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SHORT SALES AT WARSAW STOCK EXCHANGE
PRESENT EXPERIENCE AND SOME SIMULATIONS

Abstract. The paper deals with present regulations and market conditions for short sales at Warsaw Stock Exchange. The history of such transactions on the Polish market is very young – dates since January 1, 2000. The transactions are in use, till now, in a quite limited scale. We present theoretical considerations on estimating profit on short sales. Profit occurs as a result of different attitude of investors towards different financial investments decisions – time horizons, price expectations, utility functions etc. This form of investment creates specific risk – the loss when the expectations do not come true. Possibility of short sales transactions has also consequences for the optimal portfolio model – different portfolio composition as a result. Beside the characteristics of present experience with short sales on the Polish market we present simulation results for portfolio investments allowing for short sales transactions. The results of simulated investment strategy based on historical data have shown great instability of estimates of profit for optimal portfolios with short sales allowed for the model with maximal slope (mean value over standard deviation of the rates of return) and possibility of high losses. Moreover, we stress a great need for procedures helping in an optimal sample choice to estimate/forecast distribution parameters of the rates of return.

Keywords: short sales, portfolio investments.
Keywords: JEL Classification: G11.

1. INTRODUCTION

Let us introduce a simple definition of a short sale: a short sale is generally the sale of a stock an investor does not own – it is borrowed, sold and then bought after some time to be returned to the owner.

Investors who sell short believe the price of the stock will fall. If the price decreases, they can buy the stock at the lower price and make a profit – otherwise they will make a loss. In the theory of investments portfolio, allowance for a short sale means that we do not limit the solution optimal

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weights for portfolio components to non-negative values. The only constraint is that weights sum up to one. Lintner (1965) introduced the first "more realistic"[1] model of short sales in portfolio theory – "the short seller will receive interests at the riskless rate $r*$ on sales price placed in escrow, and he may or may not also receive interest at the same rate on his cash remittance to the lender of the stock. To facilitate the formal analysis, we *assume* that *both interest components* are *always received* by the short seller, and that margin requirements are 100%" (italics in original). Lintner derives the optimum portfolio for the individual investor, assuming unlimited borrowing or lending at the rate $r*$.

There are various consequences of short sales on capital market. Among them we have to mention its regulative influence on prices causing increase of supply on the market and neutralizing speculative bubbles. It can be observed on the world market (cf. Staley 1997) a strong negative correlation between stock market price and the number of open short positions. At the same time it is said that high percentage of short positions generally stimulates the market growth – short sellers have to cover their positions which causes the price rise. Great amount of open short positions can work as an indicator of price overestimation showing the existence of divergence between price and intrinsic value of the stock.

We have to stress that short sales are connected with great risk and such decisions should be supported by former deep fundamental analysis of the firm and valuation of the stock. Usually information about intention of selling is secret – the consequence of public declaration can be dramatic and can even cause the bankruptcy.

Short sales transactions are often used as a part of more complex investment strategies such as price arbitrage strategy with futures contracts on stock. To decide about the strategy one should estimate future value of stock price and compare it with present value of future contract.

The aim of this paper is to show a brief history of short sales in Poland and analyze the return on selected short sales transactions which happened during the period 2.01.2003 – 31.03.2004.

2. SHORT SALES AT WARSAW STOCK EXCHANGE – MAIN REGULATIONS

On December 21 1999 – The Council of Ministers issued the regulations on detailed principles, procedures, terms and conditions of borrowing securities. A security which can be an object of trade in short sales transactions should fulfill both the following conditions:

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[1] This is the opinion of Markowitz (1987).

- the mean turnover calculated on the base of last ten sessions is greater or equal to 1 million PLN;
- capitalization not less than 250 million PLN.

There are two kinds of agreements between participants of the trade:

- the framework borrowing agreement – an agreement determining the procedure, terms and conditions of making securities a subject of borrowing agreements, where the borrower is the brokerage house;
- the framework short sale agreement – an agreement determining the procedure, terms and conditions of making securities a subject of borrowing agreements, where the lender is the brokerage house.

There are two kinds of obligatory collaterals:

- collateral for the borrowing – established by the brokerage house as the borrower, for the claim resulting from a borrowing agreement concluded on the basis of the framework borrowing agreement;
- collateral for short sale – established by the borrower that sells borrowed securities, for the claim resulting from a borrowing agreement concluded on the basis of the framework short sale agreement.

