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Nikita Gomayun, Henry Penikas, Yulia Titova

DO HEDGING AND TRADING DERIVATIVES HAVE THE SAME IMPACT ON PUBLIC EUROPEAN BANKS' VALUE AND SHARE PERFORMANCE?

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Nikita Gomayun[1], *Henry Penikas*[2], *Yulia Titova*[3]

DO HEDGING AND TRADING DERIVATIVES HAVE THE SAME IMPACT ON PUBLIC EUROPEAN BANKS' VALUE AND SHARE PERFORMANCE?[4]

In most cases the ultimate goal of a bank is profit maximization. That depends on what derivatives one uses. Thus the objective of this research is to examine the relationship between a bank's value and characteristics of derivatives it subscribed to. The financials from 2005 to 2010 of 130 European public banks countries are examined. The study is based on two sets of data: the first one contains the accounting data on balance sheets and the profit and loss accounts from Bankscope from 2005 to 2010, while the second one includes the manually collected data from the notes to the financial statement disclosures. Regression analysis is used to trace the impact of derivative use on bank's value. Time effects and cross-country differences are controlled for. Two key research implications are as follows. The return on hedging derivatives is positively associated with the growth in bank's stock returns, whereas trading derivatives' notional value negatively impacts both Tobin's *q* and ROAA, and positively impacts risk of the bank's stocks.

Keywords: derivative, bank, value, hedging, trading, time effect.
JEL Codes: C20, C21, G20, G21

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[1] Nikita Gomayun B.Sc. student at National Research University Higher School of Economics, E-mail: gafych@gmail.com

[2] Henry Penikas PhD, Research Fellow at the International Laboratory for of Decision Choice and Analysis; National Research University Higher School of Economics, E-mail: penikas@gmail.com

[3] Yulia Titova PhD student at University Paris 1 Pantheon-Sorbonne, E-mail: yulia.titova@malix.univ-paris1.fr

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1. Introduction

Over the past three decades derivatives have played an increasingly important role in the financial world. Varieties of them are traded both at exchanges and directly without any intermediation, or over-the-counter (OTC). In 2006 the notional value of all OTC derivatives amounted to just over $400 trillion, or 8 times the total GDP of all countries [Ferguson, 2010]. The derivatives market attracts a growing number of participants due to its high liquidity – any participant can easily find a counterparty for the transaction. The participants can be divided into two groups: those who use derivatives for hedging and trading purposes.

In most cases the ultimate goal of a company and a bank in particular is profit maximization. Therefore, it is reasonable to assume that the bank's value is linked to the way it uses derivatives. Thus, **the research objective** is to examine the significance of derivatives as bank value determinants.

In this study the financials from 2005 to 2010 of 130 European banks from different countries are examined. The data was 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. [Allayannis & Weston, 1998] study the impact of foreign exchange derivatives on the value of the 720 out of the biggest non-financial American companies. As a proxy for a company's value they use Tobin's *q* and therefore an increase in the company's value is interpreted as investors rewarding a company for use of derivatives by higher market capitalization. [Bartram et al., 2009] analyze the impact of derivative use on a company'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 to indicate the fact of derivative use which take the value of one if a company uses derivatives and 0 otherwise. Such variables allow them to run logistic regressions and expose a range of factors increasing the probability of involvement in derivative transactions. The authors compare the averages of analysed variables in two subsamples – companies which use and do not use derivatives – and on the basis of this comparison they draw conclusions about any statistically significant differences between derivative-users and nonderivative-users and suggest hypotheses concerning, in particular, the impact of derivative usage on a company's value. For example, companies with broad growth opportunities which are measured by the amount of R&D expenditures are more likely to use derivatives [Geczy et al., 1996].

Our study contributes to the existing literature in two ways. First of all, we increase the information set about derivatives by proxying derivative activity by the normalized notional amounts of contracts. This allows us to take into account the differences in the intensity of derivative usage. Our unique database containing figures from disclosures on derivative transactions obtained from the notes to financial statements enabled us to control for notional amounts and fair value impact on banks' value. Secondly, we focus on the European banking sector which was not previously researched at such detail because of unavailability of unified[5] dataset on derivatives like the one on general financials Bankscope provides. European banks have homogeneous accounting and regulatory requirements that make within countries comparisons relevant.

In accordance with the stated research objective, the following hypotheses are tested:

1. Hedging banks are characterized by a zero risk premium;
2. The use of hedging derivatives is positively related to a bank's value;
3. The use of trading derivatives can be negatively related to a bank's value;
4. The nature of the influence of derivative use on a bank's value is different for globally systematically important banks.

The paper is organized as follows. Section 2 introduces the key terms related to derivatives, as defined in International Financial Reporting Standards (IFRS). Section 3 reviews previous studies. Sections 4 and 5 describes data and methodology, respectively. Sections 6 and 7 describes the data analysis and regression modeling output. Section 8 concludes the research with key insights.

2. Key terms

All European banks keep their accounts and report 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. We would like to refer the reader on basic terms stated in [IAS 39, 2009], like: financial assets, financial liability, fair value, financial instrument, derivative, forward and futures contracts, options and swaps.

[2] As for the US banks disclosures on derivatives are processed using unified templates that enable proper research (cf. Begenan et al. (2012))

As derivatives are actively used in hedging operations, we would follow the IAS Standard No. 39 logic [IAS 39, 2009] to list three main types of hedging operations: fair value hedge, cash flow hedge and hedge of a net investment in foreign operations.

According to IAS 39 a hedge is regarded as highly effecient if the price change of a hedged instrument makes up 80-125% of price change of the hedge. Profit or loss which meet the effecient hedging criteria are recognized in Other Comprehensive Income statement, i.e. in capital. Many market participants use hedging to decrease risk exposure arising from, for example, changes in oil prices, foreign exchange rate or stock index.

But why do companies get involved in hedging when shareholders can do it themselves? The hedging of risk by the whole company has several advantages. Firstly, the company's management is much more aware of the risks which a company faces. Secondly, commission charges and transaction costs per dollar are less in large deals. Moreover, the large cost 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 the risk associated with oil prices. Therefore, a question of derivative 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 non-financial Fortune 500 companies using 1990 data. These companies are the largest in the USA in terms of sales. 41% of them use currency swaps, forwards, futures, options combinations thereof. The authors find that companies with high growth opportunities and tighter financial constraints are more likely to use currency derivatives. This conclusion is consistent with the assumption that companies 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 the mean values of different variables for 154 derivative users and 218 non-users. Differences in all variables responsible for growth opportunities were found to be significant. Companies using derivatives are characterized by a higher ratio of R&D to sales and a lower ratio of capital expenditures to company's size and book-to-market value. Other significant differences are:

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

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

- Information asymmetry – the percentage of institutional ownership of the sample company, and the number of investment companies with analysts following the sample company – is greater for derivative 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 the company'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 differ in costs of implementing derivatives strategy. Derivative users are, on average, significantly bigger: $8.24m vs. $7.13m in terms of the natural logarithm of the market capitalization. They also have much more exposure to currency risk: differences are significant in almost 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. Derivative users demonstrate significantly greater mean values of these variables.

Logistic regressions are used to reveal those factors that influence the decisions about derivative usage. The relationship between the probability of derivative usage and incentives for derivative usage, in particular different measures of exposure to foreign exchange rate risk, is examined. It is derived that companies earning income in foreign currency, making sales abroad, having foreign debt, having material share of importers within the industry tend to use derivatives more often.

Thus, the authors treat the determinants of foreign exchange derivative 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, there are more derivative users than non-users. Also they experience more attention from investment companies and are characterized by greater institutional ownership and by the significant amount of options held by officers and directors.

A company's exposure to currency risk affects the possible benefits of derivative usage and the costs of hedging. Both these benefits and these costs influence overall the decision about whether and which derivatives are used. On average the sample companies used derivatives primarily for hedging rather than trading.

