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DOES LOAN PORTFOLIO DIVERSIFICATION LEAD TO BETTER RETURNS AND RISKS FOR BANKS?

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Introduction

Modern portfolio theory argues that diversification leads to reduced risks and increased returns. In context of banks, it has been stated that diversification can lessen financial intermediation costs due to asymmetric information, provide a shield against liquidity risk and reduce default and bankruptcy risk. In turn, greater diversification may lead to stable, safer, and more valuable financial institutions.

On the contrary, the corporate finance theory contends that it is better for firms to concentrate or focus their activities on a selected sector or group of sectors to reap the benefits of their knowledge of and expertise in how companies do their businesses in these sectors. Recent literature questions the beneficial role of diversification for banks, no matter which measures of diversification are used (diversification of income sources, industries, or geographical regions). Defining diversification as the mix of banks' sources of income (interest income, provisions, trading, etc.), **DeYoung and Roland (2001)**, **Stiroh (2004)**, and **Stiroh and Rumble (2006)** draw a rather bleak picture on the role of diversification. This is due to the higher volatility of non-interest income, which seems to offset or even outweigh diversification benefits. Whereas **(Jahn et al., 2013)** find banks which are specialized in certain industries have, on average, lower loan losses.

The motivation for the choice of the subject is to discuss and analyze these varying and contradicting views and aim to understand the theory behind these results and which risk management approach is beneficial for the banking sector.

This paper will analyze the following three major papers with contradicting results of loan portfolio diversification on risks and returns of Banks:

1. Banks' concentration versus diversification in the loan portfolio: new evidence from Germany by Nadya Jahn (University of Muenster), Christoph Memmel (Deutsche Bundesbank) and Andreas Pfingsten (University of Muenster).
2. Does sectoral diversification of loans and financing improve bank returns and risk in dual-banking systems? Mirzet Seho, Mansor H. Ibrahim and Abbas Mirakhor.
3. How loan portfolio diversification affects risk, efficiency, and capitalization: A managerial behavior model for Austrian banks Stefania P.S. Rossi, Markus S. Schwaiger, and Gerhard Winkler

The paper will try to provide insights on the shortcomings of the approaches used by the three stated papers and attempt to answer the question whether banks should seek to diversify or concentrate their loan portfolio.

Literature review

Banks' concentration versus diversification in the loan portfolio

Banks face a trade-off between monitoring benefits and concentration risk. Banks with a concentrated loan portfolio are expected to have better monitoring abilities, which might lower the loan portfolio's credit risk, while they are confronted with increased credit risk due to industrial concentrations. If the risk-return-profile of a loan were exogenous, i.e. outside the influence of a bank, the banks' credit portfolio risk would be higher for banks with lower diversification in the credit portfolio. However, the loan's risk-return-profile is to some extent endogenous, i.e. it can

be influenced by a bank. Due to, for instance, its monitoring activities, it is not per se clear whether diversified banks are less risky than concentrated banks.

Jahn et al. (2013) Using a unique data set on German banks' sector specific loan exposures to the real economy and the corresponding write-offs and write-downs examined the impact of loan portfolio sector concentration on credit risk, they found that (a) banks which are specialized in certain industries have, on average, lower loan losses, (b) the loss rate of a given industry in a bank's loan portfolio is lower if the bank has major exposures to this industry, and (c) the standard deviation of the loan losses is lower in the case of more focused banks. Tabak et al. (2011) regarding the impact of loan portfolio concentration on Brazilian banks' return and credit risk, measured by return on assets and non-performing loans over total loans, The authors perform both static and dynamic regression analyses using traditional concentration as well as distance measures. They find a positive relationship between bank returns and loan portfolio concentration for both the HHI and the Shannon Entropy as well as for an absolute and a relative distance measure. In addition, the HHI and Shannon Entropy have a negative influence on banks' loan portfolio credit risk; in sum, the authors find that concentration has an overall positive effect on banks' performance. whereas Rossi et al. (2009) and Bebczuk and Galindo (2007) come to the opposite conclusion examining large commercial Austrian banks and banks from Argentina, respectively.

Does sectoral diversification of loans and financing improve bank returns and risk in dual-banking systems?

Seho et al.(2021) investigate the effects of sectoral diversification of loans and financing on the risk and the returns of banks in dual-banking systems. They employ the system GMM estimator on a unique panel data of 46 Islamic and 60 conventional banks from six countries over the period 2000–2015. Their findings reveal that sectoral diversification of loans and financing reduces the

returns and increases the risk of both Islamic and conventional banks; the impact of sectoral diversification on returns varies across risk levels, with negative effects at low- and no effect at moderate- and high-risk levels; the difference between the impacts on Islamic and conventional banks across risk levels are marginal, and the adverse effects of sectoral diversification were exacerbated during the 2008 financial crisis. Expansion of loan and financing portfolios into new sectors has no impact on bank returns and risk in our sample. The findings may provide valuable implications for all stakeholders, regulators, and policymakers.

Modern Portfolio Theory suggests that through diversification, banks can lessen financial intermediation costs due to asymmetric information Tabak et al. (2011). Diversification is also seen as a bank shield against liquidity risk associated with unforeseen withdrawals Rose and Hudgins (2006). It is regarded as a means to reduce the probability of bank failure Demsetz and Strahan (1997), default risk Diamond (1984), the expected cost of financial distress Boot and Schmeits (2000), and bankruptcy risk Saunders and Walter (2012). Greater diversification may lead to more stable, safer, and more valuable financial institutions Saunders and Walter (2012). Furthermore, diversification can lower banks' vulnerability to economic downturns by spreading their exposure to various sectors Tabak et al. (2011) and improve overall financial strength and mitigate the unfavorable effects of financial crises on bank financial strength Doumpos et al., (2016). Boyd and Prescott (1986) argue that the optimal bank organization is one in which it is as diversified as possible.

