

## **On pricing unconventional prepaid forward contracts: the case of *en primeur* fine wines**

Abstract:

*En primeur* is one of the possible methods of fine wine trading. An *en primeur* agreement is an unconventional forward contract, with no guarantee of the quality of wine to be delivered and with a timing option embedding within it. In this paper we take the perspective of an institutional investor considering the purchase of *en primeur* wines on the Liv-platform, and we examine the differences in quoted fine wine prices and their dispersion around mean values over three distinct periods. Our contribution to the existing literature is threefold. Firstly, we provide a new conceptual framework for analyzing the properties of *en primeur* prices based on the cost of carry approach. Secondly, we propose a method of estimating the relevant market parameters when only sparse and non-synchronous data is available. Thirdly, we empirically estimate the parameters relevant for pricing the forward contracts (with reference to the example of a commodity prepaid forward). The results, based upon Bayesian modeling, indicate that the cost of carry increases up to 0.9598 when *en primeur* (forwards) and bottled wines (spot) are traded in parallel. Moreover, our findings confirm that price dispersion around the mean value (as measured by the standard deviation) is greater for *en primeur* wines (22.42%) than for standard bottled wines (8.2%) traded after the sale of *en primeur* wines has ended.

Key words: prepaid forwards, Bayesian methods, fine wine trading, *en primeur*, Liv-ex

JEL classification: G12, G15, Q02, L66

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## 1. Introduction

In their search for attractive risk-adjusted returns, individual and institutional investors look beyond traditional financial markets and explore investment opportunities in various non-financial assets. Fine wines belong to increasingly popular alternative asset classes that are expected to provide capital appreciation over the investment life-cycle, due to their growing consumption value and ownership dividends (Dimson et al. 2015).

Innovations in trading infrastructure (e.g. electronic trading platforms such as Liv-ex that operate similarly to stock exchanges), trade globalization (particularly growing demand from emerging markets), and the attributes of the product itself (e.g. high quality, decades-long maturing, increasing scarcity, rating) have created space for specialized investment entities - fine wine investment funds to actively operate in the fine wine market and to offer portfolio diversification for eligible investors. The Wine Source Fund, a fund regulated by the Malta Financial Services Authority (MFSA) and registered under the Alternative Investment Fund Manager's Directive (AIFMD) of the European Union, or the Wine Investment Fund, a mutual fund company incorporated under the laws of Bermuda and registered as a segregated accounts company under the Segregated Accounts Company Act 2000 of the United Kingdom, are just two examples of such entities and their possible legal instantiations. What connects them is an investment policy aimed at capital allocation in the most reputable and highly sought after vintages, primarily from the Bordeaux wine region, and the determination of their net asset value on the basis of Liv-ex prices.

*En primeur* is one of the possible methods of fine wine trading, where transactions are concluded in the early summer following the vintage, up to two to three years before the wine has become a finished product ready for delivery. This makes an *en primeur* agreement an

unconventional forward contract, with no guarantee of the quality of wine to be delivered (Ali and Nauges, 2007). More precisely, it is a prepaid forward contract with an embedded timing option: the parties agree to provide a bottled wine at a settled prepaid price at a future date (after bottling) and the seller holds the right to set the final date of the official vintage release and commencement of wine delivery. Although both practitioners and researchers tend to call *en primeur* agreements wine futures (Baciocco et al. 2014, Noparumpa et al. 2015, Ashton 2016, Cyr et al. 2017), we consider them to be formally forwards, as they lack the salient features of futures traded on derivative markets, e.g. rigorous standardization (specified quality, quantity, delivery date), high market transparency, marking to market, margin payments and daily settlements, rollover, to name but a few.

The primary market for Bordeaux *en primeur* wines operates habitually in the negociant system, where negociants – a pre-arranged group of wholesalers – contract the purchase of wines from a particular chateau in advance. Trading in the secondary market additionally involves other professional wine traders: merchants, brokers, wholesalers or investors. Transactions are performed both off- and on-exchange. Liv-ex is one of the leading global wine exchanges, providing its more than 400 members with the opportunity to trade *en primeur* wines on the electronic trading platform.

