

emojicoiñ dot fun

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Econia Labs

1 Overview

emojicoiñ dot fun bootstraps liquidity for “fair” (public allocation only, no presale) **emojicoiñ** [1] markets using a two-state mechanism popularized by **pump dot fun** [2]. The first state, known as a bonding curve, uses an abridged Concentrated Liquidity Automated Market Maker (CLAMM) with a single price range [3] as described in section 3.

Once the APT-denominated [4] market capitalization for an **emojicoiñ** reaches a predefined value, a State Transition (ST) occurs whereby APT deposits are removed from the bonding curve and locked into a Constant Product Automated Market Maker (CPAMM) [5] together with a remainder of **emojicoiñ** supply, as described in section 4.

2 Economic variables

Price p is defined per table 1 and equation 1.

Term	Notation	Asset
Base asset	b	emojicoiñ
Quote asset	q	APT

Table 1: Base and quote asset definitions

$$p = \frac{q}{b} \quad (1)$$

The economic variables in table 2 fully specify the set of numerical values required for the implementation, as derived in sections 3 through 6.

Term	Notation
APT-denominated market capitalization	m_a
Circulating emojicoiñ supply	c_e
APT-denominated spot price	p_s

Table 2: Economic variables at time of ST

As derived in section 6.4, the alternative set of economic variables in table 3 can also be used to fully specify numerical values.

3 Bonding curve state

The bonding curve is represented by a CLAMM, which functions as a CPAMM within the price range $[p_l, p_h]$ as defined by table 4, equation 2, and figure 1.

Term	Notation
$p_s^{-1} \approx$ emojicoiñs per 1 APT at ST	A
Ratio of p at ST to p at start of bonding curve	R
Total APT deposited before ST	T

Table 3: Alternative economic variables

Term	Notation
Real base reserves	b_r
Real quote reserves	q_r
Virtual base reserves	b_v
Virtual quote reserves	q_v
Liquidity	L
Low price range endpoint	p_l
High price range endpoint	p_h
Real base reserves ceiling	$b_{r,c}$
Real quote reserves ceiling	$q_{r,c}$
Virtual base reserves ceiling	$b_{v,c}$
Virtual quote reserves ceiling	$q_{v,c}$
Virtual base reserves floor	$b_{v,f}$
Virtual quote reserves floor	$q_{v,f}$

Table 4: Terms, CLAMM as a fixed-range CPAMM

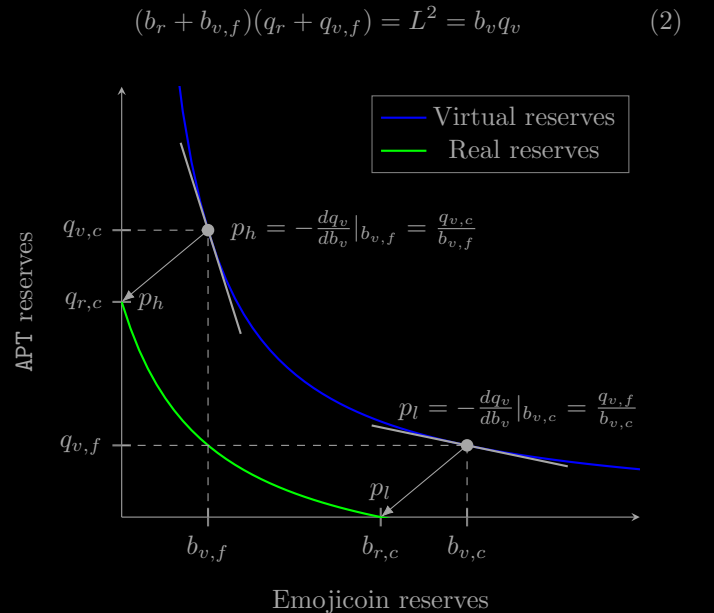


Figure 1: CLAMM as a fixed-range CPAMM

The bonding curve initializes with real emoji coin reserves c_e , which represent only a portion of total supply s_e . The remainder of emoji coin reserves r_e is set aside for the ST which occurs when $q_{r,c}$ of APT has been deposited into the bonding curve, per equation 3 as derived in section 6.1.

$$r_e = \frac{m_a - c_e \cdot p_s}{p_s}, s_e = \frac{m_a}{p_s}, q_{r,c} = m_a - c_e \cdot p_s \quad (3)$$