3. SHORT SALES TRANSACTIONS
AT WARSAW STOCK EXCHANGE

We analyzed the data available for short sales transactions, open positions in short sales thanks to the National Deposit of Securities web site for the period 2.01.2003–31.03.2004. In Figure 1 we present data for six firms present on short sales market in the analyzed period. We can observe that investors were active during the period mostly in selling short KGHM, PEKAO and PROKOM shares. In the last 4 months of the sample period we observed an intensification of investors activity in selling short NETIA shares. Transactions on TP SA and PKN ORLEN shares were rare. In general, as it was announced by the National Deposit of Securities, the value of short sales transactions during 2003 was a little bit more than 25 million PLN and the ratio of the short sale transactions value over total value of transactions in shares was from 0.01% in April 2003 to 0.56% in July 2003. We noticed that almost after each session with a great number of short sales transactions there was a significant rise in share prices possible to observe.

As it is generally difficult to analyze efficiency of investments in short sales, we have chosen several session days with large transactions in considered stocks. In our analysis we also took into account possible arbitrage strategies with futures.
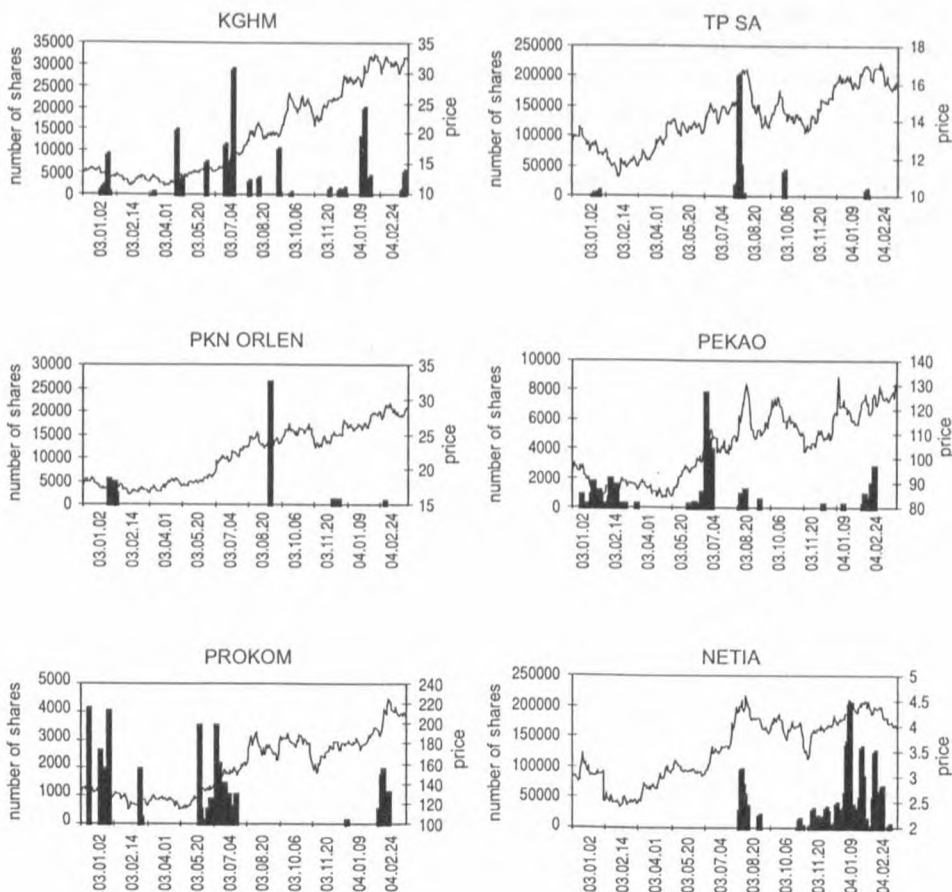
Fig. 1. Volume of short sales transactions and corresponding share prices
– Warsaw Stock Exchange, 2.01.2003–31.03.2004

4. RISK AND PROFIT ON INVESTMENT STRATEGIES WITH SHORT SALES – SOME EXAMPLES

We identified possible sources of profit on investment strategies including short sales transactions:

positive empirical verification of an expected fall of share price at the date of closing the position;

- possibility of a more effective portfolio construction taking into account interdependencies among rates of return on securities;
- possibility of a positive return using arbitrage strategy including futures.

