

## RESEARCH ARTICLE

# Inverse Futures in Bitcoin Economy

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**Abstract.** Derivatives are financial instruments whose value depend on the values of other, more basic underlying variables. One of the most common and simple derivatives is a futures contract. This manuscript introduces the new kind of futures contracts called non-linear inverse futures contracts (inverse futures in short) firstly introduced by ICBIT trading platform specifically for Bitcoin trading and later picked up by major bitcoin trading platforms.

## KEY WORDS

1. Inverse futures. 2. Bitcoin derivatives. 3. ICBIT exchange.

## 1. Introduction

Derivatives are financial instruments whose value depend on the values of other, more basic underlying variables. They became very important financial tools in the world for transferring risks from one entity to another<sup>1</sup>. In many developing countries derivatives markets are growing fast.

One of the most common and relatively simple derivatives are forward and futures contracts. Forward is an agreement to buy or sell an asset at a certain future time for a certain price. Futures contract is also an agreement between two parties to buy or sell an asset at a certain time in the future for a certain price, however, unlike forward contract, futures contracts are traded on an exchange. That is made possible by specifying certain standardized features of the contract by the exchange. Also, as these two parties to the contract usually don't know each other, the exchange also provides a mechanism that gives the two parties a guarantee the contract will be honored<sup>2</sup>.

Derivatives markets attract different types of traders who can be broadly categorized into three categories: hedgers, speculators, and arbitrageurs. Hedgers use these markets to reduce the risk that they face from potential future movements of the underlying asset value, speculators use them to bet on the future direction of the underlying asset value and arbitrageurs take offsetting positions in two or more instruments to lock in a profit<sup>3</sup>.

Bitcoin could be seen as a new emerging economy, albeit not tied to any specific country nor regulated by any single entity. Yet, it still follows common economic principles, and Bitcoin users need a derivative market.<sup>4</sup> The aforementioned three types of traders (hedger, speculators and arbitrageurs) started to prevail in the Bitcoin / US Dollar exchange market (called "spot market") in 2011 too, however there was no exchange, in its classic, regulated

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understanding, which would provide a way to trade standardized futures contracts on Bitcoin / US Dollar exchange rate, or any futures contract involving Bitcoin at all.

A special trading platform is needed to provide a service that is close to trading standardized futures contracts on a regulated exchange. Such trading platform should not require stock exchange licensing, it needs a way to settle futures contracts that does not involve clearing in fiat money, always works with positive margin (credit not possible) and still is understandable and usable by traders. Such approach was pioneered by ICBIT (now the company is doing business as OrderBook.net) in 2011 when inverse futures theory was developed by me. Later it was picked up by other companies, with a total trading volume reaching hundreds of millions of US dollars per month. “ICBIT is generally recognized as one of the largest Bitcoin derivatives firms, facilitating \$15 million worth of transactions in May 2014”, as noted<sup>5</sup> in a Written statement to the United States Commodity Futures Trading Commission by Shadab H.B.

This article introduces the concept of inverse futures contract, explains its trading and settlement rules, and provides insight into technical aspects of implementing such contract trading.

## 2. Bitcoin Derivatives Trading

The development of a Bitcoin futures market is the result of the following requirements:

- (1) All transactions must be done in Bitcoin.
- (2) No brokers or additional third parties, like a clearing house.
- (3) No mandatory customer identification.
- (4) No regulation requirements in any jurisdiction.
- (5) Ability to handle possible customer defaults.
- (6) Ability to handle possible contract defaults (illiquid contract, empty orderbook)

From here on, the terms “trading platform”, “futures exchange” or just “exchange” will be used interchangeably and provide only technical meaning without any regulatory or legal value.

The straightforward approach is to use a physically delivered futures contracts on the Bitcoin / US Dollars price, however this breaks 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> requirements above and renders practical implementation of such trading platforms impossible, as Bitcoin legal status was not (and still is not, in some jurisdictions) defined.

