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## Journal of Financial Economics

journal homepage: [www.elsevier.com/locate/jfec](http://www.elsevier.com/locate/jfec)The price of wine <sup>☆</sup>Elroy Dimson <sup>a,b,\*</sup>, Peter L. Rousseau <sup>c</sup>, Christophe Spaenjers <sup>d</sup><sup>a</sup> Cambridge Judge Business School, Trumpington Street, Cambridge CB2 1AG, United Kingdom<sup>b</sup> London Business School, Regent's Park, London NW1 4SA, United Kingdom<sup>c</sup> Vanderbilt University, Box 1819 Station B, Nashville, TN 37235, United States<sup>d</sup> HEC Paris, 1 rue de la Libération, 78351 Jouy-en-Josas, France

## ARTICLE INFO

## Article history:

Received 21 January 2014

Received in revised form

20 October 2014

Accepted 19 November 2014

Available online 20 August 2015

## JEL classification:

C43

D44

G11

G12

Q11

Z11

## Keywords:

Wine prices

Alternative investments

Price indexes

Psychic return

Bubbles

## ABSTRACT

Using historical price records for Bordeaux Premiers Crus, we examine the impact of aging on wine prices and the long-term investment performance of fine wine. In line with the predictions of an illustrative model, young maturing wines from high-quality vintages provide the highest financial returns. Past maturity, famous châteaux deliver growing non-pecuniary benefits to their owners. Using an arithmetic repeat-sales regression over 1900–2012, we estimate a real financial return to wine investment (net of storage costs) of 4.1%, which exceeds bonds, art, and stamps. Returns to wine and equities are positively correlated. Finally, we find evidence of in-sample return predictability.

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<sup>☆</sup> We are grateful to Bill Schwert (the Editor), Jianping Mei (referee), and another anonymous referee for helpful feedback and suggestions. We also thank Simon Berry and Carol Tyrrell of Berry Bros. & Rudd, David Elswood and Jeff Pilkington of Christie's, Robert Arnott, Orley Ashenfelter, David Ashmore, David Chambers, Géraldine David, Engelbert Dockner, Thierry Foucault, Will Goetzmann, Jason Hsu, Boyan Jovanovic, Roman Kräussl, Stefano Lovo, Raphael Markellos, Paul Marsh, Pedro Matos, Victor Niederhoffer, Ludovic Phalippou, Raghavendra Rau, Luc Renneboog, Mike Staunton, David Thesmar, Viktor Tsyrennikov, Patrick Verwijmeren, Michaël Visser, Mungo Wilson, Josef Zechner, and participants at the American Association of Wine Economists 2013 conference, American Economic Association 2013 conference, Eurhistock 2013 conference, European Summer Symposium in Financial Markets 2013, Luxembourg Asset Management Summit 2014, Maastricht Art Market Symposium 2013, Norwegian Financial Research Conference 2014, Q-Group 2014 seminar, Research Affiliates Advisory Panel 2014, World Investment Forum 2014, and seminars at Cambridge Judge Business School, East Anglia, Gothenburg, HEC Paris, Luxembourg School of Finance, Norwegian School of Economics, Saïd Business School, and the Spängler IQAM Research Center for data and comments. For financial support, we are grateful to the Newton Center for Endowment Asset Management at Cambridge University (Elroy Dimson) and ANR/Investissements d'Avenir under grant ANR-11-IDEX-0003/Labex Ecodec/ANR-11-LABX-0047 (Christophe Spaenjers). We have no financial relation with organizations that could benefit from our findings. All errors are ours.

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## 1. Introduction

Among wealthy individuals, fine wine is a popular investment. About one-quarter of high net worth individuals around the world own a wine collection, which on average represents 2% of their wealth (Mitchell, 2012). Many wine funds have sprung up to satisfy the increasing demand to invest in fine wines. In light of the long-standing yet rising status of high-end wines as an investment—and given the debate on the role of alternative investments in portfolio choice more generally (e.g., Swensen, 2000; Ang, Papanikolaou, and Westerfield, 2014)—a study of long-term price trends in this market and a comparison with more traditional assets is timely.

