



# Are online auction markets efficient? An empirical study of market liquidity and abnormal returns

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## ABSTRACT

Technological advances have facilitated investment in collectibles through online auction markets, where information regarding product characteristics, current and historical prices, and product availability is available to millions of market participants. However, market inefficiencies may still exist, where prices do not reflect market information and where savvy speculators can profit. Using *unit root and variance ratio tests*, we examine 8538 rare stamp and 56,997 rare coin auctions to evaluate the *efficiency of online markets*. In particular, we study *market liquidity, abnormal returns and weak-form efficiency*. We find an inverse relationship between market efficiency and liquidity. Bidder competition intrinsic to liquidity increases the chances that uninformed bidders drive up item prices, leading to the observed market inefficiencies.

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## 1. Introduction

It is common knowledge among investors that thin markets are less efficient than markets that have broader following and participation. Many housing markets, some stock markets, mortgage-backed securities markets, and collectible markets represent examples of thin markets, where purchase and sales transactions, trading, and exchange may be sporadic, and price discovery may be challenging. Together, nevertheless, they represent billions of dollars of exchange in market transactions. Increasingly, we are seeing relatively thin markets being impacted by the burgeoning technologies of the Internet, permitting such innovative approaches to transaction-making as electronic call auctions, reverse auctions, and numerous forms of digital intermediation.

With so much price information available to bidders and sellers in online auctions, the question of market efficiency in these collectible markets presents itself. By *market efficiency*, we mean that the market price is based upon all information available in the market. From this perspective, *weak-form efficiency* in a market occurs where the price for every good on the market reflects all historical information, and is available to any market participant [13]. Market efficiency is different from *operational efficiency* in that it deals with equal access to information by all market participants. By contrast, operational efficiency deals with maximizing some aspect of the operation, with

little concern about the transfer of information among all participants in the market. For example, Vragov [49] discusses how online auctions are operationally efficient in that they allow the seller to maximize common and private value surplus.

Intermediaries utilize technology to bring together geographically-fragmented markets, as a way to improve financial efficiency and market quality. These markets exhibit the classical characteristics of thin markets. We investigate the efficiency and persistence of abnormal returns in collectible markets. Collectibles are often viewed as an investment alternative, which can be used for diversification or as a hedge against inflation (like gold bullion) with some rare coins even quadrupling in value after several years. Swiatek [47] discusses how rare coins can be appealing in a bear market, and Pesando [41], Mei and Moses [37], and Wood [50] compare collectible returns to stock market prices using financial economics theory, like the *capital asset pricing model* (CAPM). Ashenfelter and Graddy [4] also point out research that shows returns on collectible items can surpass returns from fixed income securities.

Typically, auctions have not been viewed as very efficient markets, as an uninformed bidder could end up paying too much for an item or a seller could end up selling an item for a fraction of its worth [43,48]. Internet technologies, however, have increased the flow and availability of information in online auctions, allowing millions to interact, and promoting participation across the globe. This technological transformation has made auctions into a type of exchange, akin to a stock or commodities exchange. Indeed, the volume of transactions in online auctions now surpasses the volume of stocks that are bought and sold in many countries. With many more items for sale, and many more bidders

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bidding, online auctions allow collectibles as investments to take on a new practicality, making investments in collectibles bought and sold in online auctions more feasible for the typical investor. Through this lens, we investigate how efficiency has adjusted with market liquidity, as more buyers and sellers have entered the online auction market and the ratio of buyers to sellers has changed.

*Abnormal returns* occur when price levels differ from expected or previous sale prices, resulting in high or low returns for an investor. They occur due to new information in the market. Abnormal returns in an efficient market are *persistent*, indicating that other investors share a new common valuation, whereas an inefficient market with low levels of persistent returns indicates that abnormal returns are ignored. Then prices revert back to the mean price after the abnormal return occurs. We do not deny that under-informed bidders may make bids that may be too high, yet the existence of high bids is likely to inflate the price that rational and informed investors will be willing to pay for an asset.

In efficient markets, abnormal returns reflect new information, so that abnormal returns in one period carry forward to future prices. In inefficient markets, the effect of abnormal returns are often minimized or eliminated, as prices revert to a mean price. With this in mind, we will not claim that online auctions, in their current form at least, can ever be viewed as completely efficient markets. We will explore the *persistence of abnormal returns* to determine how much current returns seem to affect the level of future returns. We will check if future returns are unpredictable, as they would be in an efficient market.

We ask: Are online auction markets, such as those for rare coins and rare stamp markets, efficient? What factors might affect the persistence of abnormal returns in online auctions? How can we measure the efficiency and persistence of abnormal returns on assets traded in online markets? Can we implement a research design to assess the efficiency and persistence of abnormal returns in online auctions for collectible coins and stamps? How does the amount of trading activity play a role?

