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Contents

Introduction

One of the fastest growing areas in the economic sciences is broadly defined area of finance, with particular emphasis on the financial markets, financial institutions and risk management. Real world challenges stimulate the development of new theories and methods. A large part of the theoretical research concerns the analysis of the risk of not only economic entities, but also households.

The first Wrocław Conference in Finance WROFIN was held in Wrocław between 22nd and 24th of September 2015. The participants of the conference were the leading representatives of academia, practitioners at corporate finance, financial and insurance markets. The conference is a continuation of the two long-standing conferences: INVEST (Financial Investments and Insurance) and ZAFIN (Financial Management – Theory and Practice).

The Conference constitutes a vibrant forum for presenting scientific ideas and results of new research in the areas of investment theory, financial markets, banking, corporate finance, insurance and risk management. Much emphasis is put on practical issues within the fields of finance and insurance. The conference was organized by Finance Management Institute of the Wrocław University of Economics. Scientific Committee of the conference consisted of prof. Diarmuid Bradley, prof. dr hab. Jan Czekaj, prof. dr hab. Andrzej Gospodarowicz, prof. dr hab. Krzysztof Jajuga, prof. dr hab. Adam Kopiński, prof. dr. Hermann Locarek-Junge, prof. dr hab. Monika Marcinkowska, prof. dr hab. Paweł Miłobędzki, prof. dr hab. Jan Monkiewicz, prof. dr Lucjan T. Orłowski, prof. dr hab. Stanisław Owsiak, prof. dr hab. Wanda Ronka-Chmielowiec, prof. dr hab. Jerzy Różański, prof. dr hab. Andrzej Sławiński, dr hab. Tomasz Słoński, prof. Karsten Staehr, prof. dr hab. Jerzy Węcławski, prof. dr hab. Małgorzata Zaleska and prof. dr hab. Dariusz Zarzecki. The Committee on Financial Sciences of Polish Academy of Sciences held the patronage of content and the Rector of the University of Economics in Wroclaw, Prof. Andrzej Gospodarowicz, held the honorary patronage.

The conference was attended by about 120 persons representing the academic, financial and insurance sector, including several people from abroad. During the conference 45 papers on finance and insurance, all in English, were presented. There were also 26 posters.

This publication contains 27 articles. They are listed in alphabetical order. The editors of the book on behalf of the authors and themselves express their deep gratitude to the reviewers of articles – Professors: Jacek Batóg, Joanna Bruzda, Katarzyna Byrka-Kita, Jerzy Dzieża, Teresa Famulska, Piotr Fiszeder, Jerzy Gajdka, Marek Gruszczyński, Magdalena Jerzemowska, Jarosław Kubiak, Tadeusz Kufel, Jacek Li-

sowski, Sebastian Majewski, Agnieszka Majewska, Monika Marcinkowska, Paweł Miłobędzki, Paweł Niedziółka, Tomasz Panek, Mateusz Pipień, Izabela Pruchnicka-Grabias, Wiesława Przybylska-Kapuścińska, Jan Sobiech, Jadwiga Suchecka, Włodzimierz Szkutnik, Mirosław Szreder, Małgorzata Tarczyńska-Łuniewska, Waldemar Tarczyński, Tadeusz Trzaskalik, Tomasz Wiśniewski, Ryszard Węgrzyn, Anna Zamojska, Piotr Zielonka – for comments, which helped to give the publication a better shape.