A small literature exists on the returns to storing wine, but the findings are mixed and depend on the period being investigated. Based on four years of auction data, Krasker (1979) finds that average returns to holding red Bordeaux and California wines are no larger than returns on Treasury bills after transaction costs. Jaeger (1981) expands the time frame by four years and finds the opposite. Later studies apply more sophisticated methods for constructing price indexes, but they also work with 15 years of data or less. Burton and Jacobsen (2001), for example, estimate returns on red Bordeaux wines from 1986 to 1996 and find returns to be low and relatively volatile. Examining the subsequent decade, Lucey and Devine (2015) find that their Bordeaux and Rhone wine indexes yield returns in excess of Treasury bills and with risk below the stock market. Masset and Weisskopf (2010) study a number of wines from 1996 to 2009 and conclude that adding wine to an investment portfolio can increase its return while lowering risk. Kourtis, Markellos, and Psychoyios (2012) reach similar conclusions in a study of wine prices from 2001 to 2010.

By considering historical prices over many decades, we bring a longer-term perspective to studying the price dynamics of fine wine. Our work is in the spirit of recent research on the performance of other emotional assets such as art (e.g., Goetzmann, 1993; Mei and Moses, 2002), stamps (Dimson and Spaenjers, 2011), or violins (Graddy and Margolis, 2011). It can also be compared with studies of long-term equity and bond returns (e.g., Schwert, 1990; Siegel, 1992; Jorion and Goetzmann, 1999; Dimson, Marsh, and Staunton, 2002) and vintage effects in equities (Jovanovic and Rousseau, 2001).

Furthermore, we investigate how aging affects wine prices independently of changes in market conditions. Identifying the effects of aging requires separating them not only from time effects but also from effects related to particular vintages, and this is another dimension upon which our contribution is unique. A few studies on cross-sectional variation in wine prices show that older wines tend to command higher prices (Di Vittorio and Ginsburgh, 1996; Ashenfelter, 2008) but do not separate effects of vintage quality from age.

One reason that it is interesting to look at the effects of aging on prices and returns is that even wines which have lost their gastronomic appeal can be valuable if they provide enjoyment and pride to their owners. By estimating life-cycle price patterns, we examine if and when nonfinancial

ownership dividends codetermine price levels for well-known wines. Considering such non-pecuniary benefits along with pure financial returns is relevant from a broader asset pricing perspective. For example, nonfinancial utility could also play a role in markets for entrepreneurial investments (Moskowitz and Vissing-Jørgensen, 2002), prestigious hedge funds (Statman, Fisher, and Anginer, 2008), socially responsible mutual funds (Bollen, 2007; Renneboog, Ter Horst, and Zhang, 2011), social, environmental, and ethical portfolios (Dimson, Karakaş, and Li, 2015), and art (Stein, 1977; Mandel, 2009). Heinkel, Kraus, and Zechner (2001) and Hong and Kacperczyk (2009) show that the non-pecuniary disadvantages associated with holding particular assets could also affect expected returns.

We begin by presenting a simple and stylized model of price dynamics that accounts for fluctuations in a famous wine's consumption value and attractiveness as a collectible over its life. The model proposes that, in general, a wine's fundamental value is governed by the maximum of three measures: (1) the value of immediate consumption, (2) the present value of consumption at maturity plus the nonfinancial ownership dividends received until consumption, and (3) the present value of lifelong storage (i.e., the value as a collectible). The model ties the values of consumption and ownership dividends to financial wealth, which reflects the discretionary nature of luxury goods (Goetzmann and Spiegel, 1995; Ait-Sahalia, Parker, and Yogo, 2004). It also implies that, abstracting from changes in quality, the price appreciation of wines over time is determined by the growth rate of wealth. Cross-sectionally, the model delivers different predictions for the price patterns of low-quality and high-quality vintages of superstar châteaux over their respective life cycles. The consumption value of a low-quality vintage declines quickly after bottling and leads to a fall in price. This persists until the present value of the enjoyment associated with infinite ownership of the wine (storing without the goal of ever drinking) exceeds that of consumption, at which point prices start rising with age. Prices of high-quality vintages, which improve in quality after bottling, rise strongly until maturity and then stabilize. Eventually, as these wines begin to be regarded as collectibles instead of consumption goods, prices advance again. For all wines, financial returns reflect the effects of both wealth growth and aging on prices. The expected financial return on wine is always below the appropriate discount rate because the nonfinancial ownership dividends received while storing a bottle endogenously lower the required capital gain. This is especially relevant for wines that are long beyond maturity, as their fundamental values are determined by their value as collectibles (i.e., by the future stream of ownership dividends) and not by their consumption value.

We next describe a unique historical database of prices for five long-established Bordeaux wines: Haut-Brion, Lafite-Rothschild, Latour, Margaux, and Mouton-Rothschild—the Premiers Crus or First Growths. We construct this database using two types of price information: transaction prices realized at auctions organized by Christie's London and retail list prices of the London-based wine dealer Berry Bros. & Rudd (BBR). The data are hand-collected from various sources, including archived auction

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