A financial futures contract can be settled in cash in case when it is inconvenient or impossible to deliver the underlying asset. When a contract is settled in cash, all outstanding contracts are declared closed on a predetermined day. The final settlement price is set equal to the spot price of the underlying asset at either the opening or close of trading on that day<sup>6</sup>.

To fulfill the aforementioned requirements, a direct US Dollar / Bitcoin cash settled futures contract (referred to as USD/BTC) was launched by ICBIT trading platform for the first time in the history of Bitcoin economy in December, 2013. USD/BTC futures was quoted in Bitcoins for \$1000 USD and was cash-settled in Bitcoins according to the volume weighted average price (“VWAP”) across the three operating exchanges with the most volume in BTC-USD over the previous 30 days (as per the information on Bitcoincharts in the column “30d Volume”). The weighting was determined by the three exchanges' monthly volume in BTC-USD and the price by the three exchanges' 24HR average price (as per the information on Bitcoincharts in the column “24h Avg”).

Such contract turned out to be highly confusing for vast majority of traders. Every traders in the Bitcoin market was (and still is) used to see the price of bitcoin as “USD for 1 BTC” (or “EUR for 1 BTC”, for that matter). And all Bitcoin traders are used to the fact that they need to buy the asset (be it bitcoin or a futures contract) to profit from an increase in value: instead of going long on bitcoin one needs to short the US dollar.

In the case of the direct USD/BTC futures contract, its price at the moment of writing could be 2.3696 BTC for a spot market price of \$422, and the historical direct<sup>7</sup> and inverse price charts is shown on Fig. 1.



Fig. 1. Plot of USD/BTC from BitStamp exchange, in US dollars for 1 bitcoin, and in bitcoins for 1000 US dollars.

Obviously, 2.3696 looks less understandable than 422, and that was confirmed experimentally<sup>891011</sup> as shown in Table 1.

Table 1. Total trading volumes in US dollars of ICBIT futures contracts expired in the first quarter of 2014.

Contract name	Contract type	Expiry date	Settlement price	Total Volume, \$	Open Interest at settlement, contracts
BTC/USD-2.14 (BUG4)	Direct	2014-02-21	1.7951	63305	32606
BTC/USD-1.14 (BUF4)	Inverse	2014-01-15	\$864.9	575498	70508
BTC/USD-3.14 (BUH4)	Inverse	2014-03-14	\$636.75	3175917	367350
BTC/USD-4.14 (BUJ4)	Inverse	2014-04-18	\$484	370012	77374

### 3. Inverse Bitcoin Futures

A financial instrument which is free from the drawback mentioned above and suitable for hedge, arbitrage and speculation would be ideal for Bitcoin traders.

Let's say such contract is settled in cash (in Bitcoins), its asset is Bitcoin, and contract size is 1 Bitcoin. In a classic linear futures contract the price quoted for such contract would be in USD for the contract and accounting/settlement currency would USD.

Suppose a trader enters in a long position of 100 contracts at a price of \$400, and closes this position at \$500. The profit (variation margin) can be calculated as:

$$VM = (P_{close} - P_{open})S, (1)$$

where  $P_{open}$  is the position opening price,  $P_{close}$  is the position closing price, and  $S$  is the contract's size. So in the example above, the trader would get \$10000 of profit. This is good for a regulated exchange, but for a Bitcoin futures exchange clearing must be done in Bitcoins. Obviously, the Eq. 1 is a linear function of prices, which is shown on the Fig. 2.

I introduced a new type of contract called inverse non-linear futures contract. Its asset is US dollar and the contract size is \$10. The price is quoted in US dollars for 1 Bitcoin. The variation margin in Bitcoins in this case will be calculated according to eq. 1 but with an inverse sign, as we want traders of this contract to profit by taking long position in such contract:

$$VM = -(P_{close} - P_{open})S, (2)$$

As mentioned above, prices  $P_{open}$  and  $P_{close}$  have to be in Bitcoins for \$1 in Eq. 2, otherwise the contract becomes hard to trade. The solution is to inverse the contract prices:  $P_{open\$} = 1/P_{open}$  and  $P_{close\$} = 1/P_{close}$ , so the variation margin equation becomes:  $VM = -(1/P_{open} - 1/P_{close})S = (1/P_{close} - 1/P_{open})S$ .

