_1 y_1, \varpi_2 y_2, y_3\big) + C_{\text{PS}_2}\big(\,(1-\varpi_0)\,y_0, (1-\varpi_1)\,y_1, (1-\varpi_2)\,y_2, y_4\big) - C_{\text{FD}}\big(y_0, y_1, y_2, y_3, y_4\big) > 0, \tag{2.1}$$

where $C_{\text{PS}_1}(\cdot)$ is the cost function corresponding to the PS_1-type banks, $C_{\text{PS}_2}(\cdot)$ is the cost function of the PS_2-type banks, and $C_{\text{FD}}(\cdot)$ is the cost function of fully integrated FD-type banks. The three cost functions may differ not only in the covariate sets but also in parameters.

The distributive weights $(\varpi_0, \varpi_1, \varpi_2) \in [0,1]^3$ control the degree of relative specialization in common products that both counterfactual banks produce. To avoid excessive extrapolation, following Malikov et al. (2017), the choice of these weights is restricted to the "admissible region" defined by the following data-driven restrictions: (i) each counterfactual bank does not produce common outputs in lesser quantity than banks do in the sample, (ii) each counterfactual bank does not specialize in either common output to a greater extent than banks do in our data. That is, we require that both $\varpi_m y_m \geq \min(y_m)$ and $(1-\varpi_m) y_m \geq \min(y_m)$ *and* that the ratios of common outputs for each counterfactual bank fall in the range of such ratios observed in the sample:

$$\min\left\{\frac{y_m}{y_{m'}}\right\} \leq \frac{\varpi_m y_m}{\varpi_{m'} y_{m'}} \leq \max\left\{\frac{y_m}{y_{m'}}\right\} \tag{2.2}$$

$$\min\left\{\frac{y_m}{y_{m'}}\right\} \leq \frac{(1-\varpi_m) y_m}{(1-\varpi_{m'}) y_{m'}} \leq \max\left\{\frac{y_m}{y_{m'}}\right\}, \tag{2.3}$$

for all $m \neq m' = 0, 1, 2$. Therefore, measured are the *within-sample* diversification economies.

The quantitative measure of the degree of product diversification economics $ED(\varpi_0, \varpi_1, \varpi_2)$ (in proportions) is obtained by dividing the expression in (2.1) by $C_{\text{FD}}\big(y_0, y_1, y_2, y_3, y_4\big)$. If ED is positive (negative), then bank is said to enjoy economies (diseconomies) of diversification. If ED is zero, then bank exhibits cost invariance to product diversification. Since $ED(\varpi_0, \varpi_1, \varpi_2)$ depends on the weights choice, we adopt a *conservative* approach by performing a grid search over

the permissible range of weights between 0 and 1 at the 0.1 increments to choose the triplet that yields the *smallest* value for ED:

$$ED^* = \min_{\varpi_0,\varpi_1,\varpi_2} ED\left(\varpi_0, \varpi_1, \varpi_2\right). \tag{2.4}$$

3 Econometric approach

We estimate the variable cost function for each bank type using a fixed-effects regression:

$$\ln c_{r,it} = \beta_{r,0} + p\left(\ln \mathbf{x}_{r,it}\right)' \boldsymbol{\beta}_{r,1} + \mu_{r,i} + \varepsilon_{r,it} \quad \forall\ i = 1, \ldots, N; t = 1, \ldots, T, \tag{3.1}$$

where the subscript r indexes the bank type: $r = \text{FD}$ corresponds to the fully diversified banks producing all five outputs $(y_0, y_1, y_2, y_3, y_4)'$, $r = \text{PS}_1$ corresponds to the partially specialized banks producing all outputs but commercial/industrial loans $(y_0, y_1, y_2, y_3)'$ and $r = \text{PS}_2$ signifies the other type of partial-specialist banks offering all outputs except agricultural loans $(y_0, y_1, y_2, y_4)'$. The vector of regressors $\mathbf{x}_{r,it}$ is also r-indexed because the output quantity vector that it includes differs across the three bank types. However, $\mathbf{x}_{r,it}$ always includes variable input prices, the quantity of quasi-fixed inputs and the time trend to accommodate technological change. Vector $p\left(\ln \mathbf{x}_{r,it}\right)$ is the log-polynomial expansion of $\mathbf{x}_{r,it}$: we assume the translog. The bank fixed effect $\mu_{r,i}$ is included to control for unobserved confounders such as quality of bank management. The cost predictions based on the estimates of cost-function parameters $(\beta_{r,0}, \boldsymbol{\beta}_{r,1}')'$ for $r \in \{\text{FD}, \text{PS}_1, \text{PS}_2\}$ are then utilized to evaluate ED^*.

