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DEVELOPMENT OF FINANCIAL RISK HEDGING STRATEGIES

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ABSTRACT

The purpose of the study is to develop the theory of hedging, generalize approaches to the formation of effective risk hedging strategies, and provide recommendations for the implementation of international banks' experience in Ukrainian practice. It is proved that in the process of choosing effective strategies, it is advisable to distinguish three types of financial risk hedging: a) operational hedging (balance sheet) to ensure operational flexibility; b) market hedging (external), which involves the use of derivatives as instruments to hedge profit volatility; c) contract hedging (contractual clauses, embedded derivatives. Based on the analysis of the reports of 250 banks, it was found that Bank of America, JPMorgan Chase & Co., Goldman Sachs, Morgan Stanley, and Citigroup are the market makers in the most developed US futures market. Horizontal analysis of the balance sheets of these banks showed that although the share of derivatives designated as hedging instruments is insignificant (less than 1%) relative to term contracts recognized as trading instruments, the hedging effect is significantly higher than the gains on the trading portfolio. It was found that in international practice, the dominant direction is the hedging of interest rate risk (the share of which varies between banks from 42.52% to 61.26%), in the structure of hedging instruments, interest rate swaps prevail. The share of currency derivatives varies from 18.67% to 41.45%. Interest rate risk is hedged by over-the-counter bilateral term contracts for active operations, currency risk hedging equally covers the risks of passive and active operations. The regression analysis revealed that private credit and trading assets have an inverse effect on regional hedging exposure, and debt instruments have a direct effect. The study provides a basis for assessing the potential of using innovative risk-hedging instruments by Ukrainian banks.

Keywords: financial market, derivatives, types of hedging, banks, cash flows, risk management tools, bank portfolios, efficiency, assets

JEL Classification: D53, D81, E49, G21, G32

INTRODUCTION

Amidst economic uncertainty, risks are growing rapidly, which makes it important to find effective hedging strategies. In a modern dynamic environment, banks are the most powerful participants in the financial market, and the economic growth of any country depends on their stable functioning. In their activities, they are exposed to uncertainty and external environmental impact, which, together with the volatility of financial markets, creates threats, risks and increases their systemic vulnerability. The risk-oriented nature of the banking business increases due to the following factors: banks' desire to find additional sources of income; development of financial instruments, primarily derivatives, and the markets in which they are traded; introduction of digital technologies and going beyond the traditional intermediary function of banks; search for new types of trading and investment operations with significant profitability potential; financial innovations and diversification of the banking business (Prymostka, L. & Prymostka, H., 2018). This necessitates a constant search for banking activities risk hedging strategies which allow eliminating or limiting the risk of transactions and uncertainties associated with adverse changes in the fair value and/or cash flow of the hedged object.

Hedging is aimed at protecting business interests (investments) by limiting (mitigating) the impact of risks associated with business operations (Iatridis, 2012) using various

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techniques and instruments, which allows for increasing or stabilizing a bank's profitability. Scholars also study the information effect of hedging, when conducting hedging operations sends a positive signal to the market about the firm that uses it (De Marzo & Duffie, 1995). Chong, Chang, & Tan (2014) note that bank executives use hedging to invest excess cash and reduce risk. At the same time, hedging allows not only to minimize the negative impact of risks on banks' financial performance but also to optimize internal processes, including improving the quality and predictability of asset portfolio management, ensuring break-even operations, etc. By hedging income volatility, firms demonstrate that they are acting optimally and in the best interests of investors (Lambert, 2001). In their study of the problems of Ukrainian derivatives market development, Prymostka and Krasnova (2014) identify the low level of awareness of potential participants about the opportunities offered by derivatives as one of the reasons for the lack of interest towards this segment. At the same time, it is noted that the use of hedging strategies will contribute to macroeconomic stabilization, and the derivatives market is becoming an integral part of the modern financial space. Given the need for ongoing risk management, the study of approaches to the development of effective hedging strategies is extremely relevant. The analytical basis of the study is formed on the basis of financial statements of international banks, which are the most active participants in the derivatives market.

LITERATURE REVIEW

According to Stulz's (1984) research, the idea of hedging originated with risk-averse managers. Expected costs due to financial losses or tax structure can also be motivators for hedging (Clifford & Stulz, 1985). Marzo and Duffie (1995) believed that even if shareholders can diversify their own portfolios, corporate hedging is a desirable strategy when managers have private information that will increase expected returns. Moynihan & Alzarrad (2015) point out that hedging is a type of investment that involves compensating for potential losses associated with an investment. Hedging should be considered as a mandatory component of the overall management strategy because even a promising market position not backed by anything will not seem reliable and will not be measured at fair value (Semenchenko, 2021).

Hedging is the process of managing risks by avoiding, accepting and/or forming offsetting positions (compensating for price changes) in the market to maintain a profit margin (Quetsch, 2014). Risk hedging strategies are used both at the micro level (firms, banks, companies, etc.) and at the macro level. In the international financial system, leading powers hedged their positions in order to avoid confrontational risks (Tessman, 2012). Le (2013) advocated hedging as a rational and viable option for normalization, economic pragmatism, direct engagement, and hard or soft balancing of strategic international relations. In practice, bank executives use hedging strategies based on such derivatives as forwards, futures, swaps, and options to mitigate or offset any risks associated with maintaining profit margins and company value (Bardhan, 2013; Lindberg, 2012). It is noted that although all derivatives are used for hedging, the most widely used ones are over-the-counter forwards and swaps. Banks began to take more risks in their foreign exchange operations after identifying cost-effective market-based hedging strategies for mitigating foreign exchange risk (Churchill et al., 2014; Raihan, 2013). Sticca & Nakao (2019) argue that in a crisis, cash flow hedging avoids losses due to the deferral of other aggregate income, which creates incentives for managers to hedge. Alkebäck and Hagelin (2006) studied the patterns of derivatives use among Swedish firms and concluded that hedging was used rather as a contractual obligation. Davies et al (2006) state that Norwegian exporting firms use at least one hedging instrument. They prove that exporters who combined the use of operational and market hedging maximized firm value. Supporting the statement that hedging is one of the ways of stabilizing business market value, Prymostka (2001) interprets this activity as aimed at creating protection from possible future financial losses associated with changes in the market price of financial instruments or goods on the bank's balance sheet. Sohatska (1999) notes that hedging is one of the methods of managing financial, in particular price, risks, which allows for avoiding them or minimizing losses incurred in real markets by concluding fixed-term contracts (exchange and over-the-counter). Such activities include both short and long positions, which are hedged with such derivative instruments as futures, forwards, swaps and option contracts for the purchase or sale of currencies with the purpose of minimizing risks, increasing profitability and ensuring the ability to meet obligations, comply with capital adequacy and avoid bankruptcy. In general, hedging is one of the ways of stabilizing business market value (Prymostka et al., 2014).