Risk on capital market can be defined as a probability that the return on investment will be below the level the investor does not wish the returns to fall. Roy safety first criterion is to minimize such probability. What sources of risk can be identified when an investor uses short selling strategy? We will distinguish some of them:

• expectations of falling price were not sufficiently supported by the fundamental analysis of the firm;

• misleading inaccurate forecasts of price fall (not adequate price forecasting model, choice of statistical sample and dynamic changes of statistical characteristics, unpredictable events, etc.);

• bad choice of moments for short selling and closing positions;

• a call for stocks before the date in the borrowing agreement.

Now let us analyze some historical cases.

4.1. Selling short PROKOM stocks

Since 24.06.2003, as we can see in Figure 2, we observed a fast increase in the number of open positions in short sales from 2700 shares to 17 000 on 1.08.2003. On 19.09.2003 15 100 positions were closed. Was there a high expectation of price fall?
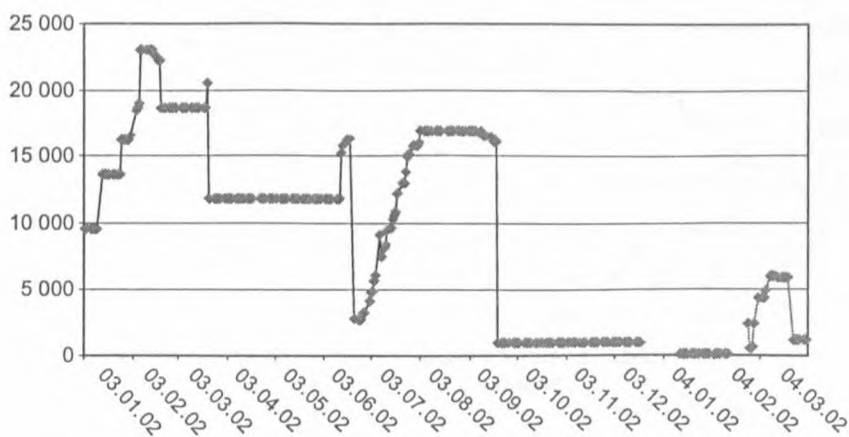

Fig. 2. Number of open positions in short sales of PROKOM shares during 2.01.2003–31.03.2004

Mean short selling price in the period 24.06 – 1.08.2003 (29 sessions) calculated as the weighted average was 146.24 PLN. Total number of shares sold short during that period was 19 570. Total income from short selling of 15 100 (this is the number of positions closed on 19.09.2003) shares was equal to 2 208 168.60 PLN. The share price on the closing date was 174.50 PLN which means that the total cost of closing short positions was

2 634 950 PLN. In consequence we have observed a total loss from short
selling equal to 426 781.40 PLN, that is about 28.26 PLN per share. Choosing
for instance 1.10.2003 as a closing position date would bring a loss about
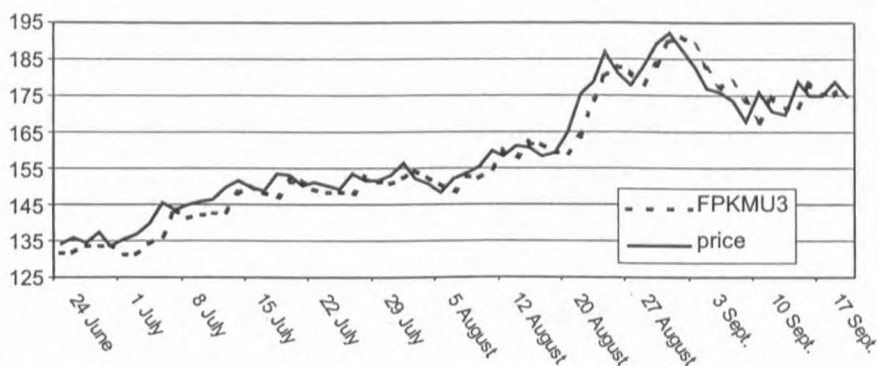17.26 PLN per share. We did not analyze transaction costs – the loss was
even higher.