To examine the relationship between product and geographic diversification, we rely on the plausibly exogenous variation in the market-diversification-facilitating intra- or interstate deregulation across U.S. states. Since each state deregulated in different year, we can utilize this variation in the timing of deregulation across states which represents an exogenous (from the perspective of individual banks) change in the capacity of banks for geographic market diversification to identify the average relationship between geographic diversification and product scope economies in the U.S. banking. Specifically, our econometric strategy is to compare economies of product diversification of banks located in the states that deregulated to those of banks located in the non-deregulated states over the same time period. That is, we estimate the following—what is effectively a generalized difference-in-differences—model:

$$ED^*_{ist} = \gamma_0 + \gamma_1 DREG_{st} + \boldsymbol{\gamma}_3' Controls_{ist} + \delta_s + \theta_t + \epsilon_{ist}, \tag{3.2}$$

where ED^*_{it} is the estimated product diversification economies for bank i in state s at time t, and $DREG_{st}$ is one of the two binary treatment variables of interest: $INTRA_{st}$ that is set to 1 in the year and after the state s enacted intrastate deregulation, $INTER_{st}$ that is equal to 1 in the year and after the state s implemented interstate deregulation. As $Controls_{ist}$, we includes log of bank total assets to control for the potential size effects; loan-loss provisions relative to total loans are

Table 1. Point Estimates of (Dis)Economies of Product Diversification

Mean	5th Pct.	1st Qu.	Median	3rd Qu.	95th Pct.
–0.267	–0.558	–0.387	–0.296	–0.174	0.094
(–0.328, –0.211)	(–0.590, –0.527)	(–0.436, –0.341)	(–0.355, –0.242)	(–0.244, –0.110)	(0.003, 0.177)

Reported are the ED^* point estimates with the corresponding two-sided 95% percentile block-bootstrap confidence intervals in parentheses. The number of bootstrap replications is 400.

added to control for credit risk; the ratio of equity to total assets controls for bank capitalization; the return on assets proxies for bank performance. As usual, we also include the state and year fixed effects. In this analysis, we focus on the subsample period prior to the 2008 crisis not only because the geographic diversification in banking had been essentially complete by the time of crisis but also to avoid the confounding effects of the latter (see Koetter et al., 2012).

4 Empirical analysis

Our data come from the Reports of Condition and Income; for the details see Supplementary Online Appendix A. Table 1 summarizes point estimates of the economies of product diversification ED^*. The estimates are observation-specific and evaluated using data for the fully diversified banks. The mean point estimate is statistically significant at –0.267 indicating that, on average, there is the potential for a 26.7% cost saving if the fully integrated joint production of loans is replaced with partially specialized banks. While most point estimates are negative, in order to make qualitative inference about the prevalence of diversification *dis*economies, we need to perform formal tests.

For statistical inference, we rely on panel data wild residual block-bootstrap which we apply to the three cost-function estimators jointly to account for the cross-equation dependence. Tests are conducted using percentile confidence intervals. Namely, we classify each bank-year based on whether its ED^* point estimate is statistically less than/equal to/greater than zero at the 5% significance level using appropriate one- or two-sided confidence bounds. Specifically, we classify a bank-year as exhibiting economies (diseconomies) of product diversification if the one-sided 95% lower (upper) confidence bound is greater (less) than zero. Otherwise, it is respectively said to exhibit product scope non-economies (non-diseconomies). A bank-year is classified as exhibiting cost invariance to product diversification if the two-sided 95% confidence interval corresponding to its ED^* point estimate contains zero; if not, it is said to be non-invariant to product diversification. These results are reported in Table 2 along with the formal hypotheses. We find that the majority of banks (∼87%) show statistically negative *dis*economies of diversification, and only a small number of banks exhibit significantly positive diversification economies or are invariant to the product scope diversification: 5.4% and 8.5%, respectively. For the discussion of evolution of diversification diseconomies over time, see Supplementary Online Appendix B.

Next, we examine the relation between the product and geographic diversification, for which we

Table 2. Tests of (Dis)Economies of Product Diversification

Category	Hypothesis	% Reject	% Fail to Reject
Economies	$H_0 : ED^* \leq 0$ *v.* $H_1 : ED^* > 0$	**5.42**	94.58
Invariance	$H_0 : ED^* = 0$ *v.* $H_1 : ED^* \neq 0$	91.47	**8.53**
Diseconomies	$H_0 : ED^* \geq 0$ *v.* $H_1 : ED^* < 0$	**87.13**	12.87

The reported sample shares correspond to the results of three pointwise tests. Sample shares of interest are in bold, with their qualitative interpretation concerning product scope diversification provided in the first column. Percentage points sum up to 100 for a given test only.

employ a difference-in-differences strategy in (3.2).[2] We estimate the impact of intra- and interstate regulatory changes that represent exogenous shocks to the capacity of banks for geographic market diversification. From Table 3, the coefficients of intra/interstate deregulation are all positive and statistically significant at the 1% significant level. Quantitatively, geographic diversification due to intrastate (interstate) banking deregulation has contributed to a 2% (1%) decrease in diseconomies of diversification. That is, although banks exhibit diseconomies of product diversification, geographic diversification helped alleviate some of these costs for most banks. This is consistent with the idea that geographic diversification brings in new customers from outside the bank's original region, thereby providing the potential benefit if bank offers more products. This result implies that the expansion of banks into different regions is complementary to product diversification.