Wanda Ronka-Chmielowiec, Krzysztof Jajuga

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THE UNIT ROOT TEST FOR COLLECTIBLE COINS' MARKET AS A PREELIMINARY TO THE ANALYSIS OF EFFICIENCY OF ON-LINE AUCTIONS IN POLAND

TEST PIERWIASTKA JEDNOSTKOWEGO DLA MONET KOLEKCJONERSKICH JAKO WSTĘP DO BADANIA EFEKTYWNOŚCI AUKCJI INTERNETOWYCH W POLSCE

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Abstract: Traditional auctions were characterized by geographical fragmentation and limited access to information. In that meaning they were considered as inefficient markets. Nowadays, online auctions become more and more popular. There are millions of participants, who buy different kinds of products every day. Information about products and historical prices is available to them thanks to new technology and wide access to the Internet. The question about the efficiency of auctions comes back. The main aim of this work is to check if online auction markets could still be inefficient and if it could be possible to gain abnormal profit. In particular, the analysis of about 300 auctions of an old coin is carried. Data comes from the biggest online auction service in Poland – Allegro.pl. The unit root test for stationarity for prices is performed and the liquidity is shortly examined. The results indicate that coin returns are stationary and their changes cannot be explained by a random walk.

Keywords: on-line auction, efficiency, collectible.

Streszczenie: Tradycyjne aukcje charakteryzowały się fragmentacją geograficzną i ograniczonym dostępem do informacji, przez co uważane były za niefektywne. Obecnie aukcje internetowe stają się coraz popularniejsze. Użytkownicy Internetu codziennie kupują dobra poprzez udział w aukcjach. Informacja o produktach i ich przeszłe ceny są szeroko dostępne dzięki nowym technologiom i dostępowi do Internetu. Problem efektywności aukcji powraca. Głównym celem tej pracy jest próba odpowiedzenia na pytanie, czy w tych warunkach aukcje internetowe mogą wciąż być traktowane jako nieefektywne i czy wobec tego możliwe byłoby osiąganie na nich ponad przeciętnych zysków. W pracy przeprowadzona jest analiza ponad 300 aukcji wybranej monety z serwisu Allegro.pl. Test pojedynczego pierwiastka dotyczący stacjonarności jest przeprowadzony i krótko zbadana jest płynność aukcji. Uzyskane rezultaty wskazują, że aukcje starych monet wydają się cechować stacjonarnością i nie można mówić w ich przypadku o błądzeniu losowym.

Słowa kluczowe: aukcja internetowa, efektywność, przedmiot kolekcjonerski.

1. Introduction

Nowadays, on-line shopping becomes more and more popular in the world of the Internet and the development of information technology. On-line auctions are one of the effective methods of purchase with the use of the Internet. The way of acting is similar to classical auctions. A seller puts up an item for auction and a person, who offers the biggest amount of money, wins it. Sometimes, it could be even a very valuable item – for example, it is said that the most precious thing sold by one of the most popular on-line auction services (Ebay) was a big yacht with ten levels and its own theatre hall and a helicopter landing pad. It was bought for 168 million dollars by a Russian Croesus Roman Abramowicz in 2006.

Ebay.com is the biggest on-line auction service in the world. It was established in 1995 and it works in 20 countries. More than 10 million items are sold per day and there are more than 120 million users all over the world. In Poland there is a very popular service Allegro.pl. Of course, individually participants usually do not possess a significant amount of money, but commonly they pose a very important market. For example, more than 40 million items are sold annually in Poland by service Allegro.pl. on-line auctions are an important part of customer2customer market.

As on-line auction market becomes common for a great number of people thanks to new technologies and the range of the Internet, the question about the efficiency of auctions comes back [Kauffman 2009]. Traditional auctions were characterized by geographical fragmentation and limited access to information. In that meaning they were considered inefficient markets. There was also a possibility that uninformed bidder would pay too much [Thaler 1992]. The growth of the flow and availability of information and wide access to the Internet in the world could change the level of inefficiency.

The efficiency was examined by Song [Song, Baker 2007], Vragov [2005] or Kuśmierczyk [2011], but in different meaning (rather operational). There is also a work examining the efficiency by verifying calendar effects on the on-line auctions [Sroczyńska- Baron 2015]. The main aim of this work is to conduct the preliminary examinations to analyse the efficiency of the online auction market in Poland, similarly to the hypothesis of the efficiency of stock exchange market.

