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THE COVID-19 PANDEMIC AND BANK PERFORMANCE: THE ROLE OF DIVERSIFICATION

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ABSTRACT

This study investigates the impact of diversification on the relationship between the COVID-19 pandemic and bank performance using a sample of 121 banking systems from 2016Q1 to 2021Q2. Using the system generalised method of moments, the findings show the negative impact of COVID-19 on the global banking system. This is consistent with the literature. Furthermore, the findings emphasise that diversification (e.g., lending diversification, income diversification, and geographic lending diversification) may mitigate the adverse effect of COVID-19 on banking performance. Therefore, a diversification strategy should be further considered to overcome future shocks.

Keywords: Loan diversification, Revenue diversification, Geographic expansion, COVID-19, Bank performance

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INTRODUCTION

The world economy has faced a significant challenge caused by the severe and unprecedented COVID-19 shocks. This seriously affects the global capital markets (e.g., the substantial volatility of markets for commodities, foreign currencies and financial assets). This pandemic has quickly altered the growth outlook of major international banks, financial institutions and credit rating agencies (Donthu & Gustafsson, 2020; Sharma et al., 2020). IMF (2020) suggests that the impact of this health crisis is more severe than that caused by the global financial crisis, and perhaps a deeper recession in the future may occur in some countries. Therefore, this global outbreak has put governments worldwide on an urgent call to control health risks to their citizens while maintaining their economic activities. Due to the spread of the Coronavirus, all economic entities, both demand and supply sides, have been affected (Sharma et al., 2020). Banks and financial institutions are not exceptional. This outbreak has triggered some precautionary responses from depositors (e.g., withdrawal rates) and financial intermediaries' peers (e.g., affecting market funding) (Elnahass et al., 2021). Additionally, governments worldwide have undertaken several measures (e.g., social distancing and lockdown policies) to deal with this crisis. The lockdown, however, has affected banks' daily operations (e.g., work from home, restrictions on the number of customers to be served at the branches) and increased their operating costs. Businesses shutting down and declining household income due to losing jobs further affect banks' profitability and increase bad debts. Due to the critical intermediation role of the banking systems as the primary source of liquidity for economies (González, 2016), the resilience of the banking sector has received much attention during the COVID-19 turmoil.

Banks are expected to actively support their economies while maintaining the stability and confidence of the financial system. They must appropriately renegotiate loans to households and firms while preserving a transparent credit risk evaluation. Banks should become active in the national economic solution, reinforcing government efforts against the crisis and bringing the actual economy on track.

The literature shows that the negative impact of the COVID-19 outbreak on the banking systems is documented by many studies (Boubaker et al., 2022; Nguyen, Le, & Ngo, 2023; Yuen et al., 2022). However, the impact of this health crisis may vary across different countries. Yan et al. (2023) advocate that a positive relationship between the COVID-19 turmoil and bank systemic risk is more pronounced in developed markets compared to emerging ones. Le, Nguyen, Vu, et al. (2022) also show that the risk-adjusted return of Vietnamese banks is

not statistically affected by the COVID-19 crisis. Elnahass et al. (2021) further argue that the effect of the pandemic may differ between conventional and Islamic banking systems. Given the impact of the COVID-19 disturbance, several studies are devoted to investigating whether diversification may help banks to overcome these challenges. The findings are also mixed. Several authors claim that income diversification may reduce the adverse impact of the COVID-19 turmoil on bank performance (Taylor, 2022; Xiazi & Shabir, 2022). Others, however, showed no significant effect of income diversification on bank performance amid the COVID-19 period (Kozak & Wierzbowska, 2022). When observing income diversification components, Ho et al. (2023) emphasise that banks should focus more on fees and commissions from operations rather than other noninterest income activities. Furthermore, Simoens and Vander Vennet (2022) demonstrate that banks may primarily benefit from functional diversification but less from loan portfolio diversification. Geographic diversification in terms of bank branches shows no significant effect. Therefore, our study attempts to answer the following questions:

> Q1: What is the impact of the COVID-19 pandemic on the global banking system?
>
> Q2: How does diversification impact the relationship between the COVID-19 pandemic and bank performance?

The contribution of this study is threefold. First, the evidence of the impact of the COVID-19 crisis on the banking systems is well documented in the literature (Demirgüç-Kunt et al., 2021; Elnahass et al., 2021). However, those studies exclusively focus on the banking sector from a micro-perspective using bank-level data. Ultimately, this leads to a missing macro perspective on the entire banking system. We contribute to that literature by using aggregate data from 121 banking systems to study whether they, as whole systems, were affected by the COVID-19 outbreak. Second, because many multinational banks have offered banking products and services in different global markets, our unique sample allows us to differentiate the effects of diversification strategies (e.g., lending diversification, revenue diversification and geographic lending diversification) on the relationship between the COVID-19 pandemic and bank performance. Last, to better measure the impact of the COVID-19 pandemic, we use three different proxies of COVID-19, including a dummy variable for the COVID-19 period, the World Pandemic Uncertainty Index, and the Discussion about Pandemic Index. This thus overcomes the disadvantage of using a dummy variable for COVID-19. Therefore, our findings provide significant implications for bank managers to pursue the appropriate diversification strategies to strengthen their performance.

Using the national level data of 121 banking systems from 2016Q1 to 2021Q2, our findings demonstrate the adverse effect of the COVID-19 pandemic on the performance of the global banking system. The findings also show that diversification generally does not benefit the banking systems. When considering the impact of the COVID-19 shock, diversification may weaken the negative impact of this crisis on banking performance. This thus provides some implications for the practitioners and the authorities.

A BRIEF LITERATURE REVIEW

COVID-19 and Bank Performance

It is acknowledged that the COVID-19 pandemic differs from other historical crises that mainly originated from the financial system. During this health crisis, governments worldwide have implemented stringent social distancing and quarantine measures to control the virus spread, thus causing both demand and supply shocks. Due to the interruption of economic activity and conventional business models, liquidity and debt repayment are a big challenge for small and medium enterprises and large corporations. Many banks in many countries thus have faced the pressure of collapse (Elnahass et al., 2021). Cochrane (2020) asserts that governments and regulators should consider the targeted bailout packages to react to bankruptcies and insolvencies due to the possible pandemic-induced financial crisis.