However other studies argue that diversification can bring increased complexity and thus increase overhead costs, agency problems and inefficiency Klein and Saidenberg (2010). Amihud and Lev (1981) argue that diversification increases agency costs ensuing from the value-reducing activities of the managers who lower their personal risk. Besides, it increases earnings volatility De Jonghe,

(2010); DeYoung and Roland, (2001); Stiroh, (2004) and reduces monitoring incentives and diversification-inducing competition Winton (1999). Diversification might also strengthen the ability of insiders to seize financial institution resources for private gain and consequently reduce the conglomerate's market value Laeven and Levine (2007).

How loan portfolio diversification affects risk, efficiency, and capitalization: A managerial behavior model for Austrian banks

Rossi et al (2009), investigated the effects that bank diversification across size and industry can have on risk, cost and profit efficiency, and bank capitalization for large Austrian commercial banks over the years 1997–2003, by using a unique dataset with data on risk and asset quality. They concluded that, although diversification negatively affects cost efficiency, it increases profit efficiency and reduces banks' realized risk, and that diversification seems to have a positive impact on banks' capitalization.

However, recent literature questions the beneficial role of diversification for banks. Baele et al. (2007) find that diversification increases systematic risk, although banks seem to benefit from diversification in their franchise. Acharya et al. (2006) show that diversification both reduces bank returns while producing riskier loan portfolios for high-risk banks. This is due to a deterioration in the effectiveness of monitoring.

So far the literature discussed presents a mixed picture of diversifications with studies such as Rossi et al (2009), Tabak et al. (2011) and Boyd and Prescott (1986) showcasing that diversification leads to lower risk and higher profits for banks, where as other studies such as Jahn et al. (2013), Seho et al.(2021) and Klein and Saidenberg (2010) find opposing views that diversification leads to higher risks, increased overhead costs, agency problems and inefficiency for the banks.

This paper will attempt to analyze these opposing views, by discussing the papers by Rossi et al (2009), Seho et al.(2021) and Jahn et al. (2013), and attempt to answer the question posed by the studies if diversification truly is beneficial for banks.

Analysis

I. Banks' concentration versus diversification in the loan portfolio: new evidence from Germany by Nadya Jahn (University of Muenster), Christoph Memmel (Deutsche Bundesbank) and Andreas Pfingsten (University of Muenster).

Jahn et al (2013) use the borrowers' statistics (Kreditnehmerstatistik) provided by the Deutsche Bundesbank as their main database and the prudential information system (Bankaufsichtliches Informationssystem, BAKIS), to capture sector specific loan exposures to the real economy and the corresponding write-offs and write-downs, allowing them to examine the impact of loan portfolio sector concentration on credit risk. They use the Herfindahl-Hirschman Index (HHI) as a concentration measure for diversification.

They establish three hypotheses regarding the relation between loan portfolio concentration and both the expected and unexpected part of credit risk:

Hypothesis 1: Banks with a concentrated loan portfolio have, on average, lower loan losses.

Hypothesis 2: For a given industry, the loss rate in a bank's loan portfolio is lower if the bank has a major exposure to this industry

Hypothesis 3: For concentrated banks, the standard deviation of the loan loss rate is lower than for diversified banks.

To test hypotheses 1 they use the following regression:

$$q_{i,t} = \beta_0 + \beta_1 Q_t + \beta_2 \Delta hq_{i,t}^{ind} + \beta_3 \Delta hq_{i,t}^{mat} + \beta_4 \Delta Q_{R(i),t}^{reg} + \beta_5 SM_{i,t} + \sum_{a=6}^{7} \beta_a X_{a,i,t} + \varepsilon_{i,t}$$

Where the dependent variable $q_{i,t}$ is the bank-wide yearly loss rate at time t regressed on loan portfolio concentration (β_5) while controlling for the composition of the loan portfolio ($\beta_1 to \beta_4$) and including further bank-specific control variables $\beta_6 to \beta_9$). The coefficients $\beta_0 to \beta_9$ are the parameters to be estimated.

The results are displayed in the following table:

	Bank-wide loss rate		
Variables	All banks	Nationwide	Regional
Q_T	0.709***	0.838***	0.702***
	(0.043)	(0.240)	(0.044)
Q_TI	0.621***	0.802***	0.610***
	(0.082)	(0.2559)	(0.087)
Q_TM	0.619***	0.900**	0.600***
	(0.110)	(0.384)	(0.118)
Q_TR	0.104**		0.103**
	(0.042)		(0.042)
HHI	-0.011***	-0.009*	-0.011***
	(0.003)	(0.005)	(0.004)
LN_TA	0.002*	0.002	0.002
	(0.001)	(0.002)	(0.001)
RWA_TA	-0.007***	-0.007*	-0.008***
	(0.002)	(0.004)	(0.002)
ROA	-0.068**	0.053*	-0.109***
	(0.030)	(0.031)	(0.026)
ER	0.010***	0.011	0.010***
	(0.004)	(0.007)	(0.004)
Constant	-0.005	-0.020	-0.003
	(0.007)	(0.023)	(0.008)
R-squared (within)	6.1%	15.9%	6.1%
R-squared (between)	9.6%	19.6%	10.6%
Number of Obs.	13,605	387	13,218
Number of Groups	2,077	91	1,986

Table 3: This table shows regression results from a standard fixed effects estimation equation with robust standard errors. The dependent variable is the bank-wide loss rate. The right-hand side of the regression equation is based on a specialization measure (HHI), common risk factors and various bank-specific control variables, see Appendix I. Yearly data is used. ***,**,* denote statistical significance at the 1, 5 and 10 percent levels, respectively. Standard errors in parenthesis.

