



Research article

How does the use of derivatives affect bank default risk, performance, and value? An examination of European and MENA countries

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Abstract: In this paper, we examined the impact of derivatives on the default risk, financial performance, and firm value of banks operating in the Europe, Middle East, and Africa (EMEA) region. The analysis was based on a balanced panel dataset comprising 189 banks (94 from Europe and 95 from the Middle East and Africa) covering the period 2011–2016. Our major findings revealed that the total notional derivatives position has a positive effect on risk mitigation, which is more pronounced in the case of hedging activities than in trading activities. Conversely, the overall use of derivatives does not exhibit a statistically significant relationship with financial performance as measured by accounting-based indicators. However, the market appears to assign a valuation premium to banks that use derivatives for hedging purposes, while banks with larger trading exposures experience a negative valuation effect. Finally, we found that the influence of total derivatives on performance and risk reduction varies significantly between European banks and those in the Middle East and Africa.

Keywords: default risk; performance; value; hedging; trading; EMEA; Islamic

JEL Codes: G14, G15, G21

1. Introduction

The derivatives market has grown significantly in recent decades, becoming a key component of the global economy (Jo et al., 2009). Traditional hedging theories posit that derivative use enhances firm value by reducing taxes, stabilizing cash flows, mitigating underinvestment problems, and influencing debt levels and costs (Nance et al., 1993; Smith and Stulz, 1985; Gay and Nam, 1998; Froot and Stein, 1998). In the banking sector, however, derivatives also serve intermediation and speculative functions that may improve profitability through fee generation and trading activities (Sinkey and Carter, 2000). Consequently, derivatives may affect bank value through risk management and enhanced financial performance. Nevertheless, empirical evidence on this relationship remains limited and inconclusive (Shen and Hartarska, 2018).

The use of derivatives for hedging and trading purposes can significantly affect banks' risk profiles, though empirical findings remain mixed. While hedging is generally expected to reduce risk and speculation to increase it, studies indicate that hedging may encourage riskier behavior, including reduced monitoring, higher leverage, and expanded lending (Otero et al., 2016; Morrison, 2005; Jiangli and Pritsker, 2008; Wagner, 2005). Several scholars argue that derivatives use can increase bank risk even when employed as hedging instruments (Duffee and Zhou, 2001; Gibson, 2007; Heyde and Neyer, 2010; Shao and Yeager, 2007). Agency concerns further suggest that managers may exploit hedging activities for private benefits, particularly in weak governance environments (Lel, 2012). Moreover, excessive derivatives use has been linked to systemic instability and heightened market volatility during the global financial crisis (Jo et al., 2009; Stulz, 2010). Empirical evidence also highlights context-dependent effects, with derivatives use producing positive and negative outcomes depending on risk type and transaction costs (Ahmed et al., 2014; Otero et al., 2020; Bae et al., 2018). Studies indicate that derivatives may increase bank risk, especially when used for speculative or suboptimal hedging purposes (Huan and Parbonetti, 2019) and are not primarily employed for hedging (Taşkın and Saryer, 2020). Furthermore, growing derivative holdings have been associated with rising systemic risk through increased asset, leverage, and operational risks (Wang et al., 2025).

In contrast, studies document beneficial risk effects of derivatives use. Titova and Girard (2012) report that derivatives have no significant impact on bank risk when used for trading but reduce risk when employed for hedging. Otero et al. (2016) found that credit derivatives trading undermines financial stability, whereas hedging activities enhance it. Deng et al. (2017) showed that hedging mitigates tradable risks such as interest rate and exchange rate exposure while enabling banks to increase credit risk through lending. Similarly, Ghosh (2017) documented improved risk-adjusted returns associated with derivatives use, indicating a risk-return tradeoff. Titova et al. (2020) further confirmed that higher hedging intensity is linked to lower risk and greater firm value. Overall, derivative activities influence bank performance and risk (Gitogo, 2012). However, the literature has largely concentrated on developed markets (Ghosh, 2017; Instefjord, 2005; Otero et al., 2016; Stulz, 1996), limiting the applicability of findings to less developed economies, where derivative access, costs, liquidity conditions, and banking structures differ substantially (Hadian and Adaoglu, 2020).

The literature highlights the need to assess the effects of derivatives on bank performance, risk, and value across economic contexts, considering derivative type and development level, yet empirical research remains limited by data constraints and inconsistent reporting, particularly in emerging

markets. The EMEA region provides a suitable setting due to its heterogeneous political, economic, and regulatory environments (Otero et al., 2018; Otero et al., 2017), suboptimal bank size in MEA countries (Olson and Zoubi, 2011), and ethical constraints associated with Islamic banking (Goaied and Sassi, 2010). Islamic finance permits derivatives primarily for hedging rather than speculation (Anwer and Habib, 2019), though technical expertise remains limited (Srairi, 2009). Emerging markets also face higher counterparty risk and financial fragility (Rossi Jr., 2009; Lin and Chang, 2012; Alles and Murray, 2010), smaller and less liquid markets (Mihaljek, 2010; Ovat, 2014), underdeveloped capital markets, limited financial expertise (Bitar et al., 2016; Neaime, 2016), scarce derivative instruments (Henry and Springborg, 2010; Mollah et al., 2017), and a dominant role of banks in financing (Belkhir et al., 2016; Cherif and Dreger, 2016; Naceur and Omran, 2011).