In this paper we take the perspective of an institutional investor considering the purchase of *en primeur* wines on the Liv-platform and examine the differences in the quoted fine wine prices depending on a predefined market scenario. More specifically, based upon Bayesian modeling, we compare the prices (present values) of prepaid forward contracts (*en primeur*) with spot prices, both theoretical and observed, for each wine producer and vintage. By employing the cost of carry concept we consider general storage costs to be the differentiation factor between forwards and spot values. In addition, we provide analysis covering price dispersion around mean values over three distinct periods: (i) when forwards are exclusively

subject to trading, (ii) when forwards and spot trade in parallel, (iii) when spot contracts are exclusively subject to trading.

Our contribution to the existing literature is threefold. Firstly, we provide a new conceptual framework for analyzing the properties of *en primeur* prices based on the cost of carry approach. Secondly, we propose a method of estimating the relevant market parameters when only sparse and non-synchronous data is available. Thirdly, we empirically estimate the parameters relevant for pricing the forward contracts (with reference to the example of a commodity prepaid forward).

## 2. Trading *en primeur* on the Liv-ex exchange

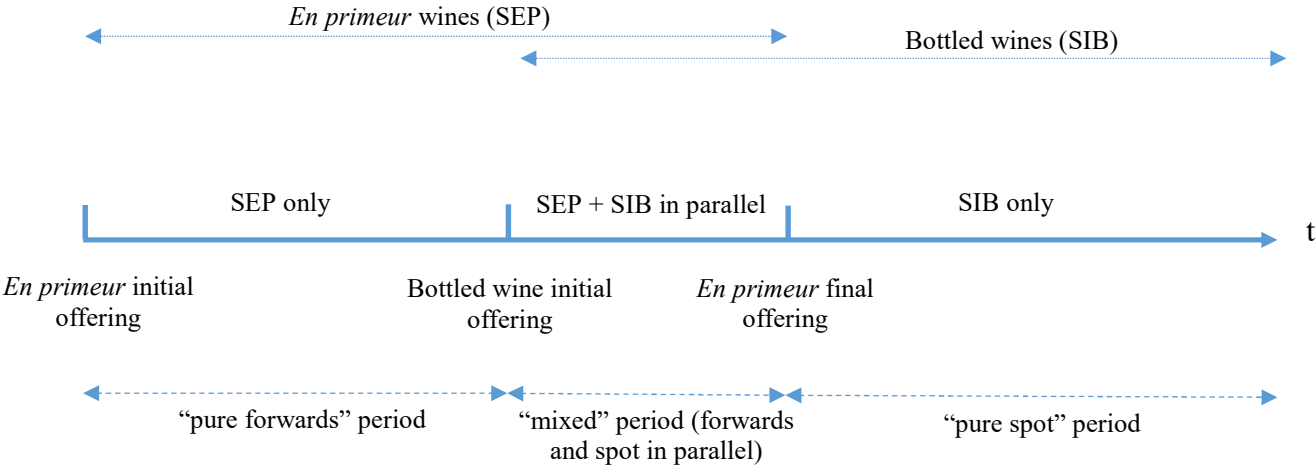
### 2.1. Contract standards

Trading on Liv-ex is carried out according to strictly predefined rules and conditions included in the Liv-ex Membership Terms (Liv-ex 2018a), which must be accepted by all exchange members. Traders post their bids and offers on the order book and if buy-sell orders match, Liv-ex, being an intermediary in each trade, buys the wine from the seller and sells it to the buyer, charging both parties transaction fees. All trades are based on three types of contracts: Standard in Bonds (SIB), Standard En Primeur (SEP), and Special (X). The major characteristics of each are presented in Table 1 (see appendix).