Fig. 3. Stock prices and prices of futures FPKMU3 of PROKOM during 24.06.2003–19.09.2003
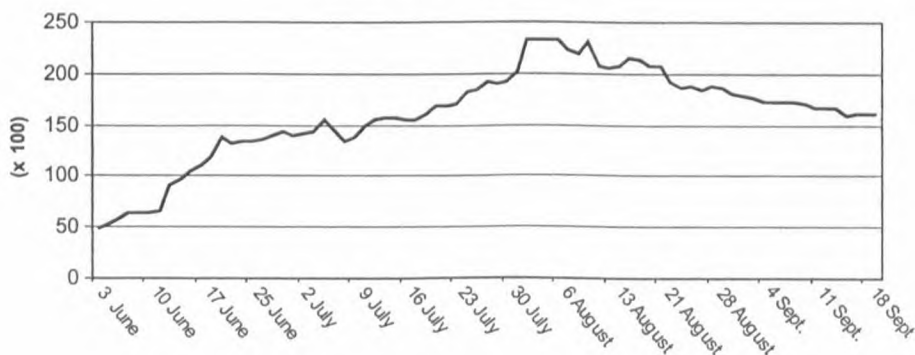(exercise date: 19.09.2003)

Fig. 4. Volume of futures FPKMU3 during 3.06.2003–19.09.2003
(exercise date: 19.09.2003)

We present in Figure 3 stock prices and prices of futures contracts
FPKMU3 (with exercise date 19.09.2003) – the only contracts traded between
24.06 – 1.08.2003 on PROKOM shares. Figure 4 illustrates volume of
contracts possessed by investors during he period when contracts were on
the market, 3.06. – 19.09.2003. The date 1.08.2003 corresponds to the maximal
number of possessed contracts – 23 300. On the exercise date 19.09.2003
the number of contracts was 16 100. It means that 15 100 futures contracts
could have been parts of arbitrage strategies with short sales. Analyzing
a return on possible arbitrage strategy including futures we have found that

mean value of considered futures contracts was 138.27 PLN. Multiplying the mean price of contract by 15 100 gives total cost of 2 087 803.26 PLN. Comparing the cost with total income from short sales results in 120 365.34 PLN of profit, almost 8 PLN per share[2].

An obvious conclusion follows: on the rising stock market we can make profits by employing arbitrage strategy combining short sales with futures contracts.

4.2. Selling Short TP SA Stocks

200 thousands of stocks were sold short on 21.08.2003. The market stock price was 15.75 PLN. Positions were closed on 1.09.2003; the stock price was 16.75 PLN. Analyzing a simple strategy of short sale we should conclude that a loss of 200 000 PLN was observed. Later on 20.09.2003 the stock price fell to the level 13.75 PLN. Looking at prices of futures contracts traded in August we found FTPSU3 with exercise date 19.09.2003 and FTPSZ3 with exercise date 19.12.2003 with mean price about 15.39 PLN. Analyzing profit on possible arbitrage strategy with futures, assuming that investors had to sell possessed futures contracts earlier than on the exercise date – it was observed that 225 000 futures FTPSU3 contracts were sold on 29.08.2003 at the closing price 16.75 PLN. We conclude that investors earned profits, which can be calculated (omitting time value) as follows:

total income on short sales (200 000 · 15.75 PLN)	3 150 000 PLN –
cost of futures contracts (200 000 · 15.39 PLN)	3 078 000 PLN +
income from selling futures contracts (200 000 · 16.75 PLN)	3 350 000 PLN –
cost of buying stocks on the market (200 000 · 16.75 PLN)	3 350 000 PLN
profit =	72 000 PLN.

Concluding, it was another example of profitable investment strategy.

5. PORTFOLIO INVESTMENTS WITH AND WITHOUT SHORT SALES ALLOWED AT THE WSE

Let us introduce the following notations used in formulating optimal portfolio models:
- $x = [x_1, x_2, ..., x_n]$ – a vector of fractions of the portfolio funds invested in n assets;

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[2] We did not take into account the value of time in our calculations – the profit is a little bit lower.

- $R_p = \sum\limits_{i=1}^{n} x_i R_i$ — a portfolio rate of return, R_i — rates of return on individual assets;
- Σ — a covariance matrix of n rates of return;
- $\sigma_p^2 = x^T \Sigma x$ — a portfolio variance.

