

2 Market Anomalies on Two-Sided Auction Platforms¹

Abstract

A market anomaly (or market inefficiency) is a price distortion typically on a financial market that seems to contradict the efficient-market hypothesis. Such anomalies could be calendar, technical or fundamental related and have been shown empirically in a number of settings for financial markets. This paper extends this stream of research to two-sided auction platforms in Electronic Commerce and empirically analyzes whether calendar anomalies are persistent on such markets. Our empirical study analyzes 78,068 transactions completed between buyers and sellers on a German auction platform and covers the period between April 2005 and May 2009. We observe a persistent turn-of-the-month effect and a day-of-the-week effect that would allow buyers to realize small additional surpluses (0.3 percent price discount). Prices are also persistently lower in the highly competitive Christmas trade period while sellers benefit from higher prices at the beginning of every year. Overall our results support the common notion that two-sided auction platforms are rather efficient markets on which we however can observe some marginal market inefficiencies.

2.1 Introduction

One of the key economic processes when a buyer and a seller engage in trading is that of price discovery, i.e. finding a price that both market sides accept. Due to the characteristics of the Internet, this process has undergone drastic changes over the past few years. Lower menu costs, the reduction of processing costs associated with price differentiation, and new possibilities to interact with prospective trading partners online have led to a number of platforms that employ auction-type mechanisms for price discovery (Bapna et al. 2004; Hinz and Spann 2008; Hinz et al. 2011).

These new platforms share some important properties with financial stock markets but are compared to financial markets still under-researched. In finance,

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the efficient-market hypothesis asserts that financial markets are “informationally efficient”. This means that investors cannot consistently achieve higher returns than the average market for a particular risk-class, given that the information is publicly available at the time of the investment (Fama 1970). However, it has been shown empirically that this hypothesis does not hold for markets like stock exchanges and market anomalies occur (e.g., Ariel 1990). A market anomaly (or market inefficiency) is a price distortion on a financial market that seems to contradict the efficient-market hypothesis. Such anomalies could be calendar, technical or fundamental related.

Stock exchanges and auction markets in Electronic Commerce have in common that a market mechanism brings together two market sides, namely buyers and sellers. This could be double auctions or English auctions or any type of auction where prices reflect the relationship between demand and supply. In an efficient market neither buyers nor sellers would be able to systematically gain higher surpluses than market averages for a longer time. If prices are lower for example on Mondays, supply would drop (i.e. sellers are not willing to sell their products/share on this day of the week and offer it on another day of the week) while demand would raise at the same time (i.e. buyers would try to buy on Mondays and thus competition amongst buyers would raise the price) until this distortion is nullified. Thus, if price distortions occur, market forces are expected to correct this distortion so that they cannot persist for a longer time or occur regularly.

If price distortions persist for a longer time, this would allow well-informed sellers and buyers to optimize their market entry and offering/bidding strategy. The intermediary would then have to reconsider his market design and could introduce tools that attenuate information asymmetries to increase the market efficiency. The aim of our paper is therefore to analyze a long time series of data of a two-sided auction platform with respect to market anomalies. We analyze 78,066 transactions in 211 weeks and check whether systematic price and sales distortions occur for products sold on a two-sided auction platform.

The remainder of our paper proceeds as follows: In the following section we will outline the previous research and will focus on research on two-sided markets and introduce the efficient-market hypothesis. We will further outline the empirical research on market anomalies. Section 2.2 will also outline that there are only few studies that examine two-sided auction markets with respect to market anomalies and thereby emphasizes the gap in literature which we will close with our empirical study which is introduced in section 3. We start with describing the platform and its business model before we report some descriptives of the analyzed data. At the core of this section we will analyze whether market anomalies can be found at this platform. We discuss the results in section

4, outline the limitations of our approach and describe opportunities for future research before we conclude the paper with final remarks.

2.2 Previous Research

2.2.1 *Two-Sided Markets*

A two-sided electronic market is defined as an interorganizational information system through which two customer populations, buyers and sellers, interact to accomplish market-making activities. It helps these customer populations to identify potential trading partners, selecting a specific trading partner and executing the transactions (Choudhury et al. 1998). In two-sided markets, an intermediary provides the platform for linking together two distinct customer populations (Rochet and Tirole 2003). For instance, the auction platform eBay provides the infrastructure as well as the rules and processes to enable transactions between two customer populations: On one side of the market eBay serves sellers with a platform to offer their products, on the other side eBay provides buyers an opportunity to purchase products. Two-sided markets have become more prevalent in the Network Economy (Shapiro and Varian 1998) and can be found in many industries (Eisenmann et al. 2006). The Internet has created new industries such as online auction houses and digital marketplaces (Ellison and Ellison 2005), where intermediaries provide a platform that brings together buyers and sellers or, generally speaking, demand and supply. In 2011, eBay reported to make 60 billion EUR in gross merchandise volume via its E-Commerce platforms (eBay 2012).