Trading SEP is allowed for authorized sellers who provide a bank guarantee, an insurance bond or a cash margin. In practice, due to the wine production cycle, SEP contracts for a given producer and vintage are the first to be transacted on the exchange, just after the *en primeur* initial offering has been made by the chateau. They remain trading for a period of approximately two years, until the pre-ordered *en primeur* stocks have been finished by the last trader. When the bottled wines enter the market, SIB contracts begin trading. As some merchants will receive their stock before others, SEP and SIB contracts may be traded in parallel on the exchange for

several months. Exhibit 1 illustrates a simplified timeline with periods for trading particular types of contracts. The phase when solely SEP contracts are subject to trade may be called a “pure forwards” period. In turn, the subsequent and shortest phase, when both SEP and SIB contracts are traded in parallel may be marked as a “mixed period”. Such parallel trading can be exemplified by the case of Mouton Rothschild 2009, which on 01-03-2012 was transacted on the Liv-ex platform under an SEP contract, whereas on 22-01-2012 under an SIB contract. Thereafter, the longest period during the lifecycle of fine wine commences, with only SIB contracts being traded – a “pure spot” period. All orders provided under SEP conditions should be considered to be prepaid forwards contracts, and all SIB orders – regular spot transactions under Liv-ex terms.

Exhibit 1. Trading SEP and SIB contracts on Liv-ex



Trading SEP in the “pure forwards” period takes place when the underlying (bottled wine) is not yet available. The lack of quotes for an underlying is not an untypical case for derivatives markets. An analogous situation, albeit over a considerably shorter time span, occurs in futures markets, for instance, when futures contracts trade while the market for the underlying is closed (Chang et al. 1995, Huang 2002, Chan 2005). It is broadly confirmed that in such cases futures

prices tend to lead the price discovery and play an informative role for the spot market (Cheng et al. 2004, Sohn and Zhang 2017).

## 2.2. Storage costs

To facilitate trade on the exchange, Liv-ex offers storage and logistics services via interconnected warehouses and collection hubs. In addition to regular transaction fees, charged on every buy-sell transaction, and settlement fees, which are incurred for each unit traded on Liv-ex platform and processed via Liv-ex warehouses, there are different types of standard and optional storage fees (Liv-ex 2018b). They are charged on a per unit basis, which is taken to be a single case of wine, whatever the quantity of bottles it holds, such as 1x75, 6x75, 12x75. The standard charges for storing wines in Liv-ex vary depending on the warehouse location (Europe or Asia). Optional storage charges may include SIB passport and photos, repacking charges, export documents or stocktaking services among others. One important component of all transaction and storage costs is that of insurance charges, calculated as a flat per month policy fee plus a percentage of the average monthly stock value on an individual storage account. Due to the complex fee structure and differences in wine stocks between traders it is hardly to indicate an average level of storage costs per unit that could be a proxy for the cost of carry. However, assuming standard fees for the case of one unit worth 1000 GBP, constituting the total monthly stock value, an estimated total for annual storage costs of 127 GBP may be calculated for this hypothetical case. Obviously, *en primeur* purchases do not incur storage or insurance charges until they are delivered.

## 3. Related literature

Fine wines have been widely regarded as an alternative asset class. Thus, an abundance of research in financial markets and wine economics literature examines their price behavior

(Ashenfelter 2008; Dimson et al. 2015; Czupryna and Oleksy 2015), investment attributes (Sanning et al. 2008; Masset and Henderson 2010, Bouri 2015, Masset et al. 2016), capabilities to hedge against inflation (Erdős and Ormos 2013) or interdependencies with other markets (Bouri and Azzi 2013, Faye et al. 2015 ).

In the case of *en primeur* wines, special attention is paid to wine critics' evaluations, which are normally carried out before the primeur selling price is determined and thus have a major influence on price formation (Jones and Storchmann 2001; Ashenfelter 2010, Hay 2010; Ali et al. 2010, Dubois and Nauges 2010; Noparumpa et al. 2015, Masset et al. 2015). In nominal terms, as estimated by Ali et al. (2010), the impact of Parker scores attributed in 2003, was equal to 2,80 euros per bottle of wine. Correspondingly, Ali and Nauges (2007) indicate the informative role of *en primeur* prices, as a 10% increase translates into a 3% increase in subsequent prices on the market for bottled wines. The strong influence of wine critics in this market, who play an analogous role to that of the rating agencies in conventional futures markets (Hay 2010), evokes the attempts to determine a standardized rating system for Bordeaux *en primeur* (Cardebat and Paroissien 2015).

