cogent economics & finance

Cogent Economics & Finance

Taylor & Francis
Taylor & Francis Group

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/oaef20

Geographic loan diversification and bank risk: A cross-country analysis

Tu DQ Le , Van TH Nguyen & Son H Tran |

To cite this article: Tu DQ Le , Van TH Nguyen & Son H Tran | (2020) Geographic loan diversification and bank risk: A cross-country analysis, Cogent Economics & Finance, 8:1, 1809120

To link to this article: https://doi.org/10.1080/23322039.2020.1809120

Published online: 17 Aug 2020.

Le et al., *Cogent Economics & Finance* (2020), 8: 1809120
https://doi.org/10.1080/23322039.2020.1809120

cogent economics & finance

FINANCIAL ECONOMICS | RESEARCH ARTICLE

Geographic loan diversification and bank risk: A cross-country analysis

Tu DQ Le[1,2]*, Van TH Nguyen[1,2] and Son H Tran[1,2]

Received: 05 May 2020
Accepted: 05 August 2020

*Corresponding author: Tu DQ Le, Institute for Development & Research in Banking Technology, University of Economics and Law, Ho Chi Minh, Vietnam, 700,000
E-mail: tuldq@uel.edu.vn

Reviewing editor:
David McMillan, University of Stirling, Stirling, UK

Additional information is available at the end of the article

Abstract: This study investigates the geographic loan expansion on bank risk using the aggregate data of 53 countries from 2005 to 2016 using the system generalized method of moments. Our findings show that global expansion tends to increase bank insolvency and reduce bank adjusted-risk-performance. Our findings further indicate loans distributed to advanced markets tend to reduce bank stability while the proportion of loans to other emerging markets and developing countries may have the potential to improve bank solvency and risk-adjusted-performance. As diversification is seen as a necessary strategy to diversify bank risks, bank managers should put more attention to emerging markets.

Subjects: Economics; Finance; Banking

Keywords: geographic loan diversification; bank stability; adjusted-risk-performance; global banking system

JEL classification: F30; G20

1. Introduction

The classical portfolio theory argues that geographic expansion can lower bank risks if returns generated by adding assets are imperfectly correlated with those by existing assets (Goetz et al., 2016). Gropp et al. (2011) emphasize that if diversification makes a bank too-big-to-fail, it can lower the risk of investing in the bank. However, geographic expansion may hinder the ability of

ABOUT THE AUTHORS

Tu DQ Le is a researcher at the Institute for Development & Research in Banking Technology, University of Economics and Law, Vietnam. His works focus on efficiency and productivity measurement in the field of banking and finance, and the industry sector, and the impact of e-commerce on economic growth. His recent papers have been published in International Journal of Managerial Finance, Managerial Finance, and Pacific Accounting Review, Post - Communist Economies, Central Bank Review, and Cogent Economics & Finance

Van TH Nguyen is a researcher at the Institute for Development & Research in Banking Technology, University of Economics and Law, Vietnam.

Son H Tran is a senior researcher at the Institute for Development & Research in Banking Technology, University of Economics and Law, Vietnam.

PUBLIC INTEREST STATEMENT

Should banks diversify across different products and/or geographic areas or should they specialize? Due to globalization and increasing competition in the domestic markets, banks tend to expand their businesses globally. However, whether these activities may help banks to diversify their risks is still questionable. If yes, which potential markets should bank go to? This study is the first attempt to examine the effect of globally geographic diversification on bank-risk-adjusted performance. More importantly, our study attempts to provide an answer on whether international banks should more focus on either emerging markets or developed markets.

a bank headquarter to monitor its subsidiaries, with a potentially negative impact on asset quality (A. N. Berger, Miller et al., 2005). To extend that diversification increases complexity, this may reduce the banks' ability to monitor loans and control risk. Empirical studies have yielded mixed findings. Acharya et al. (2006) show that since the US bank holding companies (BHC) expand geographically, their loans become riskier. In contrast, Goetz et al. (2016), and Deng and Elyasiani (2008) present evidence that geographic expansion lowers risk.

Our study contributes to the literature in several ways. Most studies examine the effect of geographic expansion on bank risk using bank-level data within a specific market or between several countries in the European market. In contrast to prior studies using bank-level data, this is the first attempt to investigate whether geographic loan diversification in the global market is beneficial using the aggregate data. Second, there appear many universal banks that have provided banking products and services in several international markets. Our unique dataset allows us to distinguish the effect of loans distributed to different markets on bank performance. Therefore, this could help banks to choose whether to expand globally and which markets should be focused on.

Using a sample of 53 countries between 2005 and 2016, our findings show that global banking systems do not benefit from diversification. When breaking down geographic expansion, loans distributed to advanced markets tend to increase bank insolvency while those distributed to emerging markets show the opposite direction. This thus suggests that the banking systems should put more attention to emerging markets if they choose to expand globally. Bank performance is negatively associated with credit risk, liquidity risk, and bank inefficiency. Also, bank solvency is positively related to bank deposits, implying that customer deposits are a primarily stable source of funding for the banking system. Furthermore, our findings stress that large capital markets improve bank performance by enhancing the screening of potential borrowers and monitoring their investment more efficiently. Lastly, bank performance is affected by economic growth, inflation, and market concentration. Our results are robust to a set of sensitivity analyses involving: (1) alternative measures of bank performance, (2) using sub-samples and controlling for financial shocks, and (3) controlling for the regulatory environment.

The remainder of this study is organized as follows. Section 2 provides a brief of relevant empirical studies on the relationship between diversification and bank risk. Section 3 provides methodology and data. Section 4 discusses the main findings while Section 5 concludes.

2. Literature review

The literature on the impact of diversification on bank risk can be divided into two main strands. The first strand is to assess the relationship between income diversification and bank risk. The second is to investigate the link between geographic expansion and bank risk.

The evidence in the first strand shows that diversification benefits are ambiguous. Early studies demonstrate that diversification strategy may have the potential to reduce risk (Gallo et al., 1996; Kwast, 1989). Diversification is a hedge against insolvency risk and mitigates the effect of costly financial distress (Froot & Stein, 1998). These studies conclude that the negative effect of diversification on bank risk holds if non-traditional activities must be at a relatively low level.

A study by Stiroh (2004) shows that increased fee-based income is associated with a decrease in risk-adjusted returns. Rather, this increase in non-interest income (NII) is accompanied by greater market risks. His findings are in line with those by Calmès and Liu (2009) in Canada, indicating that income diversification is related to greater income volatility. Indeed, a shift towards free-based income sources increases earnings volatility that accounts for leverage effects (R. DeYoung & Roland, 2001) and worsens the bank's risk-return trade-off (R. DeYoung & Rice, 2004; Stiroh & Rumble, 2006). Van Oordt (2014) further indicates that diversification via securitization results in instability for both individual banks and the whole banking system.

Similarly, the evidence in other developed markets suggests no clear diversification benefits. Köhler (2015) highlights the substantial benefits of income diversification. Such benefits are more favorable for saving and cooperative banks in Europe while investment banks face riskier. These findings are comparable to those by Chiorazzo et al. (2008) in Italy. In contrast, Baele et al. (2007) show European banks that engage more in fee-based activities can achieve higher expected returns but also suffer greater beta risk. Their findings are in line with those by Lepetit et al. (2008), Mercieca et al. (2007), and Schmid and Walter (2009), suggesting that diversification benefits are offset by increased bank risk. Although NII is found to be riskier than interest income (II), NII provides diversification benefits to bank shareholders (Williams & Prather, 2010), even or some types of it are risk-reducing when considering banks' specialization effects (Williams, 2016). Using international data, Laeven and Levine (2007) also argue that financial conglomerates have a lower market value than focused counterparts. There, therefore, exists a diversification discount in multiple activities financial firms because of the effect of agency problems. Their findings are in line with those by Nguyen (2012) in 28 liberalized finance countries.

The literature in emerging markets shows mixed findings. A study by Lee et al. (2014) points out that non-traditional activities reduce bank risk in middle- and low-income countries. Diversification gains differ between bank types—the benefits are found for commercial, cooperative, and investment banks but not for saving banks—and country-specific. Diversification, however, tends to raise the risk for banks in high-income countries that supports the earlier findings by other studies in developed markets as discussed above. Besides, a study by Sanya and Wolfe (2011) in 11 emerging economies shows that diversification across and within both II and NII activities reduce insolvency risk. Their findings are in line with those by Pennathur et al. (2012) in India, and Meslier et al. (2014) in the Philippines. The opposite results are however found in several studies by Zhou (2014); Li and Zhang (2013) in China; Le (2017) and Le (2018) in Vietnam.