In two-sided markets, both customer populations – in case of eBay buyers and sellers interacting on the platform – are crucial to the intermediary. The existence of many sellers offering products on eBay attracts more buyers to the platform. Vice versa, many buyers in turn attract more sellers (Tucker and Zhang 2010). Thus, network effects are present in two-sided markets. Network effects or network externalities are defined as a change in the surplus that a consumer derives from a good or service when the number of consumers or the demand changes (Liebowitz and Margolis 1994).

The rise and fall of several auction and shopping market places has demonstrated the strength of networks effects in this business. Shapiro and Varian (1998) indicate that strong network externalities may lead to a “winner-takes-it-all-market” where one company offers the dominant market place. Moreover, much effort has to be put into the recruitment of new sellers and buyers. On platforms the demand on one side would tend to vanish if there was no demand on the other. Evans (2003) gives a good overview on solutions existing for this

“chicken-and-egg” problem. The literature on competition in two-sided platforms, especially in microeconomics, is growing rapidly, see amongst others Caillaud and Jullien (2001), Rochet and Tirole (2003) and Rysman (2004).

Market places in the Internet have already reached a mature stage. Late followers can face enormous competitive disadvantages, requiring more marketing to overcome the barriers-of-entry erected by earlier companies with regard to consumer preference and awareness (Kerin et al. 1992). Especially in the Internet late followers suffer from these disadvantages. Particularly the number of electronic market places seems to be limited. Early entrants do have significant advantages and gain large market shares (Hidding and Williams 2003).

However, these electronic markets increase economic efficiency and offer a high transparency and low search costs for market participants (Bakos 1998) and thus fulfil better the conditions for perfect markets than traditional offline markets. Among these conditions are perfect market information, no participant with market power to dictate prices, and no barriers for participants to enter or exit the markets.

2.2.2 *Efficient Markets and Market Anomalies*

The efficient-market hypothesis requires that market participants maximize their utility and have rational expectations. Further, it requires that on average the market participants are correct. This could also mean that no market participant is correct, but on average the behaviour of all market participants evens out. Additionally the market hypothesis requires that market participants update their beliefs whenever new relevant information becomes available. The market participants do not need to be rational but their behaviour follows a normal distribution. So some market participants might bid too high or too early and some might bid too low or too late. This yields market prices that cannot be exploited with certainty to realize abnormal surpluses, especially when considering transaction and search costs. In such markets, no market participant is better than the rest in the long run and no market participant has to be right about the market. There are three common forms of the efficient-market hypothesis: the weak-form efficiency, the semi-strong-form efficiency, and the strong-form efficiency. Each has different implications for how markets work.

The weak-form efficiency says that future prices cannot be forecasted by analyzing data from the past. Market participants cannot sustainably realize abnormal surpluses even with access to the entire data of past prices since there are no patterns of price fluctuations that can be exploited with investment strategies. This means that prices follow a random walk, but many studies have shown empirically that markets follow trends for some time. This trend vanishes with time but may provide excess returns for a short period.

The semi-strong-form efficiency implies that prices incorporate publicly available new information instantly and in an unbiased fashion, such that market participants cannot realize abnormal surpluses by trading on that information. The semi-strong-form efficiency also implies that neither fundamental analysis (since all information available is always priced in) nor technical analysis (since prices follow a random walk) can help to generate abnormal surpluses in the long run. Prices will adapt to new information if the news were previously unknown and relevant. Such news lead to steep upward or downward changes in prices.

The strong-form efficiency implies that prices always reflect all public and private available information and no market participant can generate abnormal surpluses when insider trades are prohibited by law. If the strong-form efficiency is assumed then no fund manager is able to “beat the market” in the long run. Successful fund managers that were able to generate excess returns have thus just been lucky.