AIMS AND OBJECTIVES

The purpose of the study is to develop the theory of hedging, generalize approaches to the formation of effective risk hedging strategies, and provide recommendations for the implementation of international banks' experience in Ukrainian practice. To achieve the goal the following tasks must be solved:

1. Determine the essence and types of hedging strategies;

2. Reveal the features of banking risk hedging methods and tools;
3. To analyze the practice of international banks using financial derivatives to hedge risks;
4. Assess the effectiveness of hedging strategies, which will facilitate the implementation of foreign experience in the practice of Ukrainian banks.

METHODS

In the process of research, several tasks are solved at once, according to which a number of separate methods are used to solve them: a) search (collection, filtering and sorting of information about hedging strategies and instruments of international banks for generalization); b) descriptive (determination of the essence of the problem, its structuring, identification of existing (effective) hedging strategies, methods and instruments); c) analytical (analysis of the structure of term contracts on the balance sheets of banks, financial statements of banks to assess efficiency); d) statistical (construction of the regional hedging risk exposure regression equation).

The approaches to the formation of hedging strategies are generalized based on the analysis of the reports of 250 international banks. *Eikon* software was used for the collection and statistical analysis of banks' financial information. *Eikon* is a set of software products supported by *Refinitiv* on behalf of *Thomson Reuters* for meeting financial analysts' needs in the process of monitoring and analyzing financial information. Based on the results of processing the array of received information, banks and banking groups (hereinafter referred to as banks) were identified, the activities of which allow to reveal in the most in-depth and informative way the patterns of financial institutions' work regarding risk hedging.

Global turbulence and crises increase uncertainty, risks become systemic, which leads to a change in approaches to the development of hedging strategies. The COVID-19 pandemic, which began in 2019, has had a dramatic impact on financial markets and banking, increasing the impact of digitalization and necessitating the transformation of business models, as emphasized by A. Kuznetsova (2022). The term markets also underwent significant structural deformations. Financial instability affected the performance of international banks and their approaches to hedging. Therefore, the financial statements of international banks for the period 2016-2018 were chosen for analysis as the last stable period in the global dimension.

The representative sample includes *Bank of America, JPMorgan Chase & Co., Goldman Sachs, Morgan Stanley, and Citigroup*. All of the organizations surveyed are included in the global list of systemically important financial institutions. Such a sample is representative of the framework of the proposed study since it allows to conduct a detailed analysis of the areas of banks' derivatives operations, the structure of term contracts on balance sheets, and the share of derivatives recognized as hedging instruments in the financial statements.

In order to analyze the work of American banks with derivatives, Form 10-Q, a quarterly report to be filed by publicly traded corporations and submitted to the Securities and Exchange Commission (SEC), was used. Federal laws on securities require publicly traded companies to disclose information to the general public. At the end of each quarter, a company files Form 10-Q, one of many required by the SEC, for disclosing unaudited financial statements and reviewing its financial condition. The information provided to the SEC is standard but can be structured depending on the purpose of the analyst's research objectives.

A regression model was built to identify the assets that most significantly affect the hedging volumes.

For this purpose, in the regional exposure of the *Citigroup bank*, groups of assets, structured according to certain directions, are distinguished (Table 1).

Table 1. Assets of regional hedging exposure. *(Source: compiled based on data from the Citigroup)*

Indicator	Characteristic	Marking
ICG (institutional client's group)	volume of investment banking services for institutional clients	X1
GCB (global customer banking	lending to retail customers	X2
Other funded;	includes other credit corporate liabilities, loans and other categories	X3
Unfunded	includes unfunded assets and liabilities of the bank	X4

(continued on next page)

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Table 1. Continued

Indicator	Characteristic	Marking
Net MTM on derivatives/repos	net open position of the bank on derivatives and repurchase (repo) agreements (revalued at fair value); market assessment, including adjustment of the value of the price of a derivative financial instrument (derivative), position in accordance with current prices	X5
Total hedges (on loans and CVA)	hedging position for loans and CVA. CVA (Credit valuation adjustment) – the difference between the true portfolio value and the risk-free portfolio value. One of the elements of the Basel III standards related to the risk of credit assessment adjustment (CVA)	X6
Investment securities	a group of debt instruments in an investment portfolio	X7
Trading account assets	current assets are intended for quick sale	X8

We will consider each individual group as an influence factor. The factor for assessing the quality of the regression model is the coefficient of determination R^2, which shows how much the regression equation describes the dependence.

To assess the effectiveness of hedging operations, financial statement data were used, gains and losses from fair value and cash flow hedging operations were analyzed.

RESULTS

Hedging is a method of transferring a portion of possible losses from one transaction participant to another on terms agreed between them. Bessis (2015) notes that hedging can be achieved with cash instruments by the reverse impact on long positions, but usually, this is done through derivatives transactions. Holding assets on the balance sheet (or off-balance sheet accounts) is a long position that generates losses if the asset price declines. A short position is symmetrical. When a bank has both a long and a short position on its balance sheet (or off-balance sheet accounts), losses on one position are fully or partially offset by gains on the other. Thus, a perfectly protected position, although subject to uncertainty, is not at risk (Bessis, 2015). Such position alignment with the purpose of risk mitigation is interpreted as internal or operational hedging (structural balancing of operational flexibility), as opposed to external or market hedging, which involves the use of term market instruments.