The problem is whether prices of on-line auctions are based on all available information. So, in other words, the aim of the work is the attempt to answer the question: is it possible to obtain abnormal returns from on-line auction market? The liquidity of Polish on-line auctions is also examined. It is examined with the use of similar tools as during stock market prices analysis [Wood 2008; Ashenfelter, Graddy 2003]. Data coming from the biggest online auction service in Poland – Allegro.pl is used during the examination. The market of old coins' collection is analysed.

2. On-line auction service Allegro.pl

Service Allegro.pl was established in 1999 by Arjan Bakker and Tomasz Dudziak [Ocetkiewicz 2012]. Firstly, it was addressed only to hobbyists. Nobody expected it to gain such popularity, particularly without any advertising. The number of users exceeded one million in 2003. The number of users is still increasing and concurrently a lot of changes are done to streamline the purchase and sale. The new artwork, on-line payment and hire purchase were introduced. Mobile and iPhone version appeared after 2008. Nowadays, it is the biggest on-line auction service in Poland. More than 50% of Internet users visit the service at least once a month and 40 millions of items are sold per year.

Service Allegro.pl is the most popular one, service Świstak.pl takes a second place and Ebay.pl takes a third place. This is a Polish department of American service Ebay.com (the first place in the world). It was established in 2005 and, at first, putting up an auction was free. In 2008 the formula was changed (payment was implemented) and 80% of auctions were withdrawn. There were 1,2mln users of Ebay.pl in 2012 in comparison to 10mln users of Allegro.pl in that year.

Everybody can sell and buy items by service 7 days in a week and 24 hours a day. There are two options of sale: auction and formula „Buy now". Items are divided into 9 categories. The user must be registered to have full capabilities [Ogórek 2003; Kyciak et al. 2007]. There are five different kinds of auctions:

- Auction without a minimum price,
- Auction with a minimum price,
- Multi-item auction,
- Auction with the option „Buy now",
- Auction „Buy now".

There are also many functions to improve the security of transactions, for example:

- Comments system (users rate the transaction: the time of sending, cost of sending, compatibility between description of the subject and the real condition, contact with the seller),
- Buyer security programme (service gives back up to 500zł if there is no compatibility between the description of the item and the real condition or if the buyer does not receive the item),
- Full activation (the user is obliged to confirm telephone/address data).

The auctions on the Allegro.pl service are also English [Watson 2004; Kuśmierczyk 2010]. It is possible to use classical tools of the theory of games [Sroczyńska-Baron 2009], grey systems [Barczak 2013] or other methods like neuron networks [Dyduch 2011] to make an analysis of this kind of auctions. In this work the tools proper for the analysis of stock exchange market are used [Dickey, Fuller 1979].

3. Efficiency of on-line auction market

Efficiency of the markets means that the market price is based on all information available on the market. There are three kinds of efficiency at the stock exchange [Haugen 1996]:

- weak-form efficiency – share prices should contain all information represented by historical prices,
- semi strong-form efficiency – share prices should contain all public information (not only historical prices, but for example financial reports of companies),
- strong-form efficiency – share prices should contain all public and non-public information.

There is a lot of science works verifying the hypothesis connected with the capital markets [Buczek 2005]. In this work the hypothesis concerning on-line auction market in Poland is discussed. The problem is whether the price during on-line auction represents all of the historical information and if it is possible to estimate future price on the basis of historical information. So, in other words, is it possible to gain an abnormal return thanks to on-line auctions in Poland? In this way, the weak–form efficiency is examined.

Traditional auctions were rather inefficient. Nowadays, the problem of geographically fragmentary auctions disappeared when one deals with on-line auctions. It is estimated by the Central Statistical Office that 77% of household in Poland have at least one computer and 74% have Internet access [CSO 2014]. What is also important, more than half (55%) of users of the Internet use it to buy items. In this way the problem of efficiency may come back.

