
What's wrong McFly? Chicken? Back to the Bitcoin Futures

Introduction

The purpose of this article is to analyse different futures markets on cryptocurrencies and try to find justifications for excessive premia and discrepancies in prices.

Firstly, we are going to present a general overview on cryptocurrencies and futures, then a short analysis of premia and finally we'll look at the discrepancies amongst different exchanges and try to explain why this might be the case. The data was sourced directly from the exchanges.

For our previous articles on the topic: www.bsic.it/?s=bitcoin

A Note on Cryptocurrencies

Bitcoin and cryptocurrencies at large are an unconventional asset class which witnessed an exponential increase in price and popularity during the past year. Bitcoin alone increased by more than 1200% during 2017 and the total market cap of cryptocurrencies increased by more than 1600%. The beginning of 2018 saw a significant correction, Bitcoin crashed to around \$6000 before rebounding and is now trading at around \$10000.

As the reader might have gathered, cryptocurrencies are an extremely volatile asset and there have been concerns that it might be financial bubble, with memories of the infamous tulip-mania in mind. Another concern regards the amount of energy consumed by the network of miners to securely validate Bitcoin transactions and create new blocks on the blockchain. The network consumes annually more than 0.1% of the world energy consumption and if it were a country it would rank #51, just above Portugal (source: <https://digiconomist.net/bitcoin-energy-consumption>).

Fees have also sparked much controversy. Given the limit on the block size, only so many transactions can be included in the following block. This generates a market for fees to incentivize miners to include a transaction in the next block; in moments of high network load, fees could go as high as \$100 for a single high-priority transaction. For this reason, last August, a group of people decided to fork Bitcoin and increase the block size. The newly-created coin was named Bitcoin Cash (BCH) and is now worth around a tenth of Bitcoin. Since then, a few technical updates were implemented on Bitcoin and transaction fees are now to record-low levels.

A Note on Futures

Futures are standardized contracts that involve an agreement to buy or sell an asset (the underlying) at a specified price and time in the future. They are traded in many exchanges which behave as clearing houses: matching buyers and sellers and keeping track of traders' obligations and payments. In order to reduce credit risk, exchanges require traders to keep funds in their margin accounts and record the value of their positions at market price at the end of each day. There is an initial margin which determines the maximum leverage the trader can use, and a maintenance margin, usually lower, which is the margin required to keep the position open. Due to losses on positions a trader might not have enough margin on his account, in this case he receives a margin call: either he adds funds or the exchange will start liquidating his positions.

In an efficient market without frictions, arbitrage forces ensure that futures prices are such that the trader is compensated just enough for the time value of his money as well as for other costs he might incur, such as costs

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of carry. Throughout this article we will assume that a cryptocurrency does not pay dividends and that there are no costs in physically (that is, virtually) holding it, so that the price is:

$$F = Se^{r(T-t)}$$

And the implied interest rate:

$$r(T - t) = \ln\left(\frac{F}{S}\right)$$

With respect to the spot price, the future might trade at premium i.e. contango or at discount i.e. backwardation. This is determined by a number of reasons such as convenience yields, the possibility of shorting the underlying and the market expectations of future spot prices. We won't delve too much into technicalities, suffice it to say that at expiration the futures price converges to the spot but before that it happens that prices might diverge significantly. A trader who believes there is a mispricing might try to exploit the fact that the prices must converge eventually and for example short the futures and go long on the spot by borrowing money at the risk-free (strategy defined as Cash and Carry). However, if there are significant price movements, he might not have enough funds to withstand the losses and go effectively bankrupt before the expiration of the contract.

Futures on Cryptocurrencies

Derivatives are an important milestone in terms of development of a new asset class. Futures on Bitcoin have been trading since at least 2014 and those on other cryptocurrencies followed promptly. In this section we consider different futures quoted on Bitmex and try to analyse reasons behind premia and implied interest rates.