In terms of the second strand, the classical portfolio theory posits that a higher diversification in a bank's loan portfolio should reduce realized risk. Geographic expansion can diversify banking organizations across different regional economic environments, thus resulting in decreasing the variation in the organizations' earning over time. This also can generate additional value for multinational banks by enhancing the organizations' risk-expected return frontier, increasing banks' average revenues by investing in higher-expected-return assets (Berger & DeYoung, 2001). The empirical evidence of the relationship between geographic expansion and bank risk is very limited. However, some prior research using the bank-level data has come close to this aspect. Berger and DeYoung (2001) found mixed findings between geographic scope and bank efficiency in the US and conclude that some banking organizations may operate efficiently in a single area while others may outperform on a national or international basis. Also, using the Austrian data Rossi et al. (2009) show that loan portfolio diversification across different industries increases profit efficiency and alleviates banks' realized risk. More closely, a study by Goetz et al. (2016), using the US data emphasizes that geographic expansion of a bank holding company across US metropolitan statistical areas can reduce bank risk by lowering exposure to idiosyncratic local risk. On the other hand, Mercieca et al. (2007) also found that concentrated lending activities may decrease revenue volatility for small European banks. This further supports the long-term interaction hypothesis (Banerjee et al., 1994) suggests that banks taking part in community life, so-called known the domestic markets are more able to share relationships of nature and to acquire valuable information through such community networks that would not be available in international markets. This information enables banks to monitor creditors better and help develop early warning signals for distressed clients. Eventually, this may help avoid the build-up of vulnerabilities in host institutions' loan portfolios, thereby lowering the banking insolvency. These above arguments may suggest that shifting in lending from domestic to foreign markets may help the banking system to diversify the risk. Recent empirical evidence in the literature on relationship banking however documents that the information advantage resulted from relationship banking allows the banking system make better offering future loans and other information—sensitive products, and reduces risk and uncertainty associated with the lending relationship. In other

words, this relationship lending is seemingly considered as a way to translate into intertemporal smoothing of revenue volatilities over time. Taken together, the following hypothesis is formed as:

H_1: There is no impact of geographic loan diversification on bank risk-adjusted-performance.

Another issue that may arise is whether the banking system should more diversify towards the advanced or emerging markets to improve bank risk-adjusted-performance. Unfortunately, there is yet no study that examines this link. However, some proposed hypotheses in banking efficiency and empirical evidence have come close to this issue. Under the general form of global advantage hypothesis, more efficient foreign organizations can generate additional revenues via superior investment or risk management skills by offering the superior quality or various services that some customers prefer or by obtaining diversification of risks that allows them to pursue higher risk and higher expected return investment strategy (A. N. Berger et al., 2000). Under the limited form of the hypothesis, only the efficient institutions in one or a limited number of home countries with specific favorable conditions can operate more efficiently in host nations. The evidence in banking efficiency shows mixed findings. For advanced markets, foreign banks show superior performance such as in Colombia (Barajas et al., 2000), in selected developed markets in Europe (Bonin et al., 2005), in Argentina and Mexico (Dages et al., 2000), in European transition countries (Grigorian & Manole, 2002), in Hungary (Hasan & Marton, 2003), in Poland (Havrylchyk, 2006), in Central and Eastern Europe (Havrylchyk & Jurzyk, 2011), Croatia (Jemric & Vujcic, 2002; Kraft et al., 2006), in Hungary (Majnoni et al., 2003), in Australia (Sturm & Williams, 2004). The opposite results are found in Argentina (A. N. Berger, Clarke et al., 2005), in the US and some selected European markets (A. N. Berger et al., 2000), in the US (R. DeYoung & Nolle, 1996; Edward Chang et al., 1998), in developed countries (Claessens et al., 2001), in industrialized countries (Micco et al., 2007), in cross-country analysis (Miller & Parkhe, 2002), regional European Union (Miller & Richards, 2002), in Poland (Nikiel & Opiela, 2002). For emerging markets, the confounding findings are also observed. Several papers show the outperformance of foreign banks such as in China (A. N. Berger et al., 2009), Pakistan (Burki & Niazi, 2010), Thailand (Chantapong, 2005), in developing economies (Claessens et al., 2001; Micco et al., 2007), in Malaysia (Detragiache & Gupta, 2006). Sensarma (2006) however emphasizes that foreign banks are the worst performers in India. Even, Correa (2008) shows a neutral performance of foreign banks in 179 developing and developed countries. Similar results are also obtained in Argentina, Chile, and Colombia (Crystal et al., 2001) and in selected developed markets (Vander Vennet, 2003). Some research shows that foreign banks outperform in profits but have higher operating costs in cross-country analysis (Detragiache & Gupta, 2006). In contrast, Yildirim and Philippatos (2007) using 12 transition countries in Europe show the opposite findings.

To extend that, when subsidiaries in a host nation regardless of advanced or emerging markets are more efficient and earn a higher income, the benefits are then translated into the parent banks in a home country. One of the main reasons is that particular subsidiary characteristics and home and host market conditions influence the bank's ability to do business in a particular host country (Berger & DeYoung, 2001). However, foreign banks tend to perform better when regulation in the host country is relatively weak (Claessens & van Horen, 2012). This may be true for emerging markets. Besides, in the advanced markets as the host countries where there appear highly competitive in products and services offered and small share for foreign banks to take, this may induce them to invest more risky assets. Due to a higher level of transparency in regulation in these markets, however, subsidiaries may be less exposed to unfair treatment by host country government and customers. Based on these arguments, the following hypotheses are constructed:

H_2: There is no impact of loan diversification towards advanced markets on bank risk-adjusted-performance.

H_3: There is no impact of loan diversification towards emerging markets on bank risk-adjusted-performance.

3. Data and methodology

3.1. Data

It is worth noting that our data is collected at national or aggregate levels. In particular, the data on geographic loan diversification were extracted from the Financial Soundness Indicators (International Monetary Fund, 2018) while risk-adjusted-performance and other variables were collected from the Financial Development and Structural dataset (Beck et al., 2000), as well as the World Development Indicators (World Bank, 2017). After excluding missing data on geographic loan diversification and matching the three datasets, an unbalanced data of 53 countries[1] between 2005 and 2016 was obtained as described in Table 1.

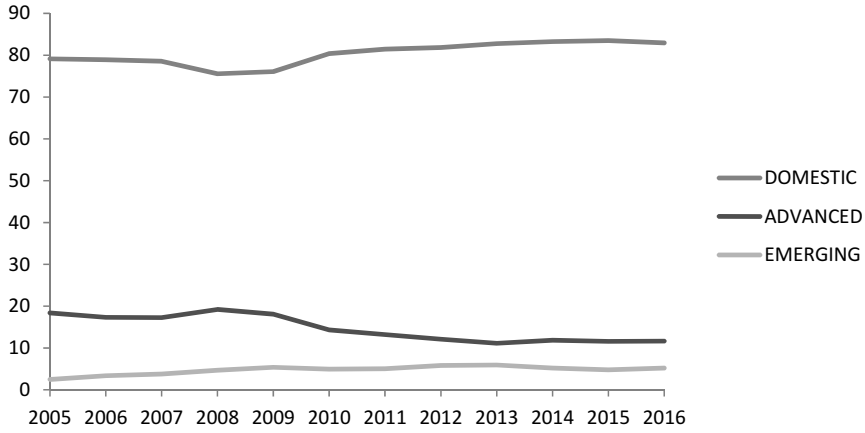
Figure 1 shows that the geographic distribution of loans to domestic markets was slightly reduced for 2005–2008 and started gradually increasing in the later period. Thereafter, this remained stable over the period 2014–2016. When observing the geographic distribution of loans to foreign markets, there appears an increase in the geographic distribution of loans to other emerging markets and developing countries (including China) from 2005 to 2013 and maintained fairly stable between 2014 and 2016 while the trend of the geographic distribution of loans to the advanced economies (excluding China) decreased over the examined period. Table 1 (Panel A) also confirms these trends. More particular, *DOMESTIC* and *EMERGING* increased from 79.12%, 2.5% from 2005 to 82.95%, 5.21% in 2016, respectively while *ADVANCED* decreased from 18.38% to 11.65% over the same period.

Table 1. Descriptive statistics of variables used in this study

Variables	Mean	Std	Min	Max	Sources
Z-score	13.71	8.15	0.02	46.95	Beck et al. (2000)
RAR_{roa}	0.93	1.42	−8.52	6.41	Author's calculation
RAR_{roe}	9.04	15.21	−101.48	48.21	Author's calculation
HHI_{loan}	0.25	0.22	0.00	0.66	Author's calculation
DOMESTIC (%)	81.02	19.72	20.67	100.00	International Monetary Fund (2018)
ADVANCED (%)	13.74	16.04	0.00	69.92	International Monetary Fund (2018)
EMERGING (%)	5.03	7.90	0.00	50.08	International Monetary Fund (2018)
CREDIT (%)	21.96	42.76	−11.80	413.56	International Monetary Fund (2018)
LIQUID (%)	28.82	13.95	4.97	72.06	International Monetary Fund (2018)
NIE (%)	58.79	23.16	−303.46	115.79	International Monetary Fund (2018)
DEPO (%)	69.83	54.66	4.46	434.36	Beck et al. (2000)
FINDEV (%)	52.01	76.58	0.13	1081.12	Beck et al. (2000)
GDPGR (%)	2.54	4.63	−36.70	25.56	World Bank (2017)
INF (%)	3.70	4.56	−4.48	48.70	World Bank (2017)
CONCEN (%)	66.82	18.17	26.99	100.00	Beck et al. (2000)

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; RAR_{ROE}, risk-adjusted returns on equity; RAR_{ROA}, risk-adjusted returns on assets; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging markets and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the annual economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks.

