




“The impact of income diversification on the stability of listed Jordanian commercial banks during the COVID-19 pandemic”

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THE IMPACT OF INCOME DIVERSIFICATION ON THE STABILITY OF LISTED JORDANIAN COMMERCIAL BANKS DURING THE COVID-19 PANDEMIC

Abstract

This study investigates the impact of the COVID-19 pandemic on the relationship between income diversification and bank stability among Jordanian commercial banks listed on the Amman Stock Exchange (ASE), using a panel Autoregressive Distributed-Lagged Model (panel-ARDL) and quarterly data from 2015 to 2021. The findings demonstrate that during the COVID-19 period, a higher proportion of non-interest income, resulting from income diversification, enhances bank stability. However, considering the entire sample period, the results suggest a potential deterioration in bank stability when banks diversify towards non-interest income, aligning with the negative effect observed in the literature. Additionally, the study identifies factors such as bank size, liquidity, loan loss provisions, cost efficiency, and the deposit ratio, which influence bank stability. These findings hold significant implications for policymakers and banks in developing countries concerned about the impact of income diversification on bank stability. They also offer valuable insights to understanding the dynamics of income diversification and its implications for bank stability in the context of the COVID-19 pandemic.

Keywords

non-interest income, income portfolio, risk taking, bank stability, COVID-19

JEL Classification

G21, G11, C23

INTRODUCTION

The banking sector has traditionally relied on interest income as its primary income source, acting as an intermediary between depositors and borrowers. However, the deregulation waves and the global financial crisis have prompted the banking sector to diversify by shifting increasingly from traditional interest income to non-interest income (fees and commissions generated from a wide variety of activities and services i.e., insurance, investment, securities trading, asset management), which are also known as nontraditional activities (Abuzayed et al., 2018; Meslier et al., 2014). The diversification strategy is adopted to expand commercial banks' activities in non-interest income and to offset the decline in income resulting from the increase in non-performing loans left by the global financial crises (Saunders et al., 2020).

Diversification is applied across all portfolios within banks, including credit facilities, deposits, investments, and most notably, the revenue portfolio. The revenue portfolio is considered as the squeezer of the total diversification process in all different types of bank portfolios (Maudos, 2017; Meslier et al., 2014). However, the net effect of income diversification on banks risk remains debatable across theoretical and empirical literature (Nisar et al., 2018).

The COVID-19 pandemic has caused unprecedented shocks to the global economy, significantly impacting financial markets and the performance of banks worldwide (Demirguc-Kunt et al., 2021; Goodell, 2020; Khatatbeh et al., 2020). Banks are considered key players in absorbing these shocks, with governments and central banks seeking their support in maintaining credit flow to firms through interventions and relaxed capital requirements (Demirguc-Kunt et al., 2021). However, the full extent of the pandemic's impact on the banking sector remains largely unknown. Consequently, understanding the relationship between income diversification and bank risks during times of economic uncertainty, such as the COVID-19 pandemic, is essential. In Jordan, the pandemic has led to a prolonged lockdown and economic challenges, prompting the Central Bank of Jordan to implement measures to mitigate the crisis. Jordanian commercial banks have experienced a significant decline in the average return on assets, dropping from 0.95% in 2019 to 0.53% in 2020 (Obeidat et al., 2021). This decline is attributed to the increase in loan loss provisions during the pandemic, impacting the banks' profitability. This study addresses the need for further research on the impact of income diversification on bank stability, particularly in Jordan, given conflicting findings in the existing literature. With the unprecedented challenges posed by the COVID-19 pandemic, understanding the relationship between income diversification and bank stability, in the period of the pandemic, is crucial. The findings will provide valuable insights for policymakers and banks in Jordan, aiding in the formulation of strategies to mitigate risks and ensure banking sector stability in times of economic uncertainty.

1. LITERATURE REVIEW AND HYPOTHESES

The proponents of income diversification are motivated by the portfolio selection theory proposed by Markowitz (1952), whereby income diversification should have a favorable impact on a bank's risk – as diversification eliminates some of banks' risks by spreading across many sources of income. This theory can also be described as the 'efficient frontier', which expresses a group of portfolios that provide a higher return at a certain level of risk, as it works to determine the optimal portfolio by comparing and selecting the highest return portfolio at different levels of risk. Ross et al. (2008) emphasize that the concept of diversification is an essential principle in modern finance theory. They conclude that with diversification, some of the individual asset risks can be eliminated. However, recent literature provides contradictory evidence for the effect of income diversification on banks' risk (Abuzayed et al., 2018; Li et al., 2021; Ocheng, 2022; Saunders et al., 2020; Williams, 2016).

