

Carbon Parameter Modifications

Parameters

The following parameters are important in the context of the carbon curve

- **y** is the token amount left to sell on the curve, in native token units (assume: ETH); we always have **yint ≥ y ≥ 0**
- **x** is a token amount in the other token; its absolute value is not important (and not tracked as it can be obtained by the invariant equation) but differences are (assume: USDC)
- **yint** is the maximal capacity of the curve; at **y=yint** the curve is full
- **pa** is the starting price of the range, ie the best price for the trader, worst for the LP, AMM; like all prices, it is always quoted in the native convention of the curve, **dy/dx** (here: ETH per USDC [sic])
- **pb** is the end price of the range, ie the worst price for the trader, best for LP, AMM; we have **pb ≤ pa** in the price convention **dy/dx**
- **A, B** are related to **pa, pb**; specifically: **B=sqrt(pb)**, **A=sqrt(pa)-sqrt(pb)**
- **pm** is the current marginal price of the range; it depends on all parameters above; note: changing **pm** downwards (**-dpm**) is safe except for the fact the price moves further away from the market, changing it upwards (**+dpm**) may not be for an active range, as the marginal price may move beyond market price and into the money

Modifications

ID	Action	y	yint	x	pa	pb	pm
TS	Trade by source	-dy	.	+dx	.	.	-dpm
TT	Trade by target	-dy	.	+dx	.	.	.
AL	add liquidity	+dy	.	.	.	.	+dpm
ALX	add liquidity expand	+dy	=y	.	.	.	. [=pa]
ALC	add liquidity (const pm)	+dy	+dyint	.	.	.	.
RL	remove liquidity	-dy	.	.	.	.	-dpm
RLC	remove liquidity (const pm)	-dy	-dyint	.	.	.	.
SPU	start price up	.	.	.	+dpa	.	+dpm
SPD	start price down	.	.	.	-dpa	.	-dpm
EPU	end price up	.	.	.	.	+dpb	+dpm
EPD	end price down	.	.	.	.	-dpb	-dpm
BP	change both prices	.	.	.	dpa	dpb	dpm
BPC1	both prices (const pm)	.	.	.	dpa	dpb	.
BPC2	both prices (const pm)	.	dyint	.	dpa	dpb	.
MPU	change marg price up	.	-dyint	.	.	.	+dpm
MPD	change marg price down	.	+dyint	.	.	.	-dpm
BPM	change prices (const pm)	.	dyint	.	dpa	dpb	.

xxx – provided as parameter; +dpm – danger zone; xxx – not initiated by LPs

Implemented actions

- Trade (**T**) is obviously implemented and can be used by everyone
- Add liquidity (**AL**) and add liquidity expand (**ALX**) will be triggered by trading on the associated curve, and therefore can be used by everyone; it increases **pm**, therefore is in theory not safe; however, as long as the curves are not overlapping there is not risk that **pm** will end up in the unsafe zone
- Add liquidity (**AL**) however may not be safe to trigger on an active curve because it does move the marginal price into the wrong direction; instead of **AL** we should always use **ALC**.
- Remove liquidity (**RL**) is safe to call as the marginal price is pushed away from the market; if this is not desired, **RLC** could be called instead (arguably this has the better semantics); **RL** needs to be able to deal with liquidity changes that have been introduced by other transaction (up or down) and react gracefully
- Price changes can be dangerous if either of the prices **pa**, **pb** go up, because in this case the marginal price **pm** will go up as well; there are two way of keeping **pm** constant:
 - the first one involves changing **pa** and **pb** in different directions, essentially symmetrically around **pm**; this runs into problems if **pm** has changed since because a trade has happened
 - the second one involves changing **yint** to ensure that **pm** sits where it was; this calculation can be done in the smart contract, and is in this case robust against intermittent changes
- Changing marginal price down (**MPD**) is always safe; changing it upwards (**MPU**) is potentially dangerous, and can possibly be front run
 - if the LP adjusts **yint** to obtain the desired **pm** and if **y** has been changed then it can be higher (liquidity transferred from linked curve; bad) or lower (liquidity traded on this curve; not that bad)
 - alternative the marginal price adjustment function can specify the desired marginal price **pm** directly, and **yint** is calculated; this again can be bad: if markets move since then **pm** can be set at the old level which can be too high