The common factors of the hypothetical portfolio, namely the nationwide (Q_T), industry (Q_TI), maturity (Q_TM) as well as the regional factor (Q_TR) are all positive and

significant at least at the 5% level. The table can be interpreted as a 1 bp increase in the nationwide factor ceteris paribus to imply a 0.7 bp increase in the bank-wide loss rate for all banks, whereas a 1 bp increase in the regional factor ceteris paribus leads on average to a 0.1 bp increase in the bank-wide loss rate. The economic significance of the common factors is smaller for regional banks than it is for nationwide banks. In turn, one might expect a higher economic influence of the regional factor which is, however, rather low. One explanation for this is that regional banks are well diversified and closely map the nationwide benchmark portfolio; for example, regional banks have a low HHI (D_REGION) of 0.1422 (0.1683) at end-2011. The first hypothesis claims that banks with a concentrated loan portfolio have, on average, lower loan losses than more diversified banks through the build-up of sector-specific knowledge

The following table displays results for Hypotheses 2:

One sample t-test	Variable: $\widehat{\Delta}$			
	Nobs	Mean	SE	t value
Overall Sample	13,605	-0.0085	0.000364	-23.4818
By year	Variable: $\widehat{\Delta_t}$			
2003	1,529	-0.0044	0.001495	-2.9160
2004	1,625	-0.0076	0.000982	-7.7141
2005	1,582	-0.0101	0.001108	-9.0731
2006	1,578	-0.0109	0.001106	-9.8708
2007	1,600	-0.0083	0.000906	-9.1167
2008	1,571	-0.0084	0.000882	-9.4857
2009	1,587	-0.0083	0.000909	-9.1769
2010	1,561	-0.0102	0.001103	-9.2730
2011	972	-0.0087	0.001248	-6.9794

Table 5: This table shows results of one sample t-tests for the variable delta hat according to *Hypothesis 2* (see section 6). Results are displayed for the overall sample and by year, period 2003-2011.

Hypothesis 2 focuses on the composition of each individual bank's total loan exposure by

raising the idea that the largest industry-specific loan exposures are accompanied by increased monitoring experience or monitoring intensity by the loan officer and therefore show lower loss rates on average. The test statistic for the overall sample reveals that the delta hat value is statistically significantly smaller than zero. Moreover, the result holds in the cross-section as the corresponding mean is statistically significantly smaller than zero for every year considered. These results confirm that banks gain increased knowledge and experience as regards their largest industry-specific loan exposures and thereby reduce the associated loan losses through corresponding monitoring benefits.

Results for Hypothesis 3, namely the impact of loan portfolio concentration on the unexpected part of credit risk, measured by the standard deviation of the bank-wide loss rates are displayed in the following table:

	SD (Bank-wide loss rate)		
Variables	All banks	Nationwide	Regional
SD_YHAT	1.1999***	2.3782***	1.1143***
	(0.147)	(0.474)	(0.152)
$\overline{HHI}$	-0.0034***	0.0004	-0.0015
	(0.001)	(0.002)	(0.001)
$\overline{LN\_TA}$	-0.0003***	0.0012**	-0.0003***
	(0.000)	(0.001)	(0.000)
$\overline{RWA\_TA}$	-0.0032***	0.0067	-0.0040***
	(0.001)	(0.005)	(0.001)
$\overline{ROA}$	-0.2641***	-0.1531	-0.2636***
	(0.057)	(0.302)	(0.058)
$\overline{ER}$	0.0020	0.0009	0.0021
	(0.002)	(0.009)	(0.002)
$\overline{CONSTANT}$	0.0093***	-0.0121*	0.0099***
	(0.001)	(0.006)	(0.001)
R-squared (between)	13.0%	74.4%	10.6%
Number of Groups	933	31	902

Table 7: This table shows regression results from a cross-sectional regression. The dependent variable is the standard deviation of the bank-wide loss rate. The right-hand side of the regression equation is based on the standard deviation of the hypothetical portfolios loss rates (SD_YHAT), the average values of the HHI and bank-specific control variables, see Appendix I. ***,**,* denote statistical significance at the 1, 5 and 10 percent levels, respectively. Standard errors in parenthesis.

The variable SD_YHAT denotes the standard deviation of the common systematic risk factors and thereby controls for the volatility of the reference loan portfolio with the same composition as that of the bank. For the samples of all banks and the regional banks, this coefficient is not statistically different from one, the theoretically expected value. A one standard deviation increase in the systematic risk factors, for example, implies an increase of about 1.2 in the standard deviation of the loan losses. According to Hypothesis 3, the paper finds evidence for the overall sample that banks with a concentrated loan portfolio – after controlling for the portfolio composition – have a lower unexpected part of credit risk than diversified banks, as their standard deviation of the loan losses is lower.

Critique

The authors in the paper analyse the relationships around the mean of the distribution, not the tail for effects on financial stability. As we are aware that diversification becomes especially important in extreme events. Hence, there has been such a push for calculating losses via C-VAR over VAR. Thus, this is an important aspect that the paper lacks to consider, where the true impact of diversification can't be truly calculating without accounting for the extreme events.