Operational (internal) hedging is implemented by using internal banking instruments to ensure operational flexibility and does not require additional market transactions aimed at minimizing the impact of mismatch risks. This is done through the alignment of assets and liabilities by amounts and terms within balance sheet positions (Prymostka et al., 2014). Operational hedging is carried out by means of balancing assets and liabilities, and its methods are quite diverse: structural balancing of assets and liabilities (matching), accounts payable and receivable; lead and lag strategy, lending and investing in foreign currency, parallel borrowing (cash pooling), structuring of counter currency flows (netting), currency "cushions".

Market (external) hedging is the creation of an off-balance sheet (artificial) exposure that allows receiving an offset for a balance sheet position by selecting the right instrument in the derivatives market that will allow offsetting changes in asset value or cash flow by compensating for potential losses through income from a financial hedging instrument (derivative). Market hedging is aimed at avoiding risks and minimizing profit variability, i.e., stabilizing it. Long (2000) argues that although the use of derivatives can be effective in terms of financial risk management, it can also be expensive. Stulz (2002) considers hedging as a separate position in a financial instrument that reduces the exposure of the aggregate position (on- and off-balance sheet) to any risk factor. Gaur and Seshadri (2005) believe that the use of market hedging leads to an increase in transaction volumes. Caldentey and Haugh (2006) note that it also allows maintaining uninterrupted trading in the financial market. Jiang and Feng (2022) argue that optimal market hedging is selective and depends on the hedger's investment capabilities. Furthermore, Park et al (2017), exploring the possibilities of financial hedging under conditions of exchange rate and demand uncertainty, argue that, in interaction with planning and pricing, hedging should help maximize expected returns while respecting the value-at-risk constraint.

In addition, according to IFRS (9) (2018), as a separate group of hedging approaches, contractual hedging is distinguished, which includes various clauses specified in the contract, embedded derivatives, and risk-sharing agreements (Krasnova &

Shevaldina, 2021). In particular, Liu and Wang (2010, 2017), studying decisions regarding outsourcing and planning activities under conditions of uncertainty, prove the effectiveness of taking into account the individual needs of the hedger to control the risks that are maximally taken into account in contract hedging.

The abovementioned types of hedging involve the use of a wide range of methods and instruments that can be used when building a hedging strategy and allow for effective risk management (Figure 1).

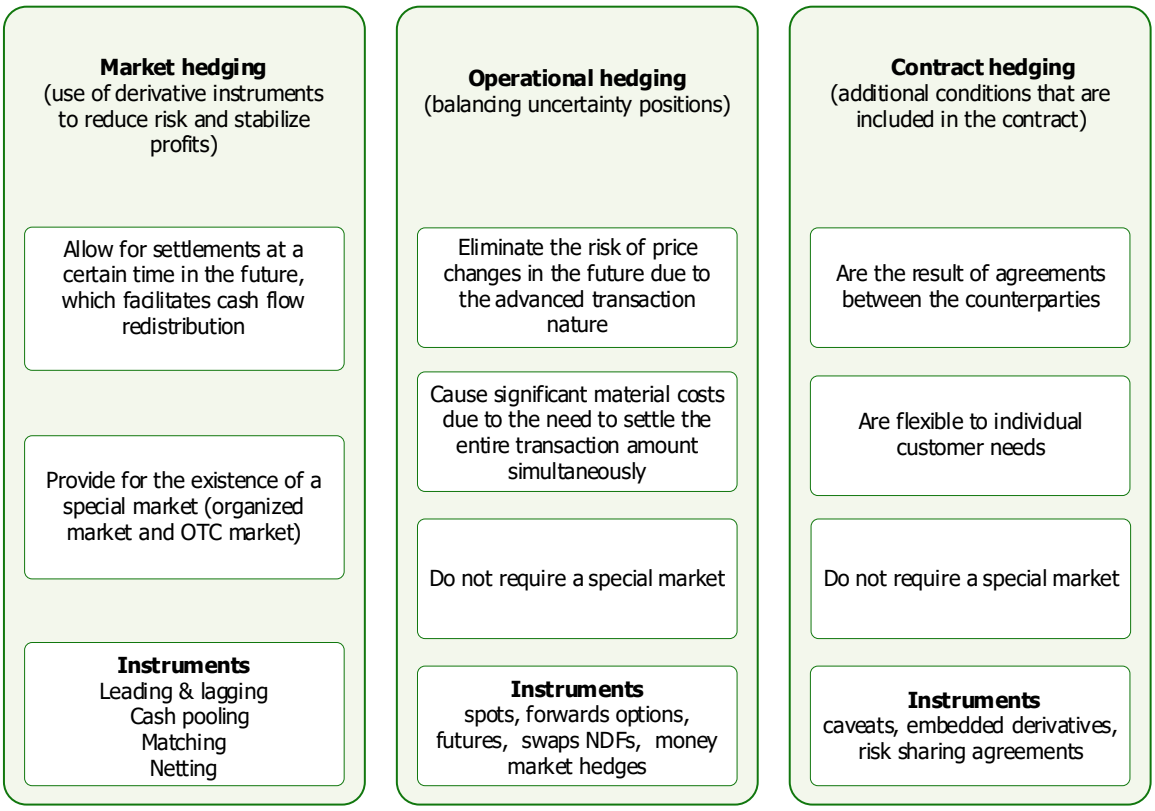

Figure 1. Taxonomy of financial risk hedging.

Recently, there have been studies that consider the joint use of market and operational hedging (Ding et al., 2007; Zhu & Kapuscinski, 2007) and even discuss their integration (Chod et al.; 2010; Zhao & Huchzermeier 2017). Chowdhry & Howe (1999) argue that firms use financial instruments to hedge short-term risks, and for managing long-term operational risks they use long-term strategy adjustments (i.e., internal operational hedging). Chod et al. (2010) show that market hedging complements investment, which contributes to the potential flexibility of cash flow management, and works as a substitute for deferral. Chen et al. (2014) investigates firms' investments and analyze decisions regarding financial and operational hedging combination under conditions of currency risk.