Figure 1. The geographic distribution of loans between 2005 and 2016 (%).



3.2. Diversification measures

We construct the Herfindahl Hirschman Index (HHI) measures for each banking system to account for diversification between geographically major lending markets. The geographic loan diversification ($HHI_{loan)}$ for each banking system is computed from the lending flows as follows:

$$HHI_{loan} = 1 - \left(\left(\frac{DOMESTIC}{LOAN}\right)^2 + \left(\frac{ADVANCED}{LOAN}\right)^2 + \left(\frac{EMERGING}{LOAN}\right)^2\right)$$

where$LOAN = DOMESTIC + ADVANCED + EMERGING$. *DOMESTIC* is a geographic distribution of loans to domestic markets, *ADVANCED* is a geographic distribution of loans to advanced economies, excluding China, *EMERGING* is a geographic distribution of loans to other emerging markets and developing countries including China. This indicator, HHI_{loan} ranges in value from zero to one, with higher values implying greater funding diversity.

3.3. Risk-adjusted-performance measures

Following Le et al. (2019), Laeven and Levine (2009), and Beck et al. (2000) and among others, we use the Z-score as an inverse measure of overall bank risk as follows:

$$Z - score = \frac{ROA + \frac{EQUITY}{Totalassets}}{\sigma_{ROA}}$$

where *ROA* is the return on assets, σ_{ROA} is the standard deviation of return on assets. A larger value of Z-score argues the greater banking stability and less overall bank risk.

Following Stiroh (2004) and others, we use risk-adjusted returns on equity (RAR_{ROE}) and risk-adjusted returns on assets (RAR_{ROA}) which are defined as:

$$RAR_{ROE_{i,t}} = \frac{ROE_{i,t}}{\sigma_{ROE_i}};\ RAR_{ROA_{i,t}} = \frac{ROA_{i,t}}{\sigma_{ROA_i}},$$

where ROE is the returns on equity, σ_{ROE} is its standard deviation over the examined period (Fu et al., 2015; Laeven & Levine, 2009). ROA is the returns on total assets, σ_{ROA} is its standard deviation over the examined period. A higher ratio exhibits higher risk-adjusted profits.

3.4. Generalized method of moments

Due to the structure of panel data, a generalized method of moments estimator (GMM) suggested by Arellano and Bover (1995) is used. The use of the GMM estimator aims at controlling for unobserved heterogeneity and endogeneity problems (Arellano, 2002). This estimator also considers unobserved

heterogeneity[2] and the persistence of the dependent variable that is well explained in the banking literature. Hence consistent estimations of the parameter can be provided.

For the endogeneity problems,[3] the system GMM estimator uses lagged values of the dependent variables (in levels and differences) and lagged values of other regressors which potentially suffer from endogeneity as instruments. Following Bond (2002) who suggests that the lagged values of the variables should be treated as endogenous as instruments, all regressors will be instrumented except for those which are considered exogenous.[4] Furthermore, Arellano-Bond autocorrelation (AR) tests and the Hansen test for over-identifying restrictions are used to determine the number of lags. More specifically, the instruments do not meet the required orthogonality conditions when the null hypothesis of the Hansen test is rejected. Additionally, the moment conditions are valid only if there appears no serial correlation in the idiosyncratic errors. The moment conditions are still valid if the null hypothesis at second-order autocorrelation (AR2) cannot be rejected.

The above arguments suggest the application of a dynamic model of bank risk that takes the following form:

$$\pi_{i,t} = \alpha_0 + \alpha_1 \pi_{i,t-1} + \alpha_2 HHI_{loan,i,t} + \alpha_3 CREDIT_{i,t} + \alpha_4 LIQUID_{i,t} + \alpha_5 NIE_{i,t} + DEPO_{i,t} + \alpha_7 FINDEV_t + \alpha_8 GDPGR_t + \alpha_9 INF_t + \alpha_{10} CONCEN_t + \varepsilon_{i,t} \quad (1)$$

As Diamond (1984) suggests that diversification can reduce risk in all types of firms including financial intermediaries, a positive impact of HHI_{loan} on risk-adjusted-performance measures is anticipated. *CREDIT*, a ratio of non-performing loans net of provisions to capital is used to control for credit risk effects. Kolari et al. (2002) and R. DeYoung and Torna (2013) show that bank insolvency is mainly driven by excessive loan defaults. *LIQUID*, a ratio of liquid assets to total assets, is used to control for bank liquidity. The expected bankruptcy cost hypothesis suggests that an increase in the relative liquid assets holdings of the banking system reduces its probability of default (Bordeleau & Graham, 2010). However, more funds invested in liquid assets given their low return relative to other assets would reduce bank profitability. *NIE*, a ratio of non-interest expenses to gross income, is used to control for bank inefficiency. The bad management hypothesis argues that inefficient banking systems may fail to control operating costs or monitor borrowers, thus resulting in higher risk. Alternatively, the skimping costs hypothesis suggests that banks tend to skimp on operating costs by reducing credit monitoring, collateral valuing, and marketing activities to achieve short-run economic efficiency. These activities, however, would deteriorate loan quality, which ultimately results in greater risk. *DEPO*, a ratio of bank deposits to Gross Domestic Product, is used to control for funding strategy. Tacneng (2015) indicates banks that rely on more deposits tend to have lower volatility of return on equity.

FINDEV, a ratio of the value of total shares traded to average real market capital, is used to control for the development of financial markets. The banking system and the capital market may be competing for sources of financing because one sector either the banking system or capital market develops at the expense of the other (Allen & Gale, 1999; Jacklin & Bhattacharya, 1988). A study by Ngo and Le (2019) however argues that the larger the capital market is, the less efficient its banking system would be.

GDPGR, the annual GDP growth rate, is used to control for the effects of economic growth. INF, the inflation rate, is used to control for the inflation effects. *CONCEN*, assets of the three largest banks as a share of assets of all commercial banks, is used to control for the effects of market power. The structure-conduct-performance hypothesis states that a highly concentrated banking system with lower competitive pressure tends to improve profits and increase the franchise value. This thus discourages bank managers to increase their risk-taking.

4. Results

4.1. The baseline model

For the ease of exposition, we focus on the general interpretation of key variables. There is a negative relationship between geographic loan diversification and risk-adjusted-performance measures as shown in Table 2. Because of the high potential endogeneity between variables used as explained above, the system GMM should be used to investigate the impact of geographic loan diversification and bank risk-adjusted-performance.[5]

The result of the Hansen test in all tables of results is reported to investigate the validity of the dynamic panel model. The findings show that the *p*-value of the Hansen test is statistically not significant in any of the models, and thus the null hypothesis cannot be rejected.[6] Hence, there is no evidence of over-identifying restrictions, implying that all conditions for the moments are satisfied and the instruments are accepted. Moreover, in the first-order autocorrelation (AR1), the hypothesis of the non-existence of AR1 between first residual differences is rejected. However, the *p*-values of AR2 are found to be statistically not significant, indicating that the moment conditions of the model are met.[7] All in all, these conclude that the estimated model meets diagnostic tests.

A number of the regression models are run. For the ease of exposition, the general interpretation of interesting and significant variables is presented. Table 3 indicates that the coefficient of μ_{t-1} is positive and significant in all models, suggesting the persistence in risk-adjusted-performance measures. Furthermore, HHI_{loan} is negatively and significantly associated with RAR_{ROA} and RAR_{ROE}, implying that geographic loan diversification fails to improve bank performance. This somewhat supports the early findings of Mercieca et al. (2007) using small European data and Acharya et al. (2006) using Italian data that banks are better off fostering traditionally established lines of lending activities. This in turns improves bank profitability. HHI_{loan} is also negatively related to the Z-score, implying that higher loan concentration improves bank solvency. This is in line with Mercieca et al. (2007). This somewhat supports the long-term interaction hypothesis (Banerjee et al., 1994) suggesting that the information advantage arising from relationship lending helps banks monitor creditors more closely and build-up early warning signals for financially distressed customers. This also may help avoid an accumulation of vulnerabilities in host institutions' loan portfolios, thereby improving the banking solvency.