Accordingly, in this study, we analyze hedging and trading derivatives in EMEA banks, examining their effects on performance, risk, and value, differences between developed and emerging economies, and profitability as a mediating channel, using manually collected data from Annual Reports and Pillar 3 Disclosures.

The remainder of this paper is structured as follows: In Section 2, we present a review of the main literature and develop the research hypotheses. In Section 3, we describe the empirical design and data. In Section 4, we outline the methodology and present the results. In Section 5, we conclude with a summary of key findings and policy implications.

2. Literature review and hypothesis developing

2.1. The relationship between derivatives and performance

Derivatives can influence firms' accounting performance and market value by generating alternative income sources, particularly through intermediation and speculative activities when traditional banking margins decline (Ashraf and Goddard, 2012; Sinkey and Carter, 2000). Speculative gains may arise from informational advantages or economies of scale, linking derivatives use to higher accounting performance and firm value. While the relationship between derivatives strategies and financial performance has been widely studied (Bae et al., 2018; Bailey and Katz, 2011; Donohoe, 2015; Kim et al., 2017), evidence within the banking sector remains limited and inconclusive (Shen and Hartarska, 2018). Studies report positive effects on profitability and efficiency using accounting measures such as ROA and ROE (Li and Yu, 2010; Rivas et al., 2006; Shen and Hartarska, 2013; Ghosh, 2017). Conversely, other research indicates no significant performance differences between derivative users and non-users or lower net interest margins among users (Sinkey and Carter, 2000; Brewer et al., 2001; Sundaram and Willey, 2009). Some researchers document negative associations, attributing weaker performance to hedging activities, risk type, or transaction and opportunity costs (Ahmed et al., 2014; Otero et al., 2020; Bae et al., 2018). Evidence from emerging markets similarly indicates adverse profitability effects of derivative use (Keffala and de Peretti, 2016; Taşkın and Sarıyer, 2020).

Drawing upon the preceding literature, it is evident that the relationship between derivatives and profitability is ambiguous, varying according to the type of derivative, the purpose of use, and the institutional context.

H1: The effect of the use of derivatives on banks' profitability is neutral.

2.2. The relationship between derivatives and risk

The relationship between derivatives and bank risk has attracted considerable attention, particularly following the global financial crisis, which raised concerns about the role of financial innovation in systemic stability (Gorton and Rosen, 1995; Klemkosky, 2013). While hedging theory suggests that derivatives reduce financial distress and its associated costs (Smith and Stulz, 1985), empirical evidence in the banking sector remains mixed (Otero et al., 2016). Banks use derivatives for hedging, intermediation, and speculation, with resulting effects shaped by changes in capital requirements, monitoring, and risk-taking behavior (Deng et al., 2017; Instefjord, 2005; Otero et al., 2016). Some researchers found that derivatives enhance financial stability or reduce insolvency risk (Ghosh, 2017; Gorton and Rosen, 1995), whereas others reported increased risk due to speculative trading, suboptimal hedging, or accounting-related earnings volatility (Li and Yu, 2010; Taşkın and Sarıyer, 2020).

Several studies document no significant relationship between derivatives and bank risk (Gilkeson and Smith, 2006; Yong et al., 2009; Keffala, 2018). When distinguishing hedging and trading activities, findings remain inconclusive. Derivative trading has been linked to heightened risk, while hedging may either mitigate or indirectly increase risk by encouraging aggressive lending (Dai and Lapointe, 2010; Attig and Dai, 2009; Deng et al., 2017). Evidence from Europe similarly varies: Derivatives used for hedging tend to reduce or have no effect on risk, whereas trading derivatives often undermine stability (Titova and Girard, 2012; Titova et al., 2020; Otero et al., 2016).

Drawing upon the literature, it can be concluded that the risk implications of derivative use depend largely on their purpose and context.

H2A: Usage of derivatives for trading purposes increases the level of risk.

H2B: Use of derivatives for hedging purposes reduces risk.

2.3. The effect of derivatives on a bank's value

Hedging theory posits that derivatives enhance firm value by reducing financial risk through lower expected taxes, smoother cash flows, mitigation of underinvestment problems, and reduced reliance on costly external financing (Nance et al., 1993; Smith and Stulz, 1985; Shapiro and Titman, 1986; Froot and Stein, 1998). However, firm value may decline when hedging is inefficient or when hedging costs outweigh benefits (Bae et al., 2016). Empirical evidence from European banks suggests that greater hedging intensity is generally associated with lower risk and higher firm value, while trading derivatives may increase valuation but with weakening effects in the post-crisis period and higher volatility

following the crisis (Titova et al., 2020). In contrast, other studies document negative valuation effects of derivative use (Miloş & Miloş, 2022; Bazic and Vanwalleghem, 2021).

The literature suggests that derivatives, especially those for hedging, generally enhance firm value, though the effect varies with context and purpose.

H3: The use of derivatives has a positive effect on banks' value

2.4. The effect of derivatives based on location, regulation, and risk exposure

An interesting question is whether this type of financial innovation affects performance and risk equally across banks. Evidence suggests that in emerging markets, financial innovation often reduces bank growth and increases fragility due to excessive risk-taking and the accumulation of non-performing assets (Lee et al., 2020; Beck et al., 2016). Hedging with derivatives in underdeveloped markets may negatively impact firm value because of inadequate practices, unrestricted product access, and high transaction costs (Hadian and Adaoglu, 2020; Allayannis et al., 2003; Keffala, 2020). Firms in emerging markets face greater volatility, low liquidity, higher costs, and counterparty risk, and their derivative markets remain small relative to developed economies (Rossi Jr., 2009; Mihaljek, 2010). Islamic banks and MENA financial systems are further constrained by structural and regulatory characteristics, including bank-dominated financing, underdeveloped capital markets, weak market integration, limited expertise, scarce sophisticated instruments, and high transaction costs (Neaime, 2016; Graham and Rogers, 2013; Mollah et al., 2017; Jabbouri, 2016).