II. Does sectoral diversification of loans and financing improve bank returns and risk in dual-banking systems? Mirzet Seho, Mansor H. Ibrahim and Abbas Mirakhor.

Seho (2021) examine the effects of sectoral diversification of loans and financing on bank returns and risk by using a data set of banks from Malaysia, Bahrain, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates covering the 2000–2015 period. All the bank-specific data, except the diversification measures, were obtained from BankScope, while the country-specific data were obtained from the World Bank Indicators database. Whereas they manually calculated the diversification measures of individual bank loan and financing per economic sectors, from banks'

annual reports. The authors construct a sample of Conventional and Islamic banks to capture the effects of diversifications on both the banking systems, due to the different nature of loaning principles of the two systems. In conventional banking debt contracts and interest (riba) are central to the understanding of financial intermediaries. Whereas the organizing principle of Islamic banking rests on riba avoidance and risk-sharing. Thus, for example, financing contracts in Islamic banks depend on the nature of the real activity that is being financed.

To measure the sectoral diversification of loans and financing, the paper uses the Herfindahl–Hirschman Index (HH) and the Shannon Entropy (SE) as two traditional measures of diversification.

They employ dynamic models to estimate the relationship between sectoral diversification and return and risk. With the following baseline model:

1) $$Return\,(Risk)_{bt} = \gamma Return(Risk)_{bt-1} + \beta\, DM_{bt-1} + \delta B_{bt-1} + \theta C_{t-1} + \tau_t + \nu_b + \varepsilon_{bt}$$

2) $$Return\,(Risk)_{bt} = \gamma Return(Risk)_{bt-1} + (\beta_1 + \beta_2\, IB_b) \times DM_{bt-1} + \lambda IB_b + \delta B_{bt-1} + \theta C_{t-1} + \tau_t + \nu_i + \varepsilon_{bt}$$

where Returnbt is the return of bank b at time t measured by Return on Average Assets (ROAAbt) or by Return on Average Equity (ROAEbt); Riskbt is the risk of bank b at time t measured by the ratio of non-performing loans and financing to total loans and financing (NPLbt); DMbt-1 is one of the diversification measures of bank b at time t-1; Bbt-1 is a vector of bank-specific variables at time t-1; Ct-1 is a vector of country-specific variables at time t-1; τt is a time-specific effect; νb is a bank-specific effect and εbt is the common error term. Equation 2 just adds a dummy for Islamic banks to the regression.

The key variable is diversification (DMbt-1). Its coefficient β captures the response of bank returns (risk) to loan and financing diversification variations. If $\beta > 0$ and is statistically significant, it implies that diversification has a positive impact on returns (risk). If $\beta < 0$, then diversification affects returns (risk) negatively.implies that diversification has a positive impact on returns (risk). If $\beta < 0$, then diversification affects returns (risk) negatively.

To capture the effects of sectoral loan diversification on bank returns at different risk levels they use they use following regressions:

3)

$$Return_{bt} = \gamma\, Return_{bt-1} + (\beta_1 + \beta_2\, RISK_{bt-1}) \times DM_{bt-1} + \eta RISK_{bt-1} + \delta B_{bt-1} + \theta C_{t-1} + \tau_t + \nu_i + \varepsilon_{bt}$$

4)

$$Return_{bt} = \gamma\, Return_{bt-1} + \beta_1\, DM_{bt-1} + \eta_1\, RISK_{bt-1} + \lambda IB_b + \beta_2(\, DM_{bt-1} \times RISK_{bt-1}) + \beta_3(\, DM_{bt-1} \times IB_b) + \eta_2(\, RISK_{bt-1} \times IB_b) + \beta_4(\, DM_{bt-1} \times RISK_{bt-1} \times IB_b) + \delta B_{bt-1} + \theta C_{t-1} + \tau_t + \nu_i + \varepsilon_{bt}$$

Equation 4) is used to test if the effects are different on Islamic and conventional banks. Finally marginal effects are used to distinguish the effects of diversification on returns as a function of risk.

The following table shows regression results for Equation 1) and Equation 2).

Impact of sectoral diversification on bank returns (ROAA & ROAE) and risk (NPL).