We employed two kinds of optimal portfolio models: minimum portfolio variance model and model with maximal slope — where slope was defined as a ratio of portfolio rate of return and portfolio standard deviation. The only constraint was sum of fractions equal to one and for models without short sales we required nonnegativity of fractions. The models are presented in Table 1.

Table 1. Optimal portfolio models

Specification	Short sales not allowed	Short sales allowed
Min variance models	$\min \sigma_p^2$ ST $\sum\limits_{i=1}^{n} x_i = 1$ $x_i \geqslant 0 \quad i = 1, 2, ..., n$	$\min \sigma_p^2$ ST $\sum\limits_{i=1}^{n} x_i = 1$
Max slope models	$\max \dfrac{R_p}{\sigma_p}$ ST $\sum\limits_{u=1}^{n} x_i = 1$ $x_i \geqslant 0 \quad i = 1, 2, ..., n$	$\max \dfrac{R_p}{\sigma_p}$ ST $\sum\limits_{i=1}^{n} x_i = 1$

The aim of the historical simulation experiment was to check the dynamic behavior of optimal solutions of the models. We based simulations on empirical data of stock prices for 19 firms included in WIG20 index. We distinguished 8 sample periods:

- January–July 2003;
- February–August 2003;
- March–September 2003;
- April–October 2003;

- May–November 2003;
- Juni–December 2003;
- July–January 2004;
- August 2003, February 2004.

Figure 5 presents optimal portfolio frontiers for models with and without short sales as well as stocks of individual firms which were taken into account using data for the last sample period. It illustrates that solutions for models allowing for short sales dominate the solutions for models without short sales. The result is very promising for short sales applications in capital investments.

Figures 6 and 7 present dynamic solutions for models with and without short sales for minimum variance and maximal slope respectively.
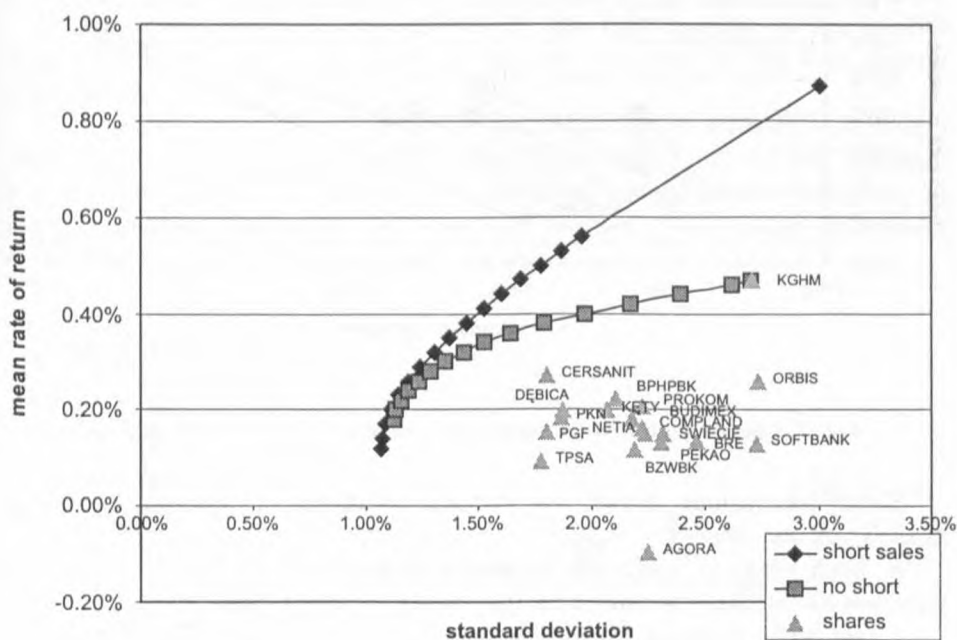
Fig. 5. Optimal portfolio frontiers for models with and without short sales
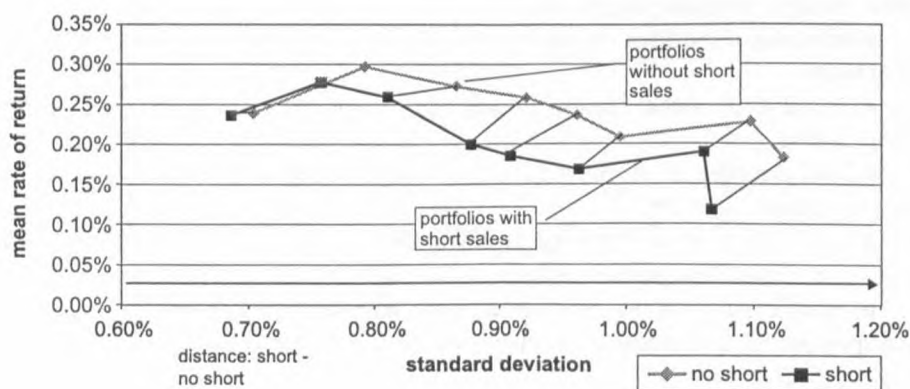(August 2003–February 2004)