It is important to note that the regression coefficients on the individual component share in the loan share measure the effect of a shift from the omitted category of the component share into an alternative since one component share has to be excluded to avoid perfect collinearity. We decompose the geographic loan distribution into the proportion of loans to the advanced economies to total loans, excluding China, denoted by *ADVANCED*, the proportion of loans to other emerging and developing countries including China to total loans, denoted by *EMERGING*. The data shown in Table 4 indicate that *ADVANCED* is negatively and significantly related to Z-score while *EMERGING* is positively associated with Z-score although it is relatively weak. This may suggest that the loans to emerging markets and developing countries possibly contribute to the improvement in bank stability. These emerging markets are poised to grow well above the global average thus they are requiring more loans to develop. This thus generates higher income for foreign banks.[8] Not least, these markets also have comparatively low penetration rates in financial services, generating many upsides and opportunities for foreign banks hoping to stake a claim. Nonetheless, this somewhat supports the early findings of Claessens and van Horen (2012) that foreign banks tend to perform better in a host country where there is a lax regulatory environment. This is quite true for the case of emerging markets.

The coefficient of *CREDIT* is negative and significant in two models, suggesting the banking systems that face higher credit risk are less stable and lower profitability. This is consistent with the findings of Dietrich and Wanzenried (2014), Athanasoglou et al. (2008). The coefficient of *LIQUID* is generally negative and significant one model, suggesting the banking systems that hold

Table 2. The correlation matrix between variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Z-score	1													
2.RAR_{ROE}	0.108	1												
3.RAR_{ROA}	0.222	0.821	1											
4.LOANDIV	−0.253***	−0.128**	−0.030	1										
5.ADVANCED	0.217	−0.132**	0.087	0.81***	1									
6.EMERGING	0.152**	0.051	0.063	0.601***	0.201***	1								
7.CREDIT	−0.251***	−0.013	0.055	0.022	−0.020	−0.020	1							
8.LIQUID	0.107*	0.139**	0.168***	0.059	0.168***	0.116*	−0.151**	1						
9.NIE	0.069	−0.149**	−0.106*	0.164***	0.159***	−0.058	0.018	−0.093	1					
10.DEPO	0.372***	−0.036	0.31***	0.588***	0.743***	0.238***	0.094	0.159***	0.114*	1				
11.FINDEV	−0.017	0.002	−0.039	0.035	0.032	−0.078	−0.112*	0.028	0.014	−0.024	1			
12.GDPGR	0.079	0.174***	0.108*	−0.239***	−0.18***	−0.058	−0.197***	0.117**	−0.187***	−0.192***	0.002	1		
13.INF	−0.250***	0.11*	0.067	−0.459***	−0.383***	−0.182***	−0.017	−0.053	−0.18***	−0.417***	−0.089	0.226***	1	
14.MP	0.030	−0.146**	−0.174***	0.419***	0.333***	0.059	0.114*	−0.101*	0.137**	0.149**	−0.036	−0.221***	−0.308***	1

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; RAR_{ROE}, risk-adjusted returns on equity; RAR_{ROA}, risk-adjusted returns on assets; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging market and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the annual economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

cogent economics & finance

Table 3. The results of baseline models

π	Z-score	RAR_{ROE}	RAR_{ROA}
π_{t-1}	0.693***(0.044)	0.387***(0.09)	0.354***(0.072)
HHI_{loan}	−7.159***(1.746)	−4.256***(1.129)	−4.368***(1.505)
CREDIT	−0.001*(0.0004)	−0.001***(0.0004)	−0.001(0.001)
LIQUID	−0.001(0.001)	0.001(0.001)	−0.003*(0.002)
NIE	−0.002**(0.001)	−0.002*(0.001)	−0.003***(0.001)
DEPO	0.053***(0.006)	−0.002(0.004)	−0.004(0.004)
FINDEV	−0.0001(0.001)	0.002***(0.0003)	0.003**(0.001)
GDPGR	0.065*(0.034)	0.102***(0.018)	0.121***(0.022)
INF	−0.098***(0.032)	−0.096***(0.025)	−0.061**(0.026)
CONCEN	0.002(0.013)	−0.015*(0.009)	−0.015**(0.007)
Constant	3.142**(1.344)	4.129***(0.705)	5.179***(0.974)
No. Obs	286	288	288
No. groups	41	41	41
AR1 (p-value)	0.001	0.000	0.000
AR2 (p-value)	0.233	0.416	0.507
Hansen test (p-value)	0.742	0.509	0.180

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; RAR_{ROE}, risk-adjusted returns on equity; RAR_{ROA}, risk-adjusted returns on assets; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging markets and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the annual economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

more liquid assets tend to have a lower profit. This is comparable with the findings of Sharma et al. (2013) that more funds invested in cash or cash equivalents tend to reduce liquidity premium in bank margin given the low return relative to other assets.[9]

NIE is negatively and significantly related to all risk-adjusted-performance measures, indicating that more efficient banks appear to be more stable and have a higher level of profitability. This supports the findings of Le et al. (2019), and Berger (1995). *DEPO* is found to have a positive impact on bank stability. This suggests that customer deposits are the main and stable source of funding for the banking system.

FINDEV is generally positively and significantly associated with three measures of risk-adjusted-performance, thus, supporting the view that capital market development and banking performance are rather considered as complementary to one another. This further supports the findings of Beccalli et al. (2006), Liadaki and Gaganis (2010), Bossone and Lee (2004), and Le and Ngo (2020) who demonstrate that large capital markets help banking system not only improve the screening of potential borrowers but also monitor their investment more efficiently and effectively—thus, improving bank performance. A positive relationship between *GDPGR* and risk-adjusted bank performance in all models supports the traditional view that economic growth may increase demand for financial products and/or services provided by the banking system during cyclical upswings, thus generating higher profitability (Athanasoglou et al., 2008; Demirgüç-Kunt & Huizinga, 1999; Dietrich & Wanzenried, 2014). Also, the negative impact of *INF* on risk-adjusted bank performance implies that a higher inflation rate may raise the risk of loan

Table 4. The results of decomposing geographic loan diversification

π	Z-score	RAR_{ROE}	RAR_{ROA}
π_{t-1}	0.705***(0.034)	0.433**(0.202)	0.354***(0.053)
HHI_{loan}	−2.088(4.353)	−8.211*(4.112)	−1.91(1.576)
ADVANCED	−0.082***(0.017)	−0.003(0.032)	0.003(0.01)
EMERGING	0.062*(0.031)	0.062(0.046)	0.02*(0.01)
CREDIT	−0.0004(0.001)	−0.001(0.003)	0.0001(0.0004)
LIQUID	−0.002*(0.001)	−0.006**(0.003)	−0.004***(0.001)
NIE	−0.002***(0.0004)	−0.004**(0.002)	−0.002**(0.001)
DEPO	0.047***(0.004)	0.035***(0.009)	−0.005(0.003)
FINDEV	0.0002(0.001)	0.015***(0.004)	0.002**(0.001)
GDPGR	0.105***(0.028)	0.131***(0.036)	0.131***(0.019)
INF	−0.09*(0.053)	0.033(0.052)	−0.023(0.02)
CONCEN	0.029(0.026)	−0.028*(0.015)	−0.023***(0.008)
Constant	1.321(2.016)	3.529*(2.081)	4.557***(0.783)
No. Obs	286	288	288
No. groups	41	41	41
AR1 (p-value)	0.001	0.001	0.000
AR2 (p-value)	0.255	0.596	0.653
Hansen test (p-value)	0.593	0.649	0.328

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; RAR_{ROE}, risk-adjusted returns on equity; RAR_{ROA}, risk-adjusted returns on assets; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging market and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the annual economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

repayment because it affects the borrowers' budgets, which ultimately threatens their liquidity and reduces their repayments (Pervan et al., 2015). More interestingly, the findings show the negative relationship between market concentration and risk-adjusted bank profitability. Nonetheless, this finding is in line with those of Le and Ngo (2020).

4.2. Robustness check

To provide a robustness check, we first use traditional measures of bank performance. Thereafter, we investigate the relationship still holds when controlling for the regulatory policy. Finally, we further examine the impact of geographic loan diversification on bank performance in subsamples.

As shown in Table 5, the coefficient of HHI_{loan} is generally negative in all models and only significant in the ROE model while the *EMERGING* is significantly and positively associated with ROA. Nonetheless, these findings confirm our main findings as above.