There are major differences between a stock market, where market efficiency is typically studied, and an online auction market. The first difference deals with *short selling*, where investors can take advantage of an overpriced stock by selling the stock now and agreeing to buy it later. There is no way to easily mimic short selling in online auction markets, thus allowing inflated prices to persist. A collectible investor is able to place an item for sale, and then purchase it in the same market later, but the immediacy of the stock market is not present. The second difference deals with the effects of individual bidders. Unlike the stock market, two bidders can drive a price above the normal valuation for an item. (This is a basis for winner's curse in online auctions.) These two factors can introduce inflated prices for an item, as two or more bidders bid up its price, resulting in high prices that may persist for the sale of the item in the future.

Far from making inefficiency irrelevant though, the differences between online auction markets and stock markets make studying efficiency imperative for investors. Online auctions have challenges that stock markets do not. Since investors make money by taking advantage of inefficiencies, these inefficiencies can make online auctions potentially more profitable than stock market investments. We will expose inefficiencies that may exist in online auction collectible markets for the investor to exploit. To do this, we provide a measure of weak-form efficiency in online auctions for collectibles, and confirm a relationship between market efficiency and market liquidity in the rare coin and rare stamp markets. Thus, *increases* in market liquidity (marked by an increase in bidder competition) lead to *decreases* in online auction market efficiency. The theoretical intuition that drives this finding is that, with stock markets, increase in the number of investors would indeed lead to greater efficiency as more investors search to profit from inefficiencies. By contrast, in online auctions, high liquidity involves many bidders competing for

the same item. It increases the likelihood that uninformed collectors drive up collectibles prices.

We draw upon theory in financial economics for this work. IS researchers are often concerned with how information is transferred among participants in online systems, and the effects this information has on system users. This becomes especially interesting when the system is a market, and the market is created with the new technologies of the Internet. We leverage the *theory of market efficiency* to discover the effects of the flow of information on prices in an electronic market.

We assess online auctions for collectible coins and stamps as a type of *market exchange*. We focus on rare coins and stamps that are commonly traded. We treat instances where the amount of trading and transaction-making varies, permitting us to consider what happens in online markets with more thinly-traded assets. Our research design enables us to investigate how the persistence of abnormal returns increases with market liquidity, as the ratio of buyers to auctions changes in online auction markets. This lets us determine how market liquidity may affect efficiency and the persistence of abnormal returns based on the price changes. Using unit root tests attributable to Dickey and Fuller [16] and variance ratio analysis based on Lo and MacKinlay [33] on data from a multi-year study involving two different markets, we show that online markets tend to be efficient if the number of auctions is relatively large in relation to the number of bidders. Although trading in online auctions is thinner than in the stock markets, we nevertheless find that online auctions increase the viability of investments in collectibles as an alternative to stocks because of their wide reach and the extent of seller and bidder participation.

**Section 2** assesses relevant theory for thin markets and technology, collectible auctions, and the related concepts of market efficiency, as a basis for our model development. **Section 3** discusses the specification of unit root and variance ratio tests, as well as some adjustments that enable us to estimate our data for relatively thinly-traded collectibles exchanged in online auctions. **Section 4** lays out our empirical analysis of a large set of data on collectible coins. We begin with an overview of the data set, continue with a discussion of modeling and estimation issues that are specific to a market (e.g., the rare coin market or the rare stamp market), and finish with a presentation of the econometric results and their interpretation. **Section 5** discusses the collectible stamp data that we analyze, and the contrasting results that we obtained. Thereafter, **Section 6** provides an interpretation of our results, and analyzes the patterns of abnormal returns observed in the collectible coin and stamp markets. We conclude with limitations and future research.

## 2. Online auction markets and market efficiency

We next discuss properties of thin markets, collectibles auction, and market efficiency concepts.

### 2.1. Thin markets and technology

Certain factors that exist in markets can cause inefficiencies. For example, the depth of the market is often limited by the degree to which assets are traded in different physical, geographic, or electronic virtual locations, causing *market fragmentation*. Also, Mendelson [38] points out that market fragmentation can occur when potential market participants cannot find one another, do not know that the other party exists, or otherwise cannot transact because of spatial, informational or other types of barriers. When there are relatively fewer traders in a market with thinly-traded assets, the market is more likely to be fragmented. The trading of securities before the advent of the telegraph is a classic example of fragmented markets, as discussed by Garbade and Silber [23]. Securities traded at vastly different prices at different stock exchanges around the United States

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