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硕 士 学 位 论 文

估算威士忌的价值回报：比较重复销售模型，特征价格模型以及混合模型

Estimating the Returns of Whisky: A Comparison of the Repeat Sales, Hedonic, and Hybrid Models

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摘要

当人们对葡萄酒和艺术品的收藏价值回报广泛研究的时候，威士忌作为潜在的投资对象最近出现在人们的眼前。因为其创纪录的出售价格，威士忌已经成为新闻头条。在这项研究中，根据来自 Bonhams 和 Mctear's 拍卖会的拍卖数据，我们对 2008 年至 2012 年的威士忌价值回报进行研究。

对于收藏品价值回报的估算，其中一个需要考虑的重要因素是合理的模型选择。在以前的收藏品研究中，针对价值回报的估算，特征价格模型和重复销售模型等曾是比较热门的选择，另外一种新的采取前两种模型优势的混合模型也被使用。本篇论文使用这三种模型去估算威士忌的价值回报。从中我们发现最有效的模型是混合模型。在整个研究过程中，通过使用该模型，威士忌的价值回报远远优于股票以及其他主要指数。

关键词：价格指数，重复销售模型，特征价格模型，混合模型，威士忌

Abstract

While the returns to collectibles such as wine and art have been studied extensively, whisky has only recently emerged as a potential investment vehicle. Whisky has been making headlines as bottles are being sold at record prices. In this study, we examine the returns to whisky from 2008-2012, using auction data from Bonhams and Mctear's.

One of the most important considerations when estimating returns to collectibles is the proper model selection. In previous studies of collectibles, the hedonic and repeat sales models have been popular choices for estimating returns, and a new hybrid model has recently been used to utilize the strengths of both of these models. This paper uses these three models in order to estimate the returns to whisky. We find that hybrid model produces the most efficient estimates, and the returns of whisky when using the hybrid model outperformed equities and other major indexes over the total period of our study.

Key Words: price index; repeat sales model; hedonic model; hybrid model, whisky

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1. Introduction

“Too much of anything is bad, but too much of good whisky is barely enough.”

-Mark Twain

1.1 Background on Whisky Market

Whisky has been featured in the news and financial journals for its large returns in recent years, and up to this point, no research has been conducted on the real returns of whisky. There are many different kinds of whiskies on the market today, and they are sold from many countries throughout the world. While many of these whiskies may taste delicious and have ardent fans, only certain bottles of whisky are being sold at auction and seeing gains in value. The vast majority of these collected and traded whiskies are Single Malt Scotch Whiskies. These are defined as being “distilled at a single distillery, (i) from water and malted barley without the addition of other cereals, and (ii) by batch distillation in pot stills”¹. In addition, a Scotch whisky must be distilled in Scotland, in one of the five regions of the country.

The market for Scotch whisky has been heating up in recent times as the value of certain bottles have sky rocketed. In November 2010, a bottle of 64-year-old Macallan scotch whisky sold at auction for \$460,000, becoming the most expensive bottle of whisky ever to be auctioned². In 2011, a bottle of Dalmore 62 was sold at a \$200,000 price tag at an airport in Singapore, making it the most expensive whisky bottle sold at retail. Financial journals have stated that the returns to whisky have been greater than gold³.

1.2 Background on Collectibles and Price Indexes

Various collectibles have been widely studied as an alternative to traditional methods of investing. Some of the more well known collectibles studied include wine and art, and previous research also has looked at the returns of antiques, coins, stamps, and violins. Across all of the collectibles studied, different methods have

¹ S. Nicol, “The Scotch Whisky Industry”, 2009

² L. Olmstead, “Whisky Outperforms Gold- Annual Returns of Over 400%”, 2012

³ L. Warwick-Ching, “Whisky Returns More Glittering Than Gold”, 2012

been used to obtain a price index of returns, and choosing the appropriate method is important for obtaining an accurate index.

This paper will examine the returns to whisky from 2008-2012 and determine the most appropriate methodology for measuring its returns. Whisky can be looked at as a collectible, such as wine or art. Collectibles are often purchased for the enjoyment of that item, whether it is to be consumed or enjoyed for aesthetic purposes. These collectible items, when held over a period of time, often change in value, and sometimes provide large returns for collectors and investors.

For this study, we will look at the previous research on wine and art, as they have the most relevant literature for the discussion of creating an index for the returns of whisky.