Variables	ROAA				ROAE				NPL			
	HHI		SE		HHI		SE		HHI		SE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ROAA/ROAE/NPL $_{t-1}$	0.574***	0.557***	0.575***	0.558***	0.428***	0.489***	0.431***	0.384***	0.854***	0.825***	0.861***	0.833***
	[0.108]	[0.114]	[0.107]	[0.112]	[0.111]	[0.084]	[0.112]	[0.105]	[0.064]	[0.072]	[0.064]	[0.070]
DM $_{t-1}$	−0.990***	−1.113***	−0.892***	−0.908***	−11.463***	−10.538***	−10.078***	−12.577***	1.743**	1.629*	1.261**	1.011
	[0.259]	[0.277]	[0.262]	[0.252]	[3.368]	[2.973]	[3.182]	[3.449]	[0.743]	[0.836]	[0.617]	[0.677]
DM $_{t-1}$ × IB		−0.006		−0.24		1.28		2.647		1.426		1.56
		[0.565]		[0.596]		[3.958]		[4.629]		[1.373]		[1.298]
Size $_{t-1}$	0.034	−0.006	0.046	0.007	0.860**	0.346	1.004**	0.820*	−0.023	−0.032	−0.032	−0.043
	[0.039]	[0.041]	[0.042]	[0.042]	[0.361]	[0.350]	[0.413]	[0.419]	[0.140]	[0.129]	[0.134]	[0.119]
Capital $_{t-1}$	0.007	0.004	0.008	0.005	−0.132**	−0.138***	−0.122**	−0.154***	0.003	0	0.005	0.003
	[0.007]	[0.007]	[0.007]	[0.007]	[0.055]	[0.046]	[0.054]	[0.048]	[0.029]	[0.028]	[0.028]	[0.026]
Credit $_{t-1}$	0.007***	0.009***	0.008***	0.009***	0.068***	0.068***	0.074***	0.078***	0.013*	0.016**	0.011*	0.015**
	[0.003]	[0.003]	[0.003]	[0.003]	[0.022]	[0.020]	[0.022]	[0.023]	[0.007]	[0.008]	[0.007]	[0.007]
GDP Growth $_{t-1}$	0.025***	0.025***	0.024***	0.025***	0.228***	0.201**	0.218***	0.254***	−0.030*	−0.031*	−0.028*	−0.030*
	[0.008]	[0.009]	[0.008]	[0.009]	[0.077]	[0.086]	[0.077]	[0.085]	[0.017]	[0.017]	[0.017]	[0.017]
Inflation $_{t-1}$	0.007	0.007	0.007	0.008	0.073	0.045	0.071	0.102	0.013	0.008	0.014	0.007
	[0.008]	[0.009]	[0.008]	[0.009]	[0.062]	[0.064]	[0.062]	[0.069]	[0.013]	[0.017]	[0.013]	[0.017]
Fin. Development $_{t-1}$	−0.008***	−0.008***	−0.007***	−0.007***	−0.048***	−0.041***	−0.040**	−0.039***	0.007	0.010**	0.005	0.008*
	[0.002]	[0.002]	[0.002]	[0.002]	[0.017]	[0.014]	[0.016]	[0.014]	[0.004]	[0.004]	[0.004]	[0.004]
Concentration $_{t-1}$	0	0.001	0.001	0.001	0.007	0.011	0.006	0.002	−0.014	−0.008	−0.015*	−0.009
	[0.002]	[0.002]	[0.002]	[0.002]	[0.018]	[0.016]	[0.019]	[0.019]	[0.009]	[0.009]	[0.008]	[0.009]
Rule of Law $_{t-1}$	−0.409***	−0.502***	−0.448***	−0.553***	−3.248	−2.417*	−3.427*	−4.096**	0.689	0.486	0.743	0.509
	[0.151]	[0.165]	[0.151]	[0.159]	[2.020]	[1.382]	[1.981]	[2.020]	[0.566]	[0.539]	[0.577]	[0.537]
IB		−0.241		−0.082		−2.22		−3.727		−0.926		−1.059
		[0.353]		[0.364]		[2.441]		[2.874]		[0.959]		[0.885]
Constant	1.307**	2.095***	0	1.644**	3.472	9.168	1.956	0	0	0	0	0
	[0.666]	[0.742]	[.]	[0.761]	[5.530]	[6.141]	[5.742]	[.]	[.]	[.]	[.]	[.]
DM $_{t-1}$ + DM $_{t-1}$ × IB = 0		−1.120**		−1.148**		−9.258**		−9.930**		3.054**		2.570**
		[0.513]		[0.576]		[3.735]		[4.305]		[1.362]		[1.294]
Observations	776	776	776	776	776	776	776	776	732	732	732	732
No. of instruments	72	74	72	74	72	63	72	84	61	84	61	84
No. of groups	96	96	96	96	96	96	96	96	92	92	92	92
AR(1) (p-value)	0.014	0.016	0.014	0.015	0.159	0.157	0.158	0.162	0.003	0.004	0.003	0.004
AR(2) (p-value)	0.380	0.411	0.367	0.394	0.220	0.191	0.213	0.240	0.817	0.854	0.817	0.858
Hansen (p-value)	0.174	0.175	0.160	0.142	0.123	0.206	0.114	0.238	0.219	0.518	0.234	0.507

(i) Standard errors in brackets, (ii) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The table shows that sectoral diversification negatively affects returns as measured by ROAA and ROAE while controlling for the bank- and country-specific variables. An increase in diversification of conventional banks by one percentage point, as measured by HHI and SE, reduces ROAA (ROAE) by about 1.11 (10.54) and 0.91 (12.58) percentage points, respectively. In the case of Islamic banks, one percentage point increase in diversification, as measured by HHI and SE, decreases ROAA (ROAE) by about 1.12 (9.26) and 1.15 (9.93) percentage points, respectively. However, statistically speaking, the impacts on the two bank types are the same, as shown by the statistically insignificant interaction term (i.e. DMt-1 × IB). It also shows that there

is strong and consistent evidence that sectoral diversification is positively associated with risk while controlling for the bank-specific and country-specific variables. This positive relationship is observed in both types of banks, Islamic and conventional. An increase in sectoral diversification of conventional banks by one percentage point increases risk by about 1.63 percentage points when measured by HHI (significant at the 10% significance level only), but is insignificant when measured by SE. In the case of Islamic banks, one percentage point increase in sectoral diversification as measured by HHI and SE raises the risk by about 3.06 and 2.57 percentage points, respectively. However, as is the case with returns, there is no difference in how diversification affects Islamic and conventional banks' risk.

Following are the marginal effects of sectoral diversification on banks returns as a function of risk.

Figure 1 Average marginal effects of sectoral diversification on ROAA as function of risk with 90% CIs.