The literature on the impact of COVID-19 on the financial system can be divided into two strands. The first strand focuses on the effects of COVID-19 on the stock markets (Ding et al., 2021). Because of our focus on the global banking system, we pay more attention to the second strand of the literature about how bank stability is affected by the COVID-19 pandemic. In contrast to prior crises, this health crisis has significantly impacted the global supply chain, caused increased unemployment rates, and thereby led to a severe loss of revenue for businesses and household income. This ultimately threatens the creditworthiness and the repayment capability of borrowers. Hence, this could affect bank stability or reduce demand for banking products and services (Bartik et al., 2020; Beck & Keil, 2021). This impact is then spread to banks by lowering their profitability and impairing bank stability. Duan et al. (2021), using 1,584 listed bank-level from 64 countries, show that the COVID-19 pandemic increases bank systemic risk. They also suggest that this adverse effect is mitigated by formal bank regulation, ownership structure and informal institutions. When using a sample of 1,090 banks from 116 countries, Elnahass et al. (2021) also indicate the negative impact of COVID-19 outbreaks on bank performance. This impact still

holds for different regions and different bank-level characteristics. However, the effect of the COVID-19 pandemic is different between conventional and Islamic banking systems.

As per resource dependence theory, corporations need value-added external resources to survive, as the internal resources are not enough to secure their operating capacity (Pfeffer & Salancik, 2003). As the stock market has also been negatively affected by COVID-19, as explained above, accessing external sources is more complicated. Undeniably, banks may be in better positions as they have had a better capitalisation and liquidity position since the global financial crisis (Carletti et al., 2020). In response to the outbreaks, many central banks have implemented several measures (e.g., reducing policy rates to enhance liquidity) to strengthen the banking system's resilience. Unfortunately, the effect of these measures may depend on other policy measures. For example, as health problems are perceived as a primary concern, the governments have still imposed stringent social distancing measures, and therefore, businesses are still shut down either temporarily or permanently. This more or less affects the public confidence in the economic systems. Even though the authorities may exercise bailout programs, this effect may still be questioned, given the unprecedented pandemic. Although the COVID-19 pandemic decreases the optimal bank interest margin and government capital supports tend to increase the margin, they theoretically reduce efficiency gain from shadow banking (Li, Xie, et al., 2021). Recently, Demirgüç-Kunt et al. (2021) pointed out the negative impact of COVID-19 shocks on bank stock returns. Furthermore, the past lessons show that the rescue plan tends to increase bank risk-taking (Duchin & Sosyura, 2014; Feng et al., 2019; Gropp et al., 2011) and perhaps induce hazard problems (Stern & Feldman, 2004). Some policy measures, such as liquidity support, borrower assistance programs and monetary easing, may help moderate the health crisis's impact, while countercyclical prudential measures do not (Demirgüç-Kunt et al., 2021). All in all, empirical studies on the adverse effects of an unprecedented COVID-19 pandemic on bank performance and stability are well documented (Danisman, 2022; Le, Ho, et al., 2022; Mirzaei et al., 2022). The first hypothesis is formed as follows:

H1: The COVID-19 outbreaks lower bank performance.

Diversification and Bank Performance

The literature on the relationship between diversification and bank performance can be divided into two groups. The first group looks at the impact of income diversification on bank performance, while the second group focuses on the effect of geographic expansion (Le et al., 2020). In the first strand, there appear to be mixed findings. Early studies show that income diversification may reduce bank

risk (Froot & Stein, 1998; Gallo et al., 1996) and risk-adjusted returns (Le, 2017). These findings are comparable with those of Chiorazzo et al. (2008), who found significant benefits of income diversification. However, the positive effect may differ among bank business models (Köhler, 2015) and income-group countries (Lee et al., 2014). Other studies show the opposite findings (Stiroh, 2004; Van Oordt, 2014). It is argued that the benefits of revenue diversification are offset by increased bank risk (Schmid & Walter, 2009; Williams, 2016). However, Le (2018) indicates that more diversified banks are associated with greater risk-taking and higher performance.

In the second group, empirical studies also indicate confounding results. Berger and DeYoung (2001) suggest that some U.S. banks may operate efficiently on a national or overseas basis while others may outperform in a single region. This somewhat supports the findings of Goetz et al. (2016), who found that geographic expansion of U.S. bank holding companies can mitigate bank risk. However, several studies show that geographic diversification tends to reduce bank profitability in the Vietnamese banking system (Le, 2020) but to improve bank stability (Le, 2021b). However, the effect of geographic expansion may differ among bank ownership. Although global expansion may reduce bank stability and adjusted-risk performance, lending expansion to emerging markets and developing countries can potentially enhance bank solvency and profitability (Le et al., 2020).

The inconclusive agreement on the benefits of diversification raises the question of whether diversification could alleviate the adverse impact of the COVID-19 pandemic. This pandemic has interrupted the global supply chain and affected the whole economy by causing demand and supply shocks. Li, Feng, et al. (2021) show that income diversification improves bank performance and lowers bank risk-taking in the US market during early 2020. The same phenomenon is obtained in the case of European-listed commercial banks (Taylor, 2022). Some income diversification components show positive outcomes, such as fees and commissions from operations (Ho et al., 2023). When investigating different types of diversification, Simoens and Vander Vennet (2022) point out that the positive effect only holds for the case of functional and loan portfolio diversification. The second hypothesis is formed as follows:

> H2: There is no significant impact of diversification types on the relationship between the COVID-19 pandemic and bank performance.

METHODOLOGY AND DATA

Methodology

Following prior studies in banking using cross-country data (Le & Ngo, 2020; Le et al., 2020), we use a system generalised method of moments estimator (GMM) to overcome unobserved heterogeneity and endogeneity issues. This method also considers the persistence of banking performance, which is well-documented in the literature (Le et al., 2020). Hence, parameters' estimations are consistently generated by the system GMM (García-Herrero et al., 2009; Le & Ngo, 2020).

