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Abstract

In most cases the ultimate goal of a firm is profit maximization. Therefore, it is reasonable to assume that the firm's value is linked to the nature of derivatives usage by the firm and the intensity of this activity. Thus, **the objective of this study** is to examine the relationship between the firms' value for financial companies (primarily, banks) and the way they use derivatives. In this study financials of 130 European banks from different countries are examined from 2005 to 2010. The study is based on two sets of data: the first set contains the accounting data from balance sheets and the profit and loss accounts of banks in 2005-2010, while the second set contains the data from the notes to the financial statements disclosures, collected manually on each individual bank. The impact of derivatives usage on the banks' value is assessed by means of the regression analysis with control variables that account for the time effect and cross-country differences. Two key results are that the firms efficiently using derivatives have higher value and the use of trading derivatives is positively associated with the growth of banks' stock returns, and for hedging derivatives, on the contrary, negatively with Tobin's *q*.

Keywords: derivative, bank's value, hedging, time effect.

JEL Codes: C20, C21, G20, G21

Contents

1. Introduction

Over the past three decades derivatives have played an increasingly important role in the financial world. Varieties of them are traded both over exchanges and directly without any intermediation, or over-the-counter (OTC). Just in 2006 the nominal value of all OTC derivatives amounted to slightly more than $ 400 bn., or 8 times the total GDP of all countries by [Ferguson, 2010]. Derivatives market attracts a growing number of participants due to its high liquidity – any participant can easily find counterparty for the transaction. All the participants can be divided into two groups: those who use derivatives for hedging purposes and those who take offsetting positions with an aim of profitable trading.

In most cases the ultimate goal of a firm is profit maximization. Therefore, it is reasonable to assume that the firm's value is linked to the nature of derivatives usage by the firm and the intensity of this activity. Thus, **the objective of this study** is to examine the relationship between the firms' value for financial companies (primarily, banks) and the way they use derivatives.

In this study financials of 130 European banks from different countries are examined from 2005 to 2010. The data are obtained from Bureau van Dijk's Bankscope database as well as collected manually from companies' financial statements.

This goal was stated in numerous existing studies. Thus, [Allayannis & Weston, 1998] study the impact of foreign exchange derivatives on the value of 720 biggest non-financial American companies. As a proxy for firm's value they use Tobin's q and therefore an increase in the company's value is interpreted by the statement that investors reward a company for use of derivatives by higher market capitalization of the company. [Bartram et al., 2009] analyze the impact of derivatives usage on the firm's risk and value. In this study, as well as in many others (see, for example, [Faff & Nguyen, 2007; Kapitsinas, 2008]), the company's value is measured similarly by Tobin's q. Almost all researchers use dummy variables as a measure of derivatives usage which take the value of one if a company uses derivatives and 0 otherwise. Such variables allow making logistic regressions and exposing a range of factors enlarging the probability of involvement in derivatives transactions. Besides, the authors compare the means of analysed variables in two subsamples – firms which use and do not use derivatives, and on the basis of this comparison they draw conclusions about any statistically significant differences between derivatives users and non-users and suggest hypotheses concerning in particular the impact of derivatives usage on a company's value. For example, firms with broad growth opportunities

which are measured by R&D expenditures, are more probable to use derivatives [Geczy et al., 1996].

Our study contributes to the existing literature in at least two ways. First of all, we increase the information content of operations with derivatives by measuring the derivatives activity by normalized notional amounts of contracts. This permits to take into account the differences in the intensity of derivatives usage. Our unique manually collected database containing the derivatives disclosures obtainetd from the notes to financial statements enabled the use of notional amounts in our analysis. Secondly, we focus on European banking sector which is characterized by some features that are of particular interest to our study. The European banks have homogeneous accounting and regulatory requirements that make comparisons relevant. Furthermore, to the best of our knowledge, this sector was largely ignored in previous studies.

In accordance with the stated objective of the study the following hypotheses are proposed to be tested:

1. Hedging banks are characterized by non-zero risk premium;
2. Use of hedging derivatives is positively related to the bank's value;
3. Use of trading derivatives can be negatively related to the bank's value;
4. Nature of the influence of derivatives usage on the bank's value and risk is different for globally systematically important banks and others.

For testing these hypotheses the work is organized as follows. Section 2 describes the key terms related to derivatives, as defined in International Financial Reporting Standards. Section 3 overviews previous studies. Data and methodology description are provided in Sections 4 and 5. Data analysis and regression modeling are performed in Sections 6 and 7. Section 8 concludes the research with key insights.

2. Definition of derivatives

All European banks keep records in conformance with IFRS. These standards regulate the accounting and recording of operations with financial instruments (including derivatives) in financial statements and contain definitions which are relevant to our research. Since there are other notions [IAS 39, 2009] in the definition of derivatives, the most important of them should

be mentioned: financial assets, financial liability, fair value, financial instrument, derivative, forward and futures contracts, options and swaps. In addition hedging operations are described.

A *financial asset* is any asset that is:

a) cash;
b) an *equity instrument* of another entity;
c) a contract that will or may be settled in the entity's own *equity instruments* and is:
   I. a non-derivative for which the entity is or may be obliged to receive a variable number of the entity's own *equity instruments*; or

   II. a derivative that will or may be settled other than by the exchange of a fixed amount of cash or another *financial asset* for a fixed number of the entity's own *equity instruments*. For this purpose the entity's own *equity instruments* do not include *puttable financial instruments*, instruments that impose on the entity an obligation to deliver to another party a pro rata share of the net assets of the entity only on liquidation, or instruments that are contracts for the future receipt or delivery of the entity's own *equity instruments*;

d) a contractual right:
   I. to receive cash or another *financial asset* from another entity; or

   II. to exchange *financial assets* or *financial liabilities* with another entity under conditions that are potentially favourable to the entity.

A *financial liability* is direct opposite to *financial assets*.

Fair value is the amount for which an asset could be exchanged, or liability settled, between knowledgeable, willing parties in an arm's length transaction.

A *financial instrument* is any contract that gives rise to a *financial asset* of one entity and a *financial liability* or *equity instrument* of another entity.

Thus, a *derivative* is a *financial instrument* or other contract within *the scope of the Standard* with all three of the following characteristics:

a) its value changes in response to the change in a specific interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit

rating or credit index, or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract (sometimes called «underlying»);

b) it requires no initial net investment or an initial net investment that is smaller than would be required for other types of contracts that would be expected to have a similar response to changes in market factors; and

c) it is settled at a future date.

It is necessary to consider briefly principal type of derivatives, which are used by companies [Hull, 4th edition]: forward and future contracts, options and swaps.

A *forward contract* is an agreement to buy or sell an asset at a certain future time for a certain price. The most popular are currency forwards, which are employed both for trading and hedging from exposure to foreign exchange rate risks (at greater length about hedging see below).

A *futures contract* resembles to forward contract, but unlike it, futures contracts are normally traded on an exchange. It has a lot of forms of underlying: interest rates, foreign exchange rates, equities, commodities. Since commercial banks' activity is not associated with goods, banks employ commodities futures exclusively for trading purposes.

There are two basic types of options - *call* and *put*. Option call gives the holder the right to buy the underlying asset by a certain date for a certain price. Issues of calculations of marginal requirements (warranties) exceed the limits of current research.

A *swap* is an agreement between two companies to exchange cash flows in the future. As a rule calculation of cash flows depends on future values of market variables.

The aforementioned derivatives are actively used in hedging operations.

In compliance with Standard № 39 [IAS 39, 2009] there are three kinds of hedging operations:

- *fair value hedge*: a hedge of the exposure to changes in fair value of a recognized asset or liability or an unrecognized firm commitment, or an identified portion of such an asset, liability or firm commitment, that is attributable to a particular risk and could affect profit or loss. This change can arise as a result of assets or liability value's dependence on certain financial value (for example, interest rate or foreign exchange rate), which is source of risk;

- *cash flow hedge*: a hedge of the exposure to variability in cash flows that is (i) attributable to a particular risk associated with a recognized asset or liability (such as all or some future interest payments on variable rate debt) or a highly probable forecast transaction and (ii) could affect profit and loss. This is similar to fair value hedge, when future cash flow from company or, vice versa, from her acts as an asset value;

- *hedge of a net investment in a foreign operations*: a hedge of the amount of the reporting entity's interest in the net assets of that operation – a hedge of investments in foreign companies;

In practice a hedge is regarded as highly effective if price change of hedged instrument makes up 80-125% of price change of the hedge. Profit or losses, which meet the effective hedging criteria, are recognized in Other Comprehensive Income statement, i.e. in capital.

A lot of market participants use hedging for decreasing risk exposures, which can refer to changes in oil price, foreign exchange rate or stock index.

We can use an example of futures market to illustrate the basic principles of hedging.. A bank should take a position, which neutralizes risk. If it is assumed that the bank will earn (lose) *a* dollars owing to the increase (decrease) of some asset's price by 1 dollar, it should take a short futures position so that it has an opposite impact on the bank's cash flows, and thus removes risk. For example, an American bank expects some future receipts in euro, but it is not aware of the future dollar/euro exchange rate direction and therefore it is not aware of the dollar equivalent of these receipts. Currency futures enable to get rid of this uncertainty and to obtain an accurate view of the future cash flow amount.