Consequently, the impact of derivatives on bank performance and risk likely differs between European and MEA banks, depending on location, regulation, and risk exposure.

H4: The use of derivatives affects bank performance and risk differently, depending on their location, regulatory context, and risk exposure.

3. Sample and data description

For the empirical analysis, we investigate the impact of derivatives usage on the performance and financial distress of banks in the EMEA region. To capture these effects accurately, we consider the notional number of derivatives and their purpose, distinguishing trading and hedging activities. Accordingly, as shown in Table 1, we construct a comprehensive database comprising the consolidated financial statements of 189 listed banks from Europe and the MEA region for the period 2011–2016, sourced from the Orbis-Bankscope database. Sample selection criteria are detailed in Table 1.

Table 1. Sample selection criteria.

World Region/Country	EMEA 15 European / 11 MEA
Accounting standards	International Accounting Standards, International Financial Reporting Standards (IFRS)
Listed banks	Listed banks
Status	Active banks
Last available year	2016

Source: Own Elaboration

For derivatives-related information, data were manually collected from annual reports and Pillar III disclosures to ensure consistency across banks and countries. Variable construction follows the methodological frameworks of Guay and Kothari (2003), Campello et al. (2011), Otero et al. (2016) and Taşkın and Sarıyer (2020). The MEA region provides a particularly compelling context to study derivatives due to its high-risk environments, heterogeneous economic conditions, and varying political stability. Empirical research in this region is challenging because of limited data availability, non-transparent disclosure practices, and restrictions on derivative use arising from Sharia'h law or regulatory constraints. Even where derivatives are permitted, their use may be limited or misapplied, reflecting low financial literacy, underdeveloped markets, and weak institutional and regulatory frameworks. These factors collectively contribute to the scarcity and heterogeneity of derivative data in the MEA region, which must be carefully accounted for in the study's empirical design.

3.1. Variables

3.1.1. Dependent variables

Bank performance and risk-taking are assessed using accounting- and market-based indicators, providing a complementary perspective (Hillegeist et al., 2004). Performance is measured using return on equity (ROE; net income divided by shareholders' equity) following Aebi et al. (2012), return on assets (ROA; profitability relative to total assets) as in Lin and Chang (2012), Baxter et al. (2013), Nair et al. (2014), and Ai et al. (2018), and Tobin's Q as a market-based measure of value creation (Ai et al., 2018). The sample comprises publicly traded banks from 26 countries (15 European and 11 MEA), totaling 189 observations.

Risk-taking is captured through accounting- and market-based measures. Accounting-based risk is proxied by the Z-score, representing the inverse probability of insolvency and a bank's distance to default (Boyd and Runkle, 1993; Michalak and Uhde, 2009; Otero et al., 2016). Market-based measures include systematic risk (Beta), reflecting exposure to overall market movements, and the Quantitative Financial Health Score (QFHS), which

estimates the likelihood of near-term financial distress based on distance to default. A summary of all dependent performance and risk indicators is presented in Table 2.

Table 2. Dependent variables.

Performance		
Return on Assets [ROA]	EBIT/Total Assets	Orbis Bankscope database
Return on Equity [ROE]	Operating result/Equity	Orbis Bankscope database
Tobin's Q [Q]	Market to Book ratio	Morningstar Direct
Risk		
Zscore [Z]	$Z \equiv \frac{ROA + \text{Capital ratio}}{\sigma_{ROA}}$	Orbis Bankscope database
Beta [Beta]	This is a measure of stock volatility in relation to the market: $R_i = \alpha + \beta_i R_m + \epsilon_i$ where: R_i is stock return, R_m is market return and ϵ_i is the error term.	Morningstar Direct
Quantitative Financial Health Score [QFHS]	This indicator reflects the likelihood that a company will face financial problems in the near future based on the Distance to Default.	Morningstar Direct

Source: Own Elaboration

3.1.2. Independent and control variables

The independent variables in this study capture the extent and purpose of derivative usage, as well as bank-specific and macroeconomic characteristics that may influence performance and risk. The summary of independent and control variables and descriptive statistics is provided in Table 3.

To measure derivative usage, we employ the total notional amount scaled by total assets (TotnotTA) to capture overall activity, as well as the total derivative positions for trading (TottradTA) and hedging (TothedTA), following Otero et al. (2016), Chang et al. (2018), Taşkın and Sarıyer (2020), and Titova et al. (2020). Notional values capture the total volume of derivative contracts and are more appropriate for our purpose than fair values in analyzing their impact on profitability, risk-taking, and firm value, as fair values can offset positions and understate actual activity.

In addition, we include a set of control variables (Table 3, Panels A and B), based on other studies (Purnanandam, 2004, 2007; Shao and Yeager, 2007; Bartram et al., 2011; Otero et al., 2016, 2019):

Credit portfolio (NetLoansTA): Measured as net loans to total assets. This variable captures the credit risk exposure of a bank's lending activities (Sarkisyan et al., 2009).

Bank size (LogTA): Total assets control for size effects; larger banks may better manage risk and diversify portfolios (García-Marco and Robles-Fernández, 2008; Huan and Parbonetti, 2019).