The first strand shows positive effects of income diversification, where a bank's stability is boosted by shifting towards non-interest income. DeYoung and Rice (2004) find that 40% of US commercial banks depend on non-interest operations to achieve profits. The study concludes that non-interest income may not replace interest income

because interest income is the major activity of banks, but what is correct is to combine the two systems into a new system in which banks conduct their commercial activities through it, and this makes banks more efficient and able to reduce costs and improve the quality of income from interest and non-interest. A similar study conducted in the US by Saunders et al. (2014) finds a positive association between the effect of diversification of revenues on the performance of bank. Saunders et al. (2014) conclude that diversifying of the banks' revenues leads to increased profits and a decrease in the degree of bankruptcy risk.

Elsas et al. (2010) argue that income diversification enhances commercial banks' performance by increasing the non-interest income share of profits and reducing the cost of capital. In Germany, Köhler (2015) finds that when a change occurs towards non-traditional activities, banks are found to be more stable and profitable. Lee et al. (2014) apply the GMM methodology to a sample of countries from Asia-Pacific region, during the period between 1995 to 2009, and find that non-interest income improves the level of profitability and increases stability, as well as reduces bank risks. Overall, this strand suggests that combining interest and noninterest income boosts the stability of banks (Köhler, 2015).

The second strand comes in contrary to studies presented in the first strand and highlights

the negative impact of income diversification on a bank's stability, starting with DeYoung and Roland (2001) find that when US banks move toward non-interest income, which increases the variability of revenues and reduces bank stability. Moreover, DeYoung and Roland (2001) contend that fees and commissions may not help banks maintain the impact of shocks from crises that banks are exposed to. This is due to three reasons, first, the nature of the work of activities based on fees and commissions does not generate a relationship between the customer and a bank, and therefore the bank is likely to lose the strength of its relationship with customers. Unlike the relationship of a business based on loans, it generates a strong relationship between the customer and the bank, and this makes loans more stable than fees. Second is the cost that when shifting from interest revenue to non-interest revenue necessitates large investments in human resources and technology, and thus reduces stability and increases profit volatility. Third, fee-based activities do not require a high degree of capital retention unlike interest income, which, requires a high degree of capital retention, and in turn leads to profit volatility.

Stiroh (2004a) analyzes a sample of community banks, in the US, during the year 1984–2000. He finds that diversification negatively affects the profitability of community banks. In addition, the increase in income based on fees and commissions leads to deterioration in banking performance. Stiroh (2004a) concludes that the US community banks may differ in size, as there are medium and small, but the small-sized are distinguished by the fact that when shifting towards non-interest income activities, they are more competitive towards development and increasing profits. In a set of subsequent studies, Stiroh concludes that non-interest revenue is comparably more volatile, and adds that diversification in commissions and fees increases profit volatility and probability of default risks of US commercial banks (Stiroh, 2004b; Stiroh, 2006). Moreover, Stiroh (2012) argues that it is not possible to ascertain the type of effect in the relationship between revenue diversification and bank risks, and contends that, over time, US banks were constantly changing their operating activities until it reaches a profitable and safe system, but unfortunately, this change will result in increased volatility of bank profit-

ability and increasing instability, eventually. He added that the best work that the bank can do to improve the level of profitable returns is to move towards a profitable business, even if it imposes a high level of risk.

Mercieca et al. (2007) find that increased dependence on non-traditional activities is linked with a decline in profits. They conclude that diversification of income and orientation towards non-interest revenue activities adversely impact the performance of European credit institutions. Maudos (2017) observes the same result of the effect, which is an increase in the proportion of non-interest revenue increases the risks of European banks. Lepetit et al. (2008) show that small-size banks that depend on their operating activities on non-interest revenue increase the risks of financial insolvency. Similarly, Acharya et al. (2006) argue that when Italian banks diversify to non-interest income, the quality control of bank loans is reduced and thus increases the level of non-performing loans. Williams (2016) finds, for a sample of Australian banks, that non-traditional activities along with traditional activities may contribute to increased systemic and non-systemic risks.

