Adaptive Balancing Rate: An Innovative Funding Rate Mechanism By ZKX

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Abstract

This paper introduces a new funding mechanism which takes into account the sudden price movements in the perpetual swap's price. Being based on Bollinger bands, this funding rate identifies jumps in the price and takes on the additional loading resulted from it. This way, unlike generic funding rate mechanisms, the rate is able represent and adapt to the volatility of the underlying asset.

1 Introduction

Perpetuals swaps the most commonly traded derivative in the cryptocurrency industry. Each swap offers exposure to the price movement of an asset with or without leverage, short or long. In order to balance the order book, an incentive mechanism was designed that pays out interest to the side with the lesser market depth. This is the funding rate and is equal to other instruments found in the traditional futures markets. Funding rates are periodic payments between traders to make the perpetual swap contract price is close to the index price. If the perpetual swap (perp for short) is trading above the underlying spot price, the funding rate would be positive meaning that long traders would pay short traders. This would discourage long positions and incentive short positions for traders. On the contrary, if the perpetual swap is trading below the underlying index, the funding rate would be negative forcing short traders to pay longs This would in turn discourage short positions and encourage long positions, thus raise the perpetual swap's price up towards the underlying. Each exchange has its own formulation for calculating the funding premium and rate. In this context, ZKX introduces the innovative "Adaptive Balancing Rate (ABR)" as its unique funding mechanism. ABR in its core depends on incorporating sudden price jumps into the funding rate increasing the impact of price dynamics. The ABR provides a premium to assets with higher implied volatility and thus reducing risk exposure for the overall market.

2 The mechanism

Calculation of ABR depends on the concept of Bollinger bands [1] which are price envelopes drawn at a standard deviation level above and below a simple moving average of the price. Below, the formulation of the bands is given:

$$\text{Upper band} = \text{Moving Average} + \text{Constant}\sqrt{\frac{\sum_{i=1}^{n}(y_i - \text{Moving Average})^2}{n}}$$

$$\text{Lower band} = \text{Moving Average} - \text{Constant}\sqrt{\frac{\sum_{i=1}^{n}(y_i - \text{Moving Average})^2}{n}}$$

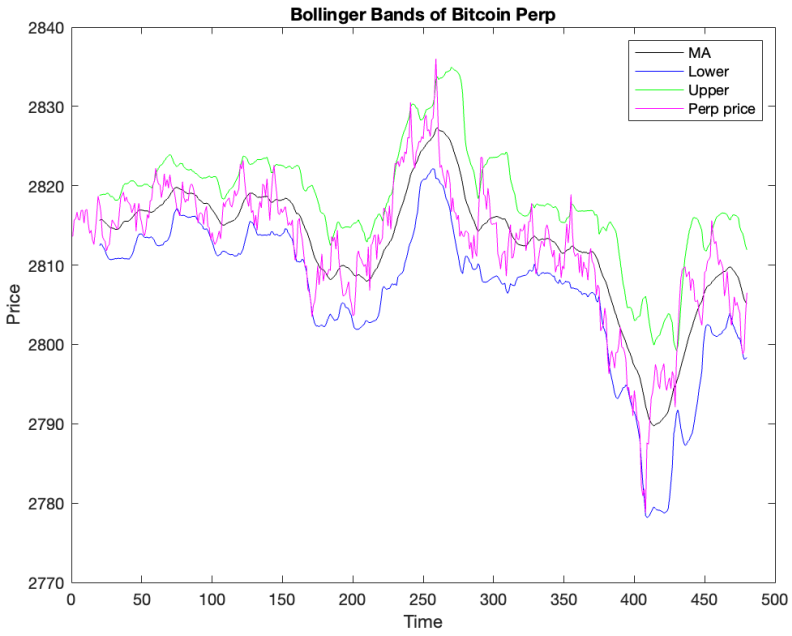

Figure 1: Bollinger bands of perpetual swap price

Figure 1 shows the Bollinger bands of the perpetual swap price data. As can be seen, the bands envelope the price updating itself for price changes in a given time window. However, there is still a certain probability of price emerging above or below the bands resulting from a sudden movement. These price differences are denoted by D_u and D_d as follows:

$$D_u = \text{Mark Price} - \text{Upper Band Value}$$
$$D_d = \text{Lower Band Value} - \text{Mark Price}$$