Regulatory policies regarding bank activity restrictions are likely to affect diversification benefits. Due to the limited data, we thus include the financial freedom variable to investigate if our results are robust when we control for this variable. It is important to note that we cannot include other regulatory variables as used in Mercieca et al. (2007) for small banks in Europe because they are not available yet in the global context. The bank regulation and supervision survey covering the period 2011 and 2016 was started in 2017 and expected to complete in 2019. Nonetheless, if our results

Table 5. The results of the relationship between geographic loan diversification and bank performance—alternative measures

π	ROE		ROA	
π_{t-1}	0.162***(0.044)	0.1002***(0.033)	0.234***(0.03)	0.253***(0.016)
HHI_{loan}	−31.379**(12.18)	−47.282***(7.943)	−0.934(1.026)	−0.958(0.903)
ADVANCED		0.084(0.057)		−0.005(0.005)
EMERGING		−0.203(0.157)		0.04**(0.019)
CREDIT	−0.011***(0.004)	−0.002(0.002)	−0.001***(0.0003)	−0.001***(0.0002)
LIQUID	−0.001(0.013)	0.007(0.006)	0.004***(0.0004)	0.005***(0.0003)
NIE	−0.024***(0.006)	−0.014***(0.004)	−0.002***(0.0004)	−0.001***(0.0003)
DEPO	0.054***(0.019)	0.028(0.021)	0.0002(0.004)	−0.001(0.002)
FINDEV	0.012(0.011)	−0.011(0.009)	0.001**(0.001)	0.001***(0.0004)
GDPGR	1.105***(0.162)	1.176***(0.095)	0.111***(0.016)	0.113***(0.009)
INF	−0.257(0.268)	−0.2*(0.122)	−0.022(0.018)	−0.016(0.013)
CONCEN	0.026(0.078)	0.104(0.054)	−0.0003(0.006)	−0.002(0.005)
Constant	14.813**(5.784)	10.290**(4.206)	0.43(0.382)	0.0004(0.402)
No. Obs	284	284	283	283
No. groups	41	41	41	41
AR1 (p-value)	0.110	0.104	0.041	0.027
AR2 (p-value)	0.127	0.123	0.148	0.149
Hansen test (p-value)	0.766	0.485	0.495	0.295

Notes: ROA, returns on assets; ROE; returns on equity; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging market and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the annual economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

regarding diversification effects are driven by the degree of the openness of the banking system or activity restrictions, the controlling for this variable will drive out the significance of our key explanatory variables. While the coefficient of this variable is not to be interpreted in a causal sense, testing for its significance provides some information on the relationship between soundness resulted from the banking freedom and the bank risk-adjusted-performance. *FREE* is a broad indicator of the openness of the banking system.[10] The index provides information on whether banks are free to extend credit, accept deposits, and conduct operations in foreign currencies, foreign banks are allowed to operate freely, and the government influences the allocation of credit. The regulatory variable is extracted from the Heritage Foundation. Following Mercieca et al. (2007), it is anticipated that greater degree of the openness of the banking system is related to less insolvency risk because a banking system operating in a more open environment tend to engage in those activities that they deem most appropriate to their strategies and objectives to control risk appropriately.

Table 6 shows that the coefficients of HHI_{loan} and *ADVANCED* are negative and significant when controlling for banking freedom. This further supports our main findings. Furthermore, the findings also suggest that increased openness of the banking system is related to less insolvency risk. This is comparable with the findings of Barth et al. (2004) and Mercieca et al. (2007).

The literature suggests that bank diversification may intensify bank instability or exacerbate the risk of financial market collapse when financial crises occur (Kim et al., 2020). Under the impact of the

Table 6. The results of the relationship between geographic loan diversification and bank performance—regulatory variable

π	Z-score	
π_{t-1}	0.701***(0.045)	0.712***(0.031)
HHI_{loan}	−7.084***(2.201)	−0.908(1.545)
ADVANCED		−0.073***(0.014)
EMERGING		0.038(0.028)
CREDIT	−0.001***(0.0004)	−0.001*(0.0003)
LIQUID	−0.002*(0.001)	−0.003***(0.001)
NIE	−0.003**(0.001)	−0.002**(0.001)
DEPO	0.057***(0.006)	0.035***(0.006)
FINDEV	−0.0004(0.001)	−0.0002(0.001)
GDPGR	0.058*(0.033)	0.086***(0.029)
INF	−0.075***(0.027)	−0.113***(0.03)
CONCEN	−0.008(0.01)	−0.013(0.015)
FREE	0.142(0.131)	0.199**(0.085)
Constant	2.899**(1.378)	3.722***(1.186)
No. Obs	286	286
No. groups	41	41
AR1 (p-value)	0.001	0.001
AR2 (p-value)	0.244	0.270
Hansen test (p-value)	0.617	0.180

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is the geographic distribution of loans to domestic markets, ADVANCED is the geographic distribution of loans to advanced economies, excluding China, EMERGING is the geographic distribution of loans to other emerging market and developing countries including China; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks; FREE, the banking freedom index. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

global financial crisis 2007–09, banks were significantly more cautious in the extension of credit (Gilchrist & Zakrajšek, 2012). Allen et al. (2014) also suggest subsidiaries of multinational bank holding companies decreased their lending activities during the crisis because this reduction in lending is strongly associated with their parent bank's lending through the interbank market. Therefore, it is crucial to control for the effect of financial shocks when examining the impact of geographic loan diversification on bank performance. We include *CRISIS*—a dummy variable that takes a value of 1 for the global financial crisis (GFC) period, otherwise 0.[11] Moreover, the limited form of global advantage hypothesis also proposes that foreign affiliates in a host nation tend to more efficient when the home and host nations have similar economic environments (A. N. Berger et al., 2000). To extend that, we test whether geographic distribution of loans to either advanced or emerging markets (host nations) from a similar market or supervisory and regulatory conditions in the home countries would enhance bank performance. Due to the small sample size, we cannot divide the sample into two subsamples: high income and low income. Instead, we use *GROUP* as measured by a dummy variable that takes a value of 1 for a high-income country, 0 otherwise.[12] Therefore, we use the interaction between *GROUP* and HHI_{loan} to examine whether the relationship between geographic loan diversification and bank performance still holds in subsamples when taking account of financial shocks. As shown in Table 7, HHI_{loan}*GROUP* is negatively related to Z-score, suggesting that for high-income countries, geographic expansion tends to be more insolvency.

Table 7. The results of the relationship between geographic loan diversification and bank performance in subgroups and using financial shock variable

π	Z-score	
π_{t-1}	0.682***(0.046)	0.659***(0.047)
*HHI_{loan}*GROUP*	−5.694***(1.663)	−0.665(3.98)
*ADVANCED*GROUP*		−0.082***(0.013)
*EMERGING*GROUP*		0.019(0.032)
CREDIT	−0.0002(0.001)	0.0003(0.001)
LIQUID	−0.002(0.001)	−0.003**(0.001)
NIE	−0.002**(0.001)	−0.003***(0.001)
DEPO	0.039***(0.006)	0.043***(0.004)
FINDEV	0.001(0.001)	−0.001(0.001)
GDPGR	0.041(0.033)	0.084***(0.027)
INF	−0.132***(0.03)	−0.128***(0.046)
CONCEN	−0.003(0.015)	−0.008(0.02)
CRISIS	−0.12(0.17)	−0.167(0.357)
Constant	4.567***(1.314)	4.477***(1.156)
No. Obs	286	286
No. groups	41	41
AR1 (p-value)	0.001	0.001
AR2 (p-value)	0.242	0.266
Hansen test (p-value)	0.388	0.579

Notes: Z-score, the returns on assets and the standard deviation of ROA, combined with the value of EQUITY; HHI_{loan}, Herfindahl Hirschman Index in terms of geographic loan diversification; DOMESTIC is geographic distribution of loans to domestic markets, ADVANCED is geographic distribution of loans to advanced economy, excluding China, EMERGING is geographic distribution of loans to other emerging markets and developing countries including China; GROUP is measured by a dummy variable that takes a value of 1 for a high-income country, 0 otherwise; HHI_{loan} *GROUP, the interaction between HHI_{loan} and GROUP; ADVANCED*GROUP, the interaction between ADVANCED and GROUP; EMERGING*GROUP, the interaction between EMERGING and GROUP; CREDIT, a ratio of non-performing loans net of provisions to capital; LIQUID, the ratio of liquid assets to total assets; NIE, the ratio of non-interest expenses to gross income; DEPO, the ratio of bank deposits to Gross Domestic Product; FINDEV, a ratio of the value of total shares traded to average real market capital; GDPGR, the economic growth rate; INF, the inflation rate, CONCEN, assets of the three largest banks as a share of assets of all commercial banks; CRISIS, a dummy variable that takes a value of 1 for global financial crisis period, and 0 otherwise. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

The negative sign of *ADVANCED*GROUP* implies that for high-income countries, more loans distributed to advanced markets reduce bank solvency. This somewhat supports the early view in the banking efficiency that the similarity of economic environments in the host and home countries is insufficient to ensure foreign banks operate efficiently than others in other nations (Sufian, 2009).

5. Conclusion

This paper investigates the impact of diversification on the performance of the global banking system. Using an aggregate dataset for 53 countries, we find no diversification benefits for the banks within geographic loan diversification between 2005 and 2016.