In emerging economies, a range of studies have highlighted the negative implications of income diversification on bank performance. For instance, Berger et al. (2010) analyze the effects of revenue diversification on 88 Chinese banks between 1996 and 2006, finding that diversification resulted in increased costs and decreased profitability. In a study on Russia, Berger et al. (2010) establish that diversification into non-interest income carries a significant cost, with the impact of diversification being contingent on its management, which in turn determines profit growth or bank risk levels. Hsieh et al. (2013) argue that simply moving towards non-interest income does not guarantee improved banking stability. Hunjra et al. (2020) reveal that non-interest income adversely influences bank risk, and revenue concentration increases risk-taking in South Asian nations. The study advises bank managers to focus on non-interest income and manage complexity through the integration of various revenue sources to limit agency costs and minimize risk. Similarly, Olalere et al. (2021) demonstrate that diversification, as represented by non-interest income and fees and

commission income, has a notably negative effect on bank stability in Malaysia and Nigeria. More specifically, the study indicates that non-interest income substantially affects banks' stability negatively, while fee and commission income's impact on stability is insignificant.

The last strand presents studies on the relationship between revenue diversification and bank stability that have yielded mixed and nonlinear results. Chiorazzo et al. (2008) found that small banks benefit from increasing their share of non-interest revenue, while big banks may experience a decrease in risk-adjusted profit. Delpachitra and Lester (2013) found no significant effect of income diversification on Australian banks' profitability and risk. Nisar et al. (2018) found that different types of non-interest income have contrasting effects on bank profitability and risks, with fees and commissions having a negative effect and other non-interest revenue activities having a positive effect. Syahyunan et al. (2017) found that income diversification has an insignificant and positive effect on bank stability in Indonesia. Lee et al. (2014) also conclude that the net effect differs based on the type of bank and the level of the country's income. These studies highlight the complexity of the relationship between revenue diversification and bank stability and the need for further research.

A limited number of studies have investigated the issue of non-interest income in the MENA and GCC regions, there is evidence to suggest that it can have a positive impact on bank stability. Al-Khoury and Arouri (2016) find that banks tend to be more stable when they rely on non-interest income. Ammar and Boughrara (2019) find that in the MENA region, only trading activities of non-interest income improve profits and stability, while other types of non-interest income increase default risk. Ashraf et al. (2016) argue that banks that engage heavily in non-interest revenue activities are more financially stable than those that only engage in interest revenue activities. Abuzayed et al. (2018) show that there is a nonlinear relationship between non-interest revenue and bank stability, with banks able to reduce risks at higher levels of diversification. In the case of Jordan, Omet (2019) finds that income from commissions may be the main driver of bank profitability in diversification, indicating a positive effect of income di-

versification on bank performance. Al-Tarawneh et al. (2017) report a positive effect of non-interest revenue on bank profits due to increasing charges and fees paid by customers. A recent study by Khatatbeh et al. (2022) suggest that banks and other financial institutions have a significant role in promoting financial development and reducing income inequality in Jordan. Therefore, stability in the banking sector is crucial for a country's economic development and prosperity.

Nevertheless, there remains limited evidence on the nexus of income diversification and bank stability during the COVID-19 period. Li et al. (2021) study the effect of non-interest revenue on the performance of American banks in light of the COVID-19 pandemic. The study found that engaging in non-interest income and expansion outside traditional activities have a favorable effect on the performance of US banks in terms of profitability and adverse effect to banking risks. In the same vein, Ocheng (2022) demonstrates that dependence on non-interest revenue results in higher and stable profits and tends to be more profitable and financially stable during the COVID-19 period. These results are confirmed by Le et al. (2022) who find that diversified Vietnamese banks experience lower risk of default during the COVID-19 period.

Overall, the literature review presents a comprehensive examination of the impact of income diversification on the stability of commercial banks, particularly in developing countries. The findings from various studies are varied and sometimes contradictory, with some suggesting that income diversification enhances stability by increasing non-interest income and reducing costs, while others argue that it may introduce volatility and risk. However, it is worth noting that income diversification could potentially serve as an effective risk mitigation strategy during times of crisis, such as the ongoing COVID-19 pandemic. Building upon these insights, this study aims to investigate the following research question: What is the specific effect of the COVID-19 pandemic on the relationship between income diversification and bank stability among Jordanian commercial banks?