These price differences are then loaded onto the funding Premium through logarithm function. That is,

$$\text{Perp price} < \text{Index price} \implies ABR_{premium} = \frac{(\text{Mark price} - \text{Index price}) + log(D_u)}{\text{Index price}}$$

$$\text{Perp price} > \text{Index price} \implies ABR_{premium} = \frac{(\text{Mark price} - \text{Index price}) - log(D_d)}{\text{Index price}}$$

At the end of each hour, the 1-hour premium is calculated as the time weighted average price (TWAP) of the premiums over the last hour. In addition to the premium component, a fixed interest rate is added that aims to account for the difference in interest rates of the base and quote currencies. The funding rate is then defined as:

$$ABR_{rate} = \frac{ABR_{premium}}{8} + 0.00125\% \tag{1}$$

The rate in (1) is charged/paid to ZKX traders every 8 hours.

3 Data Analysis

This section gives the data analysis for a given set of data between 05.11.22 and 03.01.23. We start with giving some descriptive statistics of the funding rates across different exchanges.

	ZKX-ABR	DYDX	Deribit	Binance
Mean	-3.5801e-05	-2.5696e-05	-1.5561e-04	6.9556e-06
Std. dev	7.1576e-05	4.1369e-05	4.1843e-04	1.4648e-04
Correlation to BTC	0.4050	0.2536	0.1518	0.1521

Table 1: Descriptive statistics of different exchange funding rates

Table 1 shows that the mean of ABR is negative among others with a standard deviation that is rather small despite the jump dynamics. Moreover, it has the highest correlation to BTC which is another desired sign of following market behavior successfully.

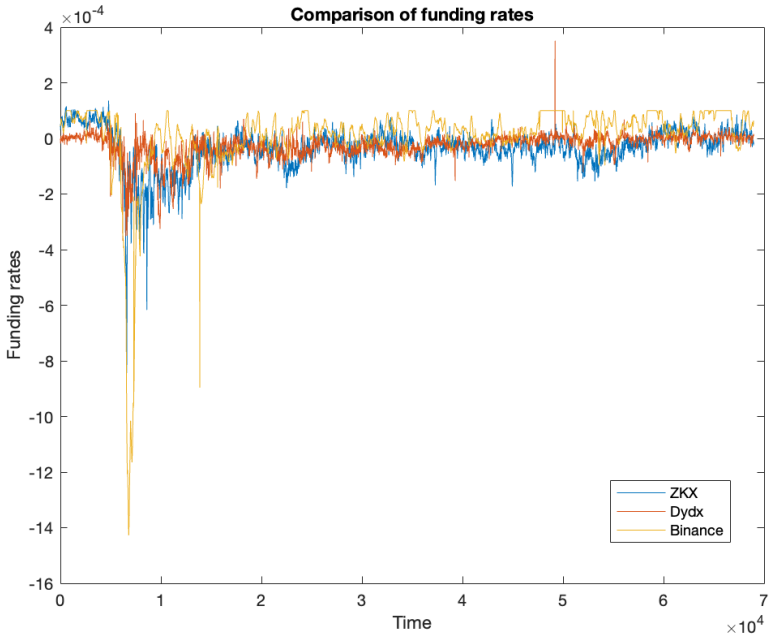

Figure 2: Comparison of funding rates (ZKX, DYDX, Binance)

Figure 2 shows the funding rates of the three exchanges, ZKX (ABR), DYDX and Binance. The ABR is in line with the other counterparties and seems to be evolving with a premium at times as a result of the loaded jump factors. Furthermore, Figure 3 illustrates the 8-hourly funding rates for the exchanges; while there is a downward spike for all exchanges, ABR significantly behaves above the other rates at the later stages, again due to the jumps in the mark price and the funding rate.