Why do companies get involved in hedging when shareholders can do it by themselves? Hedging of risk by the whole firm has several advantages. Firstly, company's management is much more aware of risks which company faces. Secondly, commission charges and transaction costs per one dollar are less in large deals. Moreover, huge amount of futures contracts does not permit individual investors to make transactions. However shareholders more easily diversify risk. They can make a portfolio of shares of companies producing oil and refining oil. Thus, they eliminate exposure to risk, associated with oil price. Therefore, a question of derivatives usage at the level of companies and banks, not shareholders, is still relevant. The next section provides the review of previous studies on this issue.

3. Literature review

[Geczy et al., 1996] study 372 Fortune 500 non-financial firms using 1990 year data. These companies are the largest in the USA in terms of sales. 41% of them use currency swaps, forwards, futures, options and its combinations. The authors find that firms with high growth opportunities and tighter financial constraints are more likely to use currency derivatives. This conclusion is consistent with the assumption that firms use derivatives in order to reduce the variability of cash flows that might otherwise impinge on profitable investments.

The authors performed univariate tests. They compared mean values of different variables for 154 derivatives users and 218 non-users.

Differences in all variables responsible for growth opportunities were found significant. Firms using derivatives are characterized by a higher ratio of R&D to sales and a lower ratio of capital expenditures to firm's size and book-to-market value. Other significant differences concern the following aspects:

- Short-term liquidity – cash and short-term investments divided by current liabilities – is lower for derivatives users.

- Incentives of managers – the natural logarithm of the market value of shares obtainable by using outstanding options – are greater for derivatives users.

- Information asymmetry – the percentage of institutional ownership of the sample firm, and the number of investment firms with analysts following the sample firm – is greater for derivatives users.

Insignificant differences are observed for the following variables:

- Managerial wealth – the natural logarithm of the market value of common shares beneficially owned (excluding options) by officers and directors.

- Substitutes for hedging – the ratio of convertible debt to firm's size.

- Tax preference – the book value of net operating loss carryforwards outstanding scaled by total assets.

- Incentives of bondholders – interest coverage ratio (EBIT to interest expenses) and long-term debt ratio (long-term debt to total assets).

Moreover, companies might be characterized by the differences in costs of implementing derivatives strategy. Derivatives users are, on average, significantly bigger: $ 8.24 mln. vs. $ 7.13 mln. in terms of the natural logarithm of the market capitalization. They are also much more exposed to currency risk: differences are significant almost in all variables. As proxies for exposure to currency risk the following ratios are used: short-term and long-term foreign debt to assets; foreign pretax income to foreign sales; foreign and export sales to total sales. Derivatives users demonstrate significantly greater mean values of these variables.

Logistic regressions are used to reveal those factors that influence the decisions about derivatives usage. The relationship between the probability of derivatives usage and incentives for derivatives usage, in particular different measures of exposure to foreign exchange rate risk, is examined. The latter appears if a firm earns income in foreign currency, makes sales abroad, has foreign debt, or imports occupies a large share in total production in the firm's industrial sector.

Thus, the authors consider the determinants of foreign exchange derivatives usage from the perspective of managers, bondholders and shareholders. It was revealed that companies with high growth opportunities and low accessibility to internal and external financing are more likely to use derivatives. In general, derivatives users are greater than non-users. Also they experience more attention from investment companies and are characterized by greater institutional ownership and by a significant amount of options held by officers and directors.

A firm's exposure to currency risk affects possible benefits of derivatives usage and costs of involvement in hedging. Both these benefits and these costs influence overall decision of usage and selection of types of derivatives. On average, sample companies used derivatives primarily for hedging rather than trading.

In their empirical work, [Allayannis & Weston, 1998] study the effect of currency derivatives usage on the value of non-financial firms. The sample includes 720 largest American non-financial companies. Tobin's q serves as a proxy for the company's value. The paper investigates whether the operations with derivatives contribute to a higher market capitalization of a company. This potential increase is interpreted as the evidence that investors reward companies that use derivatives with a higher market value.

Firstly, authors analyze differences in value between users and non-users. They conclude that derivatives users have higher mean and median values of q. Median value of hedging premium makes 0.7 (nondimensional quantity). The median firm from the whole sample has a

value of $ 2.07 bn. and q=0.95. Thus, the difference of 0.07 can be interpreted in the way that the value of companies which do not use derivatives is smaller by $ 152.5 mln., holding replacement cost of assets constant.

The sample firms represent completely different economic sectors. To control for this fact, the authors adjust q by subtracting the median value of q among all firms operating in the same sector from the company's q. In addition, firms vary with respect to the risk associated with foreign exchange rate. Some companies hold receivables denominated in foreign currency, so the importance of derivatives usage for hedging purposes is higher. Multivariate test showed that hedging premiums for such firms' (about 90% of the sample) are higher than for companies in the whole sample.

Currency derivatives are most widely used, so if a company is engaged in some operations with derivatives, then among them there will likely be currency derivatives. It is for this reason that the study focuses on currency derivatives.

The sample used by [Allayannis & Weston, 1998] consists of all non-financial firms from the COMPUSTAT database for the period from 1990 to 1995 totaling 4320 observations – 6 for each of the 720 firms. Authors excluded financial companies since most of them are marketmakers of the derivatives market and the forces driving them can be quite different.

The level of involvement in hedging is reflected by the aggregate value of currency derivatives used, including swaps. This information is published by companies in their annual reports.

During the period the number of firms using derivatives is increasing monotonically. The same trend is observed for the companies operating abroad. There is also a general trend towards a reduction of the number of non-users regardless their international activity. Additionally, over time the total value of derivatives is growing.

The authors performed a univariate test which consisted in the comparison of characteristics between derivatives users and non-users. They calculated the hedge premium as the difference in the values of ratios of derivatives' value to foreign assets. For six mean values and three median values this difference appeared to be statistically significant. It enables to conclude that investors attributed a higher value to firms using derivatives.

The authors calculated mean and median values of q. As a result, for some years the difference was negative and almost always statistically insignificant. Thus, the hypothesis about the existence of a hedging premium should be rejected.

The multivariate test was also performed, in which q was regressed on the control variables. In their study the authors conclude that the hedging premium amounts to 5.75% of the firm's value In other words, companies which use derivatives are worth about 5.75% more than non-users.

The authors also analyzed whether investors valued those companies which operate abroad. They test this hypothesis within only those companies which have foreign sales and hence are more sensitive to changes in foreign exchange rates. The results are similar to the previous ones: the signs of estimated coefficients are the same, whilst the hedging premium is higher and equal to 8.8% of the firm's value. Therefore, investors assign a higher value to international companies which use derivatives. All coefficients remain statistically significant even on the 1% significance level.

With Tobin's q used as an approximation of market value of company, the authors found considerable evidence that derivatives usage has a positive impact on the firm's market value. They found out that the hedging premium amounts on average to 5.7% of the value. Moreover, this premium is higher for companies operating in different countries. Qualitatively, the results are insensitive to various control variables, to methods of defining and calculation of q and market value and to different specifications of the model. In addition, authors do not reject the hypothesis that firms are hedging optimally, while possessing completely different values of the hedge ratio (regardless their market values).

The authors consider their result to be consistent with many theories. For example, following [Nance et al., 1993], hedging enlarges firm's value via reduction of expected tax payments, costs of financial distress or other agent costs. It occurs as a result of convex tax functions, limiting the firm's value fluctuations and control of underinvestment problem (referring to the fact that shareholders may reject positive NPV project due to the last order of priority of payments in case of the firm's bankruptcy). Despite the fact that [Allayannis & Weston, 1998] consider their results to be consistent with theoretical assumptions, they distinguish their work from previous studies because it tackles a more fundamental issue: "Does hedging increase a company's value?", while the most of papers on this topic merely looked for and examined the factors that affect the decisions about hedging.

[Bartram et al., 2009] study the impact of derivatives usage on firm's risk and market value. The sample includes 6888 non-financial companies, headquartered in 47 countries. The authors examine foreign exchange derivatives (FX), interest rate derivatives (IR), commodities derivatives (CM) and analyze the effect of its usage on the volatility of cash flows, standard error of stock returns, market value of company and β coefficients.

Employing Mann-Whitney-Wilcoxon test[1], the authors compare mean values of variables among derivatives users and non-users. Differences in all measures that are responsible for the gross exposure to the risk turned out to be significant. Hence, a firm will be more likely to hedge if they are characterized by a high gross exposure to the risk. The authors affirm that results are robust if derivatives are classified by underlying (foreign exchange rate, interest rate and commodities).

Risks of assets and liabilities are interrelated. The authors use stock exchange data and CAPM model to study a firm's net (post-hedging) exposure to risk that is the portion of risk which the firm faces after hedging. If derivatives are used for hedging then firms which initially have a high gross exposure to risk will be more likely to use derivatives. As a result, they will demonstrate the same (comparing to non-users) or even lower net exposure to risk. The results show that all measures of volatility among derivatives non-users are higher and the mean value of β is also higher. Thus, firms use derivatives for hedging rather than for trading. It should be noted that the mean value of q for derivatives users was 17% lower than for non-users (for example, in [Allayannis & Weston, 1998] it was quite the contrary: derivatives non-users had 8-10% lower value of q than users).