As stated before, Bitcoin futures don't have significant carry costs nor dividend yields. The price is then computed from the basic formula for future pricing. There are however a few caveats: several market imperfections as well as some inherent peculiarities of this asset class make the arbitrage argument somewhat weaker.

This is an example of a contract on BTCUSD, expired on December 29, 2017 with the relevant reference rate and volumes.

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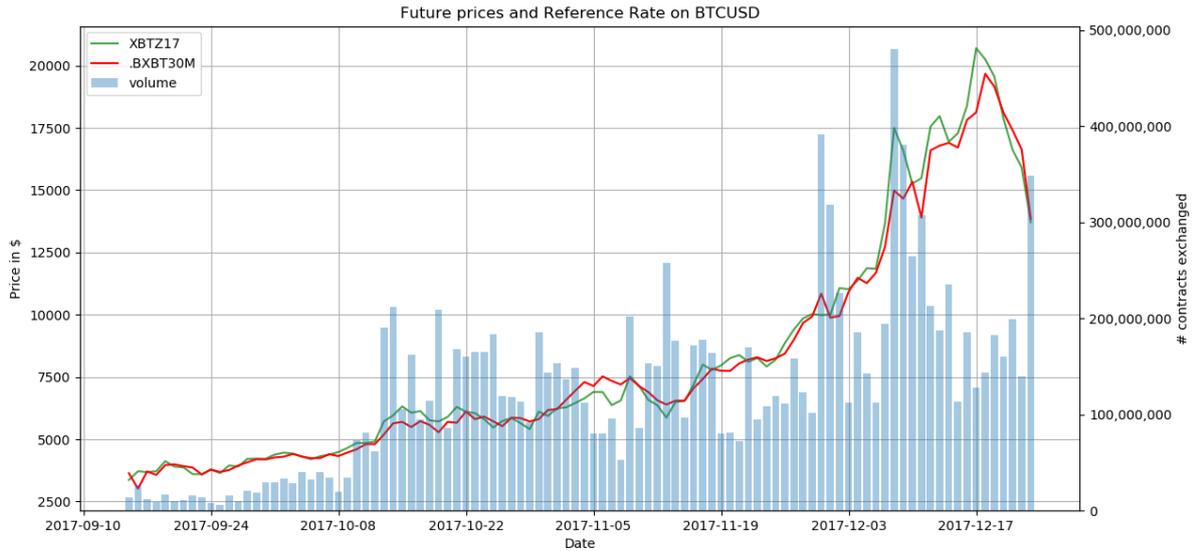