Following the above review and discussion of the literature, the main hypotheses of this study can be written as follows:

H_1 : Income diversification has a significant effect on the stability of Jordanian commercial banks.

H_2 : Income diversification has a significant effect on the stability of Jordanian commercial banks, during the COVID-19 period.

2. DATA AND METHODOLOGY

This section presents the methodology employed to investigate the influence of income diversification on bank risk within the context of 13 Jordanian commercial banks listed on the ASE. The study covers the period from 2015 to 2021, incorporating quarterly data and encompassing a total of 351 observations. The sample period is selected to cover a satisfactory period prior to the spread of the COVID-19 pandemic, in addition to the period during the spread of the COVID-19 pandemic. The sample banks are exhibited in the appendix, Table A1. The income diversification variables are measured by two proxies:

- 1) non-interest income shares (NIS); and
- 2) (ii) reverse Herfindahl-Hirschman concentration Index (RHHI).

NIS is used as a measure of the direct effect of income diversification following the literature (Chiorazzo et al., 2008; Pennathur et al., 2012; Sanya & Wolfe, 2011), and is calculated as the ratio of non-interest income to operating income as follows:

$$NIS = \frac{NON}{EBIT}, \quad (1)$$

where NON = non-interest income, and $EBIT$ = earnings before income and tax. The higher the NIS value, the more diversification there is to non-interest income related activities. Similarly, RHHI is used as an additional diversification measure following the literature (Abuzayed et al., 2018; Ammar & Boughrara, 2019; Elsas et al., 2010; Mercieca et al., 2007), where $RHHI$ is calculated as follows:

$$(RHHI) = 1 - \left[\left(\frac{NET}{Top} \right)^2 + \left(\frac{NON}{Top} \right)^2 \right], \quad (2)$$

where $Top = NET + NON$, NET = net interest income, and NON = non-interest income. The Reverse Herfindahl Hirschman concentration Index (RHHI) provides a score between 0.0 and 0.5, with the higher value implying more diversification towards non-interest income. $RHHI$ only measures the level of income diversification across interest income and non-interest income, however, it does not reflect the direct impact of non-interest income as the non-interest income shares variable (NIS). Table A2 (Appendix), presents the study variables, proxies, and their sources.

Following the literature, the general model can be specified as follows:

$$Zscore_{it} = \alpha_0 + \beta_1 Div_{it} + \beta_2 Div \cdot Covid19_{it} + \sum_{i=3}^n \beta_i X_{it} + \varepsilon_{it}, \quad (3)$$

where i and t refer to the bank and year, respectively. $Zscore$ is the bank risk proxy, Div is the diversification proxy, ($Div \cdot Covid19$) is an interaction term between the diversification proxy and COVID-19 dummy variable, where the COVID-19 dummy variable takes the value of 1 for the period from quarter two-2020 to quarter three-2021, and 0 otherwise. Finally, X is a set of control variables that are included in the model. This paper applies the Panel Autoregressive-Distributed lag methodology (Panel-ARDL) developed by Pesaran and Smith (1995) and Pesaran et al. (1999), to examine the effect of income diversification on banks stability. The ARDL methodology is best suitable when variables are stationary at $I(0)$ or $I(1)$, which is most common in the case of financial and accounting variables.

3. RESULTS

Table 1 presents the descriptive statistics for the study. The primary dependent variable is the Z-score (ZSCORE), which serves as an indicator of bank stability. The mean value of ZSCORE is 42.21, accompanied by a standard deviation of 13.07. Likewise, the study's key independent variables are the non-interest income share (NIS) and the Reverse Herfindahl Hirschman Concentration Index (RHHI). NIS has an average of 25.749 and a standard deviation of 6.733, while RHHI has a

Table 1. Descriptive statistics

Variable	ZSCORE	NIS	RHHI	LNTA	CIR	CDT	LLP	DTA	LTA
Mean	42.212	25.749	0.376	15.18	42.155	0.0689	0.000000831	66.829	0.184
Maximum	72.170	60.316	0.500	17.97	99.357	0.153	0.000005820	81.123	0.439
Minimum	16.880	13.522	0.234	13.953	-249.348	0.009	-0.000002270	49.916	0.069
Std. Dev.	13.070	6.733	0.058	0.915	26.896	0.026	0.000000978	6.554	0.064
Observations	351	351	351	351	351	351	351	351	351