Another problem relates to liquidity. At the stock exchange, the higher the liquidity, the greater the probability that informed investors will drive the price to an efficient level. Informed investor bids up an undervalued asset and bids down an overvalued one with the use of short selling. There is no short selling at on-line auctions. So, it is considered that liquidity has an opposite effect in this situation. The higher the liquidity, the greater the probability of two uniformed bidders meeting each other, which will raise the price of the item [Kauffman et al. 2009].

4. Methodology

On-line auction market efficiency will be verified by unit root test with the use of methodology shown by Kauffman [Kauffman et al. 2009]. Let $P_{i,t}$ be the indexed price for the item i at the moment t. Then, it will be calculated with the following formula:

$$P_{i,t} = \frac{price_{i,t}}{price_{i,1}},$$

where: $price_{i,t}$ – the final selling price for the item i at the moment t, $price_{i,1}$ – the average price for the item i at the first moment.

Next, let $R_{i,t}$ be the percentage return on the item i at the moment t. Then, it will be calculated with the following formula:

$$R_{i,t} = \frac{P_{i,t}}{P_{i,t-1}} - 1.$$

Prices on an efficient market should follow a random walk [Malkiel 2003]. Next step is to consider the following autoregression function:

$$R_{i,t} = \alpha_i + \beta_i R_{i,t-1} + \varepsilon_{i,t},$$

where β_i can be calculated as:

$$\beta_i = \frac{\operatorname{cov}\left(R_{i,t}, R_{i,t-1}\right)}{\sigma^2\left(R_{i,t-1}\right)}.$$

The parameter β_i gives the information, whether the returns of the item i are predictable with the use of previous returns. Random walk occurs when β_i equals 1. In this situation, the estimate of $R_{i,t}$ is a drift parameter and the return of the previous period. There is no chance to say if the return of this period will outperform or underperform the expectation. In this work as the test for random walk is used to test the efficiency of on-line auction market and the unit root test (Dickey–Fuller) is implemented.

Liquidity is the ability to sell an item rapidly, so in this research it is a ratio: bidder-to-auction. High number of bidders allows to sell the item relatively quickly and at a good price.

5. Data

Data used in the research comes from the biggest Polish on-line auction service Allegro.pl. The collectible market was chosen and examined. An old Polish coin was chosen for the examination. It is a silver coin „Trojak". King Zygmunt Stary introduced the coin to the market in 1528. The coin was produced till Stanisław Poniatowski's kingdom times [Walewski 1884]. It was used even after the partition of Poland as a popular coin. Nowadays, there is rather no possibility to count and catalogue all coins (for example there are 158 pages describing 887 kinds of this coin in catalogue of Kamiński and Kurpiewski [1990]). It is a popular and not very valuable coin.

In the research there is more than 300 auctions examined, from 1.06.2015 till 10.07.2015 at the Allegro.pl service. The coin „Trojak" of the king Zygmunt III

Waza in acceptable condition is examined to gain uniformity. All very rare or in super condition coins were rejected (there were a few really valuable coins – the most expensive one was sold by 4527 zł at that time). The auctions are divided into two groups: 1 – 21.06.2015 and 22.06 – 10.07.2015 (observations from May were used to control coins' prices). The division is connected with the time of holiday.

6. The run of research

The results of auctions for "Trojak" from 1.06 – 10.07.2015 are presented in Table 1.

Table 1. Data collected from the auctions of "Trojak" between 1.06.2015 and 10.07.2015 at Allegro.pl service.

Period	Number of auctions	Number of auctions ended by sale	Bidders	Average bids per auction	Average price (zl)
1.06-21.06	204	150	230	4.4	67
22.06-10.07	97	64	149	4.8	67.8

Source: Author's own study based on pricing at www.allegro.pl as of 10.07.2015.