Virtual reserves initialize per equation 4 as derived in section 6.2.

$$b_{v,c} = \frac{c_e^2 \cdot p_s}{2 \cdot c_e \cdot p_s - m_a}, q_{v,f} = \frac{(m_a - c_e \cdot p_s)^2}{2 \cdot c_e \cdot p_s - m_a} \quad (4)$$

The bonding curve price initializes to p_l per equation 5, also derived in section 6.2.

$$p_l = \frac{(m_a - c_e \cdot p_s)^2}{c_e^2 \cdot p_s} \quad (5)$$

During the bonding curve phase, virtual reserve amounts in the CLAMM follow a simple constant product curve invariant for swaps per table 5 and equation 6 as derived in section 6.3.

Term	Swap input	Swap output
Base	b_{in}	b_{out}
Quote	q_{in}	q_{out}

Table 5: Swap input and output definitions

$$b_{out} = \frac{b_0 \cdot q_{in}}{q_0 + q_{in}}, q_{out} = \frac{b_{in} \cdot q_0}{b_0 + b_{in}} \quad (6)$$

The ST occurs when virtual reserves reach the values from equation 7, derived in section 6.2.

$$b_{v,f} = \frac{c_e \cdot (m_a - c_e \cdot p_s)}{2 \cdot c_e \cdot p_s - m_a}, q_{v,c} = \frac{c_e \cdot p_s \cdot (m_a - c_e \cdot p_s)}{2 \cdot c_e \cdot p_s - m_a} \quad (7)$$

Notably, this results in a percent dilution at the time of ST, $d\%$, defined in equation 8 as derived in section 6.2.

$$d\% = \frac{c_e \cdot p_s}{m_a} \cdot 100\% \quad (8)$$

4 CPAMM state

At the ST, $q_{r,c}$ is withdrawn from the bonding curve and locked into a CPAMM together with r_e , thus maintaining a constant spot price throughout the ST. This results in the minting of L_i initial Liquidity Provider (LP) tokens, with L_i taken as the geometric mean of the two contributions per equation 9 as derived in section 6.5.

$$L_i = \frac{m_a - c_e \cdot p_s}{\sqrt{p_s}} \quad (9)$$

The initial LP token mint is then held by the protocol, similar in effect to burning LP tokens, thus constituting protocol-owned liquidity.

A pool fee rate f_p denominated in basis points is assessed on the output of a swap to incentivize additional LPs. By assessing the fee on the output amount and reinvesting it in the pool, spot price slippage decreases and liquidity increases for each swap.

For example figure 2 denotes a swap sell, where $f_p \cdot q_{out}$ is deducted from quote proceeds and reinvested in the pool, thus increasing available liquidity.

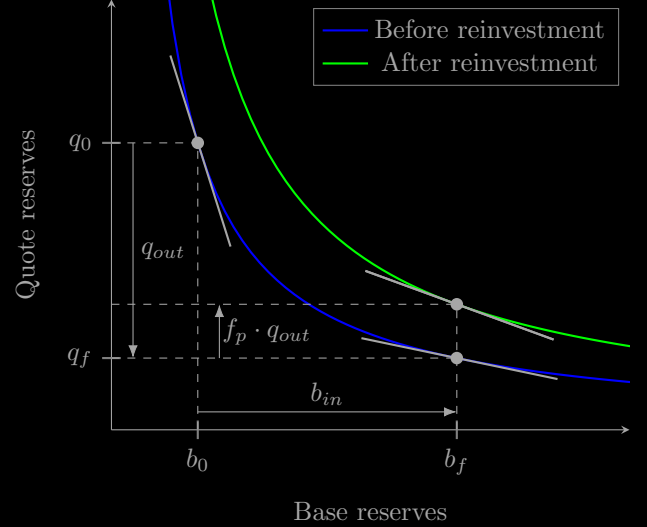


Figure 2: CPAMM swap sell with fee

5 Actual implementation values

Nominal implementation values are given in table 6.