Differences across countries can affect the propensity to hedge or trade. The results are contradictory. On one hand, companies in countries with a high level of the financial risk use derivatives more frequently. On the other hand, derivatives are used more widely in countries with a low level of economics risk. As expected by [Bartram et al., 2009], firms are more likely to hedge if derivatives market is well developed.

Companies more likely hedge if they are larger; pay dividends more often and report stock options in their financial statements. For derivatives users ratios of tangible assets, R&D expenditures and capital expenditures to total assets were smaller, that is derivatives users possess fewer growth opportunities (although in the work [Geczy et al., 1996] a positive relationship between R&S expenses and derivatives usage was found).

[1] The test consists in the ranking of elements of matched samples and subsequent addition of ranks with the calculation of special statistics, which has a normal distribution.

After studying the data for each year, [Bartram et al., 2009] conclude that hedging is more helpful in periods of economic downturns.

Derivatives usage prevails in those firms that are more exposed to interest rate, currency and commodities risks. In spite of this, derivatives users have lower values of total and systematic risk, what signals that derivatives are used mainly for hedging purposes. Hedging firms are characterized by lower cash flow volatility and face a lower systematic risk.

[Bartram et al., 2009] do not eliminate the possibility of omitted variables bias affecting their findings. This influence should be quite significant to disclaim the conclusion that derivatives users have a lower risk. On the contrary, effects of derivatives usage on the firms' value are quite sensitive to the bias.

Thus, all the considered studies (including [Geczy et al., 1996], [Allayannis & Weston, 1998], [Nance et al., 1993], [Bartram et al., 2009]) conclude that derivatives usage has a positive impact on the firms' value. The authors of these studies assume that derivatives for hedging purposes are used more actively by firms which are more exposed to corresponding risks. Nevertheless, in the aforementioned papers different estimates of quantitative impact of derivatives usage on companies' value are given, as well as the choice in favor of different determinants, influencing decisions about derivatives usage in total and for hedging purposes in particular, is made.

The shortcoming of the described works is that banks are ignored in the analysis, what could be due to the complexity of data collection and access to the required data. Thus, in the next section it will be described how the problem of data collection was solved for this research, since the problem of the analysis of how derivatives influence banks' activities is still urgent.

4. Description of sample

Most previous studies (see, for example, [Nance et al., 1993] and [Bartram et al., 2009]) on the impact of the derivatives usage on the company's value were based solely on the information whether the firm uses derivatives or not. In these studies binary choice models were employed with dependent dummy variables designating the fact of use of derivatives. Such methods do not enable to estimate the extent of companies' involvement in operations with derivatives. This requires the data on nominal and fair values of derivatives.

In addition, as a source of information on the use of derivatives by companies survey data were analyzed. The surveys were conducted by authors, for example, by e-mail, resulting in a

large proportion of ignored requests by companies. It should be emphasized that requests assumed only the answer to whether the company uses derivatives or not.

In this research the sample includes 300 largest public European commercial banks. Essentially, it is the first study to include data on transactions with derivatives on European banks. It is based on two sets of data.

The first set contains the accounting data from balance sheets and the profit and loss accounts of banks in 2005-2010. These data are obtained from Bankscope and represent the values of the following parameters in each period of the period: net income, assets, equity, deposits, loans, trading assets and liabilities, operating profit, the amount of dividends paid, the number of shares, share price and others (a total of 69 values).

The second set contains the data from the notes to the financial statements disclosures, collected manually on each individual bank. Accounting data from Bankscope are collected from the same reporting automatically thanks to the fact that the balance sheet and profit and loss account in the financial statements are presented in an aggregate form, which permits to download necessary indicators automatically and to present them in a common database. However, the situation with derivatives is complicated, since the detailed information on them is found only in the notes to financial statements. This part of the report, according to which operations are more important for the banks, is different for each bank. Hence, the only way to extract the necessary information on derivatives is collecting the data manually. This is how the data were obtained.

The form of disclosures concerning the use of derivatives is not homogeneous. For this reason, collecting the data and summarizing them in a common database is a challenging and painstaking task. Some banks do not disclose this information in a detailed way, and some are silent on the use of derivatives due to their immateriality, i.e. the volume of operations with derivatives is relatively small, and the auditors decide to omit this information. Therefore, from the initial sample of 300 banks, we retain 130 banks in the final sample that is, taking into account the period of six years, a total of 780 observations. Thus, the study is based on a balanced panel data. In result, it was possible to develop a single format in which numerical indicators are presented in the data with respect to the following indicators.

First, derivatives are divided into trading and hedging. Derivatives are designated as hedging if the hedge is recognized to be effective. In other cases derivatives are designated as trading.

Second, derivatives are classified in accordance with the underlying assets. The distinction was made between derivatives on interest rates (IR), currency (FX), equities (EQ), credit derivatives (CR) and commodities (CM).

Third, there is a breakdown by the type of contract: swaps, futures, options, forwards.

As a result, such specification covers almost all possible uses of derivatives. If this form did not enable to unambiguously refer the data to a particular category, the data were attributed to derivatives that are most frequently used by all other banks. This method has no qualitative effect on the conclusion, since, first, analyzed derivatives were aggregated by type of contract, and, second, often in controversial cases, the values of indicators were relatively small.

Derivatives' value is determined by nominal value, as well as fair values of assets and liabilities. In the case of net cash proceeds against contract they are related to assets and in the case of net payments of losses – to liabilities.

Thus, the second set based on the notes to the financial statements disclosures is a set of 75 variables, the structure of which is presented in Tables 1 and 2 below.

Table 1. Hedging derivatives

	Interest Rate	Foreign Exchange	Credit	Equity
Swap	•	•	•	•
Futures	•			
Options	•	•		•
Forward	•	•		

Note: a point corresponds to the fact of collection of indicated data.

Table 2. Trading derivatives

	Interest Rate	Foreign Exchange	Credit	Equity	Commodities
Swap	•	•	•	•	
Futures	•	•		•	•
Forward	•	•			
Options	•	•		•	
Other	•		•		

Note: a point corresponds to the fact of collection of indicated data.

Banks in their reports submit values in the currency of the country where they are registered. For comparison purposes all figures are presented in a single currency. Therefore, values in such currencies as British pound, U.S. dollar, the Danish kroner and others, were converted into euros

at the historical rates[2]. And for the face values, as stock indicators, exchange rates at the end date of the period were used, while for the fair values, as flow indicators, average exchange rates for the period were taken.

The total amount of assets of the banks in the sample equals to 51% of the total amount of assets of the entire banking system in Europe in 2010. In order to draw conclusions about the presence of effects typical to the general population, it is necessary to ensure that the resulting sample is representative, i.e. adequately covers and represents the general population of all European banks. Below are corresponding figures for each country in 2010.

Table 3. Representativeness of the data concerning the banking systems of selected countries.

№	Country	Bank assets, bn. of euros		% of the sample in total
		Total	Sample	
1	Sweden	1398	1259	90%
2	Italy	2765	2485	90%
3	Greece	493	424	86%
4	Belgium	1151	962	84%
5	England	10187	7093	70%
6	Spain	3808	2647	70%
7	Slovenia	16	10	67%
8	Portugal	532	332	62%
9	France	6385	3863	60%
10	Cyprus	144	85	59%
11	Denmark	912	516	57%
12	Austria	1131	527	47%
13	Poland	300	124	41%
14	Hungary	120	35	29%
15	Ireland	1179	313	27%
16	Czech Republic	162	28	17%
17	Finland	464	77	17%
18	Slovakia	54	9	16%
19	Rumania	82	12	14%
20	Germany	7897	1074	14%
21	Malta	51	6	11%
22	Bulgaria	38	0	0%
23	Estonia	31	0	0%

[2] Source – www.oanda.com

24	Lithuania	26	0	0%
25	Luxemburg	820	0	0%
26	Latvia	29	0	0%
27	Netherland	2707	0	0%
	Total	42881	21881	51%

Virtually all countries with the largest banking systems are represented at a level of over 50%, except for Germany and Netherland, ranked second and sixth in terms of assets of national banks, respectively. Nevertheless, due to under-representation of data in the sample relative to the total banking assets by country, the focus of the study was removed from the analysis of all European banks to public European banks, as reflected in the title of the study.

5. Methodology

The impact of derivatives usage on the banks' value is assessed by means of the regression analysis.

The set of dependent variables characterizing the activity and value of the bank consists of two parts. The first part comprises measures of profitability, calculated as ratios of profit to assets and profit to equity. Profit is measured either by net income or operation profit from the balance sheet. Values of assets and equity are taken as of the end of the reporting period. Besides that, we have also calculated average values of assets and equity for two adjacent periods to control for the fact that the fair values of derivatives reflect the results of operations with derivatives during the reported period, while values of assets and equity in the database describe the financial position at a particular date.

The second group of variables characterizes the market valuation of the bank, that is the value attributed to the bank by investors. These variables are related to the stock price at the end of the period and include the price of the stock itself, return on the price and market capitalization, which is normalized by the amount of assets. Thus, eleven indicators are used as dependent variables in different model specifications.