One can observe that the auctions of coins on Allegro.pl are very popular. There is a great interest in this kind of auctions. There are more bidders interested in purchasing than auctions. More than 70% of auctions end with a sale. There is

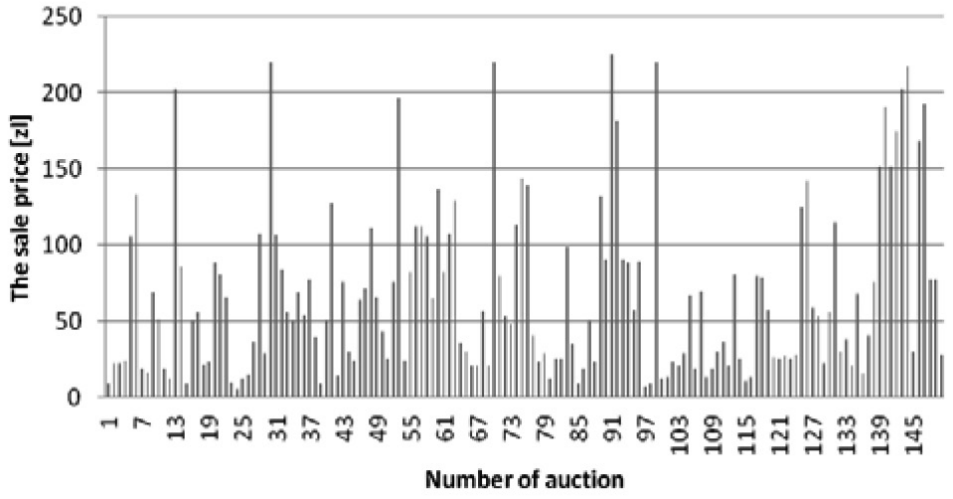

Figure 1. The sale prices of "Trojak" in the period of 1-21.06.2015 at Allegro.pl service

Source: Author's own study.

also a really high average number of bids per one auction. The division of data into two groups seems to be proper. There is a visible difference between these two periods. The number of auctions in "holiday" period was half as big as the quantity of auctions earlier. However, the sale price was the same.

Data coming from the auctions in the period 1–21.06.2015 is presented by Figure 1.

Let us check if the prices of auctions follow a random walk in examined period. The parameter β of autoregression function equals –0.15. The statistical analysis is conducted with the use of Dickey–Fuller test. The following hypothesis, connected with the equation:

$$R_{i,t} = \beta_i R_{i,t-1} + \varepsilon_t ,$$

was verified:

$$H_0: \beta_t = 1 \text{ (variable is not stationary)},$$
$$H_1: \beta_t < 1 \text{(variable is stationary)}.$$

It is equivalent with the process of analysing the following hypothesis related to the equation:

$$\Delta R_{i,t} = \delta_t R_{i,t} + \varepsilon_t ,$$

$$H_0: \delta_t = 0 \text{ (variable is not stationary)},$$
$$H_1: \delta_t < 0 \text{(variable is stationary)}.$$

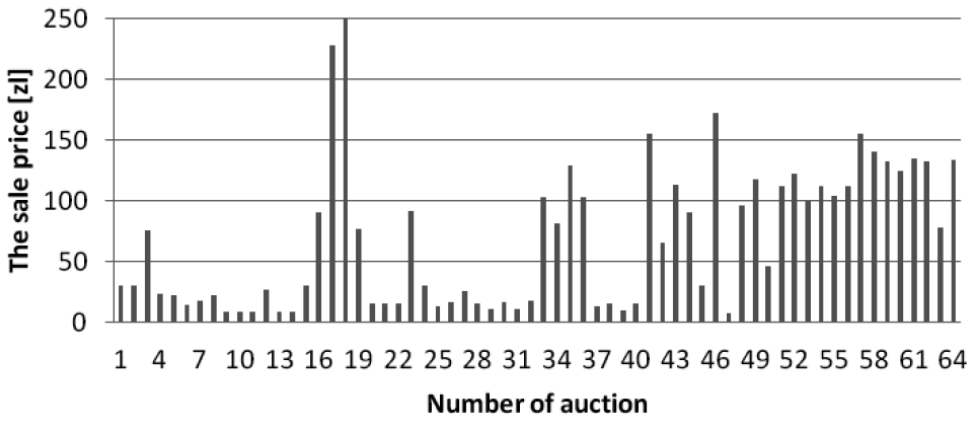

Figure 2. The sale prices of "Trojak" in the period 22.06 – 10.07.2015 at Allegro.pl service

Source: Author's own study.