For an example of endogenous problems, inefficient banking systems may be bound by more regulatory scrutiny by holding more liquid assets, increasing their regulatory capital and providing new advances with caution (Le, 2021a). Higher capitalisation may allow the banking systems to invest more in risky projects. Additional resources may be required to address these issues when facing higher risk. This thus reduces the efficiency of the banking system (Le, 2018). To address this problem, we follow the suggestion of Bond (2002) by instrumenting lagged values of the dependent and endogenous variables in the system GMM estimator, except for exogenous regressors. Note that the endogenous variables are assumed to be predetermined, while exogenous variables are strictly not associated with the individual effect. Because the system GMM is often sensitive to lags (Distinguin et al., 2013), a one-year lag of all endogenous variables as instruments will be used in this study because introducing more lags induces weak instruments. The instrumented variables in the system GMM are presented in italics across the results tables.

Our dynamic model is formed as following:

$$\pi_{i,t} = \alpha_0 + \alpha_1 \pi_{i,t-1} + \alpha_2 CRISIS_t + \alpha_3 DIV_{i,t} + \alpha_4 X_{i,t} \quad (1)$$

Where bank performance (π) can be measured in two different ways, including return on assets (*ROA*) and return on equity (*ROE*). We also use the ratio of non-performing loans to total gross loans (*NPL*) for robustness checks. *CRISIS* represents the impact of the COVID-19 pandemic. Our study uses three different proxies for *CRISIS* to reflect the characteristics of the country setting. We first use *CVD* as a dummy variable that takes a value of 1 for 2020Q1–2021Q2 as the pandemic period and 0 otherwise. Since the first reported cases on 31 December 2019 in Wuhan and followed by a global urgent call from the World Health Organisation on 11 March 2020, Elnahass et al. (2021) consider the first two quarters of the

year 2020 as a proxy for the COVID-19 pandemic period. Le, Ho, et al. (2022) extend their analysis of the relationship between this health crisis and banking performance using the extended periods from 2020Q1 to 2020Q4. Furthermore, Alabbad and Schertler (2022) investigate the impact of the COVID-19 pandemic on bank performance in dual banking countries using bank-level data up to 2021Q3. Hence, we consider the period of 2020Q1–2021Q2 as the impact of the COVID-19 outbreak on the global banking systems due to data unavailability (Ho et al., 2023; Le, Nguyen, Ho, et al., 2024). However, not all countries were immediately affected by the COVID-19 pandemic. Because the financial system does not originate the nature of this crisis, this is supposed to be a lagged effect of COVID-19 shock among countries. Thus, we use the World Pandemic Uncertainty Index (WPUI) and the Discussion About Pandemic Index (DPI) to capture better the impact of the COVID-19 shock on each economy. WPUIis constructed by counting the number of times uncertainty is mentioned within proximity to a word associated with the COVID-19 pandemic in the Economist Intelligence Unit (EIU) country reports. WPUI is the percent of the world 'uncertainty' and its variants that appear near the COVID-19 pandemic terms in EIU country reports multiplied by 1,000. *DPI* is established by counting the number of times a word related to the COVID-19 outbreak is reported in the EIU country report. DPI is the percent of the words associated with the COVID-19 pandemic episodes in EIU reports multiplied by 1,000. Both high values of these indices mean high uncertainty associated with the COVID-19 pandemic and greater discussion about the outbreak, respectively. We use the natural logarithm of *DPI* to mitigate its highly skewed distribution. Note that the *DPI* database shows that all countries have data available from 2020Q2 onwards. Therefore, using CVD as a proxy for the pandemic in our analysis is reasonable.

In this study, we use three measures of banking diversification, including lending diversification, revenue diversification, and lending diversification. We first conduct lending diversification using the Herfindahl-Hirschman Index (HHI). According to the Financial Soundness Indicators database held at the International Monetary Fund (IMF), total loans of the banking system can be distributed to seven sectors, including deposit-takers, the central bank, other financial corporations, the government, non-financial corporations, other domestic sectors and non-residents. We take their respective shares in total loans and utilise them to calculate a HHI of lending diversification. A similar procedure of the HHI is widely employed in the literature to measure banks' diversity such as funding diversity (Vo, 2020), income diversification (Chiorazzo et al., 2008; Lee et al., 2020), geographic loan diversification (Le et al., 2020), sectoral lending diversification (Le, Ho, et al., 2022), board structure diversity (Nguyen et al., 2024), and the diversity of bank–fintech cooperation (Le, Ngo, et al., 2024). Therefore, lending diversification is constructed as follows:

$$DIV1 = 1 - \left(\left(\frac{deposit - takers}{total\ loans} \right)^2 + \left(\frac{central\ bank}{total\ loans} \right)^2 + \left(\frac{other\ FC}{total\ loans} \right)^2 + \left(\frac{government}{total\ loans} \right)^2 + \left(\frac{non - FC}{total\ loans} \right)^2 + \left(\frac{other\ domestic}{total\ loans} \right)^2 + \left(\frac{non - residents}{total\ loans} \right)^2 \right) \quad (2)$$

Where, deposit-takers/total loans, the sectoral distribution of total loans to deposit-takers; central bank/total loans, the sectoral distribution of total loans to the central bank; other FC/total loans, the sectoral distribution of total loans to other financial corporations; government/total loans, the sectoral distribution of total loans to government; non-FC/total loans, the sectoral distribution of total loans to non-financial corporations; other domestic/total loans, the sectoral distribution of total loans to other domestic sectors; non-residents/total loans, the sectoral distribution of total loans to non-residents. *DIV*1 ranges in value from zero to one, with higher value arguing greater lending diversity.

Following Chiorazzo et al. (2008) and Stiroh and Rumble (2006), revenue diversification is measured as:

$$DIV2 = 1 - \left(\left(\frac{interest\ income}{total\ income} \right)^2 + \left(\frac{non - interest\ income}{total\ income} \right)^2 \right) \quad (3)$$

Where interest/total income is the ratio of interest income to total income; non-interest/total income is the ratio of noninterest income to total income. Again, *DIV*2 ranges in value from zero to one, with a greater value showing higher revenue diversification.