An effective hedging strategy includes hedging instruments, hedged items or the underlying asset whose fair value or cash flows are affected by the risk being hedged. Companies choose hedging methods and instruments according to their specific needs and plans.

Regarding the popularity of specific derivatives, global practice is quite homogeneous: usually, forward contracts are used (up to 90% of companies worldwide use them). Options and swaps are in second place: about 50% of companies work with them; futures are in third place, with up to 25% of hedgers in Asia using them, and about 10% in the UK and the USA (Hadian & Adaoglu, 2020).

Hedging can be defined as a set of strategies, instruments and techniques that allow eliminating or limiting the risk of transactions and uncertainties associated with adverse changes in the fair value and/or cash flow of a hedged object.

Market hedging of financial risks is not widely used in Ukrainian banking practice, primarily due to the underdevelopment of the derivatives market. Market hedging of financial risks is not widely used in domestic banking practice, primarily due to the underdevelopment of the derivatives market. Therefore, banks usually turn to operational hedging with the use of internal banking approaches and instruments to ensure operational flexibility. International banks, on the other hand, widely use hedging instruments, both market and operational, as well as a combination of both, to manage financial flows.

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American banks were chosen to study the foreign practice of using hedging strategies by banks in order to implement this experience in the domestic context since the futures market in the USA remains the most developed one. Foreign scholars are also studying the practice of using financial derivatives and their impact on the risks of bank holding companies (*BHCs*) in the USA. Thus, Shaofang and Matej (2014) studied the relationship between derivatives and risk on the example of American banks in the period from 1997 to 2012. They found that the use of derivatives to a large extent correlates with systemic risk positively. Interest rate, foreign exchange, and credit derivatives that cover systemic interest rate risk, exchange rate risk, and credit risk, respectively, are being used more often. The positive relationship between derivatives and risk persists for both trading and hedging derivative instruments. The positive relationship between derivatives and risk persists for both trading and hedging derivative instruments. This proves that the American banks' experience in using financial instruments for hedging various risks seems interesting for studying, adapting, and implementing in domestic practice.

Given the objectives of this study, empirical data were analyzed in terms of the structure of derivatives on the balance sheets and off-balance sheet accounts of the banks included in the sample (Figure 2).

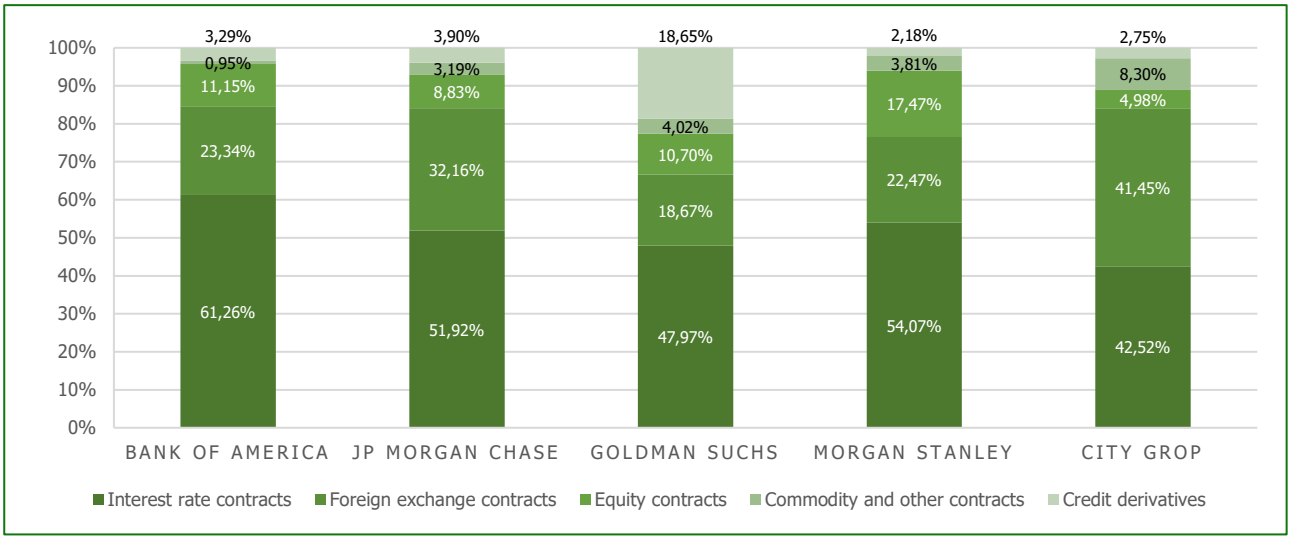

Figure 2. Structure of derivatives by type in the sample of US banks in 2018, %. *(Source: Compiled based on data from the Bank of America, Goldman Sachs, Citigroup, Morgan Stanley and JP Morgan Chase & Co official websites)*

The analysis shows that the structure of derivatives of the studied banks is dominated by interest rate contracts that cover the interest rate risk. Depending on the business model and risk profile of the bank, their share varies from 42% to 61%. The largest share of interest derivatives belongs to Bank of America, which is a financial conglomerate that provides a wide range of financial services to individuals and legal entities. The Bank actively uses interest rate swaps for the purpose of market hedging of interest rate risk, operational matching of the duration of assets with liabilities, and, in fact, lending (on the basis of the stipulation of relevant interest rates, terms and terms of settlements). The second position in the structure of derivatives of the banks under study is occupied by foreign exchange derivatives, the share of which ranges from 18.67% to 41.45%. For the investment bank Goldman Sachs, currency risk is not as significant as for Citigroup, which combines investment projects, retail banking, and the functions of a primary dealer in Treasury securities in its activities. The third level in the derivatives structure is occupied by equity derivatives (Equity contracts), the basic assets of which are equity and debt securities, the share of bonds in bank portfolios is quite high. The largest share of equity contracts is observed at the investment bank JPMorgan Chase & Co., which in 2007 was named by the British publication "Risk Magazine" as the best institution for working with derivatives over the past twenty years. The share of commodity and credit derivatives in the structure of the balance sheets of the studied US banks is insignificant and depends on the business model of the banking group. Thus, a bank focused on consumer mortgage lending has a larger share of credit derivatives in its structure. In contrast, when a banking institution focuses on investment banking, investing in corporate rights of real sector enterprises, or financing, the share of derivatives on securities will be higher.

Based on the study of derivatives in bank portfolios, let us consider the coverage of the active and passive parts of the bank's balance sheet by such instruments, and highlight the term contracts recognized in financial statements as hedging instruments and the ones that are used by banks for other purposes. To conduct a more detailed analysis of banking hedging strategies, Citigroup was chosen, which, like Merrill Lynch, suffered significant losses during the global financial crisis of 2007-2008. However, unlike Merrill Lynch, it still exists on the market today. In addition, this bank has the most

balanced structure of derivatives by type. Citigroup uses derivative contracts (forward contracts) in its operations to hedge both its own and clients' risks. Clients are offered to transfer, modify or reduce interest rate, credit, currency and other market risks using hedging instruments. *Citigroup* also manages its own risk through compensation for trading activities, controls focused on price checking and daily reporting to senior management. That is why the bank's risk profile and the use of hedging instruments by this banking group are the most balanced in the sample and therefore the most interesting and illustrative for analysis.

Hedging can be carried out by the bank by applying hedge accounting in accordance with *ASC 815* Standard by means of derivative financial instruments or by using operational (balance sheet) hedging. For example, *Citigroup* issues long-term fixed-rate debt while simultaneously entering into a fixed-rate interest rate swap with the same tenor and notional amount to synthetically convert interest payments into a net variable-rate basis. This strategy is the most common form of interest rate hedging since it minimizes net interest expense under certain conditions of the yield curve (Table 2).

Table 2. Structure of term contracts by type of Citigroup derivatives market instruments in 2018 (USD million). *(Source: compiled based on data from the Citigroup, Refinitiv official websites)*

	Hedging instruments (1)	**Trading instruments (2)**	**Share of hedging instruments in the structure by type of contract, %**	**Share of hedging instruments in the total volume of derivative contracts, %**
	2018 (1)	**2018 (2)**	= (1) / [(1) +(2)]	= (1) / (3)
Interest rate derivatives				
Swaps	273636	18 138 686	1.49	0.59
Futures and forwards	-	4 632 257	0.00	0.00
Options issued	-	3 018 469	0.00	0.00
Options purchased	-	2 532 479	0.00	0.00
Interest rate derivatives (total)	**273636**	**28 321 891**	**0.96**	**0.59**
Foreign exchange derivatives				
Swaps	57 153	6 738 158	0.84	0.12
Futures and forwards	41 410	5 115 504	0.80	0.09
Options issued	1 726	1 566 717	0.11	0.00
Options purchased	2 104	1 543 516	0.14	0.00
Foreign exchange derivatives (total)	**102393**	**14 963 895**	**0.68**	**0.22**
Derivatives on securities				
Swaps	-	217 580	0.00	0.00
Futures and forwards	-	52 053	0.00	0.00
Options issued	-	454 675	0.00	0.00
Options purchased	-	341 018	0.00	0.00
Derivatives on securities (total)	**-**	**1 065 326**	**0.00**	**0.00**
Commodity derivatives				
Swaps	-	79 133	0.00	0.00
Futures and forwards	802	146 647	0.54	0.00
Options issued	-	62 629	0.00	0.00
Options purchased	-	61 298	0.00	0.00
Commodity derivatives (total)	**802**	**349 707**	**0.23**	**0.00**
Credit derivatives				
Sold protection	-	724 939	0.00	0.00
Purchased protection	-	795 649	0.00	0.00
Total credit derivatives	**-**	**1 520 588**	0.00	0.00
Derivatives in total (3)	**376831**	**46 221 407**	**0.81**	**0.81**

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The bank recognizes an interest rate swap as a designated interest rate risk hedging instrument. The share of hedge swaps in the structure of *Citigroup's* interest rate swaps is 1.49%, and the share in the total volume of derivatives is 0.59%. *Citigroup's* ratio of interest rate and foreign exchange term contracts is about the same, and the volume of foreign exchange derivatives is twice as high as in other banks in the sample.

This situation encourages a closer look at the structure of hedging with the bank's foreign exchange contracts. In the process of its operational activities, the bank uses all available capital market instruments, swaps, options, futures and forwards. It is interesting that the share of both currency swaps and futures/forwards instruments is high, amounting to 0.84% and 0.80%, respectively.

Citigroup hedges against changes in fair value which are related to changes in the exchange rate of debt, available-for-sale securities and long-term debt denominated in the non-functional currency of an economic entity, security holdings or debt obligations that may fluctuate within or outside the USA. The hedging instrument in this case is a forward foreign exchange contract or currency swap. *Citigroup* considers the premium associated with such a forward (the difference between the spot price and the forward contract rate) as the cost of hedging. This sum is excluded from the hedging effectiveness assessment and is reflected directly in income over the life of the hedging operation.

Citigroup's regional risk-sharing strategies are quite illustrative and interesting. Operations are divided by the counterparty's location in order to distribute risk regionally. Let us define such risk sharing as regional exposure. It was established that the bank's regional exposure is associated with both credit and currency risk, but the bank considers the probability of an adverse event associated specifically with credit risk.

Banking operations with associated risks are considered at the location of the affiliated company performing the operation. Thus, a loan provided by a Chinese branch of a Swiss corporation is generally classified as a loan in China, meaning that the allocation of credit risk is shifted to China. In addition, Citigroup uses key regional centres, the most significant of which are in the United Kingdom and Ireland, in order to better serve corporate clients whose risk will be attributed to these countries, identifying such branches as crucial in the corporate governance system. Thus, the allocation of 27% of corporate loans, 27% of non-financial liabilities, 91% of investments and 83% of total loans of *Citigroup* is distributed in the United Kingdom. Let us build a graph of Citigroup's regional exposure and corresponding volumes of hedging positions (Figure 3).

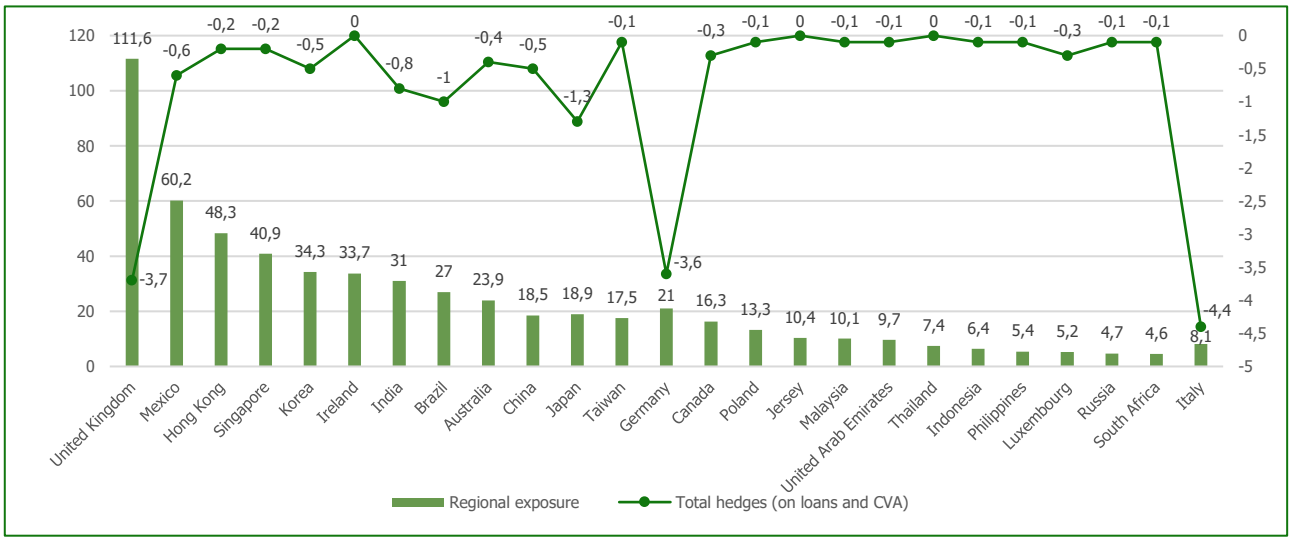

Figure 3. Citigroup's regional exposure and hedging volumes in 2018. *(Source: compiled based on data from the Citigroup, Refinitiv official websites)*

As can be seen, the lowest volumes of hedged positions are in the United Kingdom, Germany, and Italy. This raises the question of the extent to which a bank's risk exposure in a particular region and the amount of risk hedging are interdependent. In order to find this out, let us conduct a correlation analysis by using static methods. The variables in the study are: 1) total sum of regional currency exposure (USD billion); 2) hedging volumes (USD billion).

Calculations results have shown that the correlation is inverse (R = - 0.3418). This means that as exposure decreases, the volume of hedging operations increases. From an economic point of view, a negative hedge value indicates that an unfavourable event according to the risk profile has not occurred, and vice versa, if the hedge is positive, the predicted risk

scenario has been confirmed. The bank's presence in a particular region is dictated by its business model, and the amount of hedging depends on its riskiness. The bank's need to hedge the risk reflects its desire to protect its positions in countries where the risk of an unfavourable event is high. That is why in the United Kingdom, as a country with a low probability of unfavourable events, hedging volumes are insignificant, despite the high level of exposure.

In order to determine the factors that have the greatest impact on the hedging strategy formation in the regional exposure, the following regression model was built (Table 3):

$$y = 0{,}088x_1 - 0{,}558x_4 - 0{,}287 \quad (1)$$

Table 3. Values of Regression Metrics.

Regression Statistics	
Multiple R	0.863406903
R Square	0.745471479
Adjusted R Square	0.722332523
Standard Error	0.653046306
Observations	25

The resulting coefficient of determination indicates that the regression equation describes the bank's hedging of its own positions in the region at 76%. The correlation coefficient R = 0.869 confirms a rather strong linear relationship between the factors. The model allows the bank to forecast hedging volumes depending on changes in factors. The regression model allows identifying the factors in the regional exposure that have the greatest impact on hedging strategy development, namely: 1) loans to institutional customers (X1); 2) includes unfunded assets and liabilities of the bank (X4). However, when developing a hedging strategy, banks should be guided not only by quantitative factors but also by qualitative ones. These include, first and foremost, the bank's business strategy and risk appetite.

DISCUSSION

The obtained results of the study generally correlate with the conclusions reached by Shaofang and Matej (2014), who studied the relationship between derivatives and risk on the example of US banks in the period from 1997 to 2012, regarding the dominance of interest rate and currency derivatives. In contrast to their research, we note a decrease in the activity of using credit derivatives that cover credit risk and an increase in the share of stock derivatives. Such changes are a consequence of the financial crisis of 2007-2008. The thesis of Chen et al. was also confirmed. (2014) on the combination of financial and operational hedging to cover currency risk. It was found that the bank under study, in order to hedge changes in projected cash flows on currency risk, evenly covers the risks of passive and active operations by balancing the terms and volumes of assets and liabilities with a floating rate, as well as matching them with other projected operations, including hedging the risk in the market.

At the same time, hedging traditionally varies by region of the world (Marshall, 2000), as evidenced by Citigroup's regional exposure and hedging volumes. In general, the main objective of hedging strategies in Asian countries is to smooth out fluctuations in profits and prevent losses, while businesses in developed countries of Europe and the United States are more concerned about the timeliness of receipts and the sufficiency of cash flows. European and American banks pay the main attention to the management of interest rate risk. Therefore, world practice confirms that in economies with a high share of credit resources, the formation of cash flows clearly on time and in the specified volume is a cornerstone condition for the successful existence of a banking business. In terms of the practical implementation of hedging strategies, banks in Europe and the USA tend to combine market and operational hedging methods, while operational hedging dominates in Asia. This is due to the fact that operational hedging requires lower costs and is simpler to implement.

Therefore, the international experience of banks on risk hedging confirms that operational and market hedging complement each other, since the risk of non-compliance can be reduced by increasing operational flexibility, and the variability of profits can be reduced with the help of market hedging. The nature of the interaction depends on the type of risk and elasticity of the hedged asset.

From the perspective of corporate risk management principles, a net hedge should be carried out regardless of management's expectations regarding the financial result of the P&L (*Profit and Loss Report*). In this context, the current norms and rules of reporting hedging transactions and their financial results in the accounting statements, play an important role.

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The amounts of gains (losses) on interest rate hedges are included in interest income/interest expense, while the remaining amounts, including interest rate hedging amounts prior to January 1, 2018, are included in other income or Principal operations in the Consolidated statement of accrued interest income from fair value hedges both before and after January 1, 2018, and are reflected in Citigroup's net interest income (Table 4).

Table 4. Structure of gains/losses from Citigroup's fair value hedges in 2016-2018 (USD million). *(Source: compiled based on data from Citigroup, Refinitiv official websites)*

Gains/losses by net value hedging method (USD million)	2018		2017	2016
	Other income (OCI)	Net interest income	Other income (OCI)	Other income (OCI)
Gains/losses on derivatives recognized and qualified as fair value hedges				
Interest rate derivatives hedging	0	794	-891	-753
Currency derivatives hedging	-225	0	-824	-1415
Commodity derivatives hedging	-140	0	-17	182
Total gains/losses on derivatives recognized and qualified as fair value hedges	**-365**	**794**	**-1732**	**-1986**
Gains/losses on hedged objects recognized and qualified as fair value hedges				
Interest rate derivatives hedging	0	-747	853	668
Currency derivatives hedging	99	0	969	1573
Commodity derivatives hedging	124	0	18	-210
Total gains/losses on hedged objects recognized and qualified as fair value hedges	**223**	**-747**	**1840**	**2031**
Net gains/losses on hedged objects, excluding fair value hedge effectiveness assessment				
Interest rate derivatives hedging	0	-5	-7	-1
Currency derivatives hedging	14	0	96	154
Commodity derivatives hedging	7	0	1	-28
Total net gains/losses on hedged objects, excluding fair value hedge effectiveness assessment	**21**	**-5**	**90**	**125**

The analysis of Citigroup's risk hedging efficiency showed that the chosen strategy was not always successful. In 2017 the fair value hedge inefficiency amounted to USD 31 million for interest rate risk hedging and USD 49 million for currency risk hedging, which totaled USD 18 million. Hedge ineffectiveness is recognized in *P&L* form. In 2016 hedging volumes by fair value measurement method amounted to USD 84 million for interest rate hedging and USD 4 million for currency risk hedging.

It is important to note that *Citigroup* hedges the change in projected cash flows (CF) associated with floating rate assets and liabilities and other projected transactions. This involves operational hedging as well as a combination of operational and market hedges. Variable cash flows in such transactions are synthetically converted into fixed-rate cash flows by exchanging the floating rate interest rates and payment on a fixed forward interest rate of the swap. Assessment of such cash flows uses regression analysis methods or calculations of the currency offsetting coefficient for evaluating currency risk hedging. *Citigroup* hedges the changes that could potentially occur as a result of contractual rate volatility and recognizes the entire change in fair value of the cash flow on the hedging instruments through *AOCI (Accumulated Other Comprehensive Income)*.

Prior to 2017 US accounting reporting and derivative accounting standards required that the excess of the fair value of the hedged asset over the ineffectiveness of the hedge be immediately recognized in other income. The logic behind the display in reporting is as follows: with the adoption of ASU 2017-12 in the USA, banks are no longer required to immediately recognize such amounts in Other Comprehensive Income (OCI). Instead, the bank should fully remeasure the change in the value of the hedging instrument which is recognized in the accounting statements through AOCI, and inclusion in the income should occur in the period when the impact on cash flow profit is recognized (Table 5).

Table 5. Structure of gains/losses from Citigroup's cash flow hedges in 2016-2018 (USD million). *(Source: compiled based on data from the Citigroup, Refinitiv official websites)*

USD million	2018		2017	2016
Amount of gain (loss) recognized through AOCI on derivative contracts				
Interest rate derivatives	-361		-165	-219
Currency derivatives	5		-8	69
Total amount of gain (loss) recognized through AOCI on derivative contracts	**-356**		**-173**	**-150**
Amount of gain (loss) reclassified from AOCI to other income	**Other income**	**Net interest income**	**Other income**	**Other income**
Interest rate derivatives	0	-301	-126	-140
Currency derivatives	-17	0	-10	-93
Total amount of gain (loss) reclassified from AOCI to other income	**-17**	**-301**	**-136**	**-233**

Cash flow hedges of changes in fair value of hedging instruments remain in *AOCI* on the Consolidated Balance Sheets for 2016, 2017 and 2018, respectively. Such cash flows will be taken into account in future periods' gains to offset the hedged cash flows if they affect gains. Expected net gain (loss) related to cash flow hedging was reclassified through AOCI in 2018 and amounts to approximately USD 404 million. We would like to add that Citigroup discloses the fact that the maximum duration of time during which forecasted cash flows are hedged is 10 years. This means that the hedge portfolio includes both exchange-traded and over-the-counter instruments with a circulation period of no more than ten years.

Another aspect worth paying attention to is the ratio of exchange-traded and over-the-counter derivatives in the balance sheet structure since the complexity of the practical implementation of the hedging process is determined by the type of derivatives used by the bank. It is widely believed that the over-the-counter market is characterized by increased risks compared to the exchange market due to the lack of collateral for concluded contracts and the multiple excesses of the over-the-counter market volume. However, analysis of the derivatives structure of the largest American banks proved the opposite. In fact, transactions with over-the-counter instruments are technically simpler than hedging with exchange-traded derivatives (Primostka, et al., 2014). Since the terms and conditions for concluding term contracts on the over-the-counter market are aimed at maximizing a banking institution's hedging needs, taking into account its strategy and business priorities, the over-the-counter derivatives market is more flexible and creates a more favourable environment for developing effective hedging strategies.

CONCLUSIONS

Based on the results of the dynamic and statistical analysis of the structure of derivatives and the volume of risk-hedging operations of American banks, the characteristics and peculiarities of forming hedging strategies are summarized. Analysis of American banks' work with derivatives allows for a deeper understanding of hedging nature and its application in the activities of domestic banks, which will become more active in the course of financial environment transformation.

1. In international practice interest rate and foreign exchange derivatives make up the majority of bank risk hedging instruments. It was determined that interest rate risk is hedged by means of over-the-counter bilateral interest rate term contracts for active transactions while hedging currency risk evenly covers the risks of passive and active transactions.
2. Since in international banking practice, the highest risk is associated with interest rate volatility, the largest volume of derivatives transactions falls on interest rate risk hedging. Interest rate swaps prevail in the structure of interest rate risk hedging instruments, the share of which varies between banks from 42.52% to 61.26%, and their application mechanism allows for simultaneous hedging of fair value and cash flow.

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3. In terms of the impact on the change in the value of balance sheet positions in international banking, currency risk is in second place. It was established that the share of foreign exchange derivatives in banks varies from 18.67% to 41.45%, and hedging is carried out with the use of a wide range of derivative instruments. Currency forwards and futures, as well as call-and-put options, are widely used in the structure of currency risk hedging along with currency swaps. Currency risk remains the most significant risk for Ukrainian banks, which is hedged mainly by operational hedging methods. Foreign exchange derivatives are more flexible and understandable hedging instruments, and Ukrainian banks should introduce them more widely into their currency risk management practices.
4. US banking market participants almost never use the exchange market, as the over-the-counter segment of the derivatives market allows banks to choose a hedging instrument in a more flexible way. Domestic banks can also develop their hedging strategies using over-the-counter derivatives since Ukraine's exchange market is underdeveloped. Intensification of banks' hedging activities will be an impetus for over-the-counter segment of the derivatives market development.
5. Analysis of international banks' balance sheet items shows that hedging instruments cover the risks of both active and passive bank operations. Each bank determines the ratio of hedging both in the structure of the bank's asset coverage and the ratio of risk coverage depending on the chosen development strategy, business model, scale of a particular business area, and regional distribution of business. The choice of derivatives depends on the hedging strategy and the bank's risk profile.
6. As the study shows, even with well-developed derivatives markets, international banks actively use both operational and market hedging. Thus, Citigroup hedges changes in projected cash flows by balancing the terms and volumes of floating rate assets and liabilities, as well as by alignment with other projected transactions. This indicates that the bank applies market hedging strategies, combining them with operational hedging methods. Ukrainian banks should also use a combination of operational and market hedging since such approaches can compensate for the lack of certain types of derivatives in the domestic market and at the same time make hedging more efficient by using available derivatives.
7. An important conclusion is that the share of derivatives recognized as hedging instruments is small (less than 1%) relative to the share of term contracts recognized by banks as trading instruments. However, the market effect of hedging is much higher than the gains on the trading portfolio. This should become an incentive for Ukrainian banks to intensify risk hedging operations, as even a small volume of hedging operations will have a significant effect, measured both quantitatively (in monetary terms) and qualitatively, such as improving the bank's image, stabilizing profits, and increasing trust from customers and partners.
8. The considered approaches to the formation of effective hedging strategies can be used by Ukrainian market participants in the process of entering international markets in the post-war economic recovery. When entering the international market, economic entities will be exposed to financial risks that significantly affect their performance. Therefore, understanding the strategies and use of financial risk hedging instruments will help minimize their negative impact on domestic business and contribute to Ukraine's economic development. The conclusions drawn will help market participants choose the most effective and promising risk-hedging instruments and strategies, allocate resources for their development, and formulate methodological and professional support for their practical implementation.

ADDITIONAL INFORMATION

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ФОРМУВАННЯ СТРАТЕГІЙ ХЕДЖУВАННЯ ФІНАНСОВИХ РИЗИКІВ

Метою дослідження є розвиток теорії хеджування, узагальнення підходів до формування ефективних стратегій хеджування ризиків та надання рекомендацій з імплементації досвіду міжнародних банків в українську практику. Доведено, що в процесі вибору ефективних стратегій доцільно виокремлювати три види хеджування фінансових ризиків: а) операційне хеджування (балансове) для забезпечення операційної гнучкості; б) ринкове хеджування (зовнішнє), що передбачає використання деривативів як інструментів хеджування мінливості прибутку; в) контрактне хеджування (контрактні застереження, вбудовані похідні інструменти). За результатами аналізу звітності 250 банків- учасників міжнародних та регіональних строкових ринків, виявлено, що на найбільш розвиненому строковому ринку США маркет-мейкерами є Bank of America, JPMorgan Chase & Co., Goldman Sachs, Morgan Stanley, Citigroup. Горизонтальний аналіз балансів цих банків показав, що хоча частка деривативів, визнаних інструментами хеджування, є незначною (менше 1%) відносно строкових контрактів, визнаних як торгові інструменти, однак ефект від хеджування є значно вищим від прибутків за торговим портфелем. Виявлено, що в міжнародній практиці домінуючим напрямом є хеджування процентного ризику (частка якого коливається між банками від 42.52% до 61.26%), у структурі інструментів хеджування переважають процентні свопи. Частка валютних деривативів варіює від 18.67% до 41.45%. Процентний ризик хеджується позабіржовими двосторонніми строковими контрактами за активними операціями, хеджування валютного ризику рівномірно покриває ризики пасивних та активних операцій. Регресійний аналіз виявив, що на регіональну експозицію хеджування зворотни й вплив чинять приватні кредити й торго вельні активи, а прямий – боргові інструменти. Проведене дослідження сприятиме формуванню ефективних стратегій хеджування фінансових ризиків, а також створює підґрунтя для оцінки потенціалу застосування інноваційних інструментів ризик-орієнтованого управління українськими учасниками фінансового ринку.

Ключові слова: фінансовий ринок, деривативи, види хеджування, банки, грошові потоки, інструментарій управління ризиками, банківські портфелі, ефективність, активи

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