Fig1A. Note how the prices diverge significantly but converge at expiration

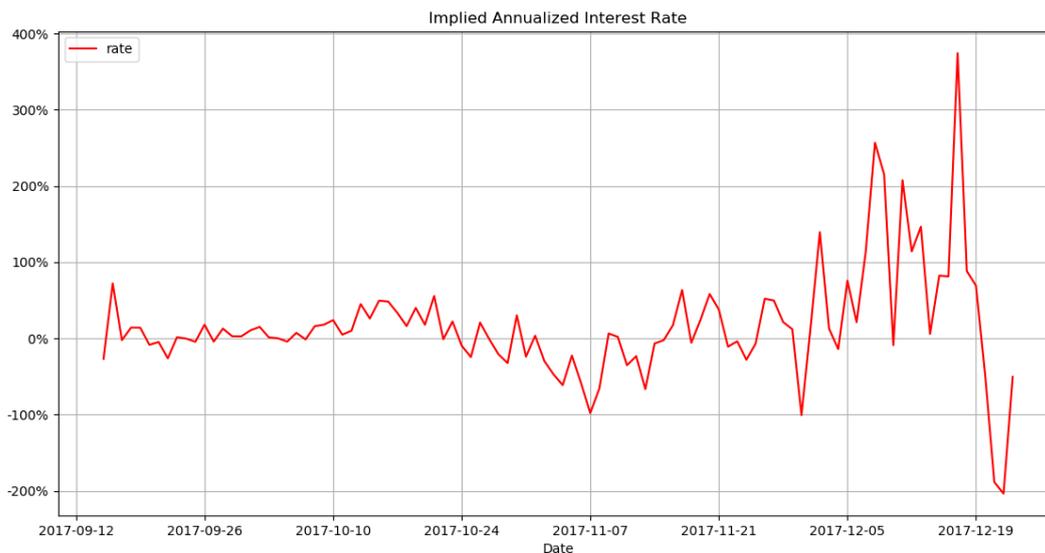
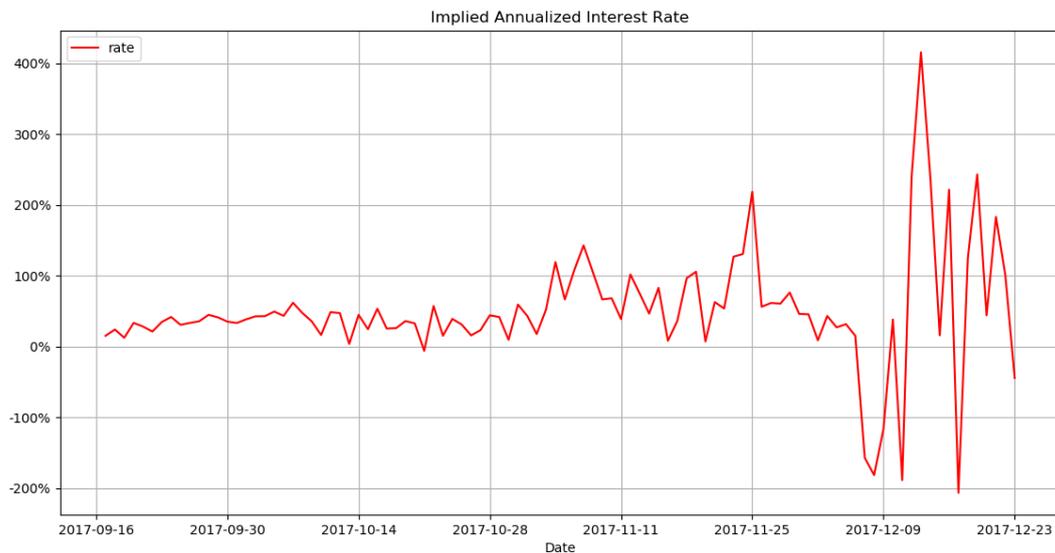
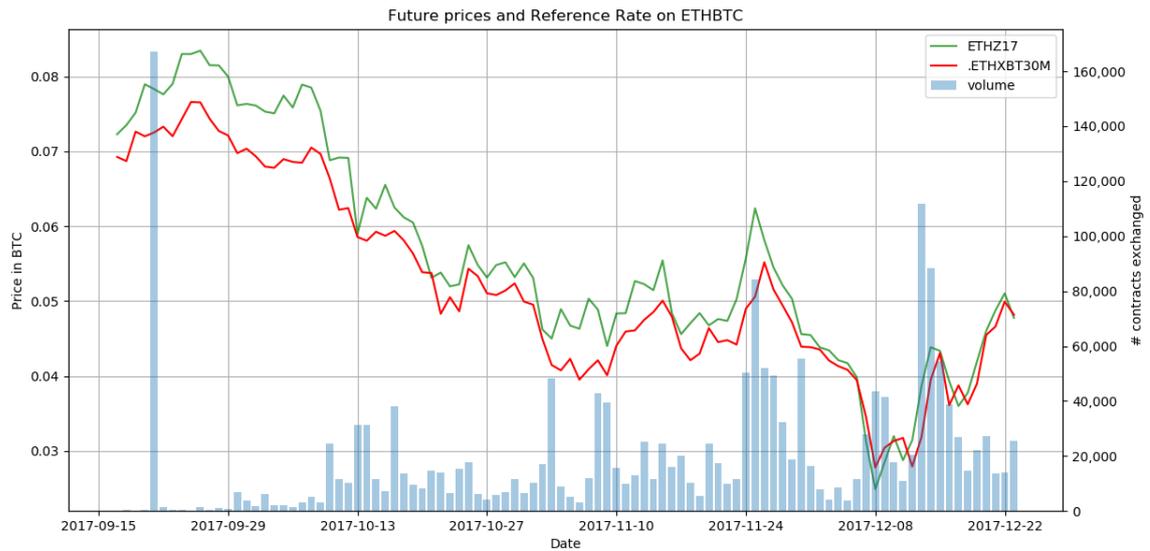