The growing interest in fine wine investments, often of a speculative nature, contributes to increased variations in market prices. The risks associated with buying wine *en primeur* are usually greater than the risks involved in purchasing other types of wine (Ashenfelter 2010, Liv-ex 2018a). This creates space for suitable risk management tools, including customized and standardized derivative instruments (Kourtis et al. 2012). Despite the failure of the only conventional wine futures contract introduced to date, Winefex by Euronex (Pichet, 2010), and existing objective limitations of wine as an underlying, resulting from considerable product differentiations (Viviani 2006), further development of various concepts and solutions enabling offsetting of the risks involved in wine trading is a necessary and desirable outcome for the growing number of market participants. Whether *en primeur*, being a “natural” prepaid forward

contract, can be employed by traders and investors to manage market risk, is one of the major research questions we address in our study.

#### 4. Methodology and data

##### 4.1. Data

Our unique dataset includes prices of Premier Cru fine wines from the Bordeaux region (Haut Brion, Lafite Rothschild, Latour, Margaux, Mouton Rothschild), vintages 1992-2008, traded under SEP and SIB conditions on the Liv-ex exchange. The time span covers a ten-year trading period (2005-2014). All data has been collected directly from the Liv-ex trading platform.

##### 4.2. Problem setting

The problems we consider are: (1) what is the value of cost of carry when both SEP and SIB contracts for the same wine and vintage are traded in parallel, and (2) what is the dispersion of the prices around the mean price (value)?

As the data on exact delivery dates for SEP contracts was not available in the trading platform, we set the fixed delivery data for *en primeur* wine at 31.05.X (where X denotes vintage + 3 years), which is compliant with the general Liv-ex terms. As informed by the Liv-ex logistics team, 90% of SEP sales are typically received by the end of June. This simplification allowed us to omit the embedded timing option from our current analysis. Additionally, we assume that the delivery period is at least 2 months (60 days), based on the typical (expected) delivery dates as received from Liv-ex.

Based upon market observations, we hypothesize that:

H1: *en primeur* wines (forwards) are traded at higher prices than bottled wines (spot) due to the cost of carry (we assume a positive value for cost-of-carry).



H2: the dispersion is lowest for standard wines (spot) in the “mixed” period, where bottled wines are being traded in parallel (SIB enables an arbitrage and acts as an “anchor”), and highest for *en primeur* wines (forwards) when no bottled wines (spot) (highest uncertainty referring to the unobserved mean spot price).

Assuming, that *en primeur* are prepaid forward contracts, we calculate the *en primeur* price, which is the time 0 prepaid forward price for wine delivery at time T, as (McDonald, 2013):

$$F_{0,T}^P = F_{0,T} \cdot e^{-r \times T} \quad (1)$$

Taking into account cost of carry, assuming continuous storage costs of  $\lambda$  to be incurred continuously and proportionally to the value of the wine, and substituting  $F_{0,T}$  by:

$$F_{0,T} = S_0 \cdot e^{(r+\lambda) \times T} \quad (2)$$

we finally express  $F_{0,T}^P$  as:

$$F_{0,T}^P = S_0 \cdot e^{\lambda \times T} \quad (3)$$

where:

$F_{0,T}^P$  - *en primeur* price at time 0 to be delivered at time T (pre-paid forward price)

$F_{0,T}$  - theoretical forward (SEP) price

$S_0$  - (theoretical) spot (SIB) price

$T$  - expiration date

$r$  - risk free interest rate

$\lambda$  – cost of carry

Now let us assume that the investor has two choices: either to buy SEP or SIB, and then to hold it to the delivery date of the *en primeur* wine.

Then we may observe that:

$$\ln\left(\frac{F_{t+1}^p}{F_t^p}\right) = \ln\left(\frac{S_{t+1}}{S_t}\right) - \lambda \cdot \Delta T \quad (4)$$

Therefore, the rate of return of *en primeur* prices should differ from the rate of return of (hypothetical) prices of SIB.