Note: ZSCORE measures the bank risk; NIS is non-interest income share, RHHI is the Reverse Herfindahl Hirschman concentration Index; LNTA is bank size; CDT is the credit risk ratio; CIR is the Operating cost and measure by the operating expenses divided to total income; LLP is the loan quality indicator; DTA is Deposit ratio; LTA is Liquidity ratio.

mean value of 0.376 and a standard deviation of 0.058. The relatively high mean values of these variables signify a greater level of diversification, suggesting that Jordanian commercial banks exhibit diversified characteristics. Descriptive statistics for the additional independent variables can be found in the table.

Table 2 displays the pairwise correlations for the variables in the study. The purpose of this correlation analysis is to identify any potential multicollinearity issues among the independent variables. According to Tabachnick and Fidell (2007), multicollinearity problems arise when the correlation between any pair of independent variables exceeds 0.9. In this case, all correlation coefficients

for the independent variables are relatively low, suggesting that there are no significant multicollinearity concerns within the study's analysis. The sole exception is the correlation between NIS and RHHI, which is anticipated since they both serve as proxies for income diversification. To mitigate multicollinearity issues, NIS and RHHI are assessed in separate models.

Table 3 exhibits the results of the panel unit root tests using the IPS test, which shows that all study variables are stationary, either at the level I(0) or at first difference I(1). As a result of these mixed stationary orders, the ARDL panel is more suitable for econometric analysis in this study. Subsequently, the results of the

Table 2. Correlation matrix

Variable	ZSCORE	NIS	RHHI	LNTA	LLP	LTA	CIR	DTA
ZSCORE	1.000	-	-	-	-	-	-	-
NIS	-0.124*	1.000	-	-	-	-	-	-
RHHI	-0.116*	0.939*	1.000	-	-	-	-	-
LNTA	-0.07	-0.072	0.091*	1.000	-	-	-	-
LLP	-0.226*	-0.105*	-0.092*	0.216*	1.000	-	-	-
LTA	-0.304*	0.058	0.077	0.151*	0.112*	1.000	-	-
CIR	0.055	-0.138*	-0.114*	-0.065	-0.213*	-0.184*	1.000	-
DTA	0.123*	-0.070	-0.086	0.123*	-0.029	0.049	-0.003	1.000

Note: * designates significance at the 10% level.

Table 3. Panel unit root tests

Measures	Level	IPS W-statistic*	Unit Root Summary
		1st difference	
ZSCORE	0.80864	-11.2704	I (1)
NIS	-2.46393	-14.8757	I (0)
RHHI	-2.38831	-15.4976	I (0)
CIR	-11.057	-24.8866	I (0)
CDT	-2.23034	-17.6444	I (0)
DTA	-1.7252	-18.8239	I (0)
LLP	-6.38061	-16.6708	I (0)
LTA	-1.42384	-16.4796	I (1)
LNTA	2.51762	-19.7015	I (1)

Note: Null Hypothesis: Unit Root. The asterisks identify significance as follows: *** designates significance at the 1% level, ** designates significance at the 5% level, and * designates significance at the 10% level.

Table 4. Summary of panel cointegration results

Model	(Dependent Variable Independent Variables)	ADF t-Statistic	ADF Prob.	Outcome
Model 1	(ZSCORE NIS, LNTA, LTA, DTA)	-3.290115	0.0005	Cointegrated
Model 2	(ZSCORE RHHI, LNTA, LTA, DTA)	-3.072533	0.0011	Cointegrated
Model 3	(ZSCORE NIS, LNTA, LTA, DTA, LLP, CIR)	-3.517199	0.0002	Cointegrated
Model 4	(ZSCORE RHHI, LNTA, LTA, DTA, LLP, CIR)	-3.509030	0.0002	Cointegrated

panel cointegration tests for the study models are summarized in the Table 4. Kao's (1999) test is used to test whether there is a long-run equilibrium relationship or not. The results of Kao's test show that all models are cointegrated, which means there is a long-run equilibrium relationship.