Table 3. Variables and hypotheses considered in the study.

Variable	Prediction	Definition	Source
	Performance / Risk		
Total Notional to Total Assets [TotnotTA]	+/-	Total notional/ Total Assets	Annual report and Pillar III disclosures
Total position trading derivatives [TottradTA]	-	Total Notional of Trading/Total Assets	Annual report and Pillar III disclosures
Total position hedging derivatives [TothedTA]	+/-	Total Notional of Hedging/Total Assets	Annual report and Pillar III disclosures
Islamic[Islamic]	-/+	Dummy variable that takes the value of 1 if it is an Islamic bank and 0 otherwise.	Authors' calculation
Size [LogTA]	+	Log (total assets)	Orbis Bank Focus Authors' calculation
Net interest margin % [NIM]	+	(Interest income - interest expense) / assets	Orbis Bank Focus
Efficiency ratio % [CosttoInc]	-/+	Cost to income	Orbis Bank Focus
Credit Portfolio % [NetloansTA]	-/+	Net Lending / total assets	Orbis Bank Focus
Capital Ratio (CapitalRat)	-/+	Equity / total assets	Orbis Bank Focus
Inflation	-	Inflation rate	World bank
GDPgrowth	+/-	Gross domestic product growth	World bank
GDPPERCap	+/-	Gross domestic product per capita	World bank

Source: Own Elaboration.

Capital ratio (CapitalRat): Shareholders' equity over total assets, reflecting loss absorption capacity and financial stability (Bertay et al., 2013; Chang et al., 2010; Coval and Thakor, 2005; Von Thadden, 2004).

Net interest margin (NIM): Difference between interest income and expenses, indicating efficiency and profitability (Michalak and Uhde, 2009; Taşkın and Sariyer, 2020; Said, 2002; Ongore and Kusa, 2013).

Cost-to-income ratio (CosttoInc): Measures operational efficiency; lower ratios indicate higher efficiency and reduced risk (Boyd and Runkle, 2006; Hanif et al., 2012).

Islamic bank indicator: Captures Shariah-compliant governance and investment restrictions, which may affect performance and risk differently from conventional banks (Safiullah and Shamsuddin, 2018; Hadriche, 2015; Ramlan and Adnan, 2016; Siraj and Pillai, 2012).

Macroeconomic variables: GDP growth (GDPgrowth), GDP per capita (GDPpercap), and inflation to account for country-specific conditions (Otero et al., 2019).

3.2. Descriptive analysis

Table 4 presents the major descriptive statistics of the sample. The sample exhibits moderate average profitability and risk levels, but with substantial dispersion across banks, reflecting differences in size, development, stability, culture, and risk management practices between European and MEA regions. For instance, average ROE is 0.88, ranging from -13.41 to over 13, while the Z-score averages 36.02, with a minimum of -4.21 and a maximum exceeding 149. Derivative usage averages near zero due to many banks not engaging in such activities, though some banks hold notional positions exceeding total assets, indicating highly leveraged activity. Other control variables (NIM, NetLoansTA, LogTA, CapitalRat, and CosttoInc) also display wide variation, highlighting institutional heterogeneity.

Comparing derivative users and non-users (Table 5), derivative-using banks show lower average ROA and Tobin's Q, while generally facing higher risk, though differences in Z-score are not statistically significant, which is consistent with evidence that derivatives may increase risk exposure (Chang et al., 2010; Huan and Parbonetti, 2019; Taşkın and Sarıyer, 2020). Higher observed risk may reflect speculative trading, over-hedging, or reverse causality, whereby inherently riskier banks adopt derivatives to mitigate exposures (Li and Marinč, 2014; Dai and Lapointe, 2010). Derivative users are typically larger banks (higher LogTA), with lower NIM and cost-to-income ratios, higher credit exposure (NetLoansTA), and lower capital ratios, which is consistent with the link between leverage and financial distress probability (Howton and Perfect, 1998; Haushalter, 2000; Graham and Rogers, 2002; Knopf et al., 2002) and the endogenous interplay between risk and hedging (Otero et al., 2016; Devashish, 2017).

Table 4. Descriptive statistics for the variables in the sample.

Variable	Obs	Mean	Std. Dev.	Min	Max
Performance					
ROA	1058	0.88	1.87	-13.41	13.02
ROE	1031	6.21	11.09	-67.58	36.46
Tobin's Q	791	1.18	1.04	0.02	10.71
Risk					
Z-score	1003	36.02	33.93	-4.21	149.44
Beta	718	1.10	0.93	0.00	4.51
QFHS	674	0.70	0.18	0.00	0.97
Derivatives Variables					
TotnotTA	985	0.46	1.29	0.00	9.04
TottradTA	975	0.37	1.16	0.00	8.43
TothedTA	1018	0.79	0.26	0.00	3.96
Other Control Variables					
Islamic	1128	0.06	0.24	0.00	1.00
LogTA	1029	5.69	1.29	2.56	8.09
NIM	1055	2.41	1.92	-14.82	21.39
CosttoInc	995	54.59	17.54	15.45	92.77
NetloansTA	1030	52.63	20.26	0.01	85.22
CapitalRat	1023	9.46	12.35	-0.04	63.65
Inflation	1128	1.88	1.83	-3.75	13.81
GDPgrowth	1128	0.46	1.88	-9.13	25.16
GDPPerCap	1128	35812.17	26493.85	2591.10	146982.00

Note: ROA measures profitability relative to total assets, while ROE assesses financial performance based on net income over shareholders' equity. Tobin's Q captures value creation. Z-score indicates distance to insolvency, Beta reflects systematic market risk, and the Quantitative Financial Health Score (QFHS) estimates the likelihood of near-term financial distress using the distance to default. Derivative usage is measured as total notional derivatives scaled by assets (TotnotTA), trading derivatives (TottradTA), and hedging derivatives (TothedTA). Islamic is a dummy variable equal to 1 for Shariah-compliant banks. Bank characteristics include size (LogTA), net interest margin (NIM), efficiency (CosttoInc), credit exposure (NetLoansTA), and capital ratio (CapitalRat). Macroeconomic controls comprise inflation, GDP growth (GDPgrowth), and GDP per capita (GDPperCap).