We expect that two-sided auction markets would at least be efficient in the weak-form. For used products, the seller has information advantages which lead to information asymmetries (see Akerlof 1970). For boxed, unused products all information is available to all market participants such that even a stronger form could be assumed. On efficient markets (in all forms) market anomalies should not occur according to theory. A market anomaly (or market inefficiency) is a price distortion on a financial market that seems to contradict the efficient-market hypothesis. Such anomalies could be calendar, technical or fundamental related and have been shown empirically in a number of settings for financial markets.

One prominent example for a calendar anomaly is the Monday effect which manifests in the belief that securities market returns on Mondays are on average less than other days of the week, and are often negative on average. The Monday effect, which is also known as Day-of-the-week effect or weekend effect, has been observed in both American and foreign exchanges (e.g., Fields 1931; Jaffe and Westerfield 1985). Ariel (1987) and Lakonishok and Smidt (1988) observed the tendency of stock prices to increase during the last two days and the first three days of each month. This effect, which is called Turn-of-the-Month effect, is most likely based on the timing of monthly cash flows of pension funds that invest in turn at this time of the month in the stock market. Lakonishok and Smidt (1988) also observed another calendar related market anomaly which they called holiday effect. Their empirical study revealed that investors can generate abnormal returns before an exchange-mandated long weekend or holiday such as Labor Day or Christmas.

Fundamental related anomalies are for example the small-cap effect (e.g., Roll, 1981), which describes the tendency that small-capitalization stocks outperform the market or the value effect (e.g., Fama and French 1998), which refers to

the positive relation between security returns and the ratio of accounting based measures of cash flow or value to the market price of the security. These fundamental related and technical related anomalies, like the momentum effect (see Jegadeesh and Titman 1993), exist exclusively in financial markets and are therefore out of the scope of this paper while calendar anomalies can in principle also exist on other markets like two-sided auction markets.

Yet, only few studies examine market anomalies in two-sided markets in Electronic Commerce. Brynjolfsson and Smith (2000) showed for example that the price dispersion for the same product on electronic markets is still substantial and thus the rule of a single market price is invalid. Ba and Pavlou (2002) revealed that reputation has a significant influence on prices in electronic markets (see Dellarocas 2003 for another overview). This finding is still in line with the efficient-market hypothesis, since a more reliable trading partner can lower the risk of being cheated by the trading partner.

On perfect markets demand should follow supply and vice versa. If demand is higher on certain days on auction platforms like eBay, prospective sellers would shift their offers to these days since they would expect higher prices and supply would rise equally. It would thus not be possible to make additional profits for sellers or achieve lower prices for buyers on particular weekdays or months for a longer period of time. However, first empirical evidence suggests that two-sided platforms suffer from persistent market anomalies that substantially influence sales and prices.

Simonsohn (2010) for example shows that a disproportionate share of auctions end during peak bidding hours and such hours exhibit lower selling rates and prices. Moreover, Simonsohn (2010) also finds that peak listing is more prevalent among sellers likely to have chosen ending time strategically, suggesting disproportionate entry is a mistake driven by bounded rationality rather than mindlessness.

This paper picks up the topic and continues to empirically examine market anomalies in two-sided electronic markets, i.e. auction platforms in particular, and focuses on calendar anomalies.

2.3 Empirical Study

For the purpose of our study, we acquired data from a German auction platform on a daily basis and analyze the sales, price, and revenues of the top-selling products over time. We label this intermediary “Platform.com”, since we do not disclose the name for reasons of maintaining confidentiality.