Lastly, the results of panel ARDL models are reported in Table 5. Six model specifications are reported to account for model specification bias as a result of the choice of explanatory variables (Khatatbeh, 2019; Khatatbeh & Moosa, 2021). Models 1 through 4 represent the baseline specifications in which the overall impact of revenue diversification on the ZSCORE is examined. Subsequently, the effect of income diversification variables during the COVID-19 pandemic is examined by introducing an interaction term between the income diversification variables and the COVID-19 dummy variable (NIS19 and RHHI19) as in models 5 and 6.

The results show that the coefficients of NIS are significant and with a negative sign in models 1, 3, and 5. The negative coefficient of NIS suggests that diversification toward non-interest income increases Jordanian commercial banks' risks and reduces their stability, which is consistent with the negative effect literature (Ammar & Boughrara, 2019; Abuzayed et al., 2018). Similarly, the results of RHHI show significant negative coefficients in models 2, 4, and 6, which confirms the findings of Lee et al. (2014). In this sense, the Jordanian commercial banks' diversification toward non-interest activities deteriorate their stability. Surprisingly, the results of the interaction terms of diversification variables and the COVID-19 dummy (NIS19 and RHHI19) show a positive effect of income diversification during the COVID-19 period.

The results suggest that bank size (LnTA) has a significant negative coefficient in all models, which means that when Jordanian commercial banks expand in size, the degree of banking stability decreases and the risk increases. These results corroborate with the findings of Ammar and Boughrara (2019) who find that bank size and stability are inversely related; however, it contrasts with the studies of Ashraf et al. (2016) and (2018) that show a positive relationship between size and stability. The results of the cost efficiency (CIR), which is measured as the operating cost divided by total income, show a negative effect in all models. As for the deposit ratio (DTA), the results show a significant positive impact on banks' stability almost in all models. These findings are in line with the study of Lee et al. (2014), who find a positive relationship between the deposit ratio and banks' stability. They argue that when the deposit rate increases, banks encounter enhanced stability. The Liquidity ratio (LTA) has a negative effect on bank stability in 4 out of 6 models, which means that an increase in liquidity ratio encounters a high risk and decreases the degree of stability for Jordanian banks. Ammar and Boughrara (2019) argue that MENA Banks have a large volume of liquid assets ratio, which exceeds the permissible limit for liquid assets that have low returns and higher risk. Abuzayed et al. (2018) suggest that GCC Banks have a higher value in liquidity ratio might lead to higher profits but simultaneously increase their credit risk. Finally, the loan loss provision ratio (LLP) results show a negative association between LLP and ZSCORE as revealed by significant negative coefficients in models 3 to 6, which implies that the degree of stability decreases, and the level of risk increases when the LLP increases. These results are consistent with Ammar and Boughrara (2019) who report a negative effect of LLP on banks stability for MENA banks.

Table 5. Panel ARDL results (dependent variable: ZSCORE)

Variable	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
Long-run coefficients						
NIS	-0.733*** (0.00)	–	-0.273*** (0.00)	–	-0.144*** (0.0063)	–
RHHI	–	-63.53*** (0.00)	–	-27.91*** (0.00)	–	-17.27*** (0.0003)
LNTA	-25.78*** (0.00)	-25.58*** (0.00)	-30.135*** (0.00)	-30.99*** (0.000)	-36.84*** (0.00)	-38.03*** (0.00)
LTA	-57.54*** (0.00)	-84.04*** (0.00)	-3.69 (0.2469)	-3.67 (0.247)	-10.96*** (0.0036)	-8.58** (0.0184)
DTA	0.741*** (0.00)	0.793*** (0.00)	0.133*** (0.0077)	0.136*** (0.0066)	0.132888*** (0.00)	0.138*** (0.0029)
LLP	–	–	-742,117*** (0.0002)	-667,993*** (0.001)	-1,113,531*** (0.0000)	-1,118,276*** (0.00)
CIR	–	–	-0.047*** (0.00)	-0.046*** (0.00)	-0.068*** (0.00)	-0.061*** (0.00)
NIS19	–	–	–	–	0.109*** (0.00)	–
RHHI19	–	–	–	–	–	6.43*** (0.00)
Short-run coefficients						
Error correction term	-0.393515 (0.0085)	-0.402400 (0.0050)	-0.247682 (0.0009)	-0.247283 (0.0013)	-0.256847 (0.0082)	-0.229259 (0.0024)
Observations	299	299	338	338	338	338
Number of lags	(1, 4, 4, 4, 4)	(1, 4, 4, 4, 4)	(1, 1, 1, 1, 1, 1, 1)	(1, 1, 1, 1, 1, 1, 1)	(1, 1, 1, 1, 1, 1, 1)	(1, 1, 1, 1, 1, 1, 1)

Note: *** designates significance at the 1% level, ** designates significance at the 5% level, and * designates significance at the 10% level.