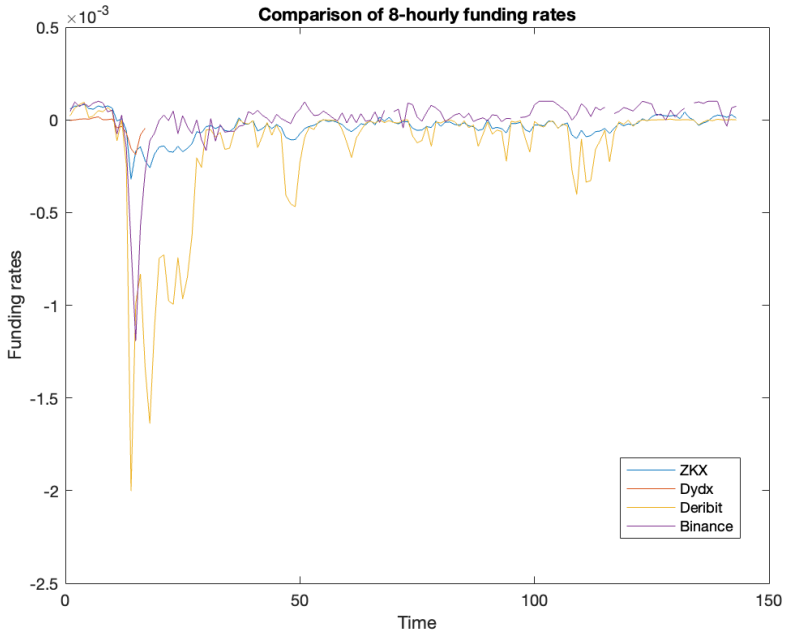

Figure 3: Comparison of 8 hourly funding rate averages across exchanges

3.1 Trading Spikes

One of the most interesting analyses to be done is on the trading range of investors depending on the rate. Figures 4, 5 and 6 illustrate the trading frequency and magnitude across exchanges. Visible spikes in the graphs display the levels of the funding rate for which highest frequency trading occur. This is a very promising interesting information for exchanges as it maps the funding window with the highest profit.