Based on the Financial Soundness Indicators database deposited at IMF, total loans of the banking system can be geographically distributed to three regions, including domestic markets, advanced economies, excluding China, and other emerging markets and developing countries, including China. We follow Le et al. (2020) to define geographic lending diversification as:

$$DIV3 = 1 - \left(\left(\frac{domestic}{total\ loans} \right)^2 + \left(\frac{advanced}{total\ loans} \right)^2 + \left(\frac{emerging}{total\ loans} \right)^2 \right) \quad (4)$$

Where total loans = 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. Similarly, the value of *DIV*3 is between zero and 1, with its larger value exhibiting greater geographic lending diversity.

To test the second hypothesis, the second model is constructed as follows:

$$\pi_{i,t} = \alpha_0 + \alpha_1 \pi_{i,t-1} + \alpha_2 CRISIS_t + \alpha_3 DIV_{i,t} + \alpha_4 CRISIS_t * DIV_{i,t} + \alpha_5 X_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where CRISIS * DIV is the interaction term between the measure of the impact of the COVID-19 pandemic and the measure of diversification. Given that DIV is an index ranging from 0 to 1 and our dependent variables are expressed in percent, our study follows Le, Ho, et al. (2022) to focus more on interpreting a significant sign of DIV and CRISIS * DIV rather than their magnitudes. This interpretation is more appropriate to our analysis since our objective is to investigate the effect of different types of diversification in general on the relationship between the COVID-19 turmoil and bank performance as a whole. In addition, the effect of using interaction terms is widely used in the literature (Chiorazzo et al., 2008; Le, Ho, et al., 2022; Le, Ngo, et al., 2022; Le, Nguyen, & Ngo, 2024; Nguyen, Le, & Tran, 2023; Saadaoui & Ben Salah, 2023; Wijethilake & Ekanayake, 2020). Using the system GMM potentially isolates its own effect of explanatory variables from group effect and another variable effect. Alternatively, if nearly perfect collinearity persists, highly correlated variables would be dropped out when using system GMM (Roodman, 2009). This is not the case for all our models, and our diagnostic tests are valid, as shown in the later section. Therefore, our estimation is reliable.

For control variables (*X*), we include bank capital (*CAP*), bank efficiency (*EFF*), liquidity risk (*LIQ*), bank intermediation (*SPR*). *CAP* is measured by regulatory Tier 1 capital to risk-weighted assets (Le & Ngo, 2020). Capitalisation may increase agency costs (Jensen & Meckling, 1976), implying that a bank with high capital may cautiously operate and ignore opportunities for earnings growth. Therefore, this incurs capital opportunity costs (Berger, 1995; Le, 2020; Le & Nguyen, 2020a). In contrast, several studies showed a positive between them (Goddard et al., 2004; Pervan et al., 2015), supporting the signalling equilibrium that banks disclose a higher capital if they expect to have superior performance in the future (Saona, 2016). *EFF* is measured by personnel expenses to gross income (Le & Nguyen, 2021). The efficient structure hypothesis advocates that efficient banks with lower production costs offer their customers discount pricing, thus increasing sales and gaining market shares. Thus, this improves banks' earnings (Berger, 1995; Le et al., 2019). However, the skimp cost hypothesis argues that

banks tend to skimp several operating activities, such as credit evaluation and monitoring, to increase short-term economic efficiency. These activities, however, would reduce loan quality and incur additional costs to address this issue (Berger & DeYoung, 1997). Ultimately, this would reduce bank profitability. *LIQ* is measured by the ratio of liquid assets to total assets (Le et al., 2020). Holding more liquid assets tends to enhance bank profitability because banks may charge higher margins to compensate for opportunity costs associated with maintaining a higher ratio of these assets (Bourke, 1989; Le, 2017; Le & Nguyen, 2020b). In contrast, a high portion of liquid assets in banks' assets tends to reduce their profitability since these assets yield lower returns (Goddard et al., 2004). *SPR* is measured by the spread between reference lending and deposit rates (Ho & Saunders, 2009). A higher spread generates significant earnings as perceived. The country-fixed effects are not introduced in our regression because this inclusion will dramatically reduce the degree of freedom of our analysis and cause too many instruments. Therefore, this reduces the robustness of our estimation. Including country-fixed effects prevents us from using a dummy variable, *CVD*, as a proxy for the COVID-19 pandemic. Also, the data on country-specific characteristics (e.g., banking competition, market concentration, banking regulation and other institutional characteristics are not available during the impact of COVID-19 or on a quarterly basis. Instead, we control for geographic area fixed effect. Our sample is divided into six regions: Europe and Central Asia, Latin America and the Caribbean, East Asia and Pacific, South Asia, Sub-Saharan Africa, North America, and Middle East and North Africa.

Data

It is noted that our data is collected at the national or aggregate level on a quarterly basis. Specifically, the data used in this analysis were primarily extracted from the Financial Soundness Indicators covering 139 countries (IMF, 2019). The data on the WPUI covering 143 countries were collected from the World Uncertainty Index database constructed by Ahir et al. (2018). Similar to Elnahass et al. (2021), the country included in our example must have at least two-quarters of the data for the year 2020 to study the impact of the COVID-19 pandemic on the banking system. After excluding missing data from our main variables and matching the two datasets, unbalanced data from 121 countries between 2016Q1 and 2021Q2 was obtained, as shown in Appendix A. This period was chosen because quarterly data was available for most countries from 2016Q1 onward. Also, our study extends our analysis until 2021Q2 to examine the acute impact of the COVID-19 pandemic on the banking system since many countries started the recovery phase at the beginning of 2021. Indeed, the global economy reached positive growth level in 2021 (World Bank, 2021).