Fig1B. As you can see, the implied interest rate varies significantly over time and turns negative when the futures price is below the spot.

Here are the same charts for a contract on ETHBTC, expired on December 29, 2017.

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There are a few reasons why premia can go so high. Firstly, Bitmex allows leverage up to 100x on Bitcoin futures which means that at any point in time there can be a significant portion of traders with highly leveraged positions; maximum leverage is lower for other cryptocurrencies but their volatility is usually higher. Combining cryptocurrencies inherent volatility with risk-management mechanisms employed by the platform such as forced liquidation and auto-deleveraging, abrupt price movements of the underlying can bring about even more volatility in the futures market. Moreover, the rate should also compensate traders both for the risk of keeping assets on an unregulated exchange, which are usually more prone to fraud and misappropriation of funds, and for low liquidity, which is a common problem on other cryptocurrencies apart from Bitcoin and Ethereum. Finally, it should be noted that Bitmex only deals in Bitcoin, with no possibility of depositing fiat currency such as US Dollars. This means that whoever wants to trade on the exchange has effectively a long position on Bitcoin, another risk that needs to be compensated for. In theory, one could hedge his position by shorting Bitcoin on another exchange.

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However, that would entail paying a funding rate to margin lenders, which varies daily depending on demand and supply, as well as the risk of keeping funds on another unregulated exchange.

Even accounting for such factors, we believe there could still be some mispricing, especially during times of sharp market movements. For this reason, when the implied interest rate is excessively high (e.g. greater than 100%) it might be profitable to exploit a contango with a convergence trade, shorting the future and taking a long position on the spot. By the same token, it might be profitable to exploit a normal backwardation taking a long position on the future and shorting the spot; in this case the potential gains might be even higher as the futures price could go back trading at premium before converging at expiration. Opening such positions would still be very risky as the prices might diverge more before converging, with risks of margin calls and subsequent forced deleveraging.

Comparison of Different Futures Markets

In this section we compare four different trading outlets listing futures on BTCUSD. Two of them, Bitmex and Deribit, are unregulated exchanges while the other two, CME and CBOE, are traditional futures exchanges based in Chicago.

There are many factors that could explain the differences in prices amongst exchanges, we identified the following as the main drivers:

- Margin requirements and leverage
- Reference rates
- Contract size
- Fees
- Trading hours
- Margin offsetting
- Price limits and trading halts
- Expiration dates

In the following table we summarized some key information regarding the four exchanges under scrutiny; note that CME and CBOE are usually accessed by brokerage firms (e.g. Ameritrade), which could require higher margins.