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

Firstly, the authors analyze the differences in value between users and non-users. They conclude that derivative users have higher mean and median values of q. The median value of the hedging premium is 7%. The median value of a company from the whole sample is $2.07b and q=95%. Thus, the difference of 7% can be interpreted as the value of companies which do not use derivatives being smaller by $152.5m, holding asset replacement cost constant.

The sample companies represent completely different economic sectors. To control for this fact, the authors adjust q by subtracting the median value of q among all companies operating in the same sector from the company's q. In addition, companies vary with respect to the risk associated with foreign exchange rate. Some companies hold receivables denominated in foreign currency, so the importance of derivative usage for hedging purposes is higher. Multivariate test showed that hedging premiums for such companies' (that form 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 derivatives, then they are likely to be involved in currency derivatives. It is for this reason that the study focuses on currency derivatives.

The sample used by Allayannis and Weston consists of all non-financial companies from the COMPUSTAT database for the period from 1990 to 1995 totaling 4320 observations – 6 for each of the 720 companies. The authors excluded financial companies because most of them are market-makers of the derivatives market and the forces driving them can be quite different.

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

During this period the number of companies using derivatives increased monotonically. The same trend is observed for companies operating abroad. Additionally, over time the total value of derivatives is growing.

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

A multivariate test was also performed, in which q was regressed on the control variables. In their study the authors concluded that the hedging premium amounts to 5.75% of the company'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 higher those companies which operate abroad. They test this hypothesis only for 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 company's value. Therefore investors assign a higher value to international companies which use derivatives. All coefficients remain statistically significant at 1% significance level.

With Tobin's q used as an approximation of market value, the authors found considerable evidence that derivative usage has a positive impact on the company's market value. They found 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, the authors do not reject the hypothesis that companies 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 a company's value via a reduction of expected tax payments, costs of financial distress or other agent costs. It occurs as a result of convex tax functions, limiting the company's value fluctuations and control of the underinvestment problem (referring to the fact that shareholders may reject with positive net present value (NPV) project due to the last order of priority of payments in case of the company'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 most papers on this topic merely looked for and examined the factors that affect the decisions whether to hedge or not.

[Bartram et al., 2009] study the impact of derivative usage on a company'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 their usage on the volatility of cash flows, standard error of stock returns, market value of company and β coefficients.

Employing the Mann-Whitney-Wilcoxon test[6], the authors compare mean values of variables among derivative 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 company will be more likely to hedge if they are characterized by a high gross exposure to 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 a CAPM model to study a company's net (post-hedging) exposure to risk, that is, the portion of risk which the company faces after hedging. If derivatives are used for hedging then companies which initially have a high gross exposure to risk will be more likely to use derivatives. As a result, they will demonstrate the same or even lower (compared to non-users) net exposure to risk. The results show that all measures of volatility among derivative non-users are higher and

[2] The test consists of the elements ranking for matched samples and subsequent addition of ranks to arrive at the special statistics, which has a normal distribution.

the mean value of β is also higher. Thus, companies use derivatives for hedging rather than for trading. It should be noted that the mean value of q for derivative 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. While companies in countries with a high level of financial risk use derivatives more frequently, derivatives are used more widely in countries with a low level of economic risk. As expected by [Bartram et al., 2009], companies are more likely to hedge if the derivatives market is well developed.

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

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

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

[Bartram et al., 2009] do not eliminate the possibility of omitted variables biase on their findings. This influence could significantly affect the conclusion that derivative users have a lower risk. On the contrary, effects of derivative usage on the companies' value are quite sensitive to bias.

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

The shortcoming of the described papers is that banks fell out of research scope, which could be due to the complexity of data collection and access to the required data. Thus, the next section describes the data collection process.

4. Description of sample

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

In this research the initial sample included 300 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: Bankscope and manually collected one.

The first set contains the balance sheet and the profit and loss accounts data of banks in 2005-2010. These data was obtained from Bankscope and contains records for the following variables 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). For descriptive statistics, please, refer to Table 5, 6 of Appendix 1.

The second set contains the data from the notes to the financial statement, collected manually on each individual bank. Accounting data from Bankscope was collected automatically due the fact that the balance sheet and profit and loss accounts in the financial statements are standardized, which allows the automatic download of the necessary indicators and allows them to be presented in a common database. However, the situation with derivatives is complicated, since detailed information on them is found only in the notes to financial statements. This part of the report, disclosed according to materiality of operations, is different for each bank. Hence, the only way to gather the necessary information on derivatives was to collect the data manually. This is how the second data set was obtained.

The format of disclosures concerning with respect to the use of derivatives is not homogeneous. For this reason, collecting the data and summarizing it in a common database was a challenging task. Some banks disclose this information in part, and some disclose nothing perhaps because of immateriality, i.e. the volume of operations with derivatives is relatively small, and the auditors might have decided to omit this information. Therefore, from the initial sample of 300 banks, we retain 130 banks in the final sample over a period of six years, totaling 780 observations. Thus, the research is grounded on a balanced panel. As a result, it was possible to develop a single data breakdown format in which numerical indicators are presented in the data with respect to the following indicators.

The second data 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.

First, derivatives are divided into trading and hedging. Derivatives are designated as hedging if the hedge is recognized to be efficient. In other cases derivatives are designated as trading. When breakdown was not available, derivatives were treated 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). For breakdown, please, refer to Figure 2, 3 of Appendix 2.

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

Such specifications cover almost all possible uses of derivatives. If this form did not enable us to unambiguously allocate the figure to a particular category, the data was attributed to derivatives that are most frequently used by all other banks. This method has no qualitative effect on the inference, since, first, the analyzed derivatives were aggregated by type of contract, and, second, often in controversial cases, the values of indicators were relatively small, i.e. immaterial.

The value of the derivatives is determined by notional value, as well as fair values of assets and liabilities. In the case of net cash proceeds against contract derivative fair value is recognized as an asset and in the case of net payments as a liability.

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[7]. For the face values, as stock variables, exchange rates at the end of the period data were used, while for the fair values, as flow variables, average exchange rates for the period were taken.

The total amount of assets of the banks in the sample equals 51% of the total amount of assets of the entire banking system in Europe in 2010. In order to make inferences about the presence of dependencies typical to the general population set of all EU banks, 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] Source – www.oanda.com

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

All countries with the largest banking systems are represented at a level of over 50%, except for Germany and The Netherlands, ranked second and sixth in terms of assets of national banking systems, 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 shifted from the analysis of all European banks to only public European banks, as reflected in the title of the study.

5. Methodology

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

The set of dependent variables characterizing the activity and value of a bank consists of two parts. The first part comprises measures of profitability, calculated as ratios of return on assets (ROA) and return on equity (ROE). Return is measured either by net income or operational profit from the balance sheet. Values of assets and equity are taken as of the end of the reporting period. In addition 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 end-date.

The second group of variables characterizes the market valuation of a bank, that is, the value attributed to the bank by investors. These variables include the stock price at the end of the period and include the price of the stock itself, the return on the price and market capitalization, which is normalized by the value of assets. Thus, eleven indicators are used as dependent variables in different model specifications (please, consult Table 5 of Appendix 1 for more information).

Due to the fact that the value of derivatives is measured in trillions of dollars and the dependent variables are calculated as ratios in percentage points, for consistency purposes it is reasonable to use explanatory variables also expressed as relative ratios to avoid size-related bias. This approach accounts for the effect of scale, which states that the amount of derivative 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 (significant at 0.1% correlation coefficients equal to 0.65 and 0.85 for notional values of hedging and trading derivatives, respectively).

The dependent variables are also divided into two groups encompassing flow and stock variables. Stock variables include ratios of notional values of derivatives (which are stock indicators) to the value of assets at the end of the reporting period. These variables characterize the degree of involvement of the bank in derivative transactions, as they reflect the extent of the interrelation of notional values of derivatives to the value of assets, that 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 for one of the five underlying assets. This separation enables us 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 of the fair values of assets and liabilities (which are flow indicators) divided by the notional values of derivatives. These ratios characterize the profitability of operations with derivatives, since they compare the value of cash flows or mark-to-market revaluation to the measure of the total use of derivatives. If for some observations the par values equal to zero, then, because of the "division by zero" problems, the ratios are also set to zero, that is, it is assumed that realizable return on derivatives disuse is zero.