Due to the fact that the value of derivatives is measured in trillions of dollars and the dependent variables are calculated as relative ratios, for consistency purposes it is reasonable to use explanatory variables also expressed as relative ratios. This approach consisting in the analysis of relative ratios accounts for the effect of scale, which states that the amount of derivatives used by larger banks is normally higher in absolute terms (this is confirmed by high values of the pairwise correlation between the value of derivatives and the amount of assets).

The explanatory variables are also divided into two groups encompassing flow and stock variables. Stock variables include ratios of nominal values of derivatives (which are stock

indicators) to the amount of assets at the end of the reporting period. These variables characterize the degree of involvement of the bank in derivatives transaction, as they reflect the extent of interrelation of nominal values of derivatives with amount of assets, which is the size of bank. This group consists of nine variables (five variables for trading derivatives and four variables for hedging derivatives). Each variable corresponds to a derivative contract on one of the five underlying assets. This separation enables to define which types of derivatives have a higher positive or negative impact on the bank's value.

Flow variables are represented by two sets of variables. The first set comprises the fair values of assets and liabilities (which are flow indicators) divided by the nominal values of derivatives. These ratios characterize the profitability of operations with derivatives, since they reflect the value of cash flows to the measure of the total use of derivatives. If for some observations nominal values are zero, then, because of the division by zero problems, the ratios are equated to zero, i.e. it is assumed that realizable return on derivatives disuse is zero.

The second set of explanatory variables consists of the ratios of the differences between fair values of assets and fair values of liabilities to nominal amounts. They characterize the net return on derivatives transactions.

Due to the fact that there are a lot of zero values of flow variables, for the purposes of the further research these variables are separated by only trading and hedging, without reference to the underlying asset. Thus, flow variables are divided into two groups, the first one including four variables (*H_FVA, H_FVL, T_FVA* and *T_FVL*) and the second one including two variables (*H_FVA_FVL* and *T_FVA_FVL*).

Time effects are controlled for through six dummy variables corresponding to the years covered in the sample. Each of them takes a value of one in a given year and zero in others.

To allow for cross-country differences two groups of variables are used. The first group consists of five dummy variables corresponding to five regions: Eurozone, the UK, Central and Eastern Europe, Northern Europe and Southern Europe. This aggregation was imposed due to the fact that some countries are presented by a small number of banks. The second group consists of three macroeconomic variables – GDP, growth of GDP and inflation rate in the country for the year. These macroeconomics variables can also describe the cross-country differences, and their main advantage over dummies is their wide variability. It should be noted that in each model either dummies of regions or the macroeconomic variables were used, but not all at once.

Thus, 11 dependent variables, 3 groups of explanatory variables and 2 groups of country variables result in 66 different specifications of regression models without an intercept. The

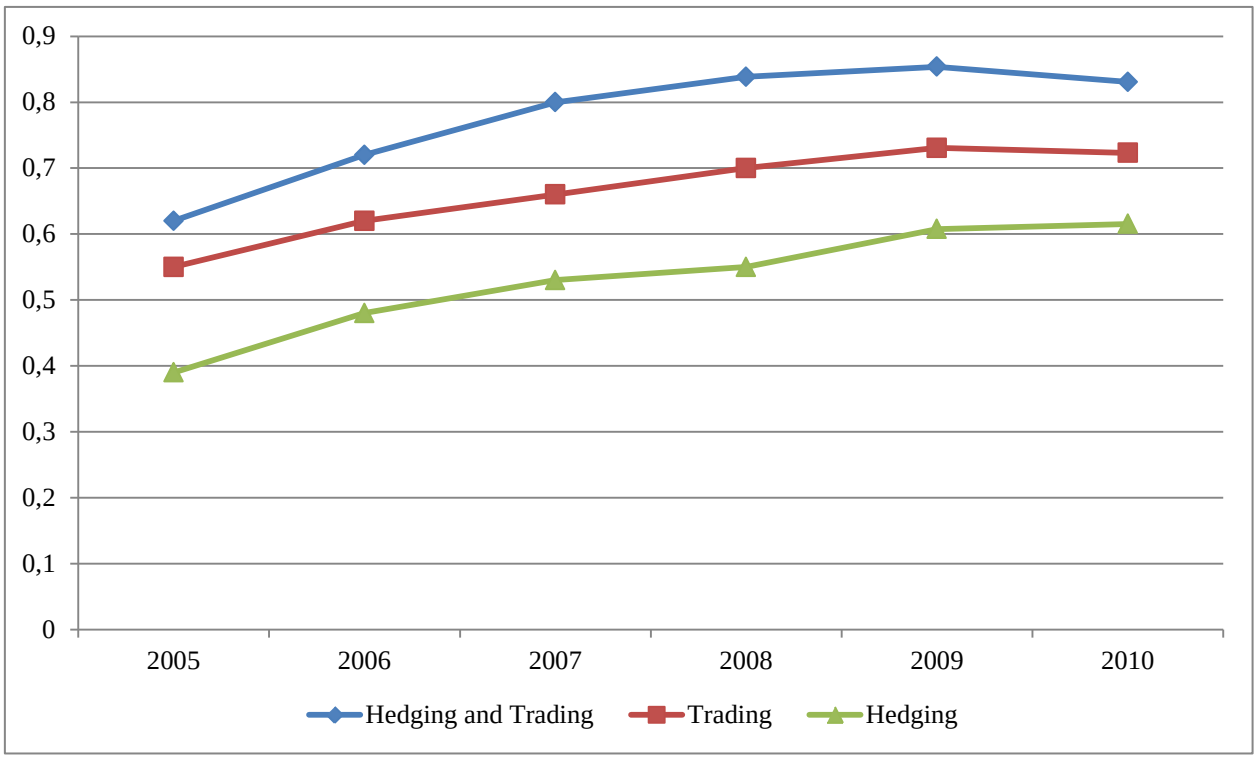
regressions were estimated with the ordinary least squares method. The 12 most interesting regression results are presented in Appendix 5, page 34.

In November 2011 the Financial Stability Board published a list of 29 systematically important banks; the stability of these financial institutions plays an important role in the whole economy. Therefore, these banks are subject to more strict control and more stringent capital requirements. Given the fact that our sample includes 10 out of these 29 banks, it is necessary to check the homogeneity of the sample. For this purpose Chow's test is performed. It tests the null hypothesis that the coefficients in the model on two sub-samples (systematically important banks and all others) are equal.

6. Initial data analysis

First, the dynamics of involvement of banks in derivatives transactions was studied. From 2005 to 2010 the number of derivatives users increases (see Fig. 1). Moreover, the total nominal value of derivatives also grows both in absolute and relative terms (see Appendix 4, page 29). It is interesting to note the decline of the nominal value of hedging derivatives and the increase of nominal value of trading derivatives in the crisis of 2008.

Figure 1. Proportion of banks which use derivatives.



Note: this dynamics conforms to [Alayannis, 1998].

Of particular interest is the hedging premium, which is the difference in the values of return or profitability between the banks the banks that hedge their risks and those that do not hedge. Note that the number of banks that use derivatives goes up from 51 in 2005 to 80 in 2010.

Average indicators of profitability (*ROAA, ROAE*), returns (*Return*) and risk (*Risk*) variables are provided in Appendix 1 (page 25):

Table 4. Comparison of mean values of variables for hedgers and non-hedgers.

	Hedging banks	Non-hedging banks	t-statistic
ROAA	1.23%	1.28%	0.22
ROAE	10.51%	10.51%	0
Risk	2.4%	2%	3.19*
Return	0.26%	6.55%	-1.82*
q	1.04	1.03	0.2461

Note: * Significant at 5%.

The table above shows that hedging banks have a lower stock returns (0.26% vs. 6.55%) and a higher stock price volatility. This finding partially contradicts the results described below, and the expectation that hedging banks will exhibit more stable dynamics of prices.

Appendix 3 (page 28) shows the calculated correlation coefficients (significant coefficients are shown in bold). As far as derivatives are concerned, there is a high positive correlation between the nominal values and all other variables contribute to the bank's value: balance sheet and income statement variables (*ROAA, ROAE, NI*) and market variables (*Cap*, *q*). In particular, the ratio of nominal values of trading derivatives and capitalization are positively correlated.

To get a better insight in the relationship between variables, Appendix 4 (page 29), provides a few scatter plots of variables involved in the specifications of the model.

7. Results

In the analyzed regressions (see Appendix 5, page 34), there is a relationship between balance measures of banks' values and explanatory flow variables: return on trading derivatives is negatively interrelated with return on equity (regression 6) and positively correlated with stock returns (regressions 3 and 4). In addition there is a visible inverse relationship between return on hedging derivatives and variables of *q* and *Risk* (regression 1, 2 and 5). Also stock variables demonstrate an interrelation with all dependent variables. The most significant of them are variables that refer to interest rate derivatives, the signs of the coefficient are different for each of the underlying assets. The degree of involvement in the use of trading derivatives is positively associated with risk (regression 9).