Table 1
Descriptive statistics of variables used

Variable	Definition	Obs.	Mean	STD	Min	Max
ROA	Return on assets	2,442	1.651	1.229	0.002	12.597
ROE	Return on equity	2,442	14.821	9.86	0.028	49.531
NPL	Non-performing loans to total gross loans	2,442	6.880	8.620	0.000	63.510
CVD	A dummy variable that equals 1 for the period of the COVID-19 pandemic, and 0 otherwise	2,442	0.223	0.416	0	1
WPUI	World Pandemic Uncertainty Index accounting for COVID-19	1,881	3.592	11.690	0	128.355
DPI	The natural logarithm of discussion about COVID-19 index	475	5.214	1.138	1.533	6.636
DIV1	HHI in terms of lending diversification	2,263	0.587	0.128	0.079	1.000
DIV2	HHI regarding revenue diversification	2,357	0.445	0.064	0.062	0.500
DIV3	HHI in terms of geographic diversification	965	0.243	0.204	0.000	0.649
CAP	Regulatory Tier 1 capital to risk-weighted assets	2,442	16.676	6.324	0.000	57.935
EFF	Personnel expenses to gross income	2,195	24.437	7.730	1.250	61.663
LIQ	Liquid assets to total assets	2,442	27.055	14.077	0.000	78.243
SPR	The spread between reference lending and deposit rates	2,442	0.047	0.078	0.000	52.53

Table 1 shows descriptive statistics of the variables used in this analysis. Our dependent variables were winsorised at 1% and 99% levels. The average return on assets (ROA) is 1.65% with low volatility (e.g., low standard deviation). When observing the return on equity (ROE) and non-performing loans (NPL), there appears to be larger volatility (e.g., high standard deviation). Thus, there is a difference in ROE and NPL among countries in our study. The same is true for the case of *WPUI* with a greater standard deviation, arguing that the impact of COVID-19 on the economy differs among countries.

Figure 1 further shows a relatively steady trend in *ROA* from 2016Q1 to 2019Q4 before starting to reduce in the latter period. This is because of the impact of the COVID-19 pandemic. However, this may rise in 2021Q1 due to the implementation of government stimulus packages to recover the economy and live with COVID-19 policy in many countries in late 2020. The same is true when observing the of the global banking system. Furthermore, there appears to be a decreasing trend in NPL overall, although there is a slightly increasing trend in the first two quarters of the year 2020. Because of a short examination period and perhaps the loan restructuring policy implemented in many countries during the COVID-19 pandemic, we could not see a significant increase in NPL during this examined period. We leave it for future analysis. However, we still perform several regressions for robustness checks when using NPL as a dependent variable.

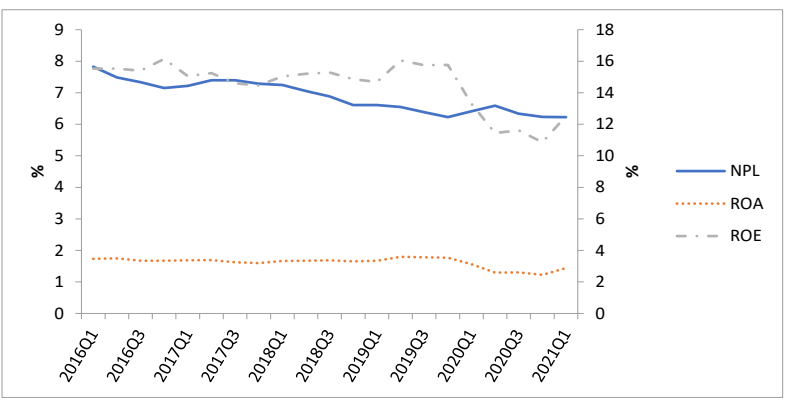

Figure 1: The evolution of ROA, NPL (left axis in percent) and ROE (right axis in percent)
Notes: A list of countries in this analysis is presented in Appendix A. 2021Q2 was excluded because data was only available in some countries.

EMPIRICAL FINDINGS

Results of Our Baseline Model

The data in Table 2 indicates no high correlations among variables used in this study.

Table 2
Correlation matrix of variables used in our analysis

ROA												
0.771	ROE											
0.010	0.034	NPL										
-0.107	-0.136	-0.034	CVD									
-0.038	-0.036	-0.028	0.568	WPUI								
-0.264	-0.195	-0.050	0.806	0.331	DPI							
-0.301	-0.218	-0.072	-0.008	-0.009	0.090	DIV1						
0.050	0.022	0.033	-0.049	-0.018	-0.066	0.180	DIV2					
-0.505	-0.293	-0.162	-0.025	0.084	0.070	0.518	0.187	DIV3				
0.172	-0.084	-0.021	0.031	-0.010	0.067	0.126	0.161	-0.057	CAP			
-0.217	-0.173	0.043	-0.009	0.016	-0.034	0.192	0.083	0.280	-0.148	EFF		
0.112	0.160	0.305	0.036	-0.021	-0.009	-0.195	0.050	-0.361	0.028	-0.150	LIQ	
0.211	0.131	0.056	0.003	0.025	-0.100	-0.233	-0.010	-0.360	0.112	-0.160	0.069	SPR

At first glance, bank performance is negatively affected by all measures of the COVID-19 pandemic. The same is true for two measures of bank diversification. However, there may be endogenous issues, as explained above. Thus, the system GMM should be preferred to examine the impact of the COVID-19 pandemic on the global banking system. We also conduct robustness checks using rudimentary methods for panel data with geographic area fixed effects. The same results are still obtained, although they are not represented for want of space (but available upon request).

As seen in all tables of results, the *p*-values of the Hansen test are statistically insignificant, implying no evidence of over-identifying restrictions. In other words, all moment conditions are met, and the instruments are valid. Additionally, the findings show statistically insignificant *p*-values of AR2, emphasising that the

conditions of the moments in our models are satisfied. Together, diagnostic tests in our estimated models are fulfilled. Furthermore, the positive and significant coefficients on lagged dependent variables show the persistence in banking profitability. This demonstrates the appropriate use of the system GMM.