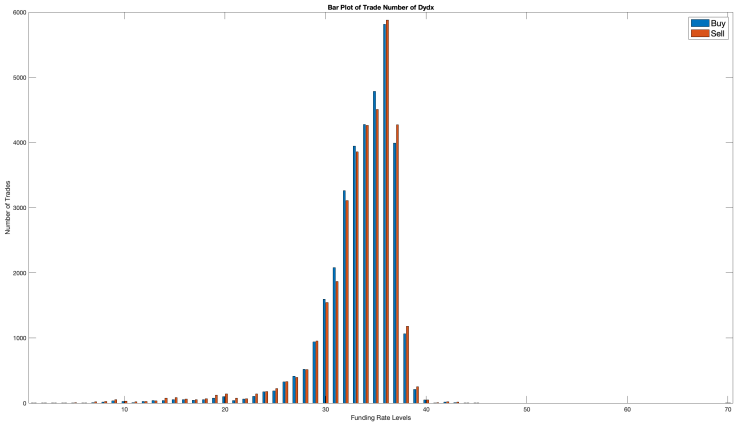

Figure 4: Bar plot of trade numbers for DYDX

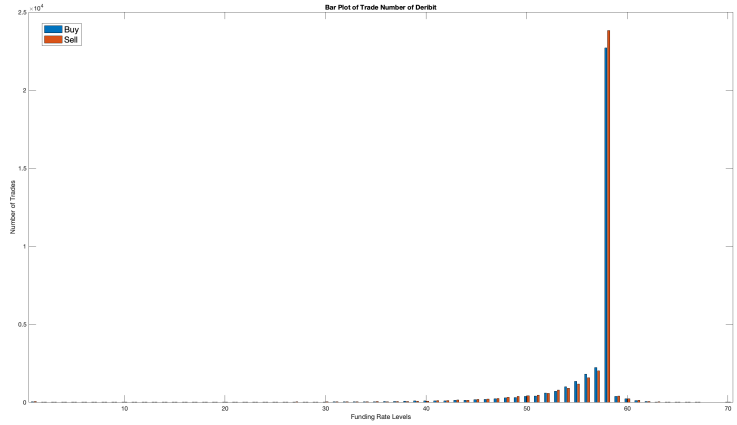

Figure 5: Bar plot of trade numbers for Deribit

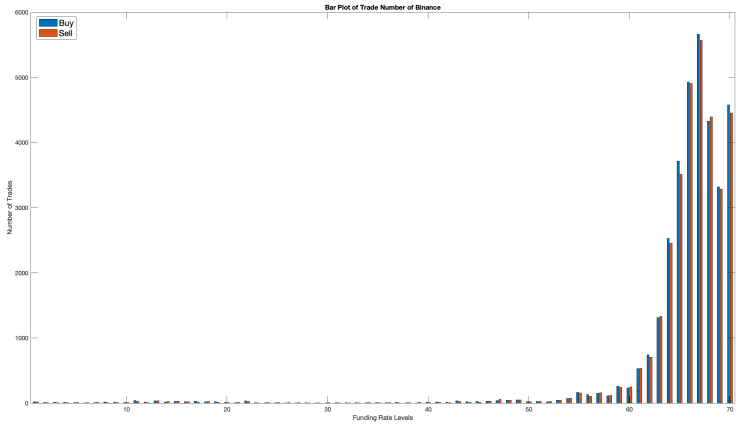

Figure 6: Bar plot of trade numbers for Binance

Since ZKX has not launched yet and the trading data is not available, we predict the trading frequency and magnitudes using classification tree method [4]. In Figure 7, the frequency and magnitude are seen to be higher than other exchanges with a wider window which is a sign for a promising trading consistency to come.

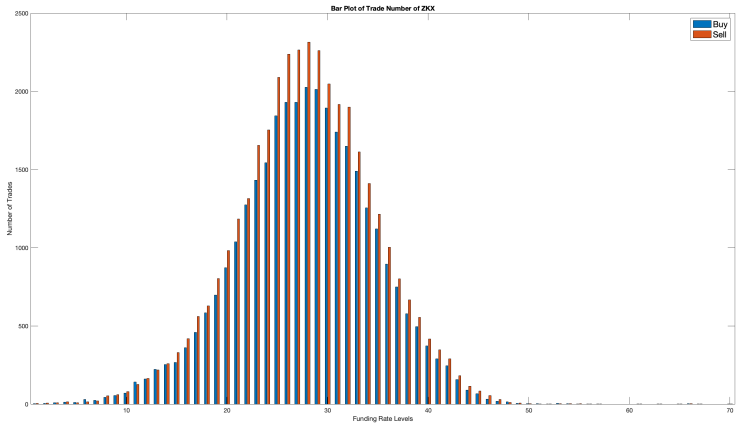

Figure 7: Bar plot of trade numbers for ZKX

Table 2 gives the ranges where trading spikes happen. The ranges show that trading spikes occur in differing neighborhoods of zero for all exchanges. If the exchanges could keep the funding rate in each respective window, the trading frequency would be at its maximum.

Exchange	Trading Spike Range
DYDX	[-0.0001722, 0.0000338]
Deribit	[-0.0016, 0.000133]
Binance	[-0.0003496 , 0.0000904]
ZKX	[-0.000094, 0.0001302]

Table 2: Trading spike ranges of different exchanges

As it can be seen from 2, the widest range with the maximum trading activity belongs to ZKX.