The second set of explanatory variables consists of the ratios of net return, i.e. of the difference between fair values of assets and fair values of liabilities, to notional amounts.

Due to the fact that there are a lot of zero values for the flow variables, they are aggregated to trading and hedging only, without reference to the underlying asset. Thus, flow variables are divided into two groups, the first one includes four variables (H_FVA, H_FVL, T_FVA and T_FVL) and the second one includes two variables (H_FVA_FVL and T_FVA_FVL).

Time effects are controlled by means of introducing 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: the 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, GDP growth rate, 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 higher variability. It should be noted that in each model either dummies of regions or the macroeconomic variables were used, but not all together.

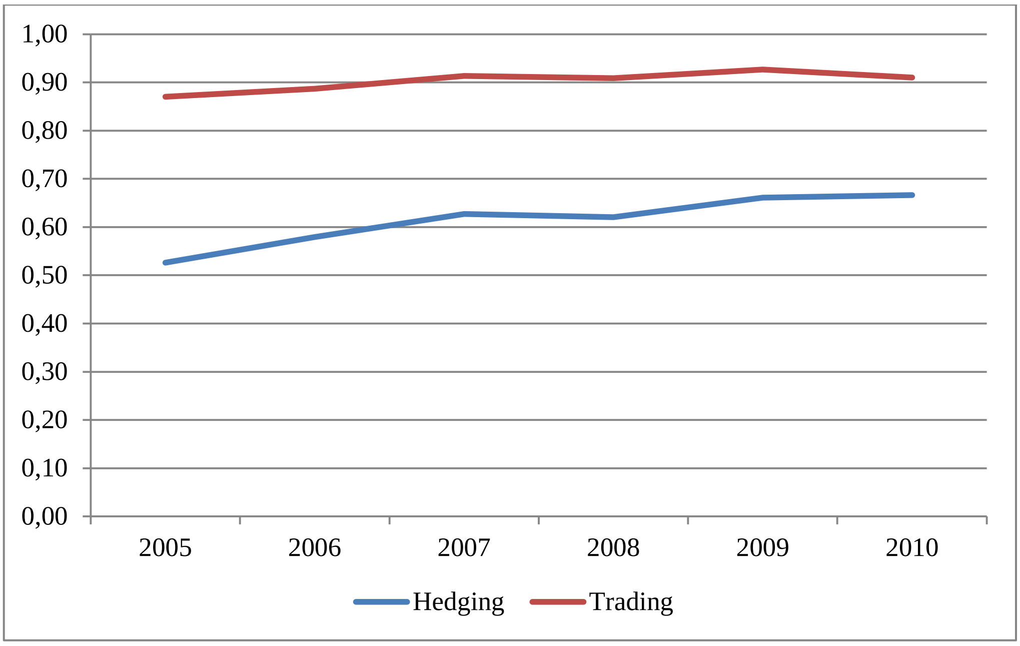
Thus, 11 dependent variables, 3 groups of explanatory variables and 2 groups of country variables result in 66 different specifications of regression models without an intercept. The regressions were estimated with the ordinary least squares method. The 12 most significant regression results are presented in Appendix 5, Table 8.

In November 2011 the Financial Stability Board published a list of 29 global 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 controls and more stringent capital requirements. Given the fact that our sample includes 10 of these 29 banks, it is interesting to check the homogeneity of the sample. For this purpose Chow test is performed. It tests the null hypothesis that the coefficients in the model on two sub-samples (systematically important banks and all the rest) are equal.

6. Initial data analysis

First, the dynamics of the involvement of banks in derivative transactions was studied. From 2005 to 2010 the number of derivative users increased (cf. Fig. 1). Moreover, the total notional value of derivatives also grew both in absolute and relative terms (cf. Fig. 4, 5 in Appendix 3). It is interesting to note the decline of the notional value of hedging derivatives and the increase of notional value of trading derivatives during the crisis of 2008. It should be also noted that on average trading derivatives volumes are tenfold greater than that of hedging derivatives.

Figure 1. Proportion of banks that use derivatives.



Note: this dynamics is in line with [Allayannis, 1998].

Of particular interest is the hedging premium, which is the difference between the values of return or profitability between the banks which hedge their risks and those that do not. Note that the number of banks that use hedging derivatives goes up from 69 in 2005 to 87 in 2010 (out of 130).

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

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

	Hedging banks	Non-hedging banks	t-statistic
ROAA	1.09%	1.65%	-3.38*
ROAE	11.17%	11.41%	-0.28
Risk	1.51%	0.98%	4.72*
Return	0.26%	6.55%	-1.82*
q	1.04	1.03	0.25

Note: * Significant at 5%.

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

Appendix 2 shows the correlation coefficients. As for derivatives, there is a negative correlation between the fair values (both assets and liabilities) and all other variables contributing to the bank's value: balance sheet and income statement variables (*ROAA, ROAE*) and market variables (*return*, *q*). In particular, the ratio of the fair values of trading derivatives and Tobin's *q* are negatively correlated.

To get a better insight in the relationship between variables, Appendix 4, provides some scatter plots of variables involved in the specifications of the model.

7. Results

Significant dependence between balance measures of banks' values and explanatory flow variables was found: return on hedging derivatives is negatively interrelated with return on equity (regression 6) and positively correlated with stock returns (regression 3). In addition there is a direct relationship between hedging intensity and the variables *q* and *ROAA* (regressions 7 and 9). Also stock variables demonstrate an interrelation with all dependent variables. The most significant of them are variables that refer to interest rate derivatives (that are predominant among derivatives); the signs of the coefficient are different for each of the underlying assets. The intensity of trading derivative use is positively associated with risk (regression 8).

Positive coefficients in regression 3 and 4 may indicate that investors, observing high degree of bank's involvement in derivative 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 higher 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 does not contradict the sign of coefficient for the net return on derivatives. The net return on hedging derivatives has negative impact on Tobin's *q* and Risk, and for trading intensity it is positive for *q* and *ROAA*. 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 a lower stock return and a higher volatility of stock prices. Thus, a dual interpretation is possible: hedging with derivatives itself is negatively interrelated with the volatility of stock prices; the impact of the net return on derivatives is exactly opposite. Furthermore, the degree of involvement in hedging is negatively correlated with *Risk* variable. It implies a lower volatility of the stock prices of banks actively involved in hedging. Thus, the impact of hedging on the volatility of stock prices and return requires 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 10th specification brings ratios for 2006 and 2007 to 1.82 and 2.07, respectively. This means that, other things being equal, profitability in 2006 was lower than profitability in 2007. In regressions with profitability as dependent variables the coefficient for 2008 is insignificant, while in regressions with market measures the coefficient is lower than 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 to estimate the effect of derivative usage by companies based on their value, despite the fact that the data refer to different time periods.

For country differences, variables reflecting the cross-country differences were included. The significance of the coefficients of the regional dummies varies by regressions. Most often they are significant (regressions 7-10). 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 two most illustrative regression equations are presented with interpretation to the estimated coefficients added.

Specification 13

$$\widehat{ROAE} = 13 * h_{ir_{nas}} - 15 * h_{fx_{nas}} - 245 * h_{cr_{nas}} - 0.03 * t_{ir_{nas}} + 1.76 * t_{fx_{nas}} + 3.63 * t_{eq_{nas}} - 5 * t_{cr_{nas}} + 21 * t_{cm_{nas}} + 7 * Year_{2005} + 9 * Year_{2006} + 10 * Year_{2007} + 3 * D_{euro} + 6 * D_{north} + 10 * D_{south} + 10 * D_{cee} + 6.7 * D_{gb}$$

From the values of the coefficients it follows that the increase in the ratio of notional value of derivatives to assets per unit is associated with an increase in profitability of 13% for hedging interest rate derivatives, a decrease of 15% for hedging currency derivatives, a decrease of 245% for hedging credit derivatives.