	Initial Margin	Maintenance margin	Maximum Leverage	Reference rate	Cash settlement	Contract size
Bitmex	1%	0.5%	100x	.BXBT30M1	BTC	1 USD
Deribit	5%	3%	20x	Deribit BTC index2	BTC	10 USD

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CME	43% ³	43%	2.33x	CME CF Bitcoin reference rate (BRR) ⁴	USD	5 BTC
CBOE	44%	40%	2.27x	Gemini Exchange Auction	USD	1 BTC

1 30-minute TWAP of the .BXBT price index, which is calculated with equal weights from Gdax and Bitstamp

2 The index is calculated by sourcing prices from Bitfinex, Bitstamp, Gdax, Gemini, itBit and Kraken, taking out the highest and lowest price and then averaging the remaining four

3 The reported margins are for Hedgers, while the initial margin for Speculators is 10% more

4 The index is calculated as a weighted median of prices sourced from Bitstamp, Gdax, itBit and Kraken

Trading fees

CME fees vary depending on the type of subscription but are usually higher than \$1.25 per side per contract, which is the cost for Individual Members. There is currently a 50% fee waiver, effective until May 31, 2018. CBOE fees can be either \$0.25 or \$0.50 per contract per side. Deribit charges 0.05% for taker orders (i.e. orders that take liquidity from the book) and gives a 0.02% rebate for maker orders (i.e. orders that add liquidity to the book). Bitmex charges 0.075% for taker orders and gives a 0.025% rebate for maker orders.

Trading hours

The futures on Bitmex and Deribit trade 24/7 while the regulated exchanges trade on regular trading hours, with minimal differences between the two. This means that during Saturdays and Sundays until 6 p.m. trading is closed on both CME and CBOE.

Margin offsetting

Deribit offers portfolio margin to experienced traders, which means that margins are calculated summing PNLs on all positions. Bitmex and CME don't offer margin offsetting while on CBOE there is 5% spread of the net difference between maintenance margins on long and short contracts.

Price limits and trading halts

Deribit and Bitmex don't apply any sort of trading halts while CME and CBOE both have limits. CME doesn't allow daily variations of more than 20% and has soft limits (i.e. trading is halted for a short period of time) at 7% and 13%. CBOE halts trading for 2 and 5 minutes for variations of 10% and 20% respectively.

Expiration dates

Bitmex futures expiry on the last Friday of the expiry month at 12:00 UTC. Deribit contracts are settled at 8:00 UTC at the end of the month. With regard to CME, trading terminates at 16:00 UTC on the last Friday of the contract month. If that day is not a business day in both the UK and the US, trading terminates on the preceding day that is a business day for both the UK and the US. Settlement is at the VWAP of outright trades between 8:59

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and 9:00 UTC, the settlement period, rounded to the nearest tradable tick. For CBOE, The Final Settlement Date for Bitcoin futures is two business days prior to the third Friday of the expiration month. If the Final Settlement Date is a CFE holiday, the Final Settlement Date will be the business day immediately preceding the holiday.

As an example, Bitmex and Deribit both list a March contract expiring on the 30. CME lists a March contract which settles on April 4 and stops trading on March 29. CBOE March contract expires on the 14 and the April contract on the 18.

Conclusion

To sum up, there are significant differences between exchanges that list Bitcoin futures, particularly between regulated and unregulated exchanges. Differences in reference rates and expiry dates render an effective arbitrage practically unfeasible. A concern arises from discrepancies in trading hours. Bitcoin is a peculiar asset and is traded on a continuous basis and so are the futures on the unregulated exchanges. On the other hand, futures on regulated exchanges are limited to traditional trading hours and given the extremely high volatility of the underlying, this might bring about problems for an effective risk-management.

It's worth noting that the value proposition of these exchanges is quite different. Unregulated exchanges require little to none verification, settle in Bitcoin and have very small contract sizes, suitable more for crypto-traders than traditional investors. Regulated exchanges on the other hand have the advantage of giving the possibility to gain an exposure to Bitcoin without having to hold the underlying, as the contracts are all settled in US Dollars. The customer base of these exchanges is more likely to be made up of institutional investors, CFD brokers in search for a hedge as well as less tech-savvy retail investors. This is reflected in a significantly higher contract size as well as higher margin requirements. All things considered, unregulated exchanges are still far more popular, with conspicuously higher volumes and open interests.

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