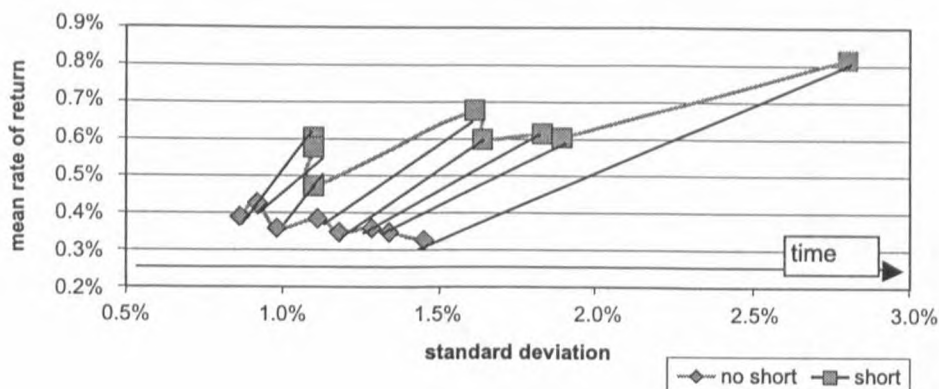Fig. 6. Optimal portfolios for minimum variance model for 8 sample periods

Fig. 7. Optimal portfolios for maximum slope models for 8 sample periods

Some conclusions drawn for optimal solutions of minimum variance models are as follows:

• both kinds of models – with and without short sales – have shown that results are very sensitive to the choice of the sample period;

• we have observed increasing tendency of portfolio risk estimates;

• faster increase of risk estimates characterizes portfolios without short sales;

• minimum variance portfolios with short sales always presented lower standard deviations and at the same time lower mean return in comparison with models without short sales.

Analyzing dynamics of optimal solutions for maximal slope models we conclude:

• results of optimization much differ for models with and without short sales;

• characteristics of portfolios with short sales occurred more sensitive to the sample choice;

• portfolios with short sales have shown a tendency of rising return with corresponding higher risk;

• portfolios without short sales were also sensitive to the sample choice but presented a tendency to diminish return with corresponding growing risk in time;

• the distance between optimal portfolios with and without short sales is growing.

We conducted also a simulation of profits on portfolio investments. The steps of the calculation procedure were the following:

• calculate estimates of standard deviations and covariances among securities;

- calculate optimal proportions of investments on individual securities;
- simulate "optimal" investment on the first session of the month following the sample period and closing the position on the first session next month.

The experiment revealed the weakness of such naive strategy – it is very risky. For minimum variance models more losses were observed for "optimal" portfolios without short sales. For maximum slope models estimates of profit were very unstable especially for "optimal" portfolios with short sales. The results are presented in Figures 8 and 9.
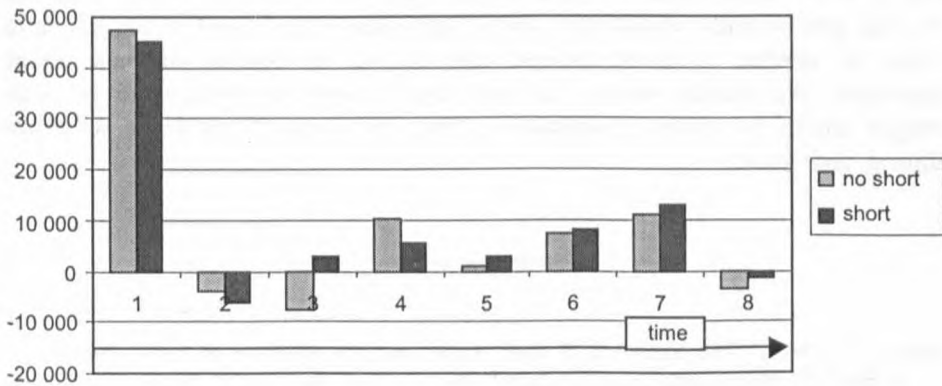