Specification 5

$$\widehat{return} = 85 * h_{fvafvl} + 84 * Year_{2005} + 81 * Year_{2006} + 50 * Year_{2007} + 81 * Year_{2009} + 51 * Year_{2010} - 59 * D_{euro} - 49 * D_{north} - 48 * D_{south} - 43 * D_{cee} - 53 * D_{gb}$$

The growth of net fair value of 1% of the notional value leads to an increase in annual stock return of 0.85% for hedging derivatives.

The hypothesis of the homogeneity of the sample was rejected, reflecting the heterogeneity of the whole sample and systematically important banks being statistically different of the rest. Also, White test for heteroskedasticity in errors and Wooldridge test [Wooldridge, 2002] for autocorrelation were conducted. In a half of regressions the null hypothesis is rejected, therefore it is necessary to adjust for heteroskedasticity and autocorrelation in the models; that will be done further on. In addition, the hypothesis on the residuals' normality was rejected for all specifications, using the Jarque-Bera statistics.

Appendix 5 provides F-statistics for Chow 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. 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. -2.1).

8. Conclusions and perspectives on further research

This study is the first to investigate the impact of derivative usage by public European banks on their value.

This study contributes to the existing literature in that it is based on a unique database of the use of derivatives by European banks. This database enables us to use quantitative indicators of derivative usage, such as the notional value, fair value of assets and liabilities. This database allows us to consider the impact of derivative 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.

Estimating 66 specifications of regressions led to the conclusion that the banks 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 companies show a lower rate of stock return (by 6.29%), while the average value of volatility of stock prices is higher (1.51% vs. 0.98%). Also the trading intensity is positively associated with risk, and for hedging derivatives, on the contrary, negatively. Therefore it can be assumed that investors require margin for banks' active derivative hedging transactions. It was found that the impact of derivatives on the value of a bank is significantly different for the systematically important banks in terms of the 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 connection with the release of new annual reports is suggested.

Second, it is possible to examine the decisions of banks to hedge or, more generally, to use derivatives via binary choice models, as is done in 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 us to use methods with panel data, where the choice of the optimal model is based on comparison of F, Lagrange Multiplier and Hausman test statistics.

9. Appendix

1. Descriptive statistics of variables.

Table 5. 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. EUR
4	Cap	Market capitalization	bn. EUR
5	MP	Stock price as at 31 December	EUR
6	Return	Stock return	%
7	Risk	Volatility of stock prices. Calculated as standard error of daily stock returns	%
8	Assets	Assets	bn. EUR
9	Equity	Equity	bn. EUR
10	q	Tobin's q – ratio of market capitalization plus assets minus equity to assets	Proportion
Absolute variables of derivatives			
11	H_IR_N	Notional value of hedging interest rate derivatives	th. EUR
12	H_IR_FVA	Fair value of hedging interest rate derivatives in assets	th. EUR
13	H_IR_FVL	Fair value of hedging interest rate derivatives in equity	th. EUR
Relative variables of derivatives			
14	H_IR_N_AS	Ratio of notional 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 notionals	Proportion
17	H_FVL	Ratio of fair value in equity for hedging derivatives to notionals	Proportion
18	H_FVA_FVL	Net return on hedging derivatives	Proportion

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

Table 6. Descriptive statistics.

Variable	Number of observations	Mean	Standard error	Min	Max	Unit of measurement
assets	758	151 000	352 000	6	2 590 000	mln. EUR
equity	758	7 653	16 500	0	124 000	mln. EUR
ni	755	741	1 909	-10 200	13 900	mln. EUR
roaa	739	1.3	2.1	-9.0	13.9	%
roae	744	11.2	11.3	-51.7	55.3	%
mp	727	24.6	38.6	0.3	333.0	EUR
return	726	3.1	46.0	-94.8	242.3	%
risk	779	1.34	1.49	0.00	9.96	%
q	670	16.9	22.4	0.0	140.6	%
h_fva_fvl	639	-0.33	2.72	-15.53	20.85	%
t_fva_fvl	608	-0.04	0.72	-5.21	5.06	%
h_fva	627	0.95	1.33	0.00	7.38	%
h_fvl	626	1.33	2.20	0.00	13.61	%
t_fva	598	1.07	1.12	0.00	8.60	%
t_fvl	594	1.12	1.19	0.00	10.61	%
h_n_as	614	14.99	23.86	0.00	190.07	%
t_n_as	567	160.26	224.72	0.00	1227.86	%

Figure 2. Pie charts for breakdown by underlying asset for hedging derivativse.