Term	Amount
A	10,000
R	12.25
$T = q_{r,c}$	1,000
m_a	4,500
$c_e = b_{r,c}$	35,000,000
r_e	10,000,000
s_e	45,000,000
$d\%$	77.7
$p_s = p_h$	0.0001
p_l	0.000008163 ...
L_i	100,000
f_p	25
$b_{v,f}$	14,000,000
$q_{v,f}$	400
$b_{v,c}$	49,000,000
$q_{v,c}$	1,400

Table 6: Nominal implementation values

This value set meets the restriction from equation 10, derived in section 6.2.

$$c_e \cdot p_s < m_a < 2 \cdot c_e \cdot p_s \quad (10)$$

Notably, for a given c_e and p_s , larger values of m_a correspond to larger R and larger $d\%$. Hence the alternative economic variable approach described in section 1, which enables direct specification of R .

m_a scales to octa-denominated [4] market capitalization m_o as shown in equation 11.

$$m_o = 10^8 m_a \quad (11)$$

For simplicity emojicoins are taken to have 8 decimals, the same as APT. Hence c_e scales to integer emojicoin subunits c_s as shown in equation 12.

$$c_s = 10^8 c_e \quad (12)$$

Applying the same scale factor across variables produces the integer values in table 7.

Constant	Amount
MARKET_CAP	450_000_000_000
EMOJICOIN_REMAINDER	1_000_000_000_000_000
EMOJICOIN_SUPPLY	4_500_000_000_000_000
LP_TOKENS_INITIAL	10_000_000_000_000
BASE_REAL_FLOOR	0
QUOTE_REAL_FLOOR	0
BASE_REAL_CEILING	3_500_000_000_000_000
QUOTE_REAL_CEILING	100_000_000_000
BASE_VIRTUAL_FLOOR	1_400_000_000_000_000
QUOTE_VIRTUAL_FLOOR	40_000_000_000
BASE_VIRTUAL_CEILING	4_900_000_000_000_000
QUOTE_VIRTUAL_CEILING	140_000_000_000
POOL_FEE_RATE_BPS	25

Table 7: Integer implementation values

6 Derivations

6.1 Supply amounts

To ensure a constant price during the ST, a portion of emoji-coin reserves must be set aside from the initial bonding curve. At the ST this emojicoin remainder r_e is locked into the CPAMM together with all of the APT from the bonding curve, yielding:

$$\begin{aligned} p_s &= \frac{q_{r,c}}{r_e} \\ p_s \cdot r_e &= q_{r,c} \\ r_e &= \frac{q_{r,c}}{p_s} \end{aligned} \quad (13)$$

Define $p_s = f(m_a, c_e, r_e)$:

$$p_s = \frac{m_a}{c_e + r_e} \quad (14)$$

Substitute (13) into (14):

$$\begin{aligned} p_s &= \frac{m_a}{c_e + \frac{q_{r,c}}{p_s}} \\ p_s \cdot \left(c_e + \frac{q_{r,c}}{p_s} \right) &= m_a \\ c_e + \frac{q_{r,c}}{p_s} &= \frac{m_a}{p_s} \\ \frac{q_{r,c}}{p_s} &= \frac{m_a}{p_s} - c_e \\ q_{r,c} &= m_a - c_e \cdot p_s \end{aligned} \quad (15)$$

Note $q_{r,c}$ is only positive for:

$$\begin{aligned} m_a - c_e \cdot p_s &> 0 \\ m_a &> c_e \cdot p_s \end{aligned} \quad (16)$$

Substitute (15) into (13):

$$r_e = \frac{m_a - c_e \cdot p_s}{p_s} \quad (17)$$

Hence total supply s_e evaluates to:

$$\begin{aligned} s_e &= c_e + r_e \\ s_e &= c_e + \frac{m_a - c_e \cdot p_s}{p_s} \\ s_e &= \frac{c_e \cdot p_s}{p_s} + \frac{m_a - c_e \cdot p_s}{p_s} \\ s_e &= \frac{c_e \cdot p_s + m_a - c_e \cdot p_s}{p_s} \\ s_e &= \frac{m_a}{p_s} \end{aligned} \quad (18)$$

6.2 Bonding curve amounts

Evaluated at p_l , (2) reduces to:

$$(b_{r,c} + b_{v,f}) \cdot q_{v,f} = L^2 \quad (19)$$

Likewise, (2) evaluated at p_h reduces to:

$$b_{v,f} \cdot (q_{r,c} + q_{v,f}) = L^2 \quad (20)$$

For $b_{r,c} = c_e$, combining (15), (19), and (20) yields:

$$\begin{aligned} (b_{r,c} + b_{v,f}) \cdot q_{v,f} &= b_{v,f} \cdot (q_{r,c} + q