Table 5. Difference of means between users and non-users.

	Non Users	Users	Diff.	Std. Error	Obs.
ROA	1.2288	0.5944	0.6344***	0.1153	1058
ROE	7.2281	5.3373	1.8908	2.0246	1031
Tobin's Q	1.3686	1.0609	0.3077***	0.0764	791
Zscore	49.961	46.0475	3.9135	4.1586	1003
Beta	0.5381	0.9887	-0.4507***	0.0876	718
QFHS	0.7356	0.6783	0.0574***	0.0135	674
LogTA_	5.6073	5.7711	-0.1638**	0.0803	1029
NIM	2.7798	2.1081	0.6718***	0.1191	1055
CosttoInc	59.2905	57.0444	2.246	1.8365	995
NetloansTA	49.1846	55.5404	-6.3558***	1.2773	1030
CapitalRat	15.2479	5.2561	9.9919***	0.8317	1023
GDPgrowth_	0.3832	0.4392	-0.056	0.1076	1027
Inflation	2.1121	1.5392	0.5729***	0.1118	1027
GDPPerCap	32198.686	39171.4623	-6972.7763***	1600.0717	1027

Note: This table reports the mean differences in dependent and independent variables between banks that use derivatives (1) and those that do not (0). Equality of means is tested using the t-statistic. Significance levels are indicated as *** (1%), ** (5%), and * (10%). Variable definitions are provided in the footnote of Table 1.

4. Methodology

The impact of derivatives on bank risk and performance has been extensively studied using panel data methods. Researchers have typically employed static or fixed-effects models (Chang et al., 2010; Purnanandam, 2007; Otero et al., 2016), with some researchers also using random-effects models (Otero et al., 2016) to control for unobserved heterogeneity across banks. However, static models assume strict exogeneity and may yield inconsistent estimates in the presence of endogeneity, which arises when leverage, hedging, and risk are jointly determined (Magee, 2013; Otero et al., 2016; Keffala, 2020; Devashish, 2017) or when credit derivative usage is influenced by ex-ante risk correlated with ex-post outcomes (Shao and Yeager, 2007). To address these concerns, we adopt a dynamic panel approach estimated via system GMM (Arellano and Bover, 1995; Blundell and Bond, 1998), suitable for “small T, large N” panels. This estimator accounts for endogeneity, fixed effects, heteroscedasticity, and autocorrelation, providing consistent estimates of the impact of derivatives on bank performance and financial stability (Roodman, 2009). The dynamic panel data model used is presented in Equation (1).

$$Y_{it} = \alpha_{it} + \beta_1 Y_{it-1} + \beta_2 [\text{Derivatives}]_{it} + \beta_3 [\text{LogTA}]_{it} + \beta_4 [\text{NIM}]_{it} + \beta_5 [\text{CosttoInc}]_{it} + \beta_6 [\text{NetloansTA}]_{it} + \beta_7 [\text{CapitalRat}]_{it} + \beta_8 [\text{Inflation}]_{it} + \beta_9 [\text{GDPgrowth}]_{it} + \beta_{10} [\text{GDPpercap}]_{it} + \text{Islamic}_i + \text{Europe}_i + \sum_{t=1}^5 \text{Year}_t + \varepsilon_{it} \quad (1)$$

In this model, Y_{it} represents the measure of risk, performance, or value for bank i in period t . This outcome is modeled as a function of the volume of derivatives (including

interest rate derivatives and credit derivatives) in addition to a set of control variables described in Sections 3.1.1 and 3.1.2. The term ε_{it} denotes the idiosyncratic error term, while α and β represent the parameters to be estimated. Specifically, β_2 correspond to our independent variables, which include the total notional derivatives to total assets (TotnotTA), total trading derivatives to total assets (TottradTA), and total hedging derivatives to total assets (TothedTA). Separate models are estimated for each measure to evaluate their distinct effects. The remaining β_j parameters capture the influence of bank-specific and macroeconomic controls. Dummy variables indicate whether a bank is Islamic or in Europe, accounting for structural and institutional differences, while year dummies control for common shocks and time trends. Instrument validity and model assumptions are assessed using the Hansen J-test for overidentifying restrictions and the Arellano–Bond AR(2) test for second-order serial correlation, providing a robust check of instrument appropriateness and GMM specification consistency.

5. Results

In this section, we present the empirical results, examining the impact of overall and type-specific derivatives usage (hedging versus trading) on bank performance and risk, with attention to accounting- and market-based measures and potential regional differences.

5.1. Results for performance and value

Table 6 reports the effects of derivatives on bank performance and value. Total notional derivatives do not significantly affect accounting-based measures (ROA, ROE) but have a positive impact on Tobin's Q, which is consistent with Hypothesis H1 and studies showing limited or mixed effects of derivatives on accounting performance (Brewer et al., 2001; Sundaram and Willey, 2009; Otero et al., 2020).