As shown in Tables 3 to 6, the negative coefficients on *CVD* imply that the profitability of the global banking system is negatively affected by the COVID-19 pandemic. Thus, the first hypothesis cannot be rejected. Although the financial system did not initially cause this crisis, the performance of the banking system has been significantly affected by this crisis. Specifically, the spread of the Coronavirus pressures the government to take several measures, such as social distancing, lockdowns and business shutdowns, which result in adverse economic impacts on households and businesses. When firms' operations are interrupted and households' income declines due to unemployment, this reduces their capability to service their debts. Consequently, this will lead to a reduction in bank profitability and an increase in non-performing loans. Nonetheless, this confirms the early findings that the COVID-19 outbreak raises bank systemic risk (Duan et al., 2021) and reduces bank performance (Elnahass et al., 2021). When using different proxies of the COVID-19 pandemic, the negative coefficients on WPUI and DPI re-emphasise the negative impact of the COVID-19 crisis on banking profitability.

Table 3
The results of return on assets (ROA) using DIV1

$\pi = ROA$	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
π_{t-1}	0.522***	0.529***	0.628***	0.603***	0.302***	0.455***
	(0.087)	(0.074)	(0.088)	(0.082)	(0.063)	(0.078)
CVD	–0.186***	–0.825**				
	(0.043)	(0.391)				
WPUI			–0.005***	–0.013		
			(0.001)	(0.016)		
DPI					–0.149***	–0.651**
					(0.024)	(0.263)
DIV1	–4.217*	–1.749	–5.624***	–3.091***	–7.064***	–6.794**
	(2.314)	(1.162)	(1.945)	(0.859)	(1.888)	(2.678)
*CVD*DIV1*		1.069*				
		(0.647)				

(*Continued on next page*)

Table 3 (*Continued*)

π = *ROA*	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
*WPUI*DIV1*				0.016 (0.028)		
*DPI *DIV1*						1.019** (0.475)
Constant	2.121 (1.677)	1.098 (1.095)	4.376*** (1.317)	2.348*** (0.437)	3.644*** (0.915)	3.864** (1.429)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	1,909	1,909	1,411	1,411	380	380
No. of instruments	26	29	32	29	38	29
AR1 (*p*-value)	0.027	0.024	0.073	0.084	0.038	0.007
AR2 (*p*-value)	0.156	0.140	0.189	0.199	0.201	0.227
Hansen test (*p*-value)	0.639	0.591	0.663	0.793	0.101	0.153

Notes: A dependent variable is *ROA*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

Table 4
The results of return on assets (ROA) using DIV2 and DIV3

π = *ROA*	Model 1	Model 2	Model 3	Model 4
π_{t-1}	0.577*** (0.011)	0.645*** (0.091)	0.407*** (0.043)	0.422*** (0.129)
CVD	–0.558*** (0.18)	–0.326*** (0.11)		
LNDPI			–1.785*** (0.145)	–0.559*** (0.19)
DIV2	–1.001 (0.741)		–18.831*** (2.18)	
DIV3		–1.806*** (0.62)		–18.508** (7.28)
*CVD*DIV2*	0.841* (0.443)			
*CVD*DIV3*		0.655* (0.382)		
*DPI *DIV2*			3.65*** (0.353)	
*DPI *DIV3*				3.349** (1.357)
Constant	0.463 (0.435)	1.418 (1.171)	9.394*** (1.141)	2.417 (2.056)
Region fixed effects	Yes	Yes	Yes	Yes

(*Continued on next page*)

Table 4 (*Continued*)

$\pi = ROA$	Model 1	Model 2	Model 3	Model 4
Control variables	Yes	Yes	Yes	Yes
No. of obs.	2,057	869	415	187
No. of instruments	48	29	36	29
AR1 (*p*-value)	0.025	0.190	0.008	0.079
AR2 (*p*-value)	0.116	0.275	0.245	0.544
Hansen test (*p*-value)	0.132	0.768	0.111	0.381

Notes: A dependent variable is *ROA*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

Table 5
The results of return on equity (ROE) using DIV1

$\pi = ROE$	Model 1	Model 2	Model 3
π_{t-1}	0.587*** (0.019)	0.636*** (0.053)	0.444*** (0.027)
CVD	–5.261** (2.316)		
WPUI		–0.31* (0.178)	
DPI			–2.975* (1.528)
DIV1	4.389 (3.638)	–4.399 (11.668)	–16.842 (16.769)
*CVD*DIV1*	5.899* (0.076)		
*WPUI*DIV1*		0.497* (0.304)	
*DPI*DIV1*			3.505 (2.902)
Constant	1.721 (1.507)	9.998 (7.407)	16.479 (10.037)
Control variables	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
No. of obs.	1,909	1,411	380
No. of instruments	48	29	36
AR1 (*p*-value)	0.025	0.091	0.090
AR2 (*p*-value)	0.290	0.232	0.620
Hansen test (*p*-value)	0.314	0.507	0.154

Notes: A dependent variable is *ROE*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

Table 6
The results of return on equity (ROE) using DIV2 and DIV3

π = *ROE*	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
π_{t-1}	0.367*** (0.065)	0.56*** (0.084)	0.396*** (0.021)	0.528*** (0.096)	0.459*** (0.026)	0.522*** (0.071)
CVD	–16.93*** (1.39)	–4.151*** (0.976)				
WPUI			–0.357*** (0.114)	–0.063 (0.073)		
DPI					–12.946*** (0.952)	–3.204** (1.404)
DIV2	–16.806* (9.121)		–19.11*** (3.783)		–131.07*** (13.787)	
DIV3		–14.55*** (4.304)		–35.03*** (10.761)		–86.324* (45.423)
*CVD*DIV2*	33.283*** (3.862)					
*CVD*DIV3*		9.068*** (3.145)				
*WPUI*DIV2*			0.695*** (0.257)			
*WPUI*DIV3*				0.257 (0.239)		
*DPI*DIV2*					26.506*** (2.268)	
*DPI*DIV3*						15.201* (8.331)
Constant	7.156 (5.555)	29.248** (13.384)	14.655*** (2.2)	46.711*** (11.452)	67.054*** (6.981)	–5.162 (14.112)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	2,057	869	1,563	718	415	187
No. of instruments	40	29	43	29	43	29
AR1 (*p*-value)	0.026	0.206	0.072	0.173	0.076	0.116
AR2 (*p*-value)	0.368	0.301	0.187	0.277	0.652	0.302
Hansen test (*p*-value)	0.335	0.911	0.130	0.568	0.230	0.179

Notes: A dependent variable is *ROE*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

When observing the impact of diversification, the coefficients of all measures are generally negative and significant in most models (Tables 3 to 6), suggesting that diversification costs may exceed its benefits. This supports the early view that bank performance tends to reduce when pursuing lending diversification (Šeho et al., 2021) or revenue diversification (DeYoung & Rice, 2004; DeYoung & Roland, 2001; Le, 2021b; Stiroh, 2004), or geographic diversification (Le, 2020; Le et al., 2020).