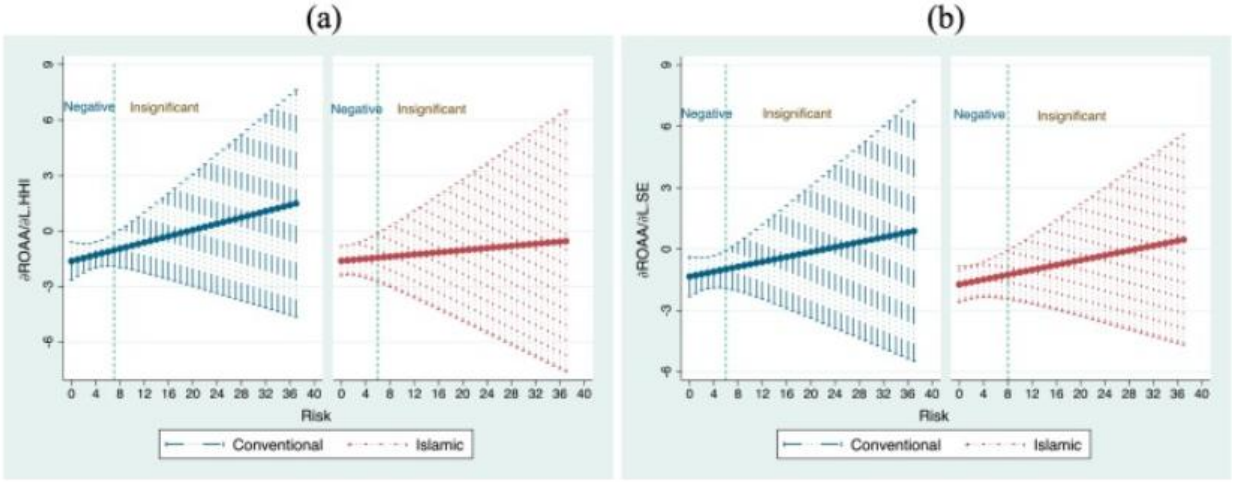
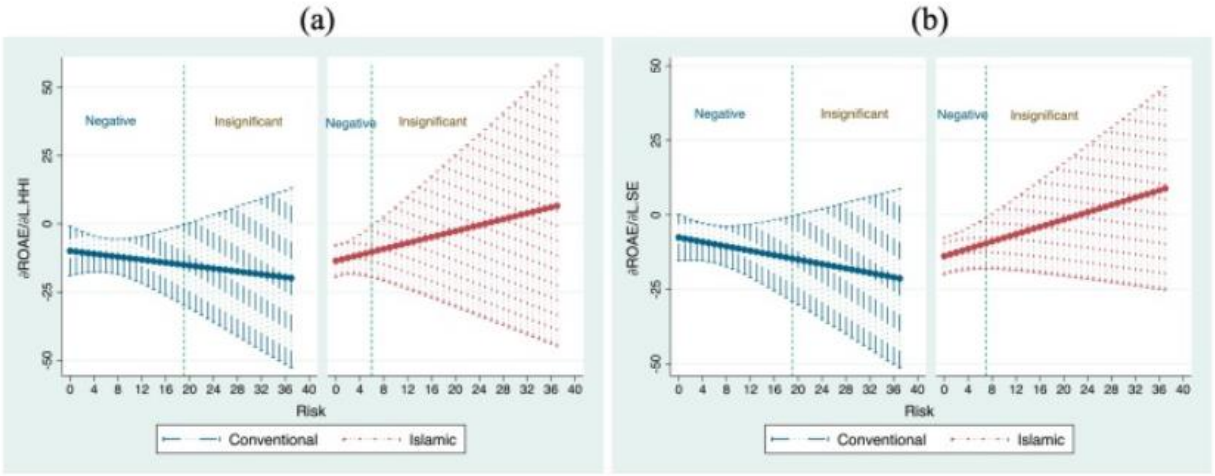


Figure 2 Average marginal effects of sectoral diversification on ROAE as function of risk with 90% CIs.



Figs. 1(a) and 1(b) reveal that the marginal effects of sectoral diversification on ROAA as measured by both HHI and SE are negative at low-risk levels in both conventional and Islamic banks.

Similar effects are observed in the ROAE-diversification relationship as a function of risk. Figs. 2(a) and 2(b) show that the marginal effects are negative at low-risk levels for Islamic banks and negative at almost all other than very high-risk levels for conventional banks.

Finally, to sum it up we see that the effect of sectoral diversification on returns as a function of risk is, for the most part, almost the same for Islamic and conventional banks. Both types of banks are negatively affected at low-risk levels, and most of the sample falls at these levels. While the effects on ROAA of Islamic and conventional banks are almost the same in direction and magnitude, the effects on ROAE of the two differ slightly.

Critique

The paper does a better job in testing against different risk levels as opposed to the previously discussed paper by Jahn et al (2013), however as we have discussed before the paper doesn't address the issue of diversification becoming especially important in extreme events.

Thus, this is an important aspect that the paper lacks to consider, where the true impact of diversification can't be truly calculating without accounting for the extreme events. Also much of the data is concentrated from banks of Malaysia (accounts for 60% of banks) where the results may have been skewed by country specific events. The paper would estimate better results if the bank data was spread more evenly across the mentioned countries.

III. How loan portfolio diversification affects risk, efficiency, and capitalization: A managerial behavior model for Austrian banks? Stefania P.S. Rossi, Markus S. Schwaiger, and Gerhard Winkler

Rossi et al (2009) investigated the effects that bank diversification across size and industry can have on risk, cost and profit efficiency, and bank capitalization for large Austrian commercial banks over the years 1997–2003 using a unique data set from the Austrian banking market provided by the Austrian Central Bank (Oesterreichische Nationalbank/OeNB). The dataset allows them to measure cost and profit efficiency and to test hypotheses on managerial behavior.