For the wine and art markets, as well as this study on whisky, there are many similarities that emerge. Auctions exist that are specifically dedicated to these collectibles, which give access to many data points. Then there is the discussion of how to treat this data, as there are many single sales of art pieces or bottles of wine, as well as many repeat sales of these items.

Wine and whisky in particular share many similar characteristics. Both wine and whisky have special qualities and characteristics that emerge after aging. The markets for wine and whisky also have connoisseurs within the industry and professional raters. While sharing similar characteristics, there are also some key differences. While wine generally gets better with age in its bottle, it also hits a peak and can spoil after a certain amount of time. The aging of whisky only takes place in the barrel, and once it is bottled, the quality of the whisky does not change. A whisky bottled in 1970 should taste the same today as it did on the day of its bottling.

Wine and whisky are both potential alternative assets for collectors and investors looking to diversify their portfolio. One of the primary reasons why wine and whisky can potentially increase in value is due to scarcity. With wine, there are certain years in which the grapes produce better wine and there are limited numbers of those grapes. In turn, there are a limited number of these bottles of wine that can be produced. With whisky, distilleries have taken advantage of the scarcity of their aged whiskies and released limited and special edition bottles that collectors seek out.

While many studies have been conducted on the wine market regarding wine as an investment, whisky has yet to be studied as a potential investment. While the history of whisky is quite old, the auction market is still relatively young, as large

auction houses, such as Bonhams, have only in recent years held exclusive auctions for whisky. Prior to 2008, since there was limited demand, whisky bottles at Bonhams had been traded together with wine in small quantities. Since that time, Bonhams went from having one auction in 2008, to having multiple auctions per year, and by 2011 whisky auctions were held almost monthly. This study will take an empirical look at the returns of whisky from 2008-2012.

Drawing upon past research in the collectibles market, the repeat sales model and hedonic model have been used extensively in estimating returns. Each one of these methods has its own strengths and weaknesses, and each one can lead to different conclusions. Therefore it is important to select the most efficient model for the data at hand. In this study, we will examine the repeat sales model, the hedonic model, and a hybrid model to determine which provides the most efficient estimates for measuring the returns to whisky, and compare these returns with the returns of other popular indexes.

1.3 Price Index Models Literature Review

The existing literature has focused primarily on the hedonic model and repeat sales model for creating a price index and estimating returns to collectibles. A hybrid model combining these two has also been used in recent studies. This section highlights each of the three models examined in this study.

1.3.1 Hedonic Model

Andrew Court first used the hedonic model in 1939 as a price index for automobiles⁴. The hedonic price index has since been used to create indexes for various collectible goods. A hedonic price index models the price of a product as a function of the characteristics within the product. These characteristics may include age, weight, height, or other qualities that describe the product. This allows one to measure changes in price over time while holding the quality and characteristics constant (Triplett, 2004).

⁴ J. Triplett, Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes”, 2004

A drawback to the hedonic model is that a large amount of data may be needed in order to hold the quality constant. For some objects, such as art and houses, the number of dimensions needed to describe the product can be quite numerous. One must factor in all of these explanatory variables to describe the price, or else the model could be subject to omitted variable bias.

However, unlike the repeat sales model, the hedonic model can make use of all sales data, which allows for more observations and the possibility of more accurate results. Also, when looking at objects infrequently traded through time, the hedonic method may be the only available choice for creating a price index.

1.3.2- Repeat Sales Model

Bailey, Muth, and Nourse (1963) originally developed the repeat sales model as a way to construct a real estate price index. As the name implies, the model was developed to look at multiple sales of the same real estate properties. It has been used extensively to create indexes for various other markets with traceable repeat sales. In terms of data used to construct the index, it's much simpler than the hedonic model, requiring only the most basic information such as the price and time of sale.

One of the common drawbacks of the repeat sales model is the amount of data that is available and able to be used. When compared to the hedonic model, it can be tough to find sales data of objects, assumed to be identical, that are traded over time. The model is also criticized due to the fact that it only uses part of the data set, since it cannot use single sale data.

Another possible problem associated with the repeat sales model is sample selection bias. When looking at art, wine, whisky, or other collectibles, some of these objects may trade more frequently than others and become more represented. In regards to whisky, some well-known distilleries produce bottles that trade more frequently than their less well-known competitors. Lower priced bottles may trade more frequently than higher priced bottles. If this happens, there could be an over-representation of some bottles, which could cause bias in the results.