Positive coefficients in regression 3 and 4 may indicate that investors, observing a high degree of involvement of a bank in derivatives transactions, bid up the share price of this company. The signs of the coefficients can be interpreted as follows: the use of hedging

derivatives reduces risk, which corresponds to a lower return. By contrast, participation in trading operations increases risk. It should be noted that the sign of the obtained coefficients for the return on derivatives do not contradict the sign of coefficient for the net return on derivatives. The coefficient for the net return on hedging derivatives is negative, and for trading derivatives it is positive. Such dependence directly confirms the previously calculated average values of the variables for two sub-samples – hedging and non-hedging banks. The results show that hedging banks are characterized by lower stock return and higher volatility of stock prices. Thus, a dual interpretation is possible: hedging with derivatives itself is positively interrelated with the volatility of stock prices; the impact of the net return on derivatives is exactly opposite. This argument is supported by the fact that estimation of the regression 15 only on hedging banks results in more significant coefficients (t-statistics are at level of 6-9). Furthermore, the degree of involvement in hedging is negatively correlated with *Risk* variable, which indicates a lower volatility of stock prices of banks actively involved in hedging. Thus, the impact of hedging on the volatility of stock prices requires a further study.

To account for time effects year dummies were included in the model. It is then possible to compare indicators of profitability and return over the years. For example, the 11^{th} specification ratios for 2006 and 2007 are 1.82 and 2.07, respectively. This means that, other things equal, profitability in 2006 was lower than profitability in 2007, and the former, in turn, was lower than profitability in 2010. In regressions with profitability the coefficient for 2008 is insignificant, while in regressions with market measures is lower than coefficients for other years. This is explained by the fact that in 2008 companies earned both high positive and negative profits, while stock prices mostly fell this year. Thus, the time effect was taken into consideration, which enables to estimate the effect of derivatives usage by companies on their value, despite the fact that the data refer to different time periods.

To eliminate the influence of the factor of belonging to a certain country variables reflecting the cross-country differences were included. The significance of the coefficients of the regional dummies vary by regressions, most often they are significant in the regressions of risk (5, 9-10). Similarly, one can compare regions by the contribution they make to the company's value. In all regressions GDP growth and inflation rate are significant factors. The coefficient for GDP is significant in a slightly lower number of specifications.

Below are two regression equations with comments to the estimated coefficients.

Specification 13

$$\widehat{ROAE} = 13.24 * h_{ir_{nas}} - 15.37 * h_{fx_{nas}} - 245.5 * h_{cr_{nas}} - 0.027 * t_{ir_{nas}} + 1.76 * t_{fx_{nas}} + 3.63 * t_{eq_{nas}} - 4.9 * t_{cr_{nas}} + 20.63 * t_{cm_{nas}} + 7.46 * Year_{2005} + 9.37 * Year_{2006} + 10.33 * Year_{2007} + 2.6 * D_{euro} + 6 * D_{north} + 10 * D_{south} + 10 * D_{cee} + 6.7 * D_{gb}$$

From values of the coefficients it follows that increase in the ratio of nominal value of derivatives to assets per unit leads to an increase of profitability of 13.24% for hedging interest rate derivatives, to a decrease of 15.37% for hedging currency derivatives, to a decrease of 245.5% for hedging credit derivatives and similarly for the other indicators.

Specification 5

$$\widehat{return} = 206 * t_{fvafvl} + 83.75 * Year_{2005} + 83.33 * Year_{2006} + 49.07 * Year_{2007} + 84.11 * Year_{2009} + 50.14 * Year_{2010} - 59 * D_{euro} - 49 * D_{north} - 50 * D_{south} - 43 * D_{cee} - 54 * D_{gb}$$

The growth of net return in the amount of 1% of the nominal value leads to an increase in annual stock return of 2.06% for trading derivatives.

The hypothesis of the homogeneity of the sample was rejected, reflecting the heterogeneity of the whole sample and specificity of systematically important banks. Also, White's test for heteroskedasticity in errors and Wooldridge's [Wooldridge, 2002] test for autocorrelation were conducted. In a half of regressions the null hypothesis is rejected, therefore it is necessary to take account of heteroskedasticity and autocorrelation in the models, which will be done in the expansion of the current study. In addition, hypothesis on the residuals' normality was rejected for all specifications, using Jarque-Bera statistic.

Appendix 5 (page 34) provides F-statistics for Chow's test as well as estimates of the coefficients in three specifications for the total sample (POOLED) and two sub-samples (GSIB, NON-GSIB). In specifications 1 and 3 the hypothesis of homogeneity of the entire sample is not rejected, despite the fact that the estimated coefficients change their signs in the regressions on systematically important banks. However, in the specification 2 the hypothesis was rejected, indicating the heterogeneity of the entire sample and specificity of systematically important banks. Therefore, it is necessary to take into account the fact that the influence of return on derivatives is more intense for systematically important banks than for others (value of coefficients -5.67 vs. -2.19).

8. Conclusions and perspectives of further research

This study is the first attempt to investigate the effect of derivatives usage by European banks on their value.

This study contributes to the existing literature in that it is based on a unique database on the use of derivatives by European banks. This database enables to use quantitative indicators of derivatives usage, such as the nominal value, fair value of assets and liabilities. All derivatives are classified by several parameters:

- purpose of use – trading or hedging;
- underlying assets;
- type of derivative contract.

This database allows to consider the impact of derivatives usage with different underlying assets on the companies' value by country and by year.

The bank value is measured by market variables as well as by different indicators of profitability. The amount of the assets itself is not the ultimate goal of a bank. The bank's management is committed to the highest rates of income and appreciation of the bank on the part of investors.

Estimating of 66 specifications of regressions led to the conclusion that the firms efficiently using derivatives have a higher value. This is consistent with [Geczy et al., 1996] and [Nance et al., 1993]. According to the descriptive statistics, hedging firms show a lower rate of stock return (lower by 6.29 percentage points), while the average value of volatility of stock prices is higher (2.4% vs. 2%). Also the use of trading derivatives is positively associated with the growth of banks' stock returns, and for hedging derivatives, on the contrary, negatively with Tobin's q. Therefore it can be assumed that investors positively appreciate banks' active derivatives trading transactions. Control variables are used to account for the time effect and cross-country differences. Additionally, it was found that the impact of derivatives on the value of the bank is significantly different for the systematically important banks and other banks in terms of impact of the profitability and return on hedging derivatives on the banks' value.

Several areas of further development of this research are possible.

First, the annual replenishment of the database in the connection with release of new annual reports is suggested.

Second, it is possible to examine the decision of the banks to hedge or, more generally, to use derivatives via binary choice models, as is done in the most existing works on this subject (see, for example, Nance et al., 1993] and [Bartram et al., 2009]).

Third, it is of interest to identify groups of banks, which are homogeneous in terms of the nature of operations with derivatives.

Fourth, the presence of time series data enables to use methods of work with panel data, where the choice of the optimal model is based on comparison of Lagrange's and Hausman's test statistics.

9. Appendix

1. Descriptive statistics of variables.

Table 4. Descriptive statistics of variables.

№	Code	Name	Dimension
General variables			
1	*ROAA*	Return on average assets	%
2	*ROAE*	Return on average equity	%
3	*NI*	Net Income	bn. euro
4	*Cap*	Market capitalization	bn, euro
5	*MP*	Stock price as at 31 December	euro
6	*Return*	Stock return	%
7	*Risk*	Volatility of stock prices. Calculated as standard error of daily stock returns	%
8	*Assets*	Assets	bn. euro
9	*Equity*	Equity	bn. euro
10	*q*	Tobin's q – ratio of market capitalization plus assets minus equity to assets	Proportion
Absolute variables of derivatives			
11	*H_IR_N*	Nominal value of hedging interest rate derivatives	th. euro
12	*H_IR_FVA*	Fair value of hedging interest rate derivatives in assets	th. euro
13	*H_IR_FVL*	Fair value of hedging interest rate derivatives in equity	th. euro
Relative variables of derivatives			
14	*H_IR_N_AS*	Ratio of nominal of hedging interest rate derivatives to assets	Proportion
15	*H_IR_FVA_FVL*	Net return on hedging interest rate derivatives	Proportion
16	*H_FVA*	Ratio of fair value in assets for hedging derivatives to nominals	Proportion
17	*H_FVL*	Ratio of fair value in equity for hedging derivatives to nominals	Proportion
18	*H_FVA_FVL*	Net return on hedging derivatives	Proportion

2. Descriptive statistics.

Observations for some variables are absent, that is why its quantity varies (see column "Number of observations").

Table 5. Descriptive statistics.