4. DISCUSSION

The study's empirical results on the impact of income diversification on the stability of listed Jordanian commercial banks during the COVID-19 pandemic reveal that income diversification has a favorable effect on bank stability. The positive coefficients indicate that more diversified banks experienced greater stability during the pandemic, supporting the observation that non-interest income boosts bank profits and stability (Lahouel et al., 2022; Mehmood & De Luca, 2023). However, the full sample results suggest that diversification towards non-interest income may deteriorate bank stability, possibly due to non-interest income being less profitable compared to interest income (Lahouel et al., 2022). These findings align with the negative effect strand of the literature in developing economies. The study also examines key predictors of bank stability (ZSCORE) (e.g., Ammar & Boughrara, 2019; Abuzayed et al., 2018; Williams, 2016; Stiroh, 2006). Moreover, the results show that bank size adversely affects

bank stability, confirming previous findings that large banks may encounter agency problems that increase bank risk as they engage in new business lines to grow their power (Demsetz et al., 1997; Kurowski & Gajewski, 2021). Similarly, increasing operating costs relative to total income (cost efficiency (CIR)) harms bank stability, suggesting that as banks effectively control their operational expenses, the degree of risk and expenses become lower (Kovner et al., 2014). These results confirm previous findings that more efficient banks can reduce costs and improve profitability, which in turn enhances stability and performance (Lozano-Vivas & Pasiouras, 2010).

The policy implications of these results are significant for the Central Bank of Jordan (CBJ), local banks, and banks in similar contexts. A trend towards diversifying towards non-interest income should be encouraged by the CBJ and adopted by local banks to protect the banking system during turbulent times, such as the COVID-19 pandemic (Mugableh et al., 2023). Moreover, bank

administrations seeking to enhance bank stability should carefully examine the performance of the main predictors of bank stability.

inclusion and support small and medium enterprises (SMEs) to enhance their stability and contribute to economic growth.

In light of the COVID-19 pandemic, banks should consider non-traditional activities for their survival and stability, as they become more relevant in a crisis. For instance, banks can focus on fee-based services, trading activities, and foreign currency to diversify income sources and improve stability (Ho et al., 2023). Additionally, banks should prioritize financial

Lastly, the Central Bank of Jordan and local banks should promote income diversification and monitor key predictors of bank stability to ensure a resilient banking system during times of crisis. By adopting these strategies, banks can better navigate economic challenges and contribute to the overall stability of the financial sector.

CONCLUSION

This study examines the impact of income diversification on the stability of Jordanian commercial banks listed on the Amman Stock Exchange (ASE), particularly during the COVID-19 period. The findings suggest that bank stability weakens as these institutions broaden their income sources to include non-interest income. However, a larger share of non-interest income contributes to reduced risk and increased stability throughout the pandemic. Moreover, the research highlights a negative relationship between bank stability and predictors such as size, liquidity ratio, loan loss provision ratio, and cost efficiency, while a positive relationship exists with the deposit ratio. The study findings have significant implications for the Central Bank of Jordan and bank administrators who are interested in ensuring the stability and robustness of the banking sector. Particularly, the study suggests that bank administrators should pursue non-interest income activities to strengthen their institutions. Additionally, the study emphasizes the importance of bank administrators being cognizant of the elements that adversely affect bank stability and taking necessary actions to address them. Future research may focus on conducting comparative analyses of income diversification's impact on profitability and risk among commercial and Islamic banks, as well as between developed and developing nations. In addition, future research may examine the effects of income diversification while differentiating the sources of non-interest income, taking into account the diverse fees and commissions structure.

AUTHOR CONTRIBUTIONS

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APPENDIX A

Table A1. The study sample of listed Jordanian commercial banks

Source: Author's own compilation.