They use a Granger-causality approach to test how diversification affects the variables of interest over time. They use the following model:

$$PROV_{s,t} = f_1(PROV_{s,\,lag}, EFF_{s,\,lag}, CAP_{s,\,lag}, HIIN_{s,\,lag}, HISI_{s,\,lag}) + \varepsilon_{1,s,t} \quad (1)$$

$$EFF_{s,t} = f_2(EFF_{s,\,lag}, PROV_{s,\,lag}, CAP_{s,\,lag}, HIIN_{s,\,lag}, HISI_{s,\,lag}) + \varepsilon_{2,s,t} \quad (2)$$

$$CAP_{s,t} = f_3(CAP_{s,\,lag}, PROV_{s,\,lag}, EFF_{s,\,lag}, HIIN_{s,\,lag}, HISI_{s,\,lag}) + \varepsilon_{3,s,t} \quad (3)$$

Where "s" identifies the bank; "t" is the time component; EFF is the level of cost/profit efficiency; PROV measures the asset quality and is computed as the net-amount of charge-offs for credit and market risk over the sum of risk-weighted assets; HIIN measures the diversification of a bank's loan portfolio across different industries by means of the corresponding Herfindahl Index

normalized to 1 for total concentration; HISI measures the degree of diversification in a bank's loan portfolio among different loan sizes/volumes measured by means of the corresponding Herfindahl Index normalized to 1 for total concentration; CAP is the ratio of equity to total assets; it is a measure of bank capitalization and a proxy for economic capital held ex-ante to cover unexpected losses; ε stands for the error term.

Eq. (1) tests the effect of diversification on ex-post realized risk. A positive sign on the Herfindahl indices, which measure concentration, provides evidence for the classical diversification hypothesis i.e higher diversification in a bank's loan portfolio should reduce realized risk, a negative sign for the lack of expertise hypothesis.

Eq. (2) tests the hypothesis that efficiency may depend on bank diversification. A positive effect of diversification on cost efficiency would yield a negative sign on the Herfindahl indices and would thus be indicative of the idiosyncratic risk hypothesis. Conversely, a positive sign on the Herfindahl indices would point towards the monitoring hypothesis.

Eq. (3) closes the model and enables them to test the economic capital hypothesis. A positive sign on the two Herfindahl indices, indicates that the amount of capital banks have to hold declines as diversification increases.

The regression results are displayed in the following table:

Dependent Variable	ΔPROV	ΔEFF	ΔCAP	ΔPROV	ΔEFF	ΔCAP
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
ΔPROV(–1)	0.0529***	–1.08E–06*	–0.0074	0.0105***	–4.68E–05***	–0.0001
ΔPROV(–2)	0.3041***	–1.45E–06***	–0.0151**	0.2295***	–1.89E–05***	0.0275**
ΔEFF(–1)	68.1020***	2.1648***	46.3064***	2.1912***	2.0287***	1.4921***
ΔEFF(–2)	–71.4608***	–1.1714***	–48.3115***	–3.0065***	–1.0315***	–1.1186***
ΔCAP(–1)	–0.1096	4.59E–06	0.4482***	0.2348***	–3.43E–05	0.3555***
ΔCAP(–2)	0.0164**	–4.85E–07*	0.0018	0.0041	–1.73E–06*	0.0091
ΔHIIN(–1)	0.0010	5.265E–07***	–0.0001	0.0193	–3.68E–06***	–0.0036
ΔHIIN(–2)	0.0123***	2.67E–07***	0.0030***	0.0162***	–3.87E–07**	0.0077***
ΔHISI(–1)	0.0231***	2.81E–07**	–0.0064***	0.0030***	–1.53E–06***	–0.0087***
ΔHISI(–2)	0.0297***	3.85E–07*	–0.0025	0.0229***	–2.18E–06***	–0.0052
Constant	0.0013**	–2.49E–07*	0.0027***	–0.0111**	–1.95E–05*	0.0049***
Structural tests	*p*-Value	*p*-Value	*p*-Value	*p*-Value	*p*-Value	*p*-Value
Sargan test	0.35	0.98	0.23	0.29	0.15	0.23
Test for autocorrelation	0.21	0.28	0.46	0.22	0.12	0.39

The results showcase that higher diversification in a bank's loan portfolio reduces realized risk as the coefficients of the independent variables are consistent with regard to the cost and profit specifications (first and fourth column of the above Table). The lagged values of the two measures of diversification (HIIN and HISI) are significant and positive suggesting that high concentration (i.e., low diversification) implies larger provisions for risk. Regarding the Eq. (2), both measures of concentration (HIIN and HISI) are positive and significant, indicating that higher concentration

increases cost efficiency, therefore the result can be interpreted as a high diversification achieved by expansion into many different industries and a very granular loan book dampens cost efficiency. Finally, the Eq. (3) in which the dependent variable is the bank's economic capital showcases mixed results as regards the impact of diversification on capital requirements. On the one hand, the overall impact of concentration across industries is positive and significant in both specifications, indicating that an increase in diversification reduces the capital required by managers, regulators, creditors and owners. This is again consistent with classical theory of finance and furthermore supports the economic capital hypothesis. On the other hand, diversification across different loan sizes does not yield a reduction in capital. However, the evidence (Eq. (3)), has to be interpreted with caution, as in both the cost and the profit efficiency specifications almost half of the coefficients are statistically not significant.