### 4.3. Estimating hypothetical fine wine value

#### 4.3.1. Model specification

We assumed that the (unobserved) value of wine (per individual bottle) for each producer/vintage changes proportionally with the Liv-ex 50 index, with a proportionality coefficient  $\beta_{p,v}$ , where  $p$  indexes the producer and  $v$  indexes the vintage.

This value is then adjusted in a single transaction, depending on

- the amount of wine being transacted (log-log relationship assumed, to directly estimate the elasticity),
- the number of *en primeur* days remaining (negative value),
- for *en primeur* wines, whether a parallel trade occurs, i.e. whether the same wine is offered in bottles concurrently (weighted by the number of *en primeur* days remaining).

More formally:

$$\text{IVal}_w = \ln(\beta_{p,v} \times \text{index}_w) + E_q \times \ln(q_w) + E_{\text{epr}}(d_w \times \text{epr}_w) + E_{\text{par}}(d_w \times \text{par}_w) \quad (5)$$

where:

- $w$  indexes the transactions,
- $\text{IVal}$  is the log value in a given transaction,
- $\text{index}$  is the value of the Liv-ex 50,
- $q$  denotes the total number of bottles sold,
- $\text{epr}$  is a dummy variable set to 1 for wines traded as *en primeur*,

- $par$  is a dummy variable set to 1 for *en primeur* wines if a market for bottled wines co-existed,
- $d$  is a (negative value) variable denoting the remaining days of *en primeur* trading,
- $\beta_{p,v}$ ,  $E_q$ ,  $E_{epr}$ , and  $E_{par}$  are parameters to be estimated.

We further assume that the actually observed price is generated from a symmetric distribution around the value, i.e. around  $\exp(IVal)$ . To account for the possibility of fat tails, we assumed this distribution to be a generalized t-Student distribution with the number of degrees of freedom,  $df$ , to be estimated. To reflect the fact that we expect larger deviations of prices for more expensive wines, we assumed that the standard deviation of this distribution is proportional<sup>4</sup> to the  $\exp(IVal)$ . Finally, we assumed that the proportionality co-efficient differs for wines traded as *en primeur* and may further differ if a parallel bottle market coexists.

#### 4.3.2. Model estimation

The model was specified in a Bayesian framework with non-informative priors (Kruschke 2014). The posterior distributions were estimated with Markov Chain Monte Carlo in the JAGS/R environment. In the simulation, 1000 adaptation, 10,000 burn-in, and 10,000 actual iterations were used with four chains (random initial values). Medians of the posterior distributions were used as point estimates, and 2.5% and 97.5% percentiles were used to construct the 95% credible intervals (95% CIs). The model convergence was tested with PSRF statistics (no problems were identified).