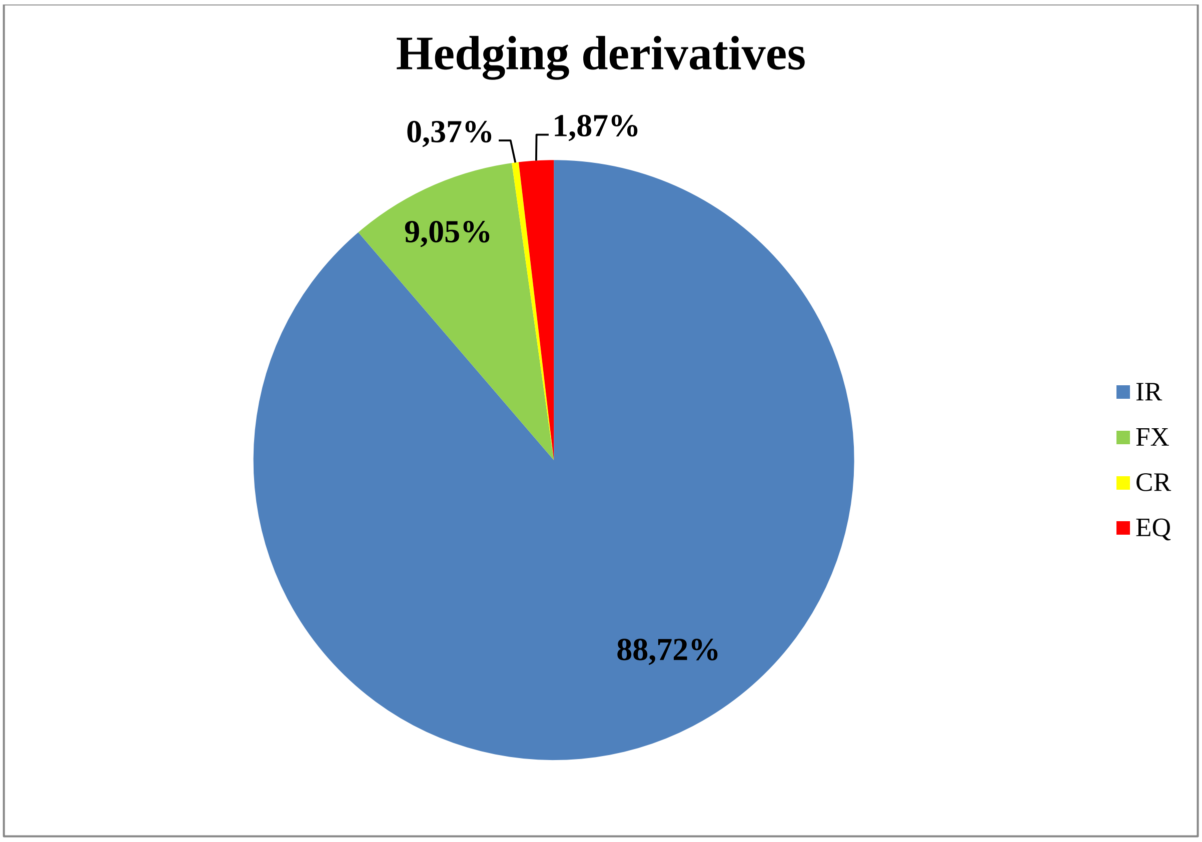
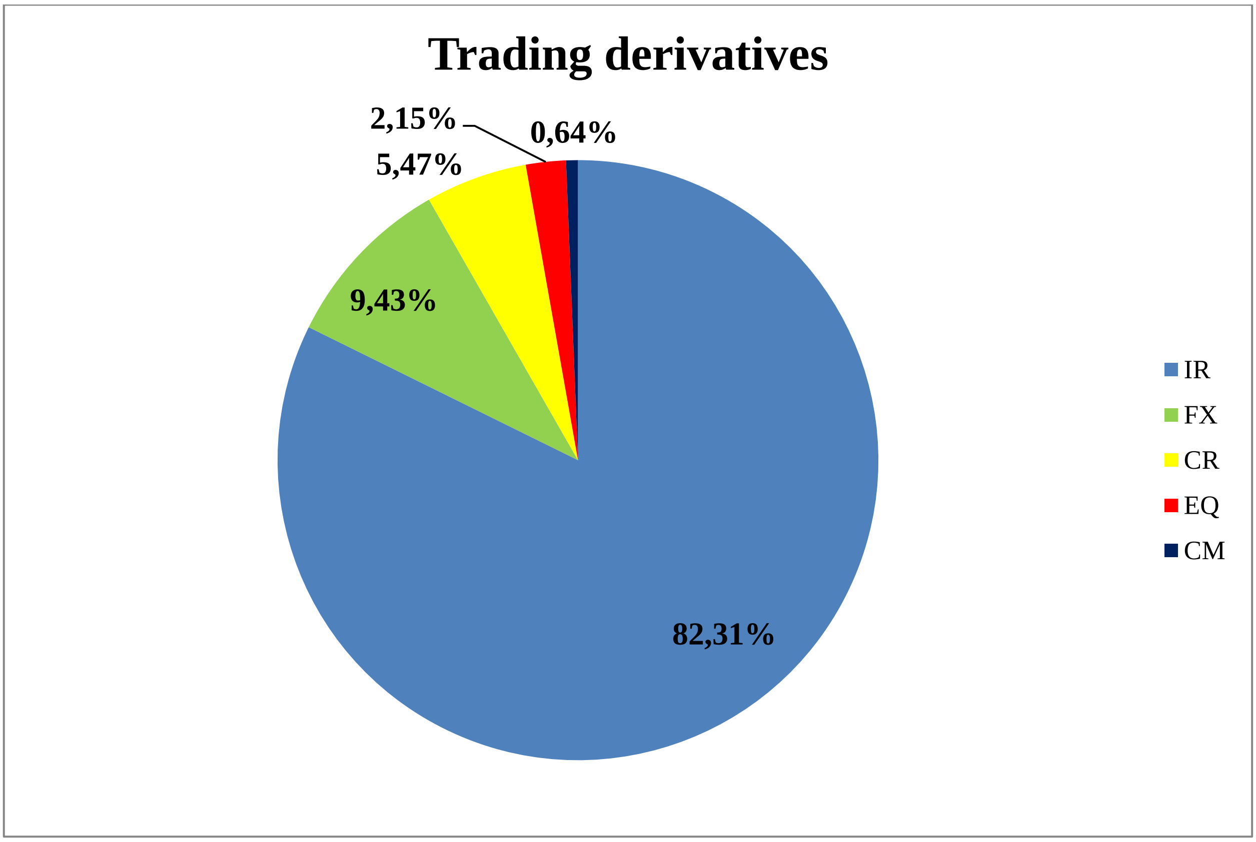


Figure 3. Pie charts for breakdown by underlying asset for trading derivatives.



2. Pairwise correlation between variables.

Table 7. Correlation coefficients.

	roaa	roae	mp	return	risk	q	h_fva_fvl	t_fva_fvl	h_fva	h_fvl	t_fva	t_fvl	h_n_as	t_n_as
roaa	1.00													
roae	**0.45**	1.00												
mp	-0.02	0.10	1.00											
return	0.09	**0.18**	**0.12**	1.00										
risk	**-0.31**	**-0.20**	-0.03	0.03	1.00									
q	**0.71**	**0.20**	-0.07	**0.14**	**-0.21**	1.00								
h_fva_fvl	-0.03	0.03	0.02	**0.11**	-0.03	0.00	1.00							
t_fva_fvl	-0.05	0.02	-0.05	0.03	-0.07	0.03	**0.23**	1.00						
h_fva	**-0.15**	-0.07	-0.10	-0.05	**0.11**	**-0.19**	**0.27**	0.03	1.00					
h_fvl	-0.05	-0.04	-0.10	**-0.21**	0.10	-0.10	**-0.81**	-0.10	**0.78**	1.00				
t_fva	**-0.25**	**-0.11**	-0.05	**-0.23**	**0.13**	**-0.33**	0.00	**0.39**	**0.13**	0.07	1.00			
t_fvl	**-0.27**	**-0.12**	-0.02	**-0.24**	**0.17**	**-0.34**	0.06	**-0.40**	**0.11**	**0.13**	**0.81**	1.00		
h_n_as	0.00	-0.03	0.00	-0.03	-0.02	0.05	**0.17**	0.00	**0.31**	**0.18**	0.02	0.00	1.00	
t_n_as	0.04	0.04	-0.04	0.08	0.05	**-0.27**	0.07	**0.19**	**0.12**	-0.03	**0.13**	0.03	**0.21**	1.00

Note: statistically significant correlations are marked in bold.

3. 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 4. Total notional value of derivatives (in bn. EUR).

