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

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Conference Presentation

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Keywords
en primeur, prepaid forwards, fine wine trading, wine contracts

Research Question
1) what is the value of cost of carry when SEP and SIB contracts are traded in parallel
2) what is the dispersion of the prices around the mean price

Methods
the cost of carry approach, a Bayesian modelling with non-informative priors

Results
1) the cost of carry increases up to 0.9598 when en primeur and bottled wines are traded in parallel
2) price dispersion around the mean is greater for en primeur

Abstract
1. Introduction
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 make 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).
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 Rothshild 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.
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 inter-connected 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. 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. Taking into account cost of carry, assuming storage costs of λ to be incurred continuously and proportionally to the value of the wine, we express $F_{(0,T)}^P$ as:

$$F_{(0,T)}^P = S_0 \bullet [e^{(\lambda \times T)}]$$

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 – time to expiration

r - risk free interest rate

λ – cost of carry

4. Model specyfication

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).

We further assume that the actually observed price is generated from a symmetric distribution around the value,

i.e. around exp("lVal"). 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 to the exp("lVal"). 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.

5. Results

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 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.