2.3.1 *Platform Description*

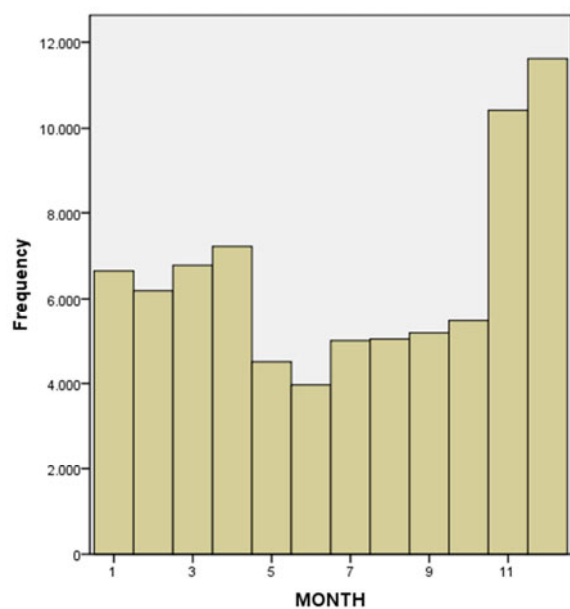
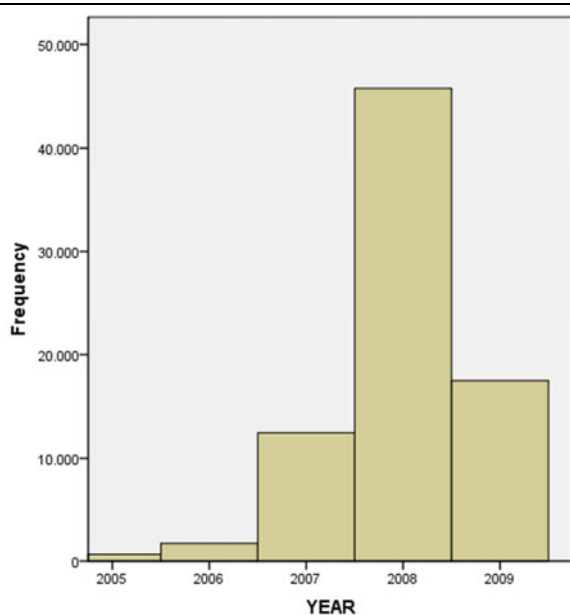
On Platform.com, sellers offer their products – such as consumer electronics, household appliances, jewellery, watches and cosmetics – to buyers. The sellers are exclusively professional retailers (in contrast to eBay) who sell to private individuals. Only brand-new, boxed products can be sold on Platform.com. The European article number (EAN) is used to identify the products unambiguously.

The intermediary is a start-up company funded in three rounds, and investors include the High-Tech Entrepreneur Fund of the German Federal Ministry of Economics and Technology. Platform.com charges sellers per transaction, while buyers can use the platform for free. Sellers pay 3 percent fee on the volume per transaction while the intermediary does not charge buyers. One market side thus subsidizes the customer population on the other market side which is a common feature in the network economy and two-sided markets. The relationship between the intermediary and its customer populations, buyers and sellers, is non-contractual. Prices include shipping costs and the intermediary offers a trusted service and takes responsibility for the sellers' action on the platform such that buyers cannot suffer from auction fraud. Therefore, the intermediary chooses the sellers quite carefully since the intermediary has to cover potential losses due to sellers' fraudulent actions.

The intermediary applies a continuous double auction to find prices which makes the platform thus comparable to common stock exchanges. In continuous double auctions multiple buyers and multiple sellers can simultaneously and continuously negotiate for the same type of good. The bids comprise offers to buy or offers to sell. Each incoming bid is matched with the best possible order on the opposite market side. If the incoming bid matches an open offer on the other market side, the intermediary initiates the transaction, otherwise the bid is collected in the order book as open. In the case of Platform.com, all prospective market participants have access to the order book and can thereby evaluate the market situation.

2.3.2 *Descriptives*

Our study comprises transaction data between buyers and sellers on Platform.com and covers the period between April 2005 and May 2009. The prices range between 0.70 EUR and 4,199.00 EUR with a mean price of 106.18 EUR. Overall, 351 different sellers sold 25,677 unique products types (as identified by the unique EAN) in 78,068 transactions to 65,894 different buyers. As this numbers indicate, the retention rate for sellers is quite high while the retention rate for buyers is very low. Most buyers only buy one product on Platform.com which the intermediary certainly has to improve if it wants to capture a significant market share in the auction market.