However, the positive coefficients on *CVD * DIV2* (in both bank performance measures) argue that revenue diversification may mitigate the negative impact of the COVID-19 pandemic on banking performance. This somewhat supports the suggestion of Ho et al. (2023) that income diversification can increase bank performance and reduce bank risk in the U.S. during the impact of the COVID-19 pandemic. Our findings also further confirm the benefits of lending diversification (*CVD * DIV1*) and geographic diversification (*CVD * DIV3*) during the impact of the COVID-19 outbreak. The same results still hold when using the interaction between alternative measures of COVID-19 and diversification measures. Although the unprecedented and adverse effects of COVID-19 on the whole economy, both domestically and internationally, are well-documented, some industrial sectors show potential and significant growth during this period since people have to increase their consumption of necessary products/services when they stay at home (Rakshit & Basistha, 2020). Therefore, more lending diversification could help the banking system reduce the bank risk and generate more profits for good borrowers to offset the losses from others. Furthermore, the COVID-19 pandemic has changed consumers' behaviour toward banking services and products. Due to the social distancing and lockdown, consumers have shifted towards online banking (Naeem & Ozuem, 2021). This would thus generate additional income for banks. Furthermore, the COVID-19 pandemic does not impact all countries equally. The difference is due to the characteristics of country-setting and especially the government responses to the COVID-19 shock (Demirgüç-Kunt et al., 2021). Therefore, some countries have recovered faster than others. Le et al. (2020) also demonstrate that the proportion of loans to other emerging markets and developing countries may potentially reduce bank insolvency and improve bank risk-adjusted performance. For this reason, geographic lending expansion may alleviate the impact of the COVID-19 shock on bank performance. Together, the second hypothesis is rejected.

Robustness Checks

We first study whether diversification can mitigate the negative relationship between the COVID-19 pandemic and bank risk. Table 7 indicates the positive coefficients on *DIV1* and *DIV2*, demonstrating that a more diversified banking

system tends to increase bank risk. This is somewhat in line with the findings of Maudos (2017), who found that diversification is related to increased bank risk. Perhaps, an inverse relationship between bank performance and diversification is due to banks engaging in different lines of business and/or different sectors in which they lack expertise and experience (Mercieca et al., 2007). Furthermore, the benefit of diversification for banks during the COVID-19 turmoil only holds for lending diversity.

Table 7
The results of non-performing loans (NPL)

$\pi = NPL$	Model 1	Model 2
π_{t-1}	0.929*** (0.0003)	0.855*** (0.022)
CVD	0.226*** (0.016)	3.595*** (0.559)
DIV1	1.243*** (0.002)	
DIV2		7.893*** (1.209)
*CVD*DIV1*	–0.212*** (0.029)	
Constant	0.828*** (0.032)	–2.209*** (0.477)
Control variables	Yes[1]	Yes[1]
Region fixed effects	Yes	Yes
No. of obs.	1,909	2,057
No. of instruments	100	38
AR1 (*p*-value)	0.002	0.001
AR2 (*p*-value)	0.641	0.550
Hansen test (*p*-value)	0.369	0.113

Notes: A dependent variable, *NPL*, is measured by the ratio of non-performing loans to total gross loans. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively. [1]LIQ variable is excluded from the set of control variables for this model.

Second, we examine whether the benefits of bank diversification during the COVID-19 turmoil may vary among country groups (e.g., advanced and developing countries as classified by the World Bank). For space savings, we only report the table results of interaction terms using CVD for ROA, as shown in Tables 8 and 9. Our main findings are still obtainable in subsamples.

Table 8
The results for developed countries

$\pi = ROA$	Model 1	Model 2	Model 3
π_{t-1}	0.606*** (0.055)	0.772*** (0.019)	0.335*** (0.464)
CVD	–2.516*** (0.825)	–1.382* (0.715)	–0.399*** (0.074)
DIV1	–1.156* (0.601)		
DIV2		1.23 (1.188)	
DIV3			0.009 (0.39)
*CVD*DIV1*	3.529*** (1.245)		
*CVD*DIV2*		2.736* (1.568)	
*CVD*DIV3*			0.381** (0.17)
Constant	1.616*** (0.552)	–1.022 (0.611)	0.304 (0.643)
Control variables	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
No. of obs.	656	676	457
No. of instruments	27	27	26
AR1 (*p*-value)	0.070	0.067	0.003
AR2 (*p*-value)	0.161	0.162	0.173
Hansen test (*p*-value)	0.369	0.295	0.232

Notes: A dependent variable is *ROA*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

Table 9
The results for developing countries

$\pi = ROA$	Model 1	Model 2	Model 3
π_{t-1}	0.562*** (0.043)	0.381*** (0.13)	0.237*** (0.028)
CVD	–0.78** (0.347)	–2.032* (1.057)	–0.83** (0.344)
DIV1	–0.725 (0.907)		
DIV2		0.061 (2.492)	
DIV3			4.359 (3.867)
*CVD*DIV1*	1.104* (0.635)		
*CVD*DIV2*		4.281* (2.427)	
*CVD*DIV3*			7.577* (4.18)
Constant	0.87 (0.822)	1.9* (1.096)	1.465 (1.442)
Control variables	Yes	Yes	Yes

(*Continued on next page*)

Table 9 (*Continued*)

π = *ROA*	Model 1	Model 2	Model 3
Region fixed effects	Yes	Yes	Yes
No. of obs.	1,253	1,381	412
No. of instruments	35	31	34
AR1 (*p*-value)	0.038	0.070	0.220
AR2 (*p*-value)	0.209	0.320	0.341
Hansen test (*p*-value)	0.600	0.506	0.972

Notes: A dependent variable is *ROA*. Variables in italics, including all control variables (as not reported due to the length restriction), are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, ** and *** is significant at 10%, 5% and 1% levels, respectively.