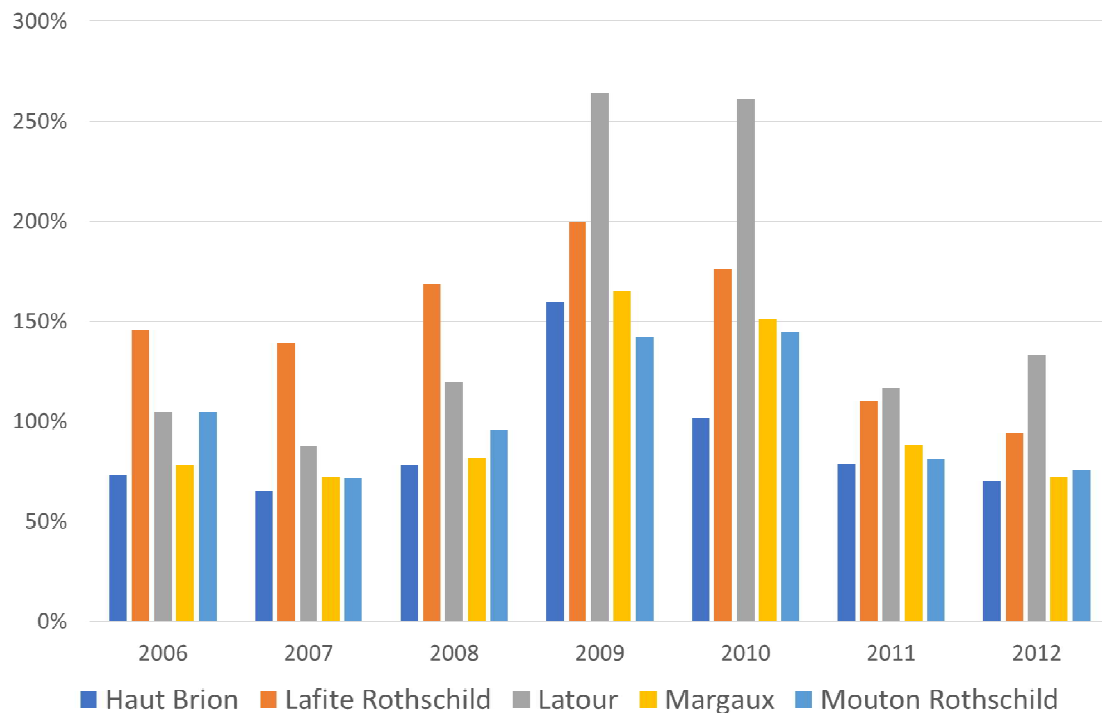
## 5. Results

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<sup>4</sup> A small constant was added to prevent numerical problems.

The results of the  $\beta$  parameters estimation are presented in figure 1 below. Clearly, vintages 2009 and 2010 provide the most value, especially for the Latour producer. For earlier vintages, Lafite Rothschild offers greater value.

Figure 1. The  $\beta$  parameters for the analysed producers and vintages.



The estimated values of other parameters are presented in table 1. Surprisingly, the point estimate of the amount elasticity is positive, suggesting a price increase for larger transactions. However, the absolute value is very small, and the 95%CrI contains zero, suggesting no significant impact of the transaction size on the price.

The impact of the *en primeur* trading on price is also non-significant. The impact of the parallel trading is significant and negative: the prices for the *en primeur* wines when the bottled wines are also available tend to be higher by 0.26% on average for each day.

There are no particularly fat tails, with the estimated number of degrees of freedom being around five. There are, however, differences in the price variability between wine types:

the variability is greatest for *en primeur* wines (decreases slightly when parallel trading is present) and not even half of that for regular trading.

Table 1. Estimated values of parameters ( $E_{epr}$  and  $E_{par}$  expressed as a per annum basis)

Parameter	Point estimate	95% CI
$E_q$	0.0033	(-0.0006; 0.0071)
$E_{epr}$	0.0037	(-0.0057; 0.0132)
$E_{par}$	-0.9598	(-1.0822; -0.8358)
SD en primeur	0.2242	(0.2117; 0.2378)
SD en primeur + parallel	0.1872	(0.1517; 0.2282)
SD other	0.0802	(0.0763; 0.0842)
df	5.63	(4.50; 7.06)

We can observe that the price dispersion around the mean value (measured by the standard deviation) has the highest value for SEP (forwards) contracts traded in the “pure forwards” period (22,42%), followed by SEP contracts traded in parallel with SIB (spot) contracts (18,72%). The additional information included in the spot prices reduces the price dispersion. We also observed that the dispersion for SEP contracts is significantly higher than the dispersion for SIB contracts, which is equal to 8,02%. This could be caused by the limited confidence in experts’ judgments and uncertainty about the ultimate quality of the wine. In addition, all risks associated with the future conditions (two years ahead) of the economy, especially in Asian emerging markets (primary China) that are important drivers of demand for fine wines in recent years, should not be disregarded.

The estimated value of cost of carry for *en primeur* contracts traded in the “pure forwards” period is zero (0,0037). As no spot contracts (SIB contracts) are available in this

period no arbitrage is ultimately possible. One explanation for this is that *en primeur* contracts substitute for missing spot contracts. Another possible explanation is that the cost of carry is offset by the missing opportunity to trade. Admittedly, it is possible to make transactions in one SEP contract several times, but usually it trades only once at the outset, because the buyer does not have any direct allocation and there is then very little incentive to trade it again because prices remain flat.