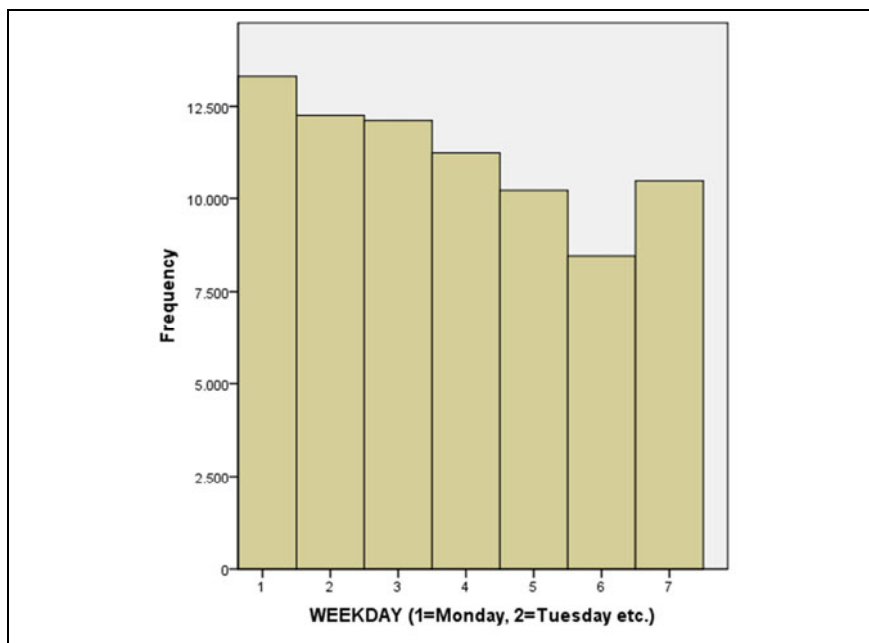


Figure 2-1: Frequency of Transactions per Year, Month and Weekday

We also plot the frequency of sales for the days of the month (see Figure 2-2). We find that at the first days of the month the number of transactions increases. The number of sales then decreases until the 25th of the month and then starts to increase again. Note that the number of transactions on the 29th, 30th and 31st is biased downwards because not every month has a 31st day etc. Cash flows (wages, rent received etc.) typically occur at these days of the month while the account balance typically drops over the month.

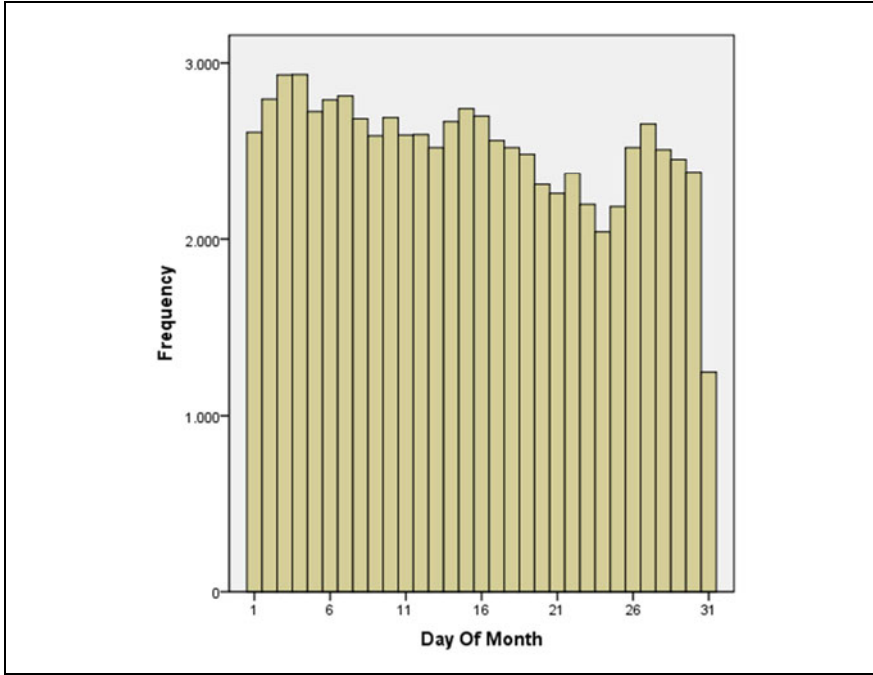


Figure 2-2: Frequency of Transactions per Day of the Month

The results presented in Figure 2-1 and Figure 2-1 indicate that demand and supply fluctuate over time but these first results do not allow to draw conclusions about the efficiency of two-sided auction markets and this platform in particular. We therefore analyze the effect of calendar regularities on sales and price quantitatively in the next chapter.

2.3.3 Analysis

We start to analyze the effect of seasonality on daily sales and thus aggregate the transactions on a daily basis. We use dummy variables for weekdays (e.g., Monday = 1 indicates that the observation was made on Monday, 0 = otherwise), for months and for years to account for the development over time.

Additionally, we introduce a dummy variable for public holidays (1 = for all public holidays in Germany, 0 = otherwise). We further create a dummy variable for the first five days and the last four days of each month and call the variable “Turn of the month”. We use Monday, December and the year 2009 as reference

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