Overall, the paper finds diversification has a positive effect on the performance of the Austrian banks. In particular, the main results show that: (i) diversification reduces realized risk and therefore the need for provisioning (ii) diversification decreases cost efficiency and increases profit efficiency (iii) diversification across industries reduces capital requirements.

Critique

The paper does a good job at analyzing the impact of diversification profit and costs for banks, it showcases that banks that diversified less had a need to provision more in costs and profits, in line with studies that good portfolio diversification is crucial to reduce regulatory capital. However, the paper suffers from the same mistake of not testing the model for extreme effects, i.e how the model and banks would have performed in case of crisis, which is a main topic of concern these days as the world has started adopting C-VAR for precisely this reason.

Recommendation

Banks play a pivotal role in economy and in functioning of the financial system, as the 2009 financial crisis taught us that extreme events in the sector can have devastating impacts on the whole economy. In the presence of systemic s risk, the bankruptcy of one or more large banks may incur sizable losses for the whole financial system by generating other bankruptcies via the simple domino effect. This more macro-economic dimension has become more important since the financial crisis of 2007-2009 and has reinforced the need to regulate bank risks.

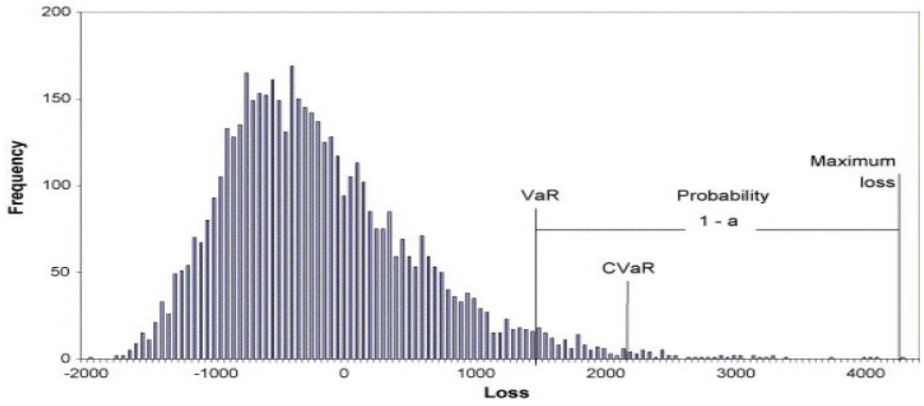
As such Basel III was introduced new rules on capital adequacy and better control of liquidity risk, closer management of risks and bank oversight, the need for CRO (Chief Risk Officer) to become more independent, more transparency in risk management and increased capital in reserves (long term) and concepts of LCR (Liquidity coverage ratio) and NSFR (Net Stable funding ratio).

The papers we discussed all found that diversification is beneficial for banks, however there was a lack of consensus on the degree of diversification. Jahn et al (2013) and Seho et al (2021) state that banks should diversify their portfolio in concentrated sectors as banks acquire considerable selection and monitoring abilities that reduce their loan portfolio's credit risk. Whereas, Rossi et al (2009) found that that exploiting diversification resulted in gains for the large Austrian commercial banks.

However, all three papers lacked stress testing incase of extreme events, while Seho et al (2021) suffered from selection bias aswell. As such in my view the papers need to address these issues, to truly capture the impact of diversification. The following steps will have better effects:

1) Testing samples of Banks who followed Basel accords and diversified via internal method and standard approach against a control group with similar bank characteristics but lower diversification.

2) Performing Back testing and stress testing: The backtest procedures can be seen as a final diagnostic check on the aggregate risk model, thus complementing the other various specific diagnostics via stimulating shocks which are more likely to occur than the historical data base suggests, simulate shocks that have never occurred but could, simulate shocks reflecting the possibility that current statistical patterns could break down, simulate shocks which reflect structural breaks which could occur. This will help capture effects when the model is test with various crisis and shock through out different time periods. Ultimately helping to capture diversification effects in case when things exceed losses captured by just a normal Var.
3) The authors in the paper Jahn et al (2013) analyse the relationships around the mean of the distribution, not the tail for effects on financial stability. As we are aware that diversification becomes especially important in extreme events. Hence, there has been such a push for calculating losses via C-VAR over VAR. Thus, this is an important aspect that the paper lacks to consider, where the true impact of diversification can't be truly calculating without accounting for the extreme events. As we can see from the figure below shows difference between loses with Var and C-Var. As seen magnitude of losses despite low frequency can be very severe, as such it is important to incorporate this factor in all studies.



4) Better sample selection as with Seho et al (2021) much of the data is concentrated from banks of Malaysia (accounts for 60% of banks) where the results may have been skewed by country specific events. The paper would estimate better results if the bank data was spread more evenly across the mentioned countries.

Conclusion:

In conclusion we analysed three papers Jahn et al (2013), Seho et al (2021) and Rossi et al (2009) and the results showed that banks ultimately benefit from diversification on a broader scale. However, we found contradicting results on the degree of diversification to adopt as Jahn et al (2013) and Seho et al (2021) argued for diversifying in concentrated sectors and Rossi et al (2009) stating that more the banks diversify greater the profit efficiency and lower risks. We ultimately concluded that further development and testing of models was needed to truly capture the diversification impact via better sample selection and performing back testing and stress testing.

Overall, diversification is better than no diversification as proven by results. The Risk metric approach should be considered by banks. Banks should try to diversify to some extent via industrial, geographical or other factors to better safeguard themselves from default risk, bankruptcy risks and liquidity risks. Furthermore, good portfolio diversification is crucial to reduce regulatory capital for banks.

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