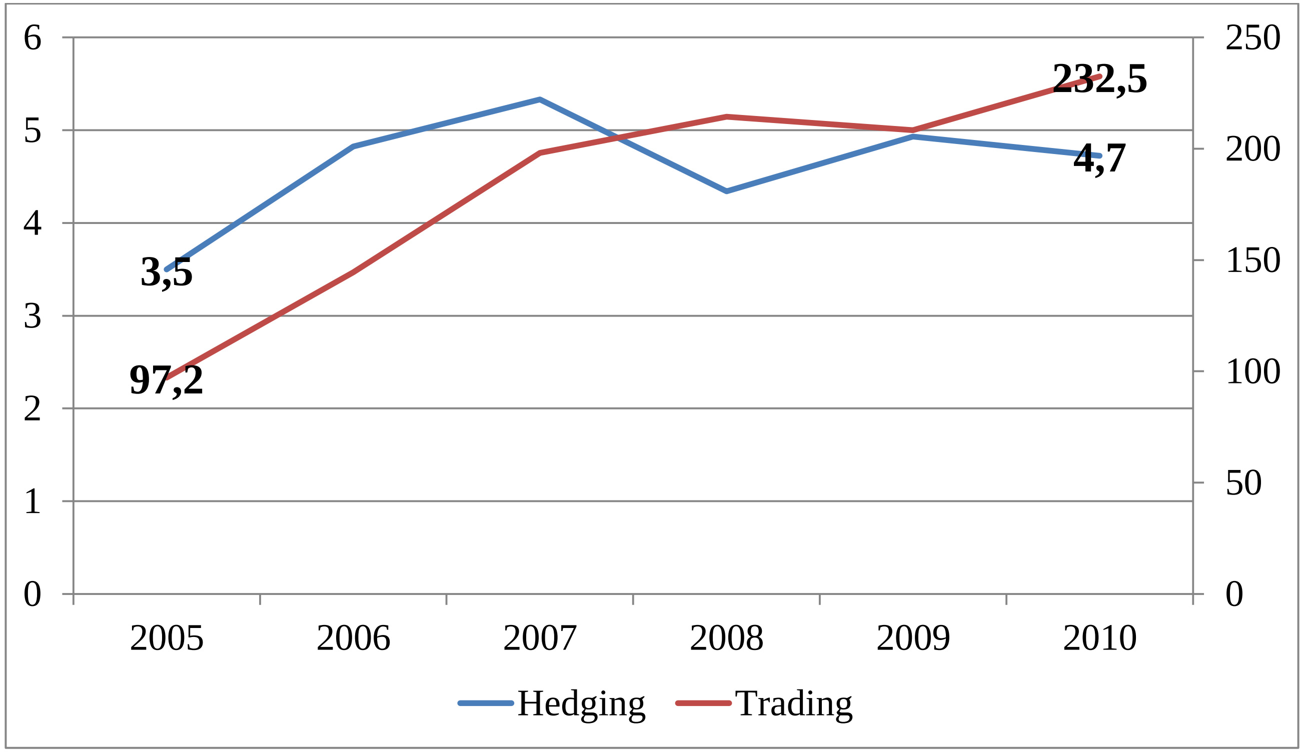
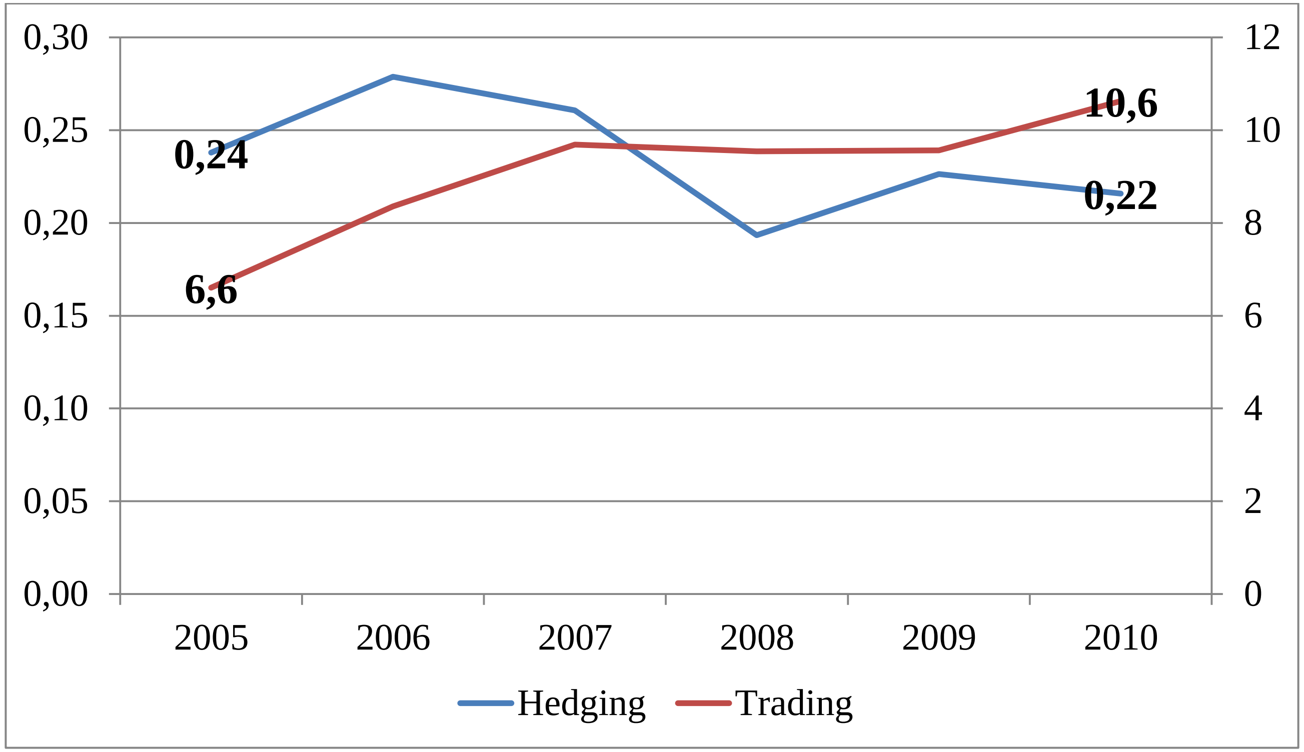


Figure 5. Ratios of the notional values to the assets.



4. Scatter plots of dependent and explanatory variables.

Figure 6. Stock return (in %) and net return on hedging derivatives (in proportions).

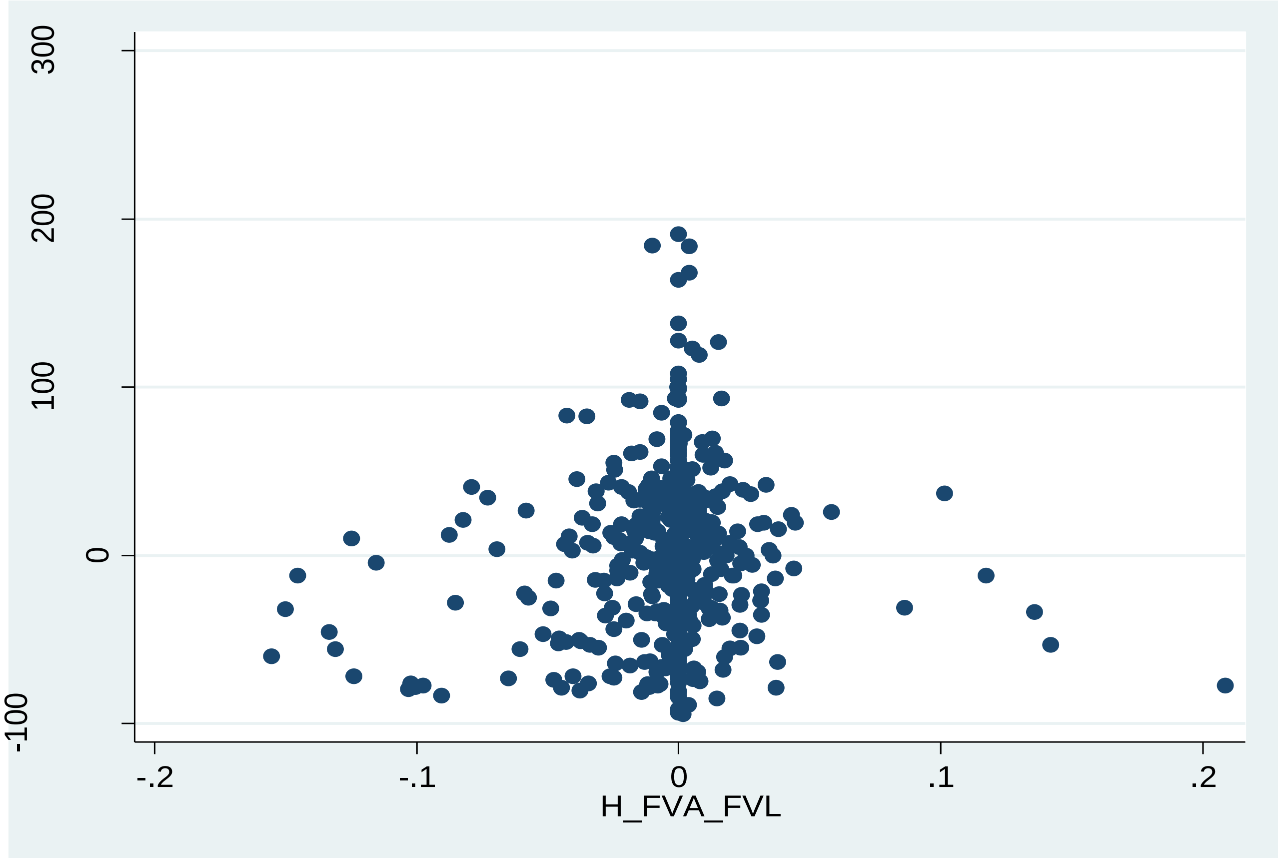


Figure 7. ROAE (in %) and return on trading derivatives (in proportions).