The contract is called non-linear inverse bitcoin futures because of the added non-linearity in the calculation above and inverse price. This makes the contract useful as a financial instrument and enables to do all accounting in Bitcoin at the same time, unlike quanto futures which are more close to gambling rather than a currency financial derivative and require more efforts to achieve same goals.

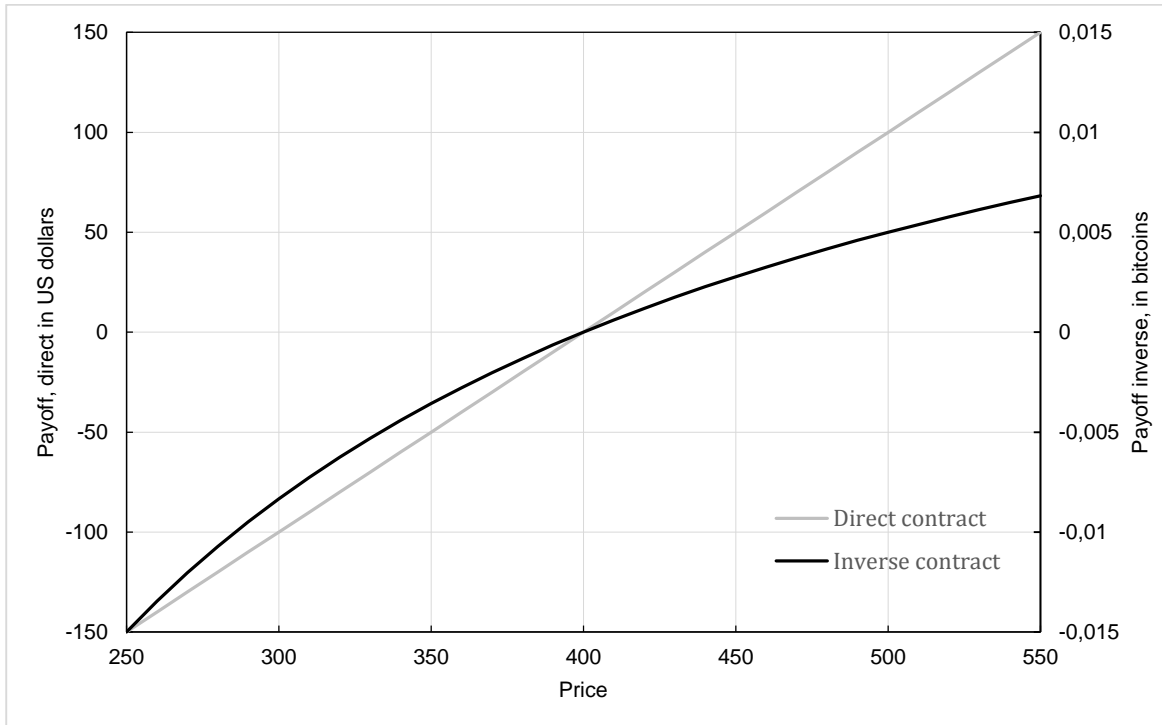


Fig. 2. Plot of futures contract's payoff in US dollars (left Y axis) and in bitcoins (right Y axis) for direct and inverse "long" bitcoin futures opened at \$400 as a variable of sell price (X axis).

*Hedging example*—A trader wants to hedge 500 BTC he bought at \$435 on the spot market. The trader spent  $\$435 \cdot 500 = \$217500$ . To hedge these bitcoins the trader needs to open a short position for 21750 inverse futures contracts at the same price \$435 or higher.