Variable	Number of observations	Mean	Standard error	Min	Max	Measuring unit
roae	777	11	12	-72	55	%
roaa	778	1	3	-19	27	%
ni	777	0.7	2	-3	14	bn. euro
cap	675	9	19	0.01	159	bn. euro
mp	720	22	30	0.3	184	euro
return	720	3	46	-95	242	%
risk	467	224	130	11	996	%
assets	780	147	348	0	2587	bn. euro
equity	780	7	16	0	124	bn. euro
h_ir_n	780	31	143	0	1750	bn. euro
h_fx_n	780	3	14	0	155	bn. euro
h_eq_n	780	0.7	3	0	26	bn. euro
h_cr_n	780	0.1	1	0	19	bn. euro
t_ir_n	780	1160	5560	0	57400	bn. euro
t_fx_n	780	132	538	0	5670	bn. euro
t_eq_n	780	30	171	0	2250	bn. euro
t_cr_n	780	77	372	0	4240	bn. euro
t_cm_n	780	9	70	0	943	bn. euro
h_ir_fva	780	0.4	1	0	12	bn. euro
h_ir_fvl	780	0.5	2	0	31	bn. euro
h_fx_fva	780	0.1	0.3	0	5	bn. euro
h_fx_fvl	780	0.1	0.4	0	6	bn. euro
h_eq_fva	780	0.02	0.1	0	2	bn. euro
h_eq_fvl	780	0.02	0.1	0	1	bn. euro
h_cr_fva	780	0.005	0.1	0	1	bn. euro
h_cr_fvl	780	0.001	0.01	0	0.1	bn. euro
t_ir_fva	780	11	54	0	825	bn. euro
t_ir_fvl	780	11	53	0	807	bn. euro

t_fx_fva	780	2.9	18	0	348	bn. euro
t_fx_fvl	780	2.6	13	0	218	bn. euro
t_eq_fva	780	1.3	7	0	117	bn. euro
t_eq_fvl	780	1.5	8	0	104	bn. euro
t_cr_fva	780	1.9	13	0	232	bn. euro
t_cr_fvl	780	1.7	12	0	214	bn. euro
t_cm_fva	780	0.5	4	0	62	bn. euro
t_cm_fvl	780	0.5	4	0	61	bn. euro
h_ir_n_as	763	8.7	15	0	119	%
h_fx_n_as	763	3.2	11	0	116	%
h_eq_n_as	763	0.4	2	0	35	%
h_cr_n_as	763	0.0	0.1	0	2	%
t_ir_n_as	763	148	392	0	4007	%
t_fx_n_as	763	29	57	0	390	%
t_eq_n_as	763	4	13	0	123	%
t_cr_n_as	763	7	27	0	311	%
t_cm_n_as	763	1	5	0	57	%
h_ir_fva_fvl	771	-0.2	3	-28	71	%
h_fx_fva_fvl	771	-0.3	8	-123	34	%
h_eq_fva_fvl	771	5	133	-401	3650	%
h_cr_fva_fvl	771	0.4	6	-19	130	%
t_ir_fva_fvl	771	0.2	5	-6	108	%
t_fx_fva_fvl	771	0.0	2	-18	25	%
t_eq_fva_fvl	771	-3	80.9	-2233	100	%
t_cr_fva_fvl	771	-1	15.0	-312	48	%
t_cm_fva_fvl	771	0.4	7.6	-4	196	%
h_fva_fvl	774	-0.2	2.7	-16	21	%
t_fva_fvl	774	0.1	2.8	-25	47	%

3. Pairwise correlation between variables.

Table 6. Correlation coefficients.

	assets	*equity*	*roaa*	*roae*	*ni*	*cap*	*q*	*mp*	*return*	*risk*	*h_n_as*	*t_n_as*	*h_fva_fvl*	*t_fva_fvl*
assets	1.00													
equity	**0.94**	1.00												
roaa	**-0.09**	**-0.07**	1.00											
roae	-0.01	0.00	**0.51**	1.00										
ni	**0.42**	**0.49**	**0.08**	**0.38**	1.00									
cap	**0.78**	**0.85**	-0.04	**0.10**	**0.65**	1.00								
q	-0.03	-0.03	0.00	**0.10**	-0.02	-0.02	1.00							
mp	-0.04	-0.04	0.00	0.06	-0.02	-0.04	-0.01	1.00						
return	**-0.07**	-0.05	**0.17**	**0.17**	**0.09**	0.04	0.04	-0.01	1.00					
risk	**0.13**	**0.10**	**-0.28**	**-0.33**	**-0.09**	**-0.07**	**-0.17**	-0.10	**-0.16**	1.00				
h_n_as	0.06	**0.07**	-0.02	-0.06	0.05	**0.08**	-0.02	-0.05	-0.04	**-0.18**	1.00			
t_n_as	**0.71**	**0.61**	**-0.08**	0.00	**0.22**	**0.44**	-0.02	-0.03	0.00	0.06	0.02	1.00		
h_fva_fvl	0.05	**0.08**	-0.04	0.03	0.06	**0.11**	0.14	0.01	**0.09**	-0.02	**0.20**	0.01	1.00	
t_fva_fvl	-0.01	-0.01	0.00	-0.03	-0.01	-0.01	0.00	-0.01	0.04	-0.05	-0.01	0.04	0.04	1.00

4. Analysis of the sample

Degree of involvement in derivatives transactions is also growing, despite the drop of the total value of hedging derivatives by 19% in 2008 from the level of 2007.

Figure 2. Total nominal value of derivatives (in bn. of dollars).

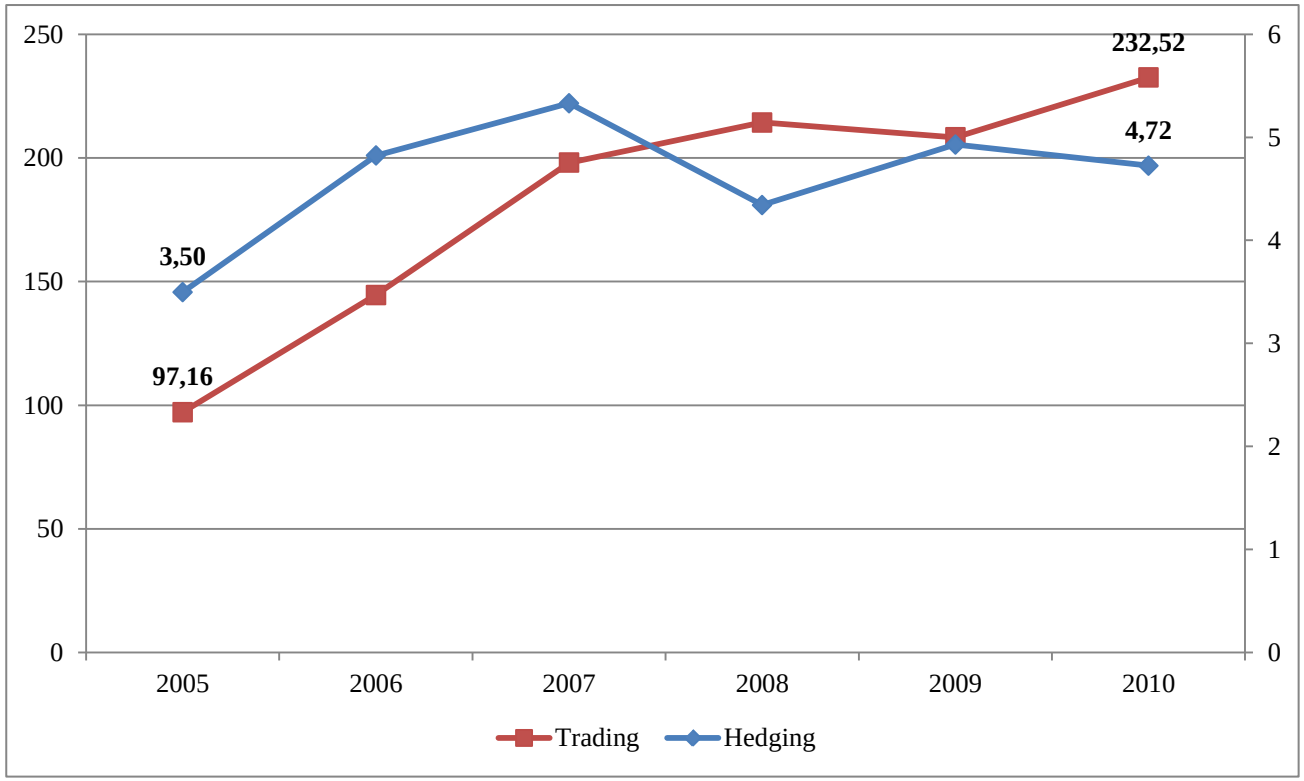
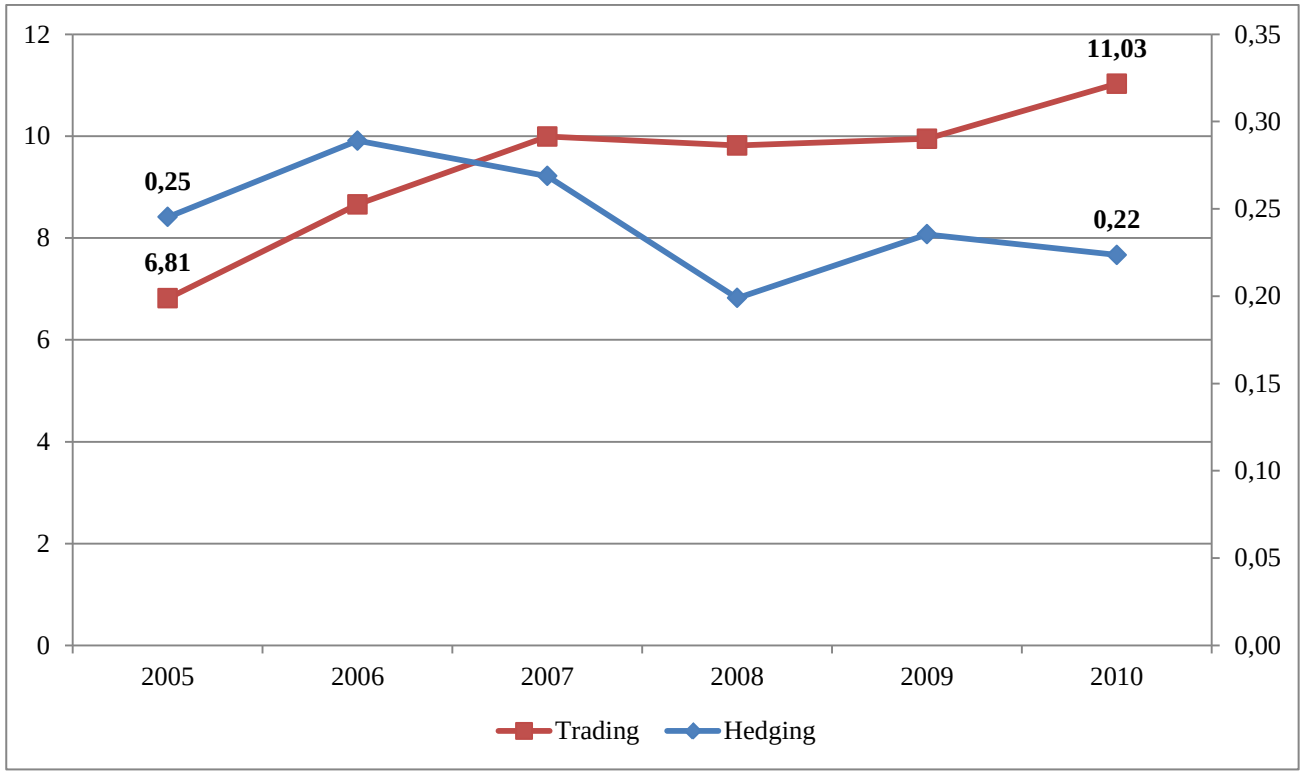