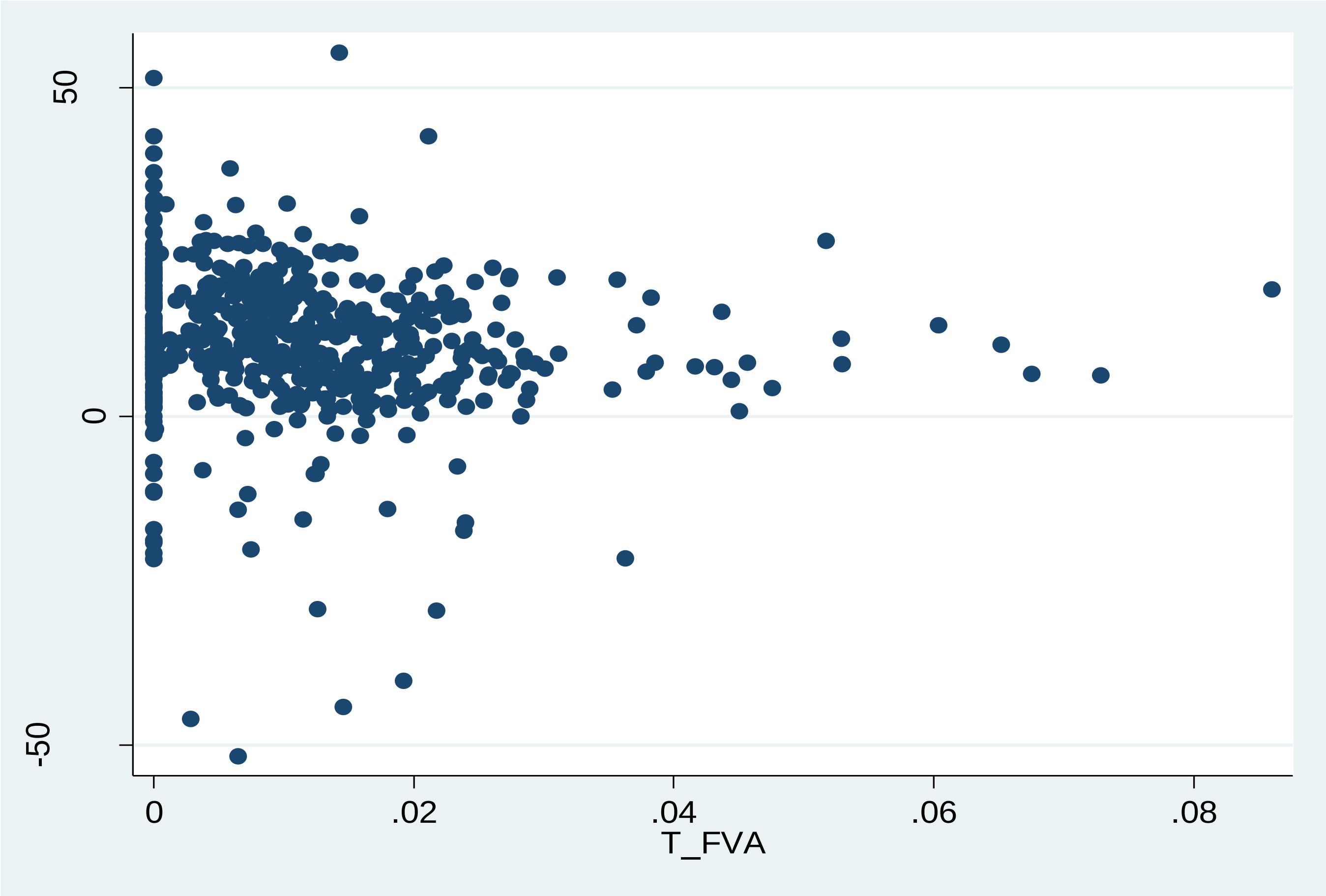


Figure 8. Log of *q* and log of return on trading derivatives.

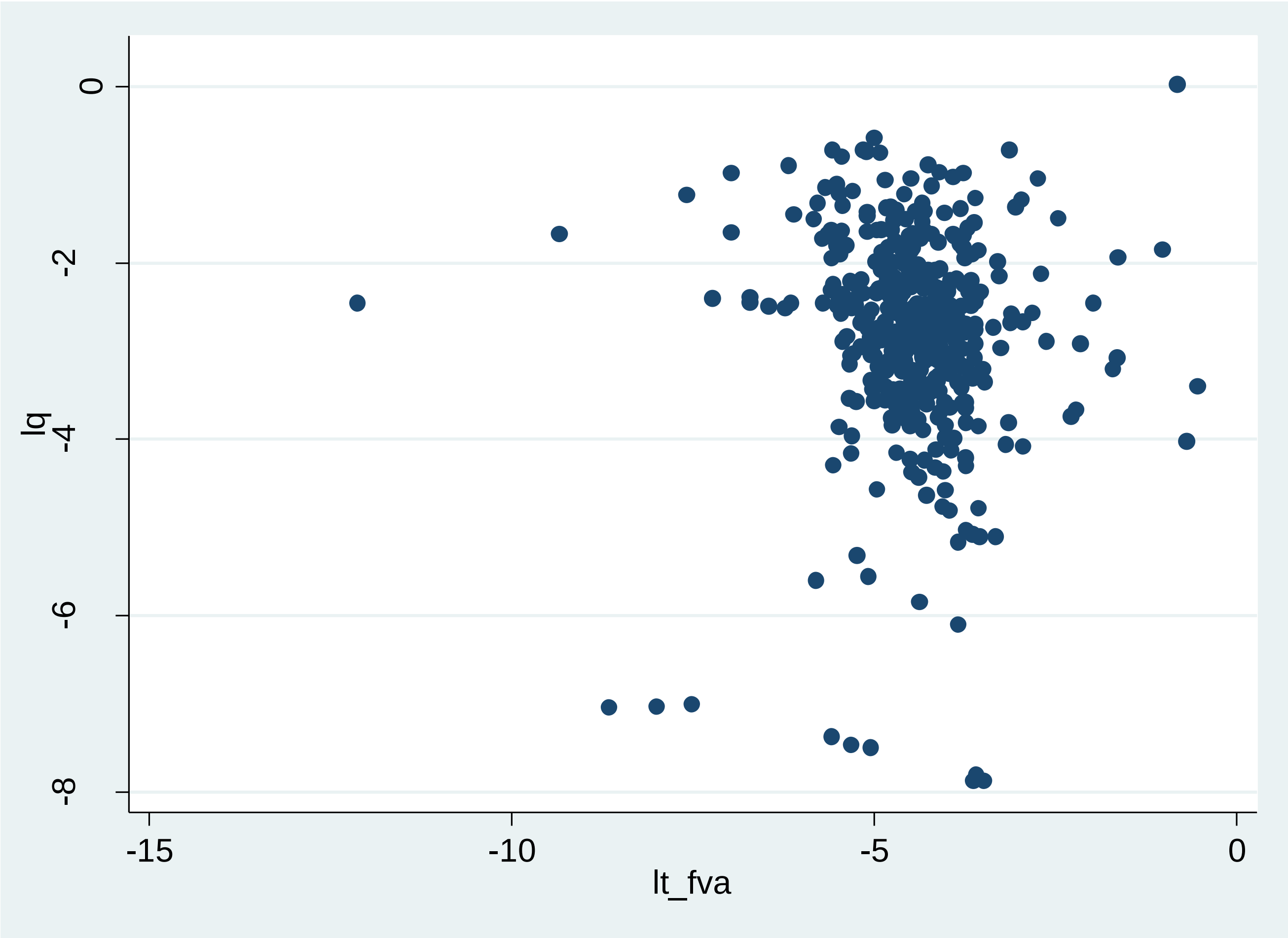
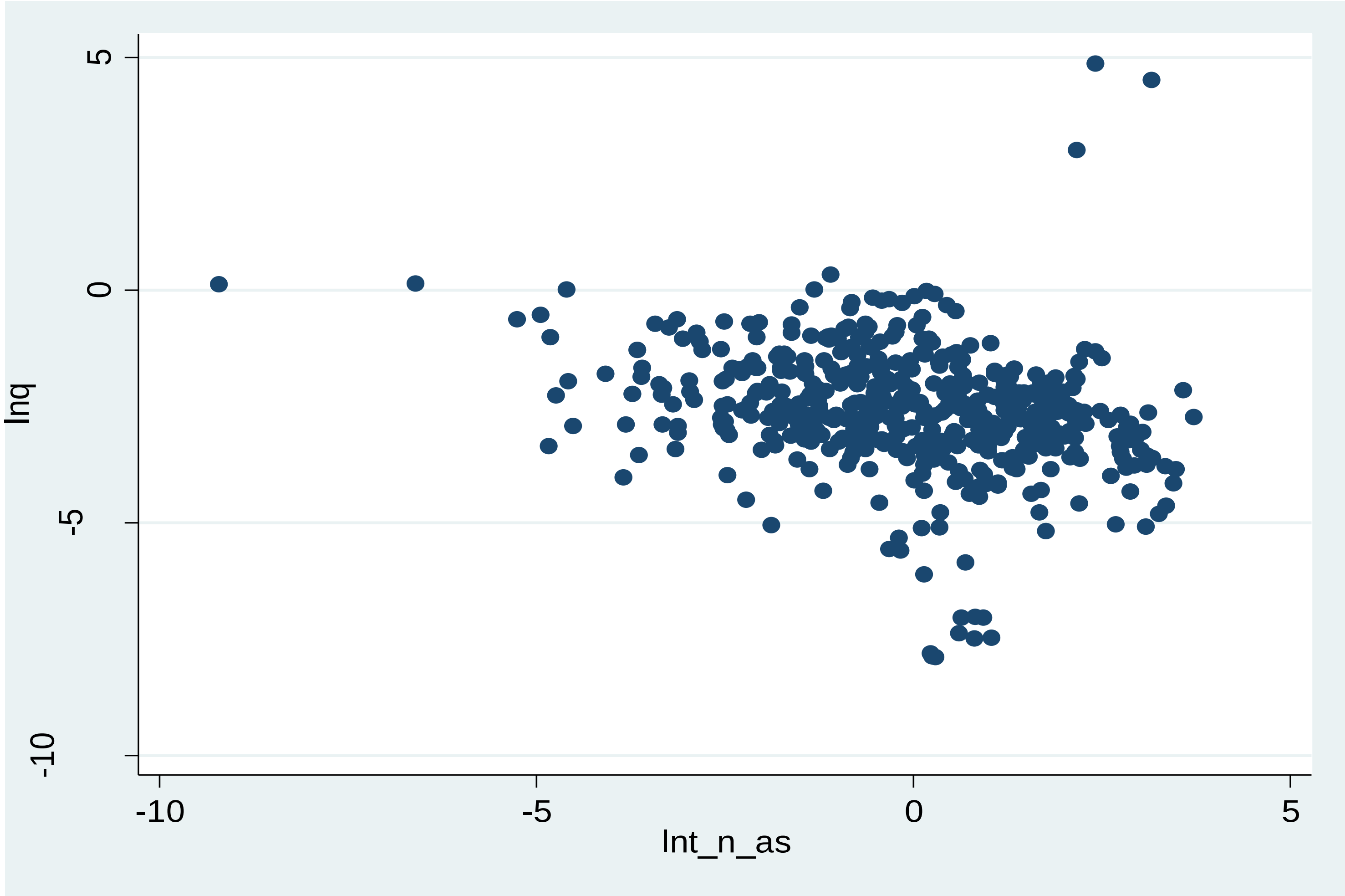