Our results are consistent with arguments that globally geographic expansion increases risk by reducing the ability of banks to control risks. The analyses also suggest a negative link between geographic diversification and risk-adjusted-performance. These results still hold when using an array of robustness tests using the traditional measure of bank performance, are substantiated when the regulatory policy on financial freedom is controlled for, and using subsamples. More interestingly, when observing the decomposition of the geographic loan

diversification, our findings indicate loans that are more distributed to advanced markets tend to increase bank insolvency while the proportion of loans to other emerging market and developing countries seem to enhance bank stability and risk-adjusted-performance. These emerging markets perhaps have comparatively low penetration rates in financial services, thus creating many opportunities for foreign banks hoping to generate greater earnings.

Acknowledgements
"This research is funded by the University of Economics and Law (Vietnam National University – Ho Chi Minh City) under grant number: CS/2019-06"

Funding
This research is funded by the University of Economics and Law (Vietnam National University – Ho Chi Minh City) under grant number: CS/2019-06.

Author details
Tu DQ Le[1,2]
E-mail: tuldq@uel.edu.vn
Van TH Nguyen[1,2]
Son H Tran[1,2]
[1] Institute for Development & Research in Banking Technology, University of Economics and Law, Ho Chi Minh, Vietnam, 700,000.
[2] Vietnam National University, Ho Chi Minh City, Vietnam, 700000.

Citation information
Cite this article as: Geographic loan diversification and bank risk: A cross-country analysis, Tu DQ Le, Van TH Nguyen & Son H Tran, *Cogent Economics & Finance* (2020), 8: 1809120.

Notes

1. The countries in the sample include Australia, Austria, Belgium, Botswana, Brunei, Cameron, Canada, Central African, Chad, Macao, Congo, Croatia, Cyprus, Czech, Denmark, El Salvador, Equatorial Guinea, Estonia, Gabon, Gambia, Georgia, Germany, Greece, Guinea, India, Indonesia, Ireland, Israel, Kazakhstan, Kenya, Korea, Latvia, Luxembourg, Malta, Mauritius, Mexico, Namibia, Netherlands, Pakistan, Philippines, Portugal, Singapore, Slovak, Spain, Sri Lanka, Switzerland, Trinidad and Tobago, Turkey, Ukraine, United Kingdom, United States, and Uruguay.
2. Given differences in corporate governance, unobservable heterogeneity across banking systems cannot be well-measured.
3. For instance, inefficient banks are unable to control operating costs, thus leading to higher risk. Also, more risky banking systems are subject to more regulatory scrutiny, therefore, they may be required to maintain a higher level of liquid assets. The causality could also go oppositely as greater risk banking systems are required to need additional managerial efforts and additional resources to deal with these issues—thus, may reduce banking efficiency.
4. It is assumed that strictly exogenous variables are not correlated to the individual effects while the endogenous variables are predetermined.
5. We also conduct robustness checks with more rudimentary approaches for panel data using fixed effects. The results confirm our main findings and are available upon request.
6. Cameron and Pravin (2010) suggest that the value of Hansen test for over-identifying restrictions should exceed 0.05, thus the null hypothesis cannot be rejected. Alternatively, there is no correlation between the instrument variables and the residuals.
7. Arellano and Bond (1991) demonstrate p-values of AR2 above 0.05 that instruments are still valid.
8. See the report of McKinsey & Company at https://www.mckinsey.com/industries/financial-services/our-insights/tapping-the-next-big-thing-in-emerging-market-banking
9. Following Ghenimi et al. (2017), we also include the interaction between *LIQUID* and *CREDIT* to examine whether both risks jointly have an impact on bank stability. However, the coefficient of *LIQUID*CREDIT* is negative and insignificant in all models although this is not reported here due to the length limitation. Nonetheless, we could not find the joint impact of liquidity risk and credit risk on bank stability.
10. Note that we use the financial freedom index to control for banking freedom effects as we cannot distinguish between them. The index is constructed upon five areas and ranging from 0 to 100, whereby higher values indicate fewer restriction or government interference.
11. We also include only CRISIS in Equation (1). The coefficient of CRISIS is statistically not significant although this is not reported here due to the length restriction.
12. The classification is based on the economic growth rate. To reduce the collinearity, GDP is excluded from the model. Additionally, seven upper middle-income countries are considered to be included a high-income group for ease of exposition in this study.

References

Acharya, V. V., Hasan, I., & Saunders, A. (2006). Should banks be diversified? Evidence from individual bank loan portfolios. *The Journal of Business*, *79*(3), 1355–1412. https://doi.org/10.1086/500679

Allen, F., & Gale, D. (1999). Diversity of opinion and financing of new technologies. *Journal of Financial Intermediation*, *8*(1), 68–89. https://doi.org/10.1006/jfin.1999.0261

Allen, F., Hryckiewicz, A., Kowalewski, O., & Tümer-Alkan, G. (2014). Transmission of financial shocks in loan and deposit markets: Role of interbank borrowing and market monitoring. *Journal of Financial Stability*, *15*, 112–126. https://doi.org/10.1016/j.jfs.2014.09.005

Arellano, M. (2002). Sargan's instrumental variables estimation and the generalized method of moments. *Journal of Business and Economic Statistics*, *20*(4), 450–459. https://doi.org/10.1198/073500102288618595

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money*, *18*(2), 121–136. https://doi.org/10.1016/j.intfin.2006.07.001

Baele, L., De Jonghe, O., & Vander Vennet, R. (2007). Does the stock market value bank diversification? *Journal*

of Banking & Finance, *31*(7), 1999–2023. https://doi.org/10.1016/j.jbankfin.2006.08.003

Banerjee, A. V., Besley, T., & Guinnane, T. W. (1994). Thy neighbor's keeper: The design of a credit cooperative with theory and a test. *The Quarterly Journal of Economics*, *109*(2), 491–515. https://doi.org/10.2307/2118471

Barajas, A., Steiner, R., & Salazar, N. (2000). The impact of liberalization and foreign investment in Colombia's financial sector. *Journal of Development Economics*, *63*(1), 157–196. https://doi.org/10.1016/S0304-3878(00)00104-8

Barth, J. R., Caprio, G., & Levine, R. (2004). Bank regulation and supervision: What works best? *Journal of Financial Intermediation*, *13*(2), 205–248. https://doi.org/10.1016/j.jfi.2003.06.002

Beccalli, E., Casu, B., & Girardone, C. (2006). Efficiency and stock performance in European banking. *Journal of Business Finance & Accounting*, *33*(1-2), 245–262. https://doi.org/10.1111/j.1468-5957.2006.01362.x

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2000). A new database on the Structure and development of the financial sector. *The World Bank Economic Review*, *14*(3), 597–605. https://doi.org/10.1093/wber/14.3.597

Berger, A. N. (1995). The profit-structure relationship in banking: Tests of market-power and efficient-structure hypotheses. *Journal of Money, Credit, and Banking*, *27*(2), 404–431. https://doi.org/10.2307/2077876

Berger, A. N., Clarke, G. R., Cull, R., Klapper, L., & Udell, G. F. (2005). Corporate governance and bank performance: A joint analysis of the static, selection, and dynamic effects of domestic, foreign, and state ownership. *Journal of Banking & Finance*, *29*(8–9), 2179–2221. https://doi.org/10.1016/j.jbankfin.2005.03.013

Berger, A. N., & DeYoung, R. (2001). The effects of geographic expansion on bank efficiency. *Journal of Financial Services Research*, *19*(2–3), 163–184. https://doi.org/10.1023/A:1011159405433

Berger, A. N., DeYoung, R., Genay, H., & Udell, G. F. (2000). Globalization of financial institutions: Evidence from cross-border banking performance. *Brookings-Wharton Papers on Financial Services*, *2000*(1), 23–120. https://doi.org/10.1353/pfs.2000.0001

Berger, A. N., Hasan, I., & Zhou, M. (2009). Bank ownership and efficiency in China: What will happen in the world's largest nation? *Journal of Banking & Finance*, *33*(1), 113–130. https://doi.org/10.1016/j.jbankfin.2007.05.016

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., & Stein, J. C. (2005). Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics*, *76*(2), 237–269. https://doi.org/10.1016/j.jfineco.2004.06.003

Bond, S. R. (2002). Dynamic panel data models: A guide to micro data methods and practice. *Portuguese Economic Journal*, *1*(2), 141–162. https://doi.org/10.1007/s10258-002-0009-9

Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Bank performance, efficiency and ownership in transition countries. *Journal of Banking & Finance*, *29*(1), 31–53. https://doi.org/10.1016/j.jbankfin.2004.06.015

Bordeleau, É., & Graham, C. (2010). The impact of liquidity on bank profitability. Ontario: Working Paper 2010-38, Bank of Canada.