Cost of carry for SEP contracts is significant and positive (the negative value in Table 1 results from the convention we used in Bayesian modeling for time, namely we modeled time before delivery as a negative value) when SIB contracts are traded in parallel. SEP contracts are traded at prices around 17% higher than the analogous SIB contracts. This may be justified as there are no storage costs for the buyer of the SEP contracts until delivery. Therefore, those investors that do not need wine immediately can buy SEP contracts instead of SIB contracts and thereby avoid additional storage costs. Nevertheless, the estimated value of cost of carry at 0.9598 does seem to be exceptionally high. This might be caused by the assumption of a two month period for delivery, which seems to be overly optimistic and market participants may expect longer delivery periods.

## 6. Conclusion and further research

In this paper we have analyzed *en primeur* fine wines which are subject to trading before they have become finished, bottled, products. By taking the perspective of an institutional investor allocating capital in the fine wine market via the Liv-ex platform, we examined the price behavior of wine forwards (Standard En Primeur) and spot (Standard In Bond) depending on a predefined market scenario. To overcome the problem of sparse data we employed a Bayesian approach.

This approach enabled us to positively verify both hypotheses. In our first hypothesis, we postulated that *en primeur* wines (forwards) are traded higher than standard wines (spot) due to the cost of carry. Our results indicate that the cost of carry equals 0 in the first (“pure forwards”) period and increases up to 0.9598 in the second (“mixed”) period, when *en primeur* and bottled wines are traded in parallel. Furthermore, our findings confirm that the price dispersion around the mean value (as measured by the standard deviation) has the highest value for *en primeur* contracts traded in the “pure forwards” period (22,42%), followed by *en primeur* contracts traded in the “mixed” period (18,72%), what is consistent with our second hypothesis. The additional information included in the spot prices reduces the price dispersion.

Our subsequent research will concentrate on the behavioral and microstructural aspects of *en primeur* trading, the hedging potential of *en primeur* wines and the valuation of embedded timing options.

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## APPENDIX

Table 1. Characteristics of Liv-ex contracts

	Standard In Bond (SIB)	Standard En Primeur (SEP)	Special (X)
Price	In GBP/EUR to include delivery to a Liv-ex warehouse. Stock must be under bond.	In GBP/EUR to include delivery to a Liv-ex warehouse.	In GBP/EUR to include delivery to a Liv-ex warehouse.
Conditions	Wine is in its original packaging and in good condition.	SIB terms apply.	Specified if not compliant with SEP or SIB.
Payment	Payment is due 7 days from the end of the period in which the trade is invoiced. (Liv-ex will invoice trades once stock has been received in its London warehouse. There is no extended credit terms. Liv-ex will pay sellers 7 days after the end of the period in which the trade is invoiced or will send net amount as agreed.	Payment is due 7 days from the end of the period in which the trade is invoiced. (Liv-ex will issue an invoice on day of trade for En Primeur transactions). All sales will be backed by a guarantee. iv-ex will pay the seller on receipt of the guarantee or according to normal payment terms if later.	Normal terms (buyer pays 7 days from the period end; Liv-ex pays 7 days from period end) unless specified in special terms.
Delivery conditions for sellers	Seller must deliver to Liv-ex within 14 days of trade	By the end of May, two years following the producer's initial En Primeur offering. (Failing that, within 60 days of the bottled wine being ready for collection at the property).	Specified by seller on the exchange.
Availability in buyer's Liv-ex account	On arrival with Liv-ex, the wine is checked and released to the buyer. It can take up to 30 days from the data of trade to be made available to the buyer, subject to cleared funds being received.	On arrival with Liv-ex, the wine is checked and released to the buyer. Wine is made available to the buyer by the end of June two years following the initial offering by the chateau/grower/property producing the wine or earlier	On arrival with Liv-ex, the wine is checked and released to the buyer. Stock will be available to the buyer within two weeks of receipt by Liv-ex, subject to cleared funds being received.
Minimum order size	One unit	One unit	Specified if not complied with SEP or SIB.

Source: Liv-ex, [www.liv-ex.com](http://www.liv-ex.com) (accessed: 18-05-2018)