This health crisis has had a great impact worldwide regardless of country groups, compared with the previous financial crisis in which the financial systems in the developed countries were most affected (Fang et al., 2013). Similar results are still acquired when using other measures of bank profitability (e.g., *ROE*) and the COVID-19 pandemic (e.g., *WPUI* and *DPI*). Nonetheless, this reemphasises the global impact of COVID-19 shocks and the benefits of diversification to moderate the effect of this health crisis.

CONCLUSION

This study investigates the impact of the COVID-19 outbreak and diversification on the performance of the global banking system using a sample of 121 countries from 2016Q1 to 2021Q2. The findings show that the global banking system was negatively affected by the COVID-19 pandemic. In general, bank diversification is found to decrease bank performance. This suggests that the costs of an aggressive diversification strategy outweigh the benefits, signifying that bank diversification may solely result from serious agency conflicts. When considering the impact of COVID-19 shocks, the findings show that a diversification strategy may reduce the adverse effect of this crisis on bank performance. Therefore, diversification may benefit the banking system in dealing with the impact of the unprecedented COVID-19 outbreak. This health disaster discontinued the international supply chain and the global economy in terms of supply and demand. Most authorities implemented social distancing and business lockdown policies, thus directly affecting banking systems' operation and impacting households' income and firms' earnings across different industries. Ultimately, this reduced the borrowers'

repayment capacity and funding sources, thus affecting bank profitability. For that reason, banks should increase various potential sources of earnings derived from pursuing different diversification strategies such as shifting towards non-traditional activities, maintaining financing to different sectors that performed well during the COVID-19 (e.g., energy, healthcare and utilities (Le, Nguyen, Ho, et al., 2024)), and geographic lending expansion, especially countries without stringent or loosing COVID-19 lockdowns. Nonetheless, our empirical results support the hypothesis that banks have pursued a diversification strategy to address the strategic uncertainty in their sector (foot-in-the-door strategy) (Boot, 2003). Therefore, bank managers should consider strategic options cautiously to overcome diversification costs, strengthen their earnings in the long run and deal with future uncertainty.

This study may suffer from limitations. Although we used three different measures of the COVID-19 crisis, future research may consider alternative measures, such as a number of confirmed or death cases (Ding et al., 2021; Ho et al., 2023), to confirm our findings. Also, the rapid growth of fintech and bigtech credit has challenged the global banking system, especially during and post-COVID-19 outbreak (Cornelli et al., 2023; Le, 2022; 2023; Le, Ho, Nguyen, & Ngo, 2021). In response, banks further speed up the digitalisation, especially fintech services adoption (Ben Ali, 2022; Katsiampa et al., 2022) and bank-fintech cooperation (Le, Ngo, et al., 2024). Fintech adoption allows banks to reap diversification benefits (e.g., reducing costs) by offering new products/services, thus widening their customer base. Applying big data and artificial intelligence can help banks predict customers' behaviour better and improve credit scoring models, thus increasing bank lending expansion. However, the digitalisation is not a free of costs. Banks' legacy information technology and organisation structure may hinder their capacity to develop new fintech services (Hornuf et al., 2021). Also, fintech-adopted banks may be the target of cyberattacks (Forcadell et al., 2020). Therefore, banks may approach cooperation with fintech firms. The product-related partnership allows banks to broaden their portfolios and use different distribution channels to reach new customers (Le, Ngo, et al., 2024). Bank-fintech alliance is crucial to banks' efforts to boost growth through innovation and secure their positions in an increasingly evolving marketplace. However, EY-Parthenon 2022 reported that approximately 40% of all bank-fintech cooperations failed to operationalise, primarily due to scalability problems, inadequate strategies and poor organisational alignment about execution (Moseson & Akuma, 2023). Nonetheless, future studies may consider whether these two strategies may affect the relationship between diversification and bank performance.

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APPENDIX

Appendix A

The list of countries in our sample

Albania	Estonia	Lebanon	Portugal
Anguilla	Eswatini	Lesotho	Romania
Antigua and Barbuda	Ethiopia	Lithuania	Russia
Argentina	Finland	Luxembourg	Rwanda
Armenia	France	Macao	Samoa
Australia	Georgia	Madagascar	San Marino
Austria	Germany	Malawi	Saudi Arabia
Bangladesh	Ghana	Malaysia	Seychelles
Belarus	Greece	Maldives	Slovak
Belgium	Grenada	Malta	Slovenia
Bolivia	Guatemala	Mauritius	Solomon
Bosnia and Herzegovina	Guinea	Mexico	South Africa
Botswana	Honduras	Moldova	Spain
Brazil	Hong Kong	Montenegro	Sri Lanka
Brunei	Hungary	Montserrat	St Kitts and Nevis
Bulgaria	Iceland	Mozambique	St Lucia
Cambodia	India	Namibia	St Vincent and Grenadines
Canada	Indonesia	Nepal	Sweden
Chile	Iraq	Netherlands	Switzerland
China	Ireland	Nicaragua	Tanzania
Colombia	Israel	Nigeria	Thailand
Comoros	Italy	North Macedonia	Tonga
Costa Rica	Japan	Norway	Trinidad and Tobago
Croatia	Kazakhstan	Pakistan	Turkey
Cyprus	Kenya	Panama	Uganda
Czech	Korea	Papua New Guinea	UK
Denmark	Kosovo	Paraguay	Ukraine
Djibouti	Kuwait	Peru	United Arab Emirates
Dominica	Kyrgyz	Philippines	US
El Salvador	Latvia	Poland	Uzbekistan
			Zambia