Because 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), we further explore the relationship between product and geographic diversification for banks of different sizes. Using the standard Federal Financial Institutions Examination Council classification, we divide banks into three size-related categories. Bank with over $500 million in total assets (in 2005 year equivalent) are classified as large banks, banks with assets between $100 and $500 million are classified as medium-sized banks, and banks with under $100 million in assets are classified as small banks. We then reestimate the difference-in-differences regressions for each bank group (see Table 3). The effect of intra/interstate deregulation are insignificant for small banks. For medium banks, both coefficients are significantly positive. For large banks, while the two are positive, the effect is only significant for the intrastate deregulation. Thus, product-scope-based cost savings stimulated by geographic diversification were capitalized on mainly by medium-sized and large banks.

We also study temporal dynamics of removing geographic restrictions on economies of product diversification. The results reported in Table 4 show that the deregulation effects on diversification economies were not instantaneous but cumulatively increased over the time.

[2]Evidently, ED^* is an unobserved structural estimand and, to operationalize our analysis, we replace it with its estimate $\widehat{ED}^*$ constructed using the estimated cost-function parameters from (3.1). Unlike with "generated regressors," this does not complicate inference because $\widehat{ED}^*$ is a regressand. Intuitively, any deviation of $\widehat{ED}^*$ from ED^* due to the sampling error gets additively absorbed in the error ϵ_{ist}.

Table 3. Difference-in-Differences Regressions

	All Banks	Small Banks	Medium Banks	Large Banks
$INTRA$	0.0203***	0.0048	0.0209***	0.0235***
	(0.0065)	(0.0047)	(0.0043)	(0.0097)
R-squared	0.448	0.680	0.189	0.474
$INTER$	0.0112***	0.0039	0.0148***	0.0044
	(0.0044)	(0.0039)	(0.0062)	(0.0100)
R-squared	0.447	0.680	0.186	0.471
Observations	241,925	160,795	65,365	15,765

Reported are the $DREG$ coefficients from (3.2) using the 1977–2007 data. Small banks – banks with under $100 million in assets; medium banks – banks with assets between $100 and $500 million; large banks – banks with over $500 million in total assets. $INTRA$ – 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. Clustered (at the state level) standard errors in parentheses: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 4. Temporal Dynamics in the Deregulation Effects on (Dis)Economies of Product Diversification

	$INTRA$	$INTRA$
$DREG(0)$	0.0118**	0.0149***
	(0.0054)	(0.0036)
$DREG(1,2)$	0.0162**	0.0188***
	(0.0066)	(0.0057)
$DREG(3,4)$	0.0178**	0.0237***
	(0.0085)	(0.0082)
$DREG(>5)$	0.0303***	0.0293***
	(0.0108)	(0.0098)
Observations	153,461	153,342
R-squared	0.479	0.479

Reported are the coefficients from (3.2) using the 1977–2007 data in which $DREG$ is replaced with a series of $DREG$-based variables. Namely, $DREG(0)$ is set equal to one the year in which the state implemented deregulation, $DREG(1,2)$ is set to one in years 1 and 2 after the state implemented deregulation, $DREG(3,4)$ is set to one in years 3 and 4 and, lastly, $DREG(>5)$ is set to one for all years beyond year 5 after the deregulation. Clustered (at the state level) standard errors in parentheses: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

5 Concluding remarks

This paper investigates how economies of product diversification in U.S. banking are effected by changes in the bank's capacity for geographic market expansion (in and out of state). Using the data on U.S. commercial banks between 1977 and 2018, we find that the majority of banks (87%) exhibit *dis*economies of diversification, with the magnitude thereof increasing further after the 2008 global financial crisis. We also find that inter/intrastate banking deregulation helped decrease these scope diseconomies, albeit very modestly by 1–2% points, but these gains lasted for several years after the implementation. Thus, geographic diversification helped alleviate only some of the product-diversification costs. While market expansion likely resulted in new customers from outside the bank's original region, these benefits did not decrease cost diseconomies by much. We further find that small banks did not experience decrease in their scope diseconomies, likely because they remained in their original markets. The largest beneficiaries seem to be medium-sized banks, which improved their scope diseconomies in the wake of both the inter- and intrastate deregulation.

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