No.	Bank Name	Established Year	Total Assets 2021 (In Million USD)	Website
1	Arab Bank	1930	63,805	https://www.arabbank.jo
2	Housing Bank	1974	11,613	https://hbtfc.com
3	Bank Al Etihad	1991	8,816	https://www.bankaletihad.com
4	Capital Bank of Jordan	1996	6,072	https://www.capitalbank.jo/
5	Cairo Amman Bank	1960	5,090	https://www.cab.jo
6	Jordan Kuwait Bank	1977	4,232	https://www.jkb.com
7	Jordan Ahli Bank	1965	4,104	https://ahli.com
8	Bank of Jordan	1960	3,859	https://bankofjordan.com
9	Arab Jordan Investment Bank	1978	3,240	https://www.ajib.com
10	Société Générale Bank / Jordan	1993	2,367	http://www.sgbj.com.jo
11	Jordan Commercial Bank	1978	2,035	https://www.jcbank.com.jo
12	Invest Bank	1989	1,830	https://www.investbank.jo
13	Arab Banking Corporation	1989	1,732	https://www.bank-abc.com

Table A2. Summary of variables definitions, measurement, and previous literature

Variables	Proxy	Measurement	Previous Literature
Dependent Variable			
ZSCORE	ZSCORE	$ZSCORE = \frac{ROA + CAPITALIZATION}{SDROA}$	Abuzayed et al. (2018); Lee et al. (2014)
Main Independent Variables			
RHHI	Reverse Herfindahl Hirschman concentration Index	$RHHI = 1 - \left[\left(\frac{NET}{Top} \right)^2 + \left(\frac{NON}{Top} \right)^2 \right]$	<p>Positive (+) Lee et al. (2014)</p> <p>Negative (-) Chiorazzo et al. (2008); Stiroh and Rumble (2006)</p>
NIS	Non-Interest income share	$NIS = \frac{NON}{EBIT}$	<p>Positive (+) Saunders et al. (2014); Al-Tarawneh et al. (2017)</p> <p>Negative (-) Obeidat et al. (2021); Mercieca et al. (2007); DeYoung and Roland (2001)</p>
Other Independent Variables			
LnTA	Bank size	The Natural Logarithm of Banks Total Assets	<p>Positive (+) Meslier et al. (2014); Sanya and Wolfe (2011); DeYoung and Rice (2004)</p> <p>Negative (-) Ammar and Boughrara (2019); Al-Tarawneh et al. (2017)</p> <p>Mixed Effect Abuzayed et al. (2018); Stiroh and Rumble (2006)</p>
ROA	Return on Assets	$(ROA) = \frac{NI}{TA}$	Ammar and Boughrara (2019); Meslier et al. (2014); Goddard et al. (2008); Lepetit et al. (2008)
CIR	Cost efficiency	$CIR = \frac{Operating\ expenses}{Total\ income}$	Negative (-) Ammar and Boughrara (2019); Abuzayed et al. (2018); Al-Tarawneh et al. (2017)
CDT	Credit Risk	$CDT = \frac{Non - performing\ loans}{TL}$	<p>Positive (+) Lin et al. (2012)</p> <p>Negative (-) Ammar and Boughrara (2019); Abuzayed et al. (2018)</p>

Table A2 (cont.). Summary of variables definitions, measurement, and previous literature

Variables	Proxy	Measurement	Previous Literature
LLP	Loan loss Provision ratio	$LLP = \frac{\text{provision for Loan Losses}}{TA}$	Positive (+) Lee, Yang, et al. (2014) Negative (-) Ammar and Boughrara (2019)
DTA	Deposits ratio	$DTA = \frac{\text{Deposit}}{TA}$	Positive (+) Al-Tarawneh et al. (2017); Lee et al. (2014); Lee, Yang, et al. (2014); DeYoung and Rice (2004)
LTA	Liquidity ratio	$LTA = \frac{LIQ}{TA}$	Positive (+) Nisar et al. (2018) Negative (-) Ammar and Boughrara (2019)
COVID-19 Dummy Variables – Interaction terms			
<i>NIS19</i>	NIS 19	Interaction term of the NIS with the Dummy variable of 1 for crises years and 0 for other years	
<i>RHHI19</i>	RHHI 19	Interaction term of the RHHI with the Dummy variable of 1 for crises years and 0 for other years	