Figure 9. Log of *q* and log of notional of trading derivatives to assets.



5. Results. Estimation of regressions.

Table 8. Selected specifications.

	Модель	1	2	3	4	5	6
	Зависимая переменная	*q*	*q*	*Return*	*Return*	*Risk*	*ROAE*
	Наблюдения	663	663	604	711	464	740
	R2	0.98	0.98	0.47	0.46	0.85	0.56
Доходности	H_FVA_N	-0.45	-	-		-	-
	H_FVL_N	0.73	-	-		-	-
	T_FVA_N		-	-	1.66	-	-
	T_FVL_N		-	-	-1.83	-	-
Чистая доходность	H_FVA_FVL	-	-0.69	85.43	-	-2.54	
	T_FVA_FVL	-			-		-22.08
Годы	2005	1.09	1.02	84.31	0.06	-1.94	9.04
	2006	1.10	1.01	80.62		-1.67	10.64
	2007	1.08	0.99	49.71	-0.32	-1.55	10.63
	2008	0.99	0.92		-0.73		
	2009	1.02	1.05	80.81	0.37		
	2010	1.02	0.95	50.63	-0.24	-1.04	
Регионы	Euro	-0.05	-	-58.59	-	3.18	3.74
	North		-	-48.57	-	3.02	6.30
	South		-	-47.85	-	4.13	10.56
	CEE	0.08	-	-43.10	-	3.61	11.54
	GB		-	-53.48	-	3.70	8.24
Макро	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

	Модель	7	8	9	10	11	12
	Зависимая переменная	*lnq*	*Risk*	*ROAA*	*Risk*	*ROAE*	*ROAA*
	Наблюдения	355	398	390	456	760	739
	R2	0.89	0.67	0.44	0.85	0.56	0.25
Суммарные номиналы	H_N_AS	0.22	-0.26	0.15	-	-	
	T_N_AS	-0.28	0.3	-0.34	-	-	-0.08
Номиналы	H_IR_N_AS	-	-	-		13.24	-
	H_FX_N_AS	-	-	-		-15.37	-
	H_EQ_N_AS	-	-	-	-1.78		-
	H_CR_N_AS	-	-	-		-245.48	-
	T_IR_N_AS	-	-	-	0.07	-0.27	-
	T_FX_N_AS	-	-	-		1.76	-
	T_EQ_N_AS	-	-	-	-0.59	3.63	-
	T_CR_N_AS	-	-	-		-4.90	-
	T_CM_N_AS	-	-	-		20.63	-
Годы	2005	-0.65	0.43	1.70	1.82	7.46	-1.27
	2006	-0.58	0.62	1.54	2.07	9.37	-1.41
	2007	-0.53	0.70	1.70	2.13	10.33	-1.20
	2008	-1.54	2.05	0.52	3.69		-3.09
	2009	-1.25	2.26	0.47	3.57		
	2010	-1.42	1.40	0.63	2.62		-1.91
Регионы	Euro	-		-	-	2.80	-
	North	-		-	-	6.00	-
	South	-		-	-	10.63	-
	CEE	-	0.46	1.03	-	10.61	-
	GB	-	-0.83	1.87	-	6.70	-
Макро	GDP	0.04	-	-	-33.98	NA	96.68
	GDPGR	0.15	-	-		NA	0.18
	INF	0.40	-	-		NA	0.52
White test	p-value	0.00	0.02	0.00	0.28	1.00	0.22
Wooldrige test	p-value	0.03	0.00	0.25	0.18	0.34	0.52

Table 9. Chow's test.

	Specification 3		
	GSIB	NON-GSIB	POOLED
	Return		
H_FVA_FVL	142.88	89.88	85.43
y5	85	85	84
y6	86	80	81
y7	49	50	50
y9	92	80	81
y10	60	50	51
EURO	-65	-58	-59
NORTH	-52	-48	-49
SOUTH	(omitted)	-47	-48
CEE	(omitted)	-43	-43
GB	-71	-50	-53

$F_{11;\,586}$	1.23
p-value	0.74

	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

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

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Nikita Gomayun

B.Sc. student at National Research University Higher School of Economics

E-mail: gafych@gmail.com

Henry Penikas

PhD, Research Fellow at the International Laboratory for of Decision Choice and Analysis; National Research University Higher School of Economics

E-mail: penikas@gmail.com

Yulia Titova

PhD student at University Paris 1 Pantheon-Sorbonne

E-mail: yulia.titova@malix.univ-paris1.fr