The statistic is calculated as δ/S_δ and equals –12.08. It has got an asymmetric distribution with the expected value below zero. The critical value (reading from the

Dickey–Fuller tables) equals –2.56 (at the level of significance 0.01). The critical value is less than the statistic, so hypothesis H_0 should be rejected. It means that the random walks (which characterize an efficient market) did not occur during the period of 1-21.06.2015. What is more, the liquidity is rather high (1.13) in comparison to other auctions (for example observed at Ebay.com [Kaufmann et al. 2009]).

Data coming from the auctions in period 22.06–10.07.2015 is presented by Figure 2.

Let us check if the prices of auctions follow a random walk. The parameter β of autoregression function equals –0.14. The statistical analysis is conducted with the use of Dickey–Fuller test, as before. The statistic is calculated and equals –8.45. It has got an asymmetric distribution with the expected value below zero. The critical value (reading from the Dickey–Fuller tables) equals –2.58 (at the level of significance 0.01). The critical value is less than the statistic so the hypothesis H_0 should be rejected. It means that the random walks (which characterize an efficient market) did not occur also during the period of 22.06-10.07.2015. What is more, the liquidity is even higher (1.5) in comparison to the earlier period.

7. Conclusions

The on-line auction market, as the important part of the current financial market, was examined. The chosen auctions from Allegro.pl service were analysed. The auctions of the coin "Trojak" were chosen for research. They are very popular in that service. The level of liquidity is rather high (more than 1). Most of the auctions are finished with the sale. There are nearly 5 bids per one auction.

Traditional auctions used to be inefficient. This research is the beginning of bigger work focusing on the problem of efficiency of on-line auctions in Poland. It was showed that the random walks (which characterize an efficient market) did not occur during the analysis of prices of auctions. It seems to be a good start to prove the hypothesis that on-line auctions are still inefficient despite the good access to Internet in Poland and new technologies. This means that it could be possible to gain an abnormal return during the on-line auctions.

This is particularly possible when the auctions of old coins are analysed. Sometimes the collector is ready to pay much more for the item if, for example, it is the only one he misses to fill his whole collection. When old coins are considered, it should be also mentioned that sometimes bidders could be uninformed properly, for example because of small knowledge about the collectible in the world or if they are a beginning collector. The efficiency of the on-line auctions should be checked also with other branches of the market – for example the RTV (prices are more or less obvious), when the situation seems to be different.

The observations were divided into two groups: before holiday and during this time, but the conclusions are the same. There are definitely less auctions during holidays, but the liquidity is rather the same and inefficiency could be observed in

both periods. What is more, the level of liquidity is rather high in both situations, so one could say that if there is a strong liquidity, there could be an inefficiency – there is a bigger probability that two bidders will increase the price. It is a conclusion opposite to stock exchange efficiency.

Of course, one can meet many problems during similar research. One of them is connected with the problem of thin markets. In this research there was an assignment: the next number of the auction means the next number of a period. In this way the number of periods between trades is 1. But in real life, when there are bigger irregularities, it could be necessary to reduce the impact, for example one can use Dimson and Marsh method. Next part of the research will involve and develop this problem further.

The research presented in this article needs more tests and a bigger number of data in the future, but until now all conclusions of this initial examination connected with the efficiency and liquidity of the on-line auctions in Poland are similar to the well-developed work of Kaufmann, Spaulding and Wood [Kaufmann et al. 2009], where the Ebay.com service was analysed.

The on-line auction market is more and more popular in Poland. The institute Homo Homini says that every third user of the Internet would sell his items via an on-line auction. It is estimated that the average person has got unnecessary things worth about 3000zl. In that way, it seems to be important to know the mechanisms which create the on-line auction market and all kinds of anomalies one can meet.

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