Trading derivatives negatively affect Tobin's Q without influencing accounting measures, reflecting market penalties for speculative activity (Bazih & Vanwalleghem, 2021), whereas in developed markets, trading derivatives are positively associated with value (Chang et al., 2010; Titova et al., 2020).

Hedging derivatives show a positive, though mostly non-significant, effect on ROA and ROE, and a significant positive effect on Tobin's Q, supporting Hypothesis H3 and the hedging literature (Batten and Hogan, 2002; Mengle, 2007; Angelini, 2012; Titova et al., 2020). Differences with Bazih and Vanwalleghem (2021), who found negative effects in emerging markets, likely reflect sample composition, especially the share of banks from developed economies.

Overall, derivatives have a neutral effect on accounting performance, while market valuation favors hedging and penalizes trading. Capital ratios positively influence Tobin's Q, and the Islamic and Europe dummies are positively associated with market value, though only the Europe dummy significantly affects accounting measures, suggesting regional differences in the impact of derivatives on performance.

Table 6. The effect of derivatives on performance and value.

Variable	ROA	ROE	Tobin's Q	ROA	ROE	Tobin's Q	ROA	ROE	Tobin's Q
ROA_ (T-1)	0.2962***			0.0666			0.2932***		
ROE (T-1)		-0.0335			0.2129			-0.0254	
Tobin's Q (T-1)			0.9282***			0.9221***			0.9304***
TotnotTA_	-0.0011	-0.0319	0.0034**						
TottradTA_				0.2935	1.7374	-0.0147** *			
TothedTA_							0.0023	0.0372	0.0035**
Islamic	-0.5808	-3.287	0.3776*	-1.4165	1.9568	0.3539*	-0.51420	-2.38370	0.36460
LogTA_	-0.6056**	-11.7910** *	-0.0122	-0.3262	-3.287	0.039	-0.31420	-6.04490	0.00120
NIM_	0.0012	0.6754	0.0161	-0.0818	0.5665	0.0176	0.04000	1.64710	0.02030
CosttoInc_	0.0003	-0.0851	-0.0064*	-0.0109 *	-0.0336	-0.0067*	-0.00020	-0.0751*	-0.0071* *
NetloansTA	-0.0132	0.1317	-0.0059	-0.0153	0.0101	-0.0073	-0.0199*	-0.03210	-0.00550
CapitalRat	-0.0176	-0.6423***	0.0381***	-0.0032	-0.2478	0.0386***	-0.01300	-0.5374** *	0.0406***
Inflation_	0.0333	0.0839	-0.0241	0.0285	0.0528	-0.0271	0.02520	-0.02030	-0.02500
GDPgrowth_	-0.0306	0.7858	0.0099	0.026	0.6189	0.0145	-0.02670	0.93220	0.00500
GDPPerCap_	0.0000**	0.0001	0.0000	-2.5544 *	-17.965 7	0.7992***	-1.8839* *	-28.7996*	0.7600***
EUROPE	-2.6022** *	-45.0927**	0.6819**	0.0000*	0.0000	0.0000	0.0000**	0.00010	0.00000
-cons	0.00000	92.9441***	0.00000	0.0000	32.2776	0.0000	0.00000	0.00000	0.00000
N	705	696	485	705	696	484	737	728	515
hansen	121.7833	111.71	105.5092	69.6729	64.2872	105.8357	127.3718	123.1737	106.8306
ar 2	-1.7072	-1.583	0.9479	-1.652	-0.0836	0.9864	-1.7927	-1.5932	0.9164

Note: This table reports the panel data estimates obtained using the generalized method of moments (GMM), with ROA, ROE, and Tobin's Q as dependent variables. Following Arellano and Bond (1991), given the short time dimension relative to the number of banks, all available lagged values of variables are used as instruments. AR(2) tests for second-order serial correlation, while the Hansen test of over-identifying restrictions confirms instrument validity under the null hypothesis of no correlation between instruments and errors. Significance levels are denoted as *** (1%), ** (5%), and * (10%). The Europe dummy equals 1 if the bank is in Europe. Variable definitions are provided in the footnote of Table 1.

5.2. Result for risk

Table 7 presents the estimated effects of derivative usage on bank risk and financial stability. The results indicate that total notional derivatives significantly increase the Z-score and QFHS while reducing systematic risk (Beta), suggesting that derivatives generally lower

bank risk, enhance distance to default, and improve financial health, which is consistent with Bazih and Vanwalleghem (2021).

When considering trading derivatives, the effect is significant only for QFHS, indicating a limited risk reduction, potentially reflecting the use of trading derivatives to generate fees or stabilize operations; this contrasts with Bazih and Vanwalleghem (2021) and Chang et al. (2018), who reported increased Beta from trading, and with Li and Marinč (2014) and Huan and Parbonetti (2019), who highlighted the risk-increasing potential of speculative or suboptimal hedging.

Table 7. The effect of derivatives on the risk of banks.