If the price goes down to e.g. \$300 and the trader wants to close the hedge, the variation margin for this trade would be:  $VM = (1/300 - 1/435) \cdot 10 \cdot 21750 = 225$  bitcoins. Adding that up to the amount of bitcoins he had before, the trader now holds 725 bitcoins, selling those at spot market for \$300, the return would be  $725 \cdot \$300 = \$217500$ .

If the price goes up to e.g. \$600 and the trader wants to close the hedge, the variation margin for this trade would be:  $VM = (1/600 - 1/435) \cdot 10 \cdot 21750 = -137.5$  bitcoins. Adding that up to the amount of bitcoins he had before, the trader now holds 362.5 bitcoins, selling those at spot market for \$600, the return would be  $362.5 \cdot \$600 = \$217500$ .

The example above omits trading fees for simplicity reasons, and it also does not say that a certain amount of trader's bitcoins would have to be held as collateral, however it illustrates how inverse futures contracts are used as a classic futures contract but without exchange, clearing house, fiat money transfers, brokers, etc.

#### 4. Conclusion

Inverse bitcoin futures became a derivative instrument of choice for many financial companies and individual traders. They are traded on a number of trading platforms: OrderBook.net (where they were first introduced), OKCoin, Huobi's BitVC, and other.

As the Bitcoin market matures and prices become more stable there may be less of a need for derivatives to reduce price volatility. But for now, Bitcoin derivatives serve the very real purpose of furthering the widespread adoption of a digital commodity that in all likelihood has enormous innovative potential<sup>12</sup>.

Inverse futures described in this article may find use outside Bitcoin economy too. The inverse bitcoin futures can be used for Chinese Yuan, Euro, Russian Ruble and other currencies. As an example, they could be used on Moscow Exchange (MOEX) instead of a rather complicated approach to futures on USD/RUB Exchange Rate used there now<sup>13</sup>.

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## Notes and References

<sup>1</sup> John C. Hull. *Options, Futures and Other Derivatives*. Prentice Hall; 7 edition 1 (2008)

<sup>2</sup> Id. at 3-6

<sup>3</sup> Id. at 9-15

<sup>4</sup> Bragin, A.V. "Bitcoin derivatives markets: History, development and present state." *Swiss Derivatives Review* **1.54** 8-9 (2014)

<sup>5</sup> Shadab, H.B. "Regulating Bitcoin and Block Chain Derivatives" *Written statement to the Commodity Futures Trading Commission* 10 (2014)

<sup>6</sup> John C. Hull. *Options, Futures and Other Derivatives*. Prentice Hall; 7 edition 34 (2008)

<sup>7</sup> No author. "Raw historical price data of BitStamp (USD)" *Bitcoin Charts* (accessed 29 December 2015) <http://bitcoincharts.com/charts/bitstampUSD#rg730zigDailyztgCzm1g10zm2g25zv>

<sup>8</sup> No author. "BTC/USD-2.14 instrument specification". *OrderBook.net* (accessed 28 December 2015) <https://orderbook.net/symbols/BUG4>

<sup>9</sup> No author. "BTC/USD-1.14 instrument specification". *OrderBook.net* (accessed 28 December 2015) <https://orderbook.net/symbols/BUF4>

<sup>10</sup> No author. "BTC/USD-3.14 instrument specification". *OrderBook.net* (accessed 28 December 2015) <https://orderbook.net/symbols/BUH4>

<sup>11</sup> No author. "BTC/USD-4.14 instrument specification". *OrderBook.net* (accessed 28 December 2015) <https://orderbook.net/symbols/BUJ4>

<sup>12</sup> Shadab, H.B. "Regulating Bitcoin and Block Chain Derivatives" *Written statement to the Commodity Futures Trading Commission* 16 (2014)

<sup>13</sup> No Author. "Si-3.16 Contract Specification". *Moscow Exchange* (accessed 29 December 2015) <http://moex.com/en/contract.aspx?code=SiH6>