1.3.3 Hybrid Model

The hybrid model has a relatively short history, first developed by Case and Quigley (1991) for the housing market. As with the other two models described in this paper, the hybrid model was later adopted by other markets, and has since been used to estimate returns to wine (Fogarty and Jones, 2011), Picasso prints (Locatelli and Zanola, 2005), and now whisky. The hybrid model takes advantage of both models and is able to use all of the data available.

The main drawback of the hybrid model is that the data collection can be intensive, since it uses both the hedonic model and the repeat sales model data. For some markets, the hybrid model may be tough to implement, however, the whisky market is well suited for this model. Whisky has few and easy to obtain characteristics comprising the hedonic model and repeat sales data is becoming more widely available due to more frequent auctions.

1.4 Collectibles Literature Review

As stated previously, the art and wine markets share many similarities with the whisky market and this paper will use the same methodologies in estimating returns. In this section, we will briefly examine the uses and developments of the three models as they relate to estimating the returns of wine and art.

1.4.1 Wine

William Krasker (1979) first studied the returns of wine from 1973-1977, using the repeat sales approach, with only a very small sample of 137 observations. He also used an estimated storage cost of \$1.40 per bottle and concluded that the real returns of wine were about the same as the risk free rate. Two years later, in 1981, Elizabeth Jaeger (1981) extended the data that Krasker studied to an eight-year period with 199 observations, from 1969-1977, revised the storage costs from Krasker's study to \$0.499 per case, and she found with the repeat sales model that the actual returns of wine were above 12%.

Roman Weil (1993) also uses the repeat sales model and follows an actual investor's portfolio of wine for 15 years, from 1977-1992. Over the period, the returns were about 9.9% per year, which was less favorable than stocks during that same time period. There were also only 68 observations during the period, and the portfolio was not optimized in any clear way, which makes it hard to reach any meaningful conclusions about the real returns of wine based on this study.

As Bordeaux wine was seen as the wine providing the greatest returns, Burton and Jacobsen (2001) exclusively measured the returns on red Bordeaux wine from 1986-1996 using the repeat sales model, and they created a price index for the wine by creating more homogeneity, classifying the wines by the same vineyard and vintage. They ended up with a sample of 315 wines in the index with 10,500 transactions. They found that the rate of return during the time period was 7.9% per year, with a real return of about 3.1% on average. As with the other studies, this study showed a meaningful return but still underperformed when compared to equities during this time period.

James Fogarty has written extensively on wine and first uses the hedonic model (2006) and measures quarterly return estimates during the 1990-2000 period. He divides the wine into 4 categories based on quality and also factored in expert ratings. In total, the portfolio estimate's returns were 11.9% per year and showed little correlation with other assets. Fogarty (2010) again estimates returns to Australian wine, this time using the repeat sales regression. His studies have shown that there are positive returns to wine and that wine can be used to diversify a portfolio.

Masset and Weisskopf (2010) analyzed wine returns using the repeat sales model, from 1996-2009. They created a General Wine Index to represent all the wines in the study, which had nominal returns of greater than 12% per year. This was the first study of wine that showed returns greater than equities over the same time period.

Fogarty, together with Callum (2011), examined three methods to calculate returns of wine. The authors estimated the returns using the hedonic, repeat sales, and hybrid models to determine the most efficient model for studying the returns to wine. Using 14,102 quarterly observations from 1988-2000, they calculated mean returns of 4.9% per year. This result was based on the hybrid model, which was concluded to be the most efficient model with the lowest standard deviation.

1.4.2 Art

Anderson (1974) first studied the art market, using observations from 1780-1970 using both the hedonic and repeat sales models. He concluded that the average real returns using the hedonic model were 2.6% per year. Using the repeat sales method the real returns were 3% per year. Anderson also found that the returns of more modern paintings were greater than that of old historical paintings. Baumol(1986) went even further back in time and used 642 observations from 1642-1961. Baumol calculated returns using the repeat sales method and excluded transactions that were traded within a twenty-year time frame. This led to very small real returns of 0.55% per year. Choosing to exclude transactions within the twenty-year time frame also ignored some of the most traded and most valuable pieces of the time.