Bossone, B., & Lee, J.-K. (2004). In finance, size matters: The "systemic scale economies" hypothesis. *IMF Staff Papers*, *51*(1), 19–46. https://doi.org/10.2307/30035861

Burki, A. A., & Niazi, G. (2010). Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. *Applied Economics*, *42*(24), 3147–3160. https://doi.org/10.1080/00036840802112315

Calmès, C., & Liu, Y. (2009). Financial structure change and banking income: A Canada–U.S. comparison. *Journal of International Financial Markets, Institutions and Money*, *19*(1), 128–139. https://doi.org/10.1016/j.intfin.2007.09.003

Cameron, A. C., & Pravin, K. T. (2010). *Microeconometrics using Stata, revised edition* (2nd revised ed.). Stata Press.

Chantapong, S. (2005). Comparative study of domestic and foreign bank performance in Thailand: The regression analysis. *Economic Change and Restructuring*, *38*(1), 63–83. https://doi.org/10.1007/s10644-005-4523-5

Chiorazzo, V., Milani, C., & Salvini, F. (2008). Income diversification and bank performance: Evidence from Italian Banks. *Journal of Financial Services Research*, *33*(3), 181–203. https://doi.org/10.1007/s10693-008-0029-4

Claessens, S., Demirgüç-Kunt, A., & Huizinga, H. (2001). How does foreign entry affect domestic banking markets? *Journal of Banking & Finance*, *25*(5), 891–911. https://doi.org/10.1016/S0378-4266(00)00102-3

Claessens, S., & van Horen, N. (2012). Being a foreigner among domestic banks: Asset or liability? *Journal of Banking & Finance*, *36*(5), 1276–1290. https://doi.org/10.1016/j.jbankfin.2011.11.020

Correa, R. (2008). Cross-border bank acquisitions: Is there a performance effect? *Journal of Financial Services Research*, *36*(2), 169. https://doi.org/10.1007/s10693-008-0043-6

Crystal, J., Dages, B. G., & Goldberg, L. S. (2001). Does foreign ownership contribute to sounder banks in emerging markets? The Latin American experience. In R. E. Litan, P. Masson, & M. Pomerleano (Eds.), *Open doors: Foreign participation in Emerging Financial System* (p. 5). Brookings Press.

Dages, B. G., Goldberg, L. S., & Kinney, D. (2000). Foreign and domestic bank participation in emerging markets: Lessons from Mexico and Argentina. *Economic Policy Review*, *6*(3), 17-36. https://doi.org/10.3386/w7714

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review*, *13*(2), 379–408. https://doi.org/10.1093/wber/13.2.379

Deng, S. E., & Elyasiani, E. (2008). Geographic diversification, bank holding company value, and risk. *Journal of Money, Credit, and Banking*, *40*(6), 1217–1238. https://doi.org/10.1111/j.1538-4616.2008.00154.x

Detragiache, E., & Gupta, P. (2006). Foreign banks in emerging market crises: Evidence from Malaysia. *Journal of Financial Stability*, *2*(3), 217–242. https://doi.org/10.1016/j.jfs.2006.06.001

DeYoung, R., & Nolle, D. E. (1996). Foreign-owned banks in the United States: Earning market share or buying it? *Journal of Money, Credit, and Banking*, *28*(4), 622–636. https://doi.org/10.2307/2078074

DeYoung, R., & Rice, T. (2004). Noninterest income and financial performance at U.S. Commercial Banks. *Financial Review*, *39*(1), 101–127. https://doi.org/10.1111/j.0732-8516.2004.00069.x

DeYoung, R., & Roland, K. P. (2001). Product mix and earnings volatility at commercial banks: Evidence from a degree of total leverage model. *Journal of Financial Intermediation*, *10*(1), 54–84. https://doi.org/10.1006/jfin.2000.0305

DeYoung, R., & Torna, G. (2013). Nontraditional banking activities and bank failures during the financial crisis.

Journal of Financial Intermediation, *22*(3), 397–421. https://doi.org/10.1016/j.jfi.2013.01.001

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies*, *51* (3), 393–414. https://doi.org/10.2307/2297430

Dietrich, A., & Wanzenried, G. (2014). The determinants of commercial banking profitability in low-, middle-, and high-income countries. *The Quarterly Review of Economics and Finance*, *54*(3), 337–354. https://doi.org/10.1016/j.qref.2014.03.001

Edward Chang, C., Hasan, I., & Hunter, W. C. (1998). Efficiency of multinational banks: An empirical investigation. *Applied Financial Economics*, *8*(6), 689–696. https://doi.org/10.1080/096031098332727

Froot, K. A., & Stein, J. C. (1998). Risk management, capital budgeting, and capital structure policy for financial institutions: An integrated approach. *Journal of Financial Economics*, *47*(1), 55–82. https://doi.org/10.1016/S0304-405X(97)00037-8

Fu, X. M., Lin, Y. R., & Molyneux, P. (2015). Bank capital and liquidity creation in Asia Pacific. *Economic Inquiry*, *54* (2), 966–993. https://doi.org/10.1111/ecin.12308

Gallo, J. G., Apilado, V. P., & Kolari, J. W. (1996). Commercial bank mutual fund activities: Implications for bank risk and profitability. *Journal of Banking & Finance*, *20*(10), 1775–1791. https://doi.org/10.1016/S0378-4266(96)00024-6

Ghenimi, A., Chaibi, H., & Omri, M. A. B. (2017). The effects of liquidity risk and credit risk on bank stability: Evidence from the MENA region. *Borsa Istanbul Review*, *17*(4), 238–248. https://doi.org/10.1016/j.bir.2017.05.002

Gilchrist, S., & Zakrajšek, E. (2012). Bank lending and credit supply shocks. In F. Allen, M. Aoki, J. Fitoussi, N. Kiyotaki, R. J. Gordon, & J. E. Stiglitz (Eds.), *The global macro economy and finance. International Economic Association Series* (pp. 154–176). Palgrave Macmillan.

Goetz, M. R., Laeven, L., & Levine, R. (2016). Does the geographic expansion of banks reduce risk? *Journal of Financial Economics*, *120*(2), 346–362. https://doi.org/10.1016/j.jfineco.2016.01.020

Grigorian, D. A., & Manole, V. (2002). *Determinants of commercial bank performance in transition: An application of data envelopment analysis*. IMF Working Papers No. 02/146.

Gropp, R., Hakenes, H., & Schnabel, I. (2011). Competition, risk-shifting, and public bail-out policies. *The Review of Financial Studies*, *24*(6), 2084–2120. https://doi.org/10.1093/rfs/hhq114

Hasan, I., & Marton, K. (2003). Development and efficiency of the banking sector in a transitional economy: Hungarian experience. *Journal of Banking & Finance*, *27*(12), 2249–2271. https://doi.org/10.1016/S0378-4266(02)00328-X

Havrylchyk, O. (2006). Efficiency of the Polish banking industry: Foreign versus domestic banks. *Journal of Banking & Finance*, *30*(7), 1975–1996. https://doi.org/10.1016/j.jbankfin.2005.07.009

Havrylchyk, O., & Jurzyk, E. (2011). Profitability of foreign banks in Central and Eastern Europe: Does the entry mode matter? 1. *Economics of Transition*, *19*(3), 443–472. https://doi.org/10.1111/j.1468-0351.2010.00406.x

International Monetary Fund. (2018). *Financial soundness indicators*. Retrieved from Washington, D.C. International Monetary Fund.

Jacklin, C. J., & Bhattacharya, S. (1988). Distinguishing Panics and Information-based Bank Runs: Welfare and Policy Implications. *Journal of Political Economy*, *96*(3), 568–592. https://doi.org/10.1086/261552

Jemric, I., & Vujcic, B. (2002). Efficiency of banks in Croatia: A DEA approach. *Comparative Economic Studies*, *44*(2–3), 169–193. https://doi.org/10.1057/ces.2002.13

Kim, H., Batten, J. A., & Ryu, D. (2020). Financial crisis, bank diversification, and financial stability: OECD countries. *International Review of Economics & Finance*, *65*, 94–104. https://doi.org/10.1016/j.iref.2019.08.009

Köhler, M. (2015). Which banks are more risky? The impact of business models on bank stability. *Journal of Financial Stability*, *16*, 195–212. https://doi.org/10.1016/j.jfs.2014.02.005

Kolari, J., Glennon, D., Shin, H., & Caputo, M. (2002). Predicting large US commercial bank failures. *Journal of Economics and Business*, *54*(4), 361–387. https://doi.org/10.1016/S0148-6195(02)00089-9

Kraft, E., Hofler, R., & Payne, J. (2006). Privatization, foreign bank entry and bank efficiency in Croatia: A Fourier-flexible function stochastic cost frontier analysis. *Applied Economics*, *38*(17), 2075–2088. https://doi.org/10.1080/00036840500427361

Kwast, M. L. (1989). The impact of underwriting and dealing on bank returns and risks. *Journal of Banking & Finance*, *13*(1), 101–125. https://doi.org/10.1016/0378-4266(89)90022-8