Variable	Zscore	Beta	QFHS	Zscore	Beta	QFHS	Zscore	Beta	QFHS
Zscore_	0.9912***			0.9946***			0.9676***		
Beta		-0.0899**			-0.0770*			-0.0796*	
QFHS			0.2609***			0.2453**			0.2643***
TotnotTA_	0.0341*	-0.0068**	0.0012***						
TottradTA_				-0.1542	-0.022	0.0082*			
TothedTA							0.0394*	-0.0054**	0.0009**
Islamic	-0.9503	0.7818	0.1899	-0.8327	0.9712	0.1147	0.1272	1.1723	0.1743
LogTA_	2.3241	0.5842***	-0.0063	1.6186	0.5110*	-0.0303	2.3764**	0.5504***	-0.0144
NIM	0.2947	0.0927	-0.0069	0.1998	0.0548	-0.0145	0.2738	0.0619	-0.0068
CosttoInc_	-0.0197*	0.0023	-0.0020***	-0.0152	0.0012	-0.0023***	-0.0198*	0.001	-0.0018***
NetloansTA	-0.1205**	-0.0126*	-0.0008	-0.1006*	-0.0071	-0.0008	-0.1038*	-0.01	-0.0004
CapitalRatio	-0.1556	0.0542*	-0.0026	-0.177	0.0606*	-0.0044	-0.1562	0.0618**	-0.0025
Inflation_	-0.4227**	0.0521	0.0011	-0.3887**	0.0425	0.0064	-0.4463**	0.0591	0.0044
GDPgrowth_	-0.2285	-0.0653	0.0216**	-0.1568	-0.0398	0.0188**	-0.2055	-0.0674	0.0234**
GDPPerCap_	-0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
EUROPE	4.4495	3.3971***	-0.0744	2.1664	3.2956***	-0.1596**	3.8004	3.4739***	-0.0779
_cons	0.0000	-3.8533**	0.6454***	2.2523	-3.5116	0.8746***	0.0000	-3.6420**	0.0000
N	663	592	364	662	591	363	695	622	388
Hansen	102.6383	100.8248	92.828	102.8806	101.4674	86.3366	104.5642	104.9932	92.179
ar2	-1.46	-1.1858	0.0008	-1.51	-1.1219	0.452	-1.3719	-1.1374	-0.2123

Note: This table reports the panel data estimates using the generalized method of moments (GMM), with ROA, ROE, and Tobin's Q as dependent variables. Arellano and Bond (1991), all available lagged values of variables are used as instruments due to the short time dimension relative to the number of banks. AR(2) tests for second-order serial correlation, while the Hansen test of over-identifying restrictions confirms instrument validity. Significance levels: *** 1%, ** 5%, and * 10%. The Europe dummy equals 1 if the bank is in Europe. Variable definitions are provided in the footnote of Table 1.

Hedging derivatives, in contrast, exhibit a positive effect on Z-score and QFHS and a negative effect on Beta, supporting Hypothesis H2B and confirming prior evidence that higher hedging intensity reduces risk while enhancing bank value (Otero et al., 2016; Deng et al., 2017; Bazih and Vanwalleghem, 2021; Titova et al., 2020).

Overall, these findings suggest that derivatives reduce bank risk regardless of purpose, but the effect is more pronounced for hedging than for trading, reinforcing the view that the primary channel through which derivatives add value is risk mitigation rather than speculative gains or intermediation profits.

5.3. Results for banks operating in underdeveloped markets

Table 8. The Effect of derivatives on risk and performance of banks operating in undeveloped markets.

Variable	ROA	ROE	Tobin's Q	Zscore	Beta	QFHS
ROA_ (T-1)	0.4170**					
ROE_ (T-1)		0.1587*				
Tobin's Q (T-1)			0.3251			
Zscore_				1.0365***		
Beta					-0.2596	
QFHS						-0.0113
TotnofTA__	6.69	31.5095	1.1745	-0.0693	2.2466	-0.1603
Islamic	-0.3053	-0.1167	-0.4086	-6.7263	-1.0312	0.1023
LogTA_	0.7581*	3.9905	0.5041	0.3515	0.229	0.113
NIM_	0.1022	0.6345	0.2467	-0.2808	-1.2375*	0.0108
CosttoInc_	0.0003	0.0101	0.0014	-0.0041	0.0036	-0.0032***
NetloansTA	-0.0032	0.072	-0.0061	-0.0508	-0.0399	-0.0009
CapitalRatio	0.0322	0.0541	0.0243	-0.0449	-0.0029	-0.0009
Inflation_	0.0931	0.392	0.0145	-0.5039	0.077	0.0028
GDPgrowth_	0.0155	2.5172	-0.0433	-0.1979	0.5658	-0.0276
GDPPerCap_	-0.1421	-3.2078	0.3279	0.00020	0.00010	0.00000
cons	0.0000	0.0000	-6.2697	0.00000	3.42680	0.00000
N	174	173	86	163	120	58
Hansen	35.2838	28.8365	12.6386	23.4361	8.2913	19.3952
ar2	-1.2204	0.102	0.9024	-1.814	-0.6731	-1.32999278

Note: This table presents GMM panel estimates with ROA, ROE, and Tobin's Q as dependent variables. Model diagnostics, including specification errors, fit, normality, and multicollinearity, are assessed. Following Arellano and Bond (1991), all available lags are used as instruments due to the short time dimension. AR(2) tests for second-order serial correlation, and the Hansen test of over-identifying restrictions (degrees of freedom in parentheses) confirms instrument validity. Significance levels: *** 1%, ** 5%, and * 10%. The Europe dummy equals 1 for banks in Europe. Variable definitions are provided in the footnote of Table 1.