3.2 Black Swan Event

In this section we take a look at what happens during a black swan event, i.e. a very large jump in the mark price and the funding rate. The data unfolds that the maximum upward jump occurred in mark price on '11/10/22 13:32' with the magnitude 316.21$. Next table gives the different exchanges' funding rate reactions to this black swan event:

Date	ZKX	DYDX	Deribit	Binance
'11/10/22 13:31'	3.1118e-05	-0.00041915	0.00052187	-0.00041915
'11/10/22 13:32'	**3.3462e-05**	**-8.279e-06**	**-0.000984**	**-0.0004242**
'11/10/22 13:33'	2.3824e-05	-7.3728e-06	-0.0029926	-0.00042424

Table 3: Funding rates during upward jump

As can be seen from Table 3 ABR reacted to this jump efficiently with a loading jump factor of 2.3440e-06. Other exchanges do not react to this jump in the same way except for DYDX which changes at a lower value.
Maximum downward jump, on the other hand, happened at time '11/08/22 04:12' with size 206.59$. Table 4 shows that for this sudden decrease in mark price, only ZKX and DYDX rates are affected and are reduced. However ABR's downward jump magnitude is found to be 3.9674e-05 which is almost four times larger than DYDX's.

Date	ZKX	DYDX	Deribit	Binance
'11/08/22 04:11'	4.4703e-05	2.4983e-05	0	7.716e-05
'11/08/22 04:12'	**5.0288e-06**	**1.34e-05**	**0**	**7.716e-05**
'11/08/22 04:13'	1.5566e-05	2.4718e-05	0	8.468e-05

Table 4: Funding rates during downward jump

After observing the equally strong reaction of ABR to unexpected price move-

ments of the perpetual swap, one might wonder its long-term benefits and the profit and loss it provides. Next section investigates this phenomenon.

3.3 Profit and loss

This section compares the ABR methodology with already existing generic funding rate formulas in the market. The formulas we consider are as follows.

Generic formula 1:

$$\frac{\max(0, \text{Impact bid price} - \text{Index price}) - \max(0, \text{Index price} - \text{Impact ask price})}{\text{Index price}}$$

Generic formula 2:

$$\max(0.0005, \text{Premium rate}) + \min(-0.0005, \text{Premium rate})$$

where

$$\text{Premium rate} = \frac{\text{Mark Price} - \text{Index price}}{\text{Index price}}.$$

In the next table P&L values are assessed for 8-hourly funding. With an initial short position value of 1000$ the ABR and the generic funding rates are compared in terms of their accumulated funding payments given that the positions are held and untouched during these selected days.

Short Perp	**Initial position**	**Accumulation**	**PnL**
ABR	1000$	1001.4367$	0.0014
Generic formula 1	1000$	996.3102$	-0.0037
Generic formula 2	1000$	977.6393$	-0.0224

Table 5: Comparison of P&L values

Table 5 reveals that the ABR funding mechanism is the only one yielding a positive PnL compared to other counter parties.

4 Conclusion

In this study, we have analyzed multiple aspects of the ZKX's Adaptive Balancing Rate (ABR) as a new innovative funding rate methodology. First, we provided a quantitative description of the mechanism together with its dependence on the Bollinger bands concept. Then, we investigated its statistical properties before moving on to a trading frequency analysis. To characterize the trading behavior under different funding rates, we calculated trading spike windows which represent the time frame with the highest trading frequency.
Next, we studied the reaction of ABR to black swan events, i.e. when there is

a sudden high magnitude jump in the mark price and, concluded with a longer-term profit and loss analysis. The ABR is shown to perform equally strong during black swan events by taking into account price jumps for volatile assets and also providing a wide window for trading spikes. Moreover, the long-term profit and loss analysis shows that ABR is able to provide an accumulated value that is in line with its peers.

References

[1] Bollinger, J. (1992). Using bollinger bands. Stocks & Commodities, 10(2), 47-51.

[2] Cryptarbitrage, (2020). Perpetual Swap Funding. https://insights.deribit.com/education/perpetual-swap-funding/

[3] Gogel, D. (2022). Perpetual Funding Rate, Detailed explanation of funding rate. https://help.dydx.exchange/en/articles/4797443-perpetual-funding-rate

[4] Hastie, T., Tibshirani, R., Friedman, J. H., Friedman, J. H. (2009). The elements of statistical learning: data mining, inference, and prediction (Vol. 2, pp. 1-758). New York: springer.