Laeven, L., & Levine, R. (2007). Is there a diversification discount in financial conglomerates? *Journal of Financial Economics*, *85*(2), 331–367. https://doi.org/10.1016/j.jfineco.2005.06.001

Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, *93*(2), 259-275. https://doi.org/259-275.10.1016/j.jfineco.2008.09.003

Le, T. D. (2017). The interrelationship between net interest margin and non-interest income: Evidence from Vietnam. *International Journal of Managerial Finance*, *13*(5), 521–540. https://doi.org/10.1108/IJMF-06-2017-0110

Le, T. D. (2018). Bank risk, capitalisation and technical efficiency in the Vietnamese banking system. *Australasian Accounting Business & Finance Journal*, *12*(3), 42–61. https://doi.org/http://dx.doi.10.14453/aabfj.v12i3.4

Le, T. D., & Ngo, T. (2020). The determinants of bank profitability: A cross-country analysis. *Central Bank Review*, *20*(2), 65–73. https://doi.org/10.1016/j.cbrev.2020.04.001

Le, T. D., Tran, S. H., & Nguyen, L. T. (2019). The impact of multimarket contacts on bank stability in Vietnam. *Pacific Accounting Review*, *31*(3), 336–357. https://doi.org/10.1108/PAR-04-2018-0033

Lee, -C.-C., Yang, S.-J., & Chang, C.-H. (2014). Non-interest income, profitability, and risk in banking industry: A cross-country analysis. *The North American Journal of Economics and Finance*, *27*, 48–67. https://doi.org/10.1016/j.najef.2013.11.002

Lepetit, L., Nys, E., Rous, P., & Tarazi, A. (2008). Bank income structure and risk: An empirical analysis of European banks. *Journal of Banking & Finance*, *32*(8), 1452–1467. https://doi.org/10.1016/j.jbankfin.2007.12.002

Li, L., & Zhang, Y. (2013). Are there diversification benefits of increasing noninterest income in the Chinese banking industry? *Journal of Empirical Finance*, *24*, 151–165. https://doi.org/10.1016/j.jempfin.2013.10.004

Liadaki, A., & Gaganis, C. (2010). Efficiency and stock performance of EU banks: Is there a relationship? *Omega*, *38*(5), 254–259. https://doi.org/10.1016/j.omega.2008.09.003

Majnoni, G., Shankar, R., & Varhegyi, E. (2003). *The dynamics of foreign bank ownership: Evidence from Hungary*. Policy Research Working Papers, The World Bank.

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European banks: Benefits from diversification? *Journal of Banking & Finance*, *31*(7), 1975–1998. https://doi.org/10.1016/j.jbankfin.2007.01.004

Meslier, C., Tacneng, R., & Tarazi, A. (2014). Is bank income diversification beneficial? Evidence from an emerging economy. *Journal of International Financial Markets, Institutions and Money*, *31*, 97–126. https://doi.org/10.1016/j.intfin.2014.03.007

Micco, A., Panizza, U., & Yañez, M. (2007). Bank ownership and performance. Does politics matter? *Journal of Banking & Finance*, *31*(1), 219–241. https://doi.org/10.1016/j.jbankfin.2006.02.007

Miller, S. R., & Parkhe, A. (2002). Is there a liability of foreignness in global banking? An empirical test of banks' X-efficiency. *Strategic Management Journal*, *23*(1), 55–75. https://doi.org/10.1002/smj.212

Miller, S. R., & Richards, M. (2002). Liability of foreignness and membership in a regional economic group: Analysis of the European Union. *Journal of International Management*, *8*(3), 323-337. https://doi.org/323-337.10.1016/S1075-4253(02)00071-6

Ngo, T., & Le, T. (2019). Capital market development and bank efficiency: A cross-country analysis. *International Journal of Managerial Finance*, *15*(4), 478-491. https://doi.org/478-491.10.1108/IJMF-02-2018-0048

Nguyen, J. (2012). The relationship between net interest margin and noninterest income using a system estimation approach. *Journal of Banking & Finance*, *36*(9), 2429–2437. https://doi.org/10.1016/j.jbankfin.2012.04.017

Nikiel, E. M., & Opiela, T. P. (2002). Customer type and bank efficiency in Poland: Implications for emerging market banking. *Contemporary Economic Policy*, *20*(3), 255–271. https://doi.org/10.1093/cep/20.3.255

Pennathur, A. K., Subrahmanyam, V., & Vishwasrao, S. (2012). Income diversification and risk: Does ownership matter? An empirical examination of Indian banks. *Journal of Banking & Finance*, *36*(8), 2203–2215. https://doi.org/10.1016/j.jbankfin.2012.03.021

Pervan, M., Pelivan, I., & Arnerić, J. (2015). Profit persistence and determinants of bank profitability in Croatia. *Economic Research-Ekonomska Istraživanja*, *28*(1), 284–298. https://doi.org/10.1080/1331677X.2015.1041778

Rossi, S. P., Schwaiger, M. S., & Winkler, G. (2009). How loan portfolio diversification affects risk, efficiency and capitalization: A managerial behavior model for Austrian banks. *Journal of Banking & Finance*, *33*(12), 2218–2226. https://doi.org/10.1016/j.jbankfin.2009.05.022

Sanya, S., & Wolfe, S. (2011). Can banks in emerging economies benefit from revenue diversification? *Journal of Financial Services Research*, *40*(1), 79–101. https://doi.org/10.1007/s10693-010-0098-z

Schmid, M. M., & Walter, I. (2009). Do financial conglomerates create or destroy economic value? *Journal of Financial Intermediation*, *18*(2), 193–216. https://doi.org/10.1016/j.jfi.2008.07.002

Sensarma, R. (2006). Are foreign banks always the best? Comparison of state-owned, private and foreign banks in India. *Economic Modelling*, *23*(4), 717–735. https://doi.org/10.1016/j.econmod.2006.04.002

Sharma, P., Gounder, N., & Xiang, D. (2013). Foreign banks, profits, market power and efficiency in PICs: Some evidence from Fiji. *Applied Financial Economics*, *23*(22), 1733–1744. https://doi.org/10.1080/09603107.2013.848026

Stiroh, K. J. (2004). Diversification in banking: Is noninterest income the answer? *Journal of Money, Credit, and Banking*, *36*(5), 853–882. https://doi.org/10.1353/mcb.2004.0076

Stiroh, K. J., & Rumble, A. (2006). The dark side of diversification: The case of US financial holding companies. *Journal of Banking & Finance*, *30*(8), 2131-2161. https://doi.org/2131-2161.http://dx.doi.10.1016/j.jbankfin.2005.04.030

Sturm, J.-E., & Williams, B. (2004). Foreign bank entry, deregulation and bank efficiency: Lessons from the Australian experience. *Journal of Banking & Finance*, *28*(7), 1775–1799. https://doi.org/10.1016/j.jbankfin.2003.06.005

Sufian, F. (2009). Determinants of bank efficiency during unstable macroeconomic environment: Empirical evidence from Malaysia. *Research in International Business and Finance*, *23*(1), 54–77. https://doi.org/10.1016/j.ribaf.2008.07.002

Tacneng, R. (2015). The impact of minority foreign ownership and controlling shareholder on bank risk and performance: Evidence from an emerging economy. *Managerial Finance*, *41*(5), 526–546. https://doi.org/10.1108/MF-06-2013-0137

Van Oordt, M. R. (2014). Securitization and the dark side of diversification. *Journal of Financial Intermediation*, *23*(2), 214–231. https://doi.org/10.1016/j.jfi.2013.05.001

Vander Vennet, R. (2003). Cross-border mergers in European banking and bank efficiency. In H. Herrmann & R. Lipsey (Eds.), *Foreign direct investment in the real and financial sector of industrial countries* (pp. 295–321). Springer.

Williams, B. (2016). The impact of non-interest income on bank risk in Australia. *Journal of Banking & Finance*, *73*, 16–37. https://doi.org/10.1016/j.jbankfin.2016.07.019

Williams, B., & Prather, L. (2010). Bank risk and return: The impact of bank non-interest income. *International Journal of Managerial Finance*, *6*(3), 220–244. https://doi.org/10.1108/17439131011056233

World Bank. (2017). *World Development Indicators (WDI)*.

Yildirim, H. S., & Philippatos, G. C. (2007). Efficiency of banks: Recent evidence from the transition economies of Europe, 1993–2000. *European Journal of Finance*, *13*(2), 123–143. https://doi.org/10.1080/13518470600763687

Zhou, K. (2014). The effect of income diversification on bank risk: Evidence from China. *Emerging Markets Finance and Trade*, *50*, 201-213. https://doi.org/201-213.10.2753/REE1540-496X5003S312

***Cogent Economics & Finance* (ISSN:) is published by Cogent OA, part of Taylor & Francis Group.**