Regional differences in derivative market structure, monetary policy, and central bank interventions shape the impact of derivatives on bank performance and risk. Banks in advanced economies benefit from liquid markets, comprehensive regulation, and proactive oversight, facilitating effective risk management, whereas institutions in less developed regions face limited market access, higher costs, and institutional constraints, reducing the benefits of derivatives (Rossi Jr, 2009; Henry and Springborg, 2010; Mollah et al., 2017; Jabbouri, 2016).

Consistent with Hypothesis H4, Table 8 shows that total derivatives usage in underdeveloped countries has no significant effect on performance or risk, and disaggregated analyses by hedging or trading yield similar non-significant results. These findings highlight that the effects of derivatives are context-dependent, differing markedly between Europe and the MEA region due to regulatory, market, and institutional factors.

6. Robustness checks and summary of the effect of derivatives on risk and performance

To complement the dynamic panel analysis, we estimate a Panel-Corrected Standard Errors (PCSE) model, robust to heteroskedasticity and autocorrelation (Bailey and Katz, 2011; Moundigbaye et al., 2018), which largely confirms the system GMM results. Derivative usage significantly reduces risk across accounting- and market-based measures, with hedging derivatives increasing Z-score and QFHS and lowering Beta, supporting H2B, while trading derivatives show a limited impact, modestly reducing risk via QFHS contrary to H2A (Li and Marinč, 2014; Huan and Parbonetti, 2019).

Table 9. Summary of result and hypothesis testing.

Hypothesis	Expected sign and result	Actual Result
H1: The effect of the use of derivatives on banks profitability is neutral.	(No effect)	(Yes) Derivatives have no effect on profitability
H2A: Usage of derivatives for trading purposes increases the level of risk	(Increases risk)	No (trading reduces risk for market measures) yes (trading increases risk for accounting measures)
H2B: hedging reduces risk.	(Reduces risk)	(Yes) hedging reduces risk for market and accounting measures
H3: The use of derivatives has a positive effect on banks' value	(Increases Value)	(Yes) Hedging (only on QFHS) Trading
H4: Usage of derivatives affects banks' performance and risk differently, depending on their location, regulation, and risk-faced.	(No effect on undeveloped market)	(Yes) Derivatives have no effect on risk and performance of undeveloped market)

Performance effects remain neutral for accounting measures (ROA, ROE), consistent with H1, but hedging derivatives are positively valued in Tobin's Q, whereas trading positions may reduce market valuation, partially supporting H3. The effects are context-dependent: In developed markets, hedging enhances stability and market value, whereas in underdeveloped regions, including Egypt, Iraq, Jordan, Lebanon, Oman, and Palestine, derivatives have no significant impact due to structural and institutional constraints, such as limited instruments, underdeveloped capital markets, low liquidity, and high transaction costs (Henry and Springborg, 2010; Mollah et al., 2017; Jabbouri, 2016; Mihaljek, 2010).

Overall, derivatives primarily create value through risk reduction rather than accounting-based performance, with hedging providing consistent stability benefits and trading having weaker, less predictable effects (Table 9).

7. Conclusions

In this study, we examine the impact of derivatives on default risk, financial performance, and market value for 189 banks across Europe, the Middle East, and Africa (EMEA) over 2011–2016. The results indicate that derivative usage does not significantly affect accounting-based performance measures such as ROA and ROE. From a market perspective, however, banks employing derivatives for hedging are valued positively, whereas those with larger trading exposures may experience a negative market effect. These findings suggest that market participants reward effective risk management through hedging, rather than speculative or trading activities, which may primarily serve as portfolio diversification or customer intermediation strategies.

Regarding risk, derivatives significantly reduce bank risk, particularly when used for hedging. Hedging derivatives increase the Z-score and financial health measures while lowering systematic risk, whereas trading derivatives exert a weaker, less consistent impact. These results support hedging theories, emphasizing that derivatives primarily create value by mitigating risk rather than by generating trading profits or directly enhancing accounting performance.

Regional analysis reveals substantial disparities. In underdeveloped markets, limited derivative usage, regulatory restrictions, market illiquidity, and high transaction costs constrain their effectiveness, resulting in no significant impact on either performance or risk. These findings underscore the importance of hedging for banks in emerging economies to maintain market value and reduce default risk. Policymakers and regulators are encouraged to foster market development, enhance liquidity, and relax hedging-related restrictions to enable effective risk management.

Key limitations include restricted data availability in underdeveloped countries, low derivative usage, and Shariah-compliant constraints. Furthermore, the use of notional values as a proxy for derivative exposure, necessary for consistency across banks and countries, does not capture the true market or credit risk of derivative positions. Additionally, important market-based measures, such as credit ratings and CDS spreads, are unavailable for many banks, potentially affecting the assessment of derivatives' effects on valuation and default risk. Future research would benefit from broader data coverage to enable more comprehensive analyses of derivatives' role in emerging and less developed financial systems.

Author contributions

Luis Otero: Conceptualization, investigation, methodology, original draft, data curation, formal analysis, review and editing.

Darine Marouf: Investigation, data collection, methodology, writing, review and editing.

Pablo Durán: Investigation, methodology, data curation, formal analysis writing, review and editing.
 Luis-Ignacio Rodríguez: Investigation, data collection, methodology, writing, review and editing.
 All authors read and approved the final manuscript.

Use of AI tools declaration

The manuscript's language was reviewed and improved with the assistance of an artificial intelligence (AI) tool. All final decisions and content remain the responsibility of the authors.

Conflict of interest

The authors declare no conflict of interest.

Data Availability Statement

The data used in this study are obtained from commercial database, as well as from publicly available information disclosed by companies, and are available from the corresponding author upon reasonable request.

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