Figure 3. Ratios of the nominal values to the assets.



5. Scatter plots of dependent and explanatory variables.

Figure 5. Stock return and net return on hedging derivatives (in proportions).

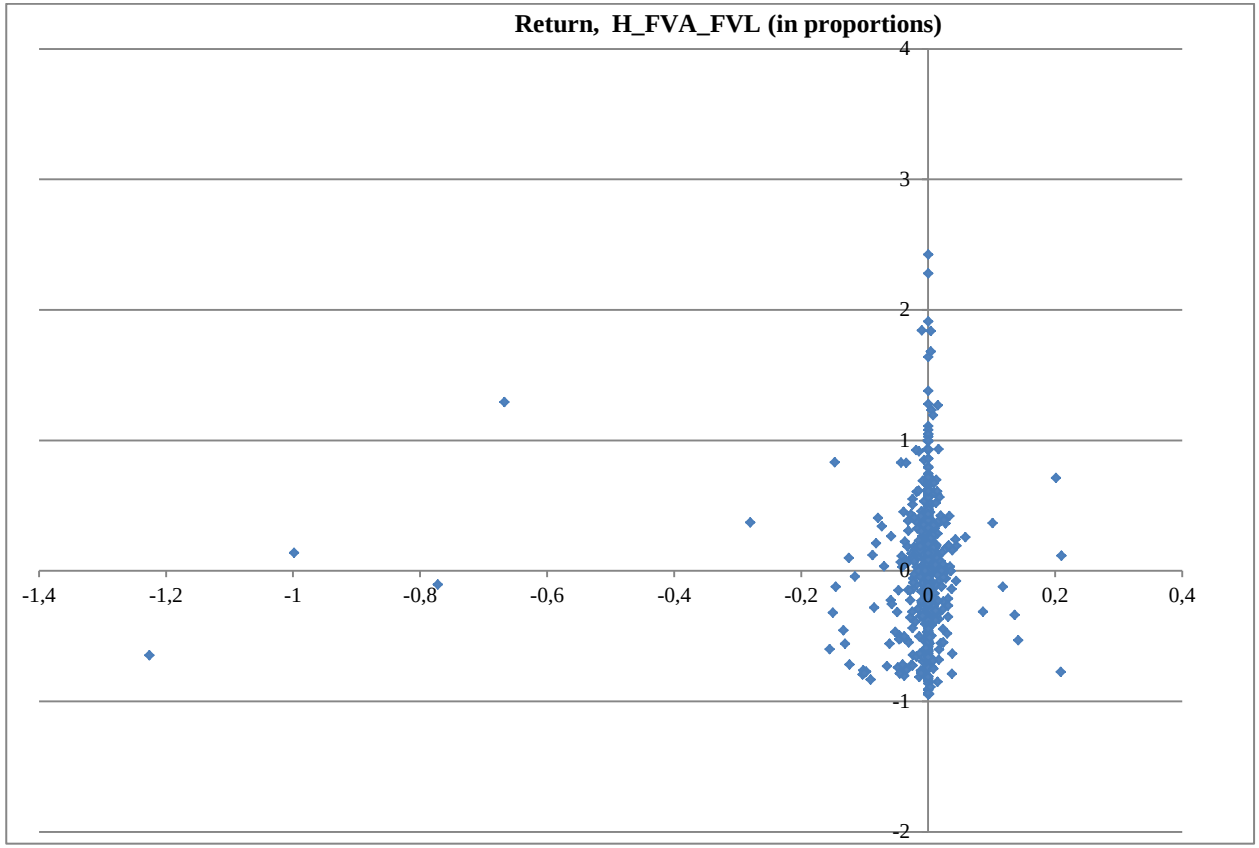


Figure 5. Stock returns and net return on trading derivatives (in proportions).