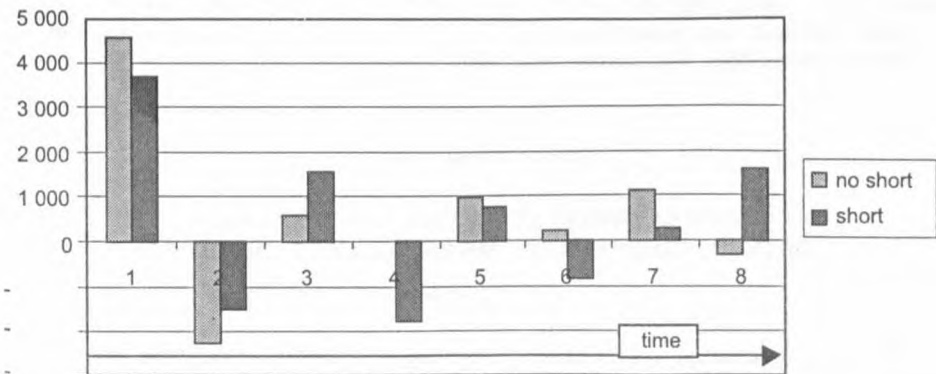Fig. 8. Profits on min variance models in 8 sample periods

Fig. 9. Profits on max slope models for 8 sample periods

6. FINAL REMARKS

It was difficult to notice positive returns on short selling individual securities at WSE during the analyzed period January 2003 – March 2004. Nevertheless, we have shown the efficiency of some arbitrage strategies with futures contracts which gave high profits to investors. The market was rising in general in the analyzed period – on the rising market combining short sales with futures contracts can make profits. Transactions on short selling are still rare – average number of securities with open short position was 8, while more than 30 were allowed for short selling. In our analysis we did not include collaterals and commissions paid and value of time which is needed in more precise calculations of profits on investment strategies. We should stress the need for procedures helping in optimal sample choice to estimate/forecast returns, deviations, covariance structure among securities.

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Iwona Konarzewska

KRÓTKA SPRZEDAŻ NA GPW W WARSZAWIE: DOTYCHCZASOWE DOŚWIADCZENIA, KILKA SYMULACJI

(Streszczenie)

W artykule omawiamy dotychczasowe uregulowania i warunki funkcjonowania krótkiej sprzedaży na GPW w Warszawie. Historia takich transakcji na rynku polskim jest krótka, datuje się od 1.01.2000 r. i stosowane są one, na razie, w dość ograniczonym zakresie. Przedstawimy teoretyczne rozważania na temat szacowania zysków ze stosowania krótkiej sprzedaży. Zyski pojawiają się tu w wyniku różnego podejścia inwestorów do inwestycji w papiery wartościowe – różne horyzonty inwestowania, inne oczekiwania odnośnie do kształtowania się kursów. Z tą formą inwestowania wiąże się także specyficzne ryzyko – strata w przypadku gdy oczekiwania się nie spełnią. Możliwość krótkiej sprzedaży papierów wartościowych ma swoje konsekwencje dla modelu optymalnego portfela inwestycji finansowych – prowadzi do

wyboru innego składu portfela. Analizujemy również portfele konstruowane z wykorzystaniem kontraktów futures. Obok charakterystyki dotychczasowych doświadczeń z tą formą inwestowania na rynku polskim przedstawiono wyniki symulacji zysków z inwestycji portfelowych z uwzględnieniem krótkiej sprzedaży. Pokazały one dużą niestabilność ocen zysków z optymalnych portfeli inwestycyjnych z wykorzystaniem krótkiej sprzedaży i możliwość występowania dużych strat. Podkreślamy ogromne znaczenie algorytmów optymalnego doboru próby dla estymacji i prognozowania parametrów rozkładu stóp zwrotu.