Goetzmann (1993) also used the repeat sales method to create an art index studying a period from 1715 to 1986. He found that since 1900, the art index outperformed stocks and bonds with nominal returns of 17.5%. During this same period, Goetzmann also found that there was a high volatility of 52.8%. Continuing research using the repeat sales method, Pesando(1993) calculates returns on modern prints from 1977-1992. He found that the prints had 7.6% nominal returns and only average 1.5% real returns.

Chanel, Gérard-Varet, and Ginsburgh (1994) first use the hybrid method, with the idea to study all paintings of the time, not just those with multiple sales, in order to create a more robust index using more data. They created an index using 32 well-known artists from 1962-1988 and averaged an annual return of 7% real returns over the period.

Mei and Moses (2002) studied 4,896 pairs of repeat sales from 1875-2000 to create an art index. They found that from 1875-1999, the average real returns were 4.9% per year. It was one of the first studies of the art market showing that art outperformed some fixed income securities, although it still underperformed when compared to stocks.

Richard Agnello(2002) extends the research of using the hedonic method for the art market with 25,217 observations from 1971-1996 and finds returns of 4.2% per year. Continuing this research, Renneboog and Spaenjers(2011) sampled from 50

years of data,, from 1957-2007, and also used the hedonic model to create an index.

They had similar conclusions as Agnello, finding real returns of 3.97% per year.

They also found that from 1982-1997 the annual real returns were higher at 5.19%.

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2. Methodology

2.1 Data Selection

The data used for this paper is taken from a collection of auction data from Bonhams and McTear's and originally contained 4,322 traded bottles of whisky from 2008-2012, held at auctions in the US, Hong Kong, and the UK. All bottles in the original data set contained a price, date traded, and distillery name, along with various other details of the bottle. Only standard size 750 milliliter bottles containing a distillation year, bottling date, and age were used in order to accurately determine matching bottles and obtain accurate and reliable data. The distillation year is defined as the year the whisky was produced before maturing in a cask. The bottling date is the year that the whisky was placed in the bottle after it has matured in the cask. The age is the difference between the two, representing the amount of time the whisky was matured. Bottles that did not contain all of the relevant information were removed, and the following data frequency and distribution of the 1,480 remaining bottles can be seen in Table 1.

Table 1- Data Frequency and Distribution

| | US | UK | HK | Total |
|--------------|-----|------|----|-------|
| 2008 | 0 | 88 | 0 | 88 |
| 2009 | 147 | 261 | 39 | 447 |
| 2010 | 140 | 279 | 0 | 419 |
| 2011 | 106 | 255 | 8 | 369 |
| 2012 | 11 | 137 | 9 | 157 |
| Total | 404 | 1020 | 56 | 1480 |

Multiple bottles with matching distillery, distillation date, bottling date, and age, traded in the same time period, were averaged together to get the average sale price. Each bottle price includes the premium paid at auction, which ranged from 18%-25%, and bottles traded in the UK and Hong Kong are converted into US dollars based on the average yearly exchange rate for the year in which they were traded.

After obtaining the average bottle price per period in US dollars, this left a total of 927 observations. 400 of these observations were single sales, which means that the bottle was only traded one time throughout the observed period. 204 observations were first sales, which means each bottle contained matching bottles of repeat sales in later periods. 323 observations were repeat sales. Of these repeat sales, 88 bottles traded 3 times, 26 bottles traded 4 times, and 5 bottles traded 5 times.

2.2 Model Overview

Measuring price indexes on collectibles is a challenging problem, as each index has its drawbacks. Through the literature review, it is apparent that the measure of various collectibles using different price index methods has led to various conclusions on the real performance returns. Therefore, selecting the appropriate method for the item and data set has proved to be very important. In this section, we will outline the methodology of each model and provide a hypothetical portfolio of whisky to illustrate the calculation of the index.

2.2.1 Hedonic

The hedonic model reflects the assumption that heterogeneous goods can be described by their qualities and characteristics (Eurostat, 2010). Every auction has many whisky bottle sales that come from a number of different brands or distilleries. These whisky bottles can be described by various characteristics. The set of observed whisky sales is $w \in \mathbf{W} = \{1, \dots, W\}$ and the time periods $t \in \mathbf{T} = \{1, \dots, T\}$. The characteristics x_w is a $K \times 1$ vector describing all bottles of whisky w . The hedonic regression shows how each characteristic contributes to the price. For this study, the independent variables are distillation year and age, along with dummy variables for time and distillery. The hedonic model becomes

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