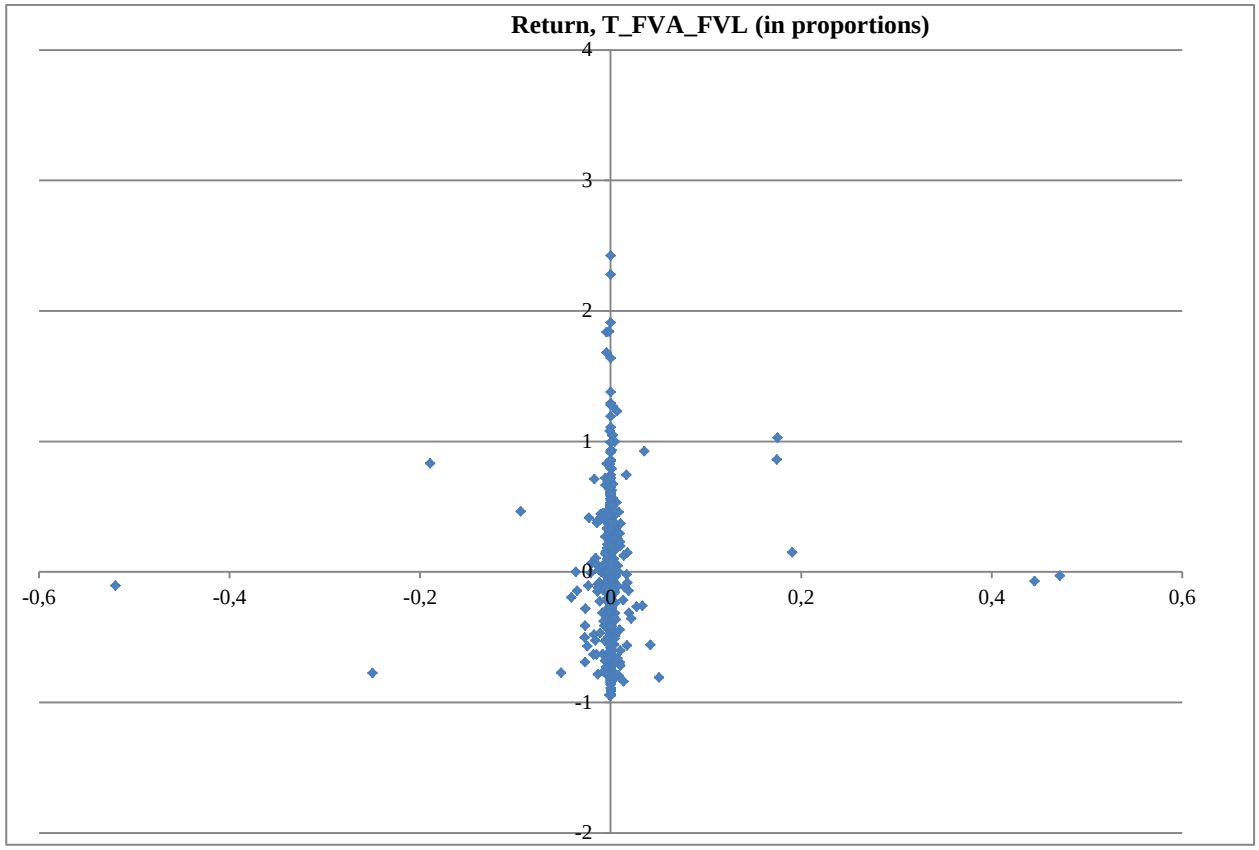
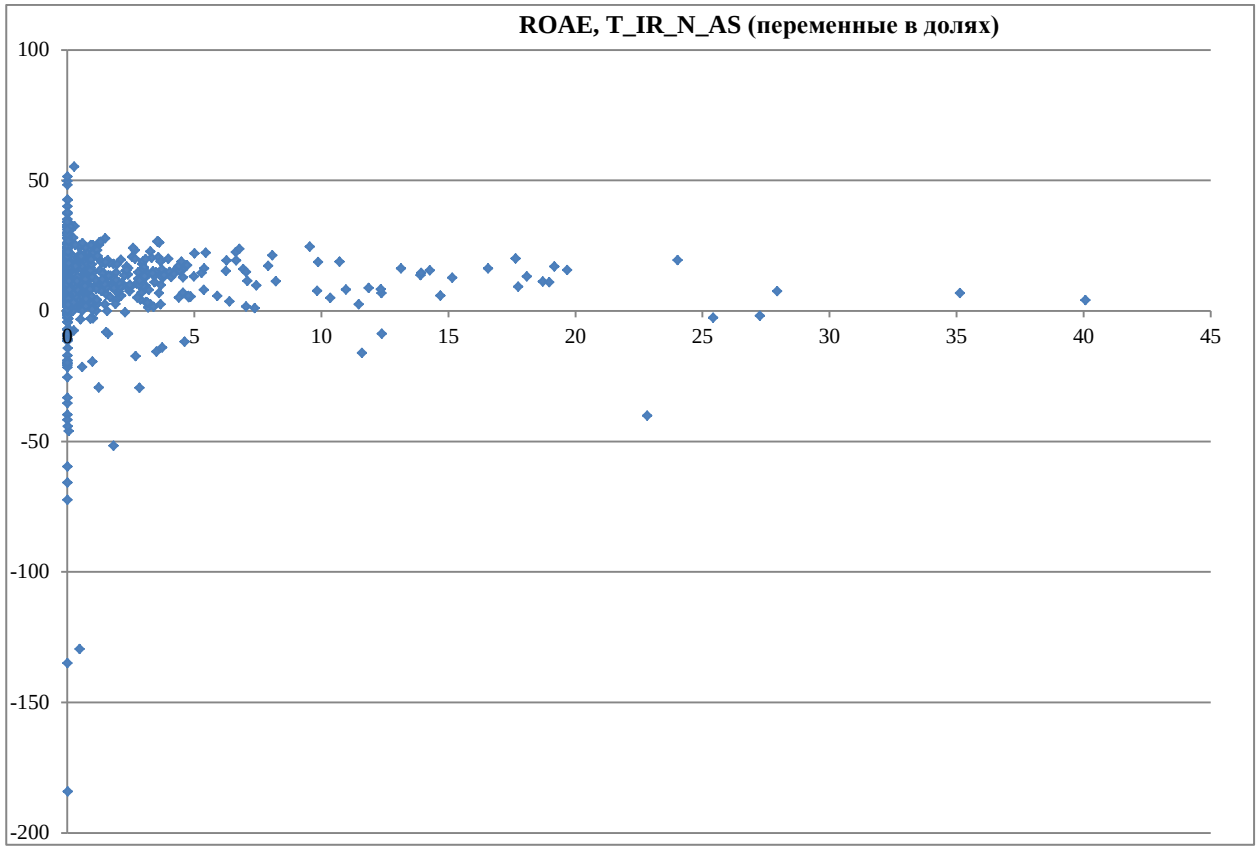


Figure 6. Return on average equity and ratio of the nominal value of trading derivatives to the assets (in proportions).



5. Results. Estimation of regressions.

Table 7. Selected specifications.

	Model	1	2	3	4	5	6
	Dependent variable	*q*	*q*	*Return*	*Return*	*Risk*	*ROAE*
	Observations	663	663	711	711	464	740
	R2	0.98	0.98	0.45	0.46	0.85	0.56
Return	H_FVA_N	-0.45	-	-		-	-
	H_FVL_N	0.73	-	-		-	-
	T_FVA_N		-	-	1.66	-	-
	T_FVL_N		-	-	-1.83	-	-
Net return	H_FVA_FVL	-	-0.69		-	-2.54	
	T_FVA_FVL	-		205.99	-		-22.08
Years	2005	1.09	1.02	83.75	0.06	-1.94	9.04
	2006	1.10	1.01	83.33		-1.67	10.64
	2007	1.08	0.99	49.07	-0.32	-1.55	10.63
	2008	0.99	0.92		-0.73		
	2009	1.02	1.05	84.11	0.37		
	2010	1.02	0.95	50.14	-0.24	-1.04	
Regions	Euro	-0.05	-	-58.67	-	3.18	3.74
	North		-	-48.50	-	3.02	6.30
	South		-	-49.61	-	4.13	10.56
	CEE	0.08	-	-42.96	-	3.61	11.54
	GB		-	-54.41	-	3.70	8.24
Macro	GDP	-		-	5.25	-	-
	GDPGR	-	0.01	-	0.04	-	-
	INF	-	0.02	-	0.03	-	-
White test	p-value	0.27	0.17	0.80	0.05	0.05	0.82
Wooldrige test	p-value	0.00	0.00	0.13	0.18	0.07	0.10

	Model	7	8	9	10	11	12
	Dependent variable	*q*	*q*	*Risk*	*Risk*	*ROAE*	*ROAA*
	Observations	658	658	453	456	760	739
	R2	0.98	0.98	0.85	0.85	0.56	0.25
Aggregated nominal	H_N_AS	-			-	-	
	T_N_AS	-	-0.002	0.05	-	-	-0.08
Nominal	H_IR_N_AS	0.14	-	-		13.24	-
	H_FX_N_AS		-	-		-15.37	-
	H_EQ_N_AS		-	-	-1.78		-
	H_CR_N_AS		-	-		-245.48	-
	T_IR_N_AS	-0.003	-	-	0.07	-0.27	-
	T_FX_N_AS		-	-		1.76	-
	T_EQ_N_AS		-	-	-0.59	3.63	-
	T_CR_N_AS	-0.02	-	-		-4.90	-
	T_CM_N_AS	0.08	-	-		20.63	-
Years	2005	0.08	1.02	1.69	1.82	7.46	-1.27
	2006	0.09	1.01	1.96	2.07	9.37	-1.41
	2007	0.07	0.99	1.96	2.13	10.33	-1.20
	2008		0.92	3.61	3.69		-3.09
	2009		1.05	3.49	3.57		
	2010		0.96	2.53	2.62		-1.91
Regions	Euro	0.95	-	-	-	2.80	-
	North	1.00	-	-	-	6.00	-
	South	1.03	-	-	-	10.63	-
	CEE	1.08	-	-	-	10.61	-
	GB	1.04	-	-	-	6.70	-
Macro	GDP	-		-29.35	-33.98	NA	96.68
	GDPGR	-	0.01			NA	0.18
	INF	-	0.02			NA	0.52
White test	p-value	0.00	0.96	0.00	0.28	1.00	0.22
Wooldrige test	p-value	0.00	0.00	0.25	0.18	0.34	0.52

Table 8. Chow's test.

	Specification 3		
	GSIB	NON-GSIB	POOLED
	Return		
T_FVA_FVL	-1571	220	206
y5	75	85	84
y6	82	83	83
y7	45	49	49
y9	91	83	84
y10	59	49	50
EURO	-60	-58	-59
NORTH	-50	-48	-48
SOUTH	(omitted)	-49	-50
CEE	(omitted)	-43	-43
GB	-67	-52	-54

$F_{11;\ 689}$	0.95
p-value	0.49

	Specification 1		
	GSIB	*NON-GSIB*	*POOLED*
	q		
H_FVA_N	0.17	-0.52	-0.45
H_FVL_N	0.27	0.75	0.73
y5	1.03	1.10	1.09
y6	1.03	1.10	1.10
y7	1.01	1.09	1.08
y8	0.98	0.99	0.99
y9	0.99	1.03	1.02
y10	0.98	1.02	1.02
EURO	-0.02	-0.06	-0.05
CEE	(omitted)	0.07	0.08

$F_{10;\ 643}$	0.56
p-value	0.91

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	Specification 2		
	GSIB	*NON-GSIB*	*POOLED*
	Risk		
H_FVA_FVL	-5.67	-2.19	-2.54
y5	-3.57	-1.73	-1.94
y6	-3.31	-1.45	-1.67
y7	-2.87	-1.38	-1.55
y10	-1.93	-0.93	-1.05
EURO	4.44	3.02	3.18
NORTH	4.56	2.87	3.03
SOUTH	(omitted)	4.02	4.13
CEE	(omitted)	3.49	3.61
GB	4.62	3.50	3.70

$F_{10;\ 444}$	3.90
p-value	0.00

$$\boldsymbol{F} = \frac{(RSS_{POOLED} - (RSS_{GSIB} + RSS_{NON-GSIB})/k}{(RSS_{GSIB} + RSS_{NON-GSIB})/(n-2k)} \sim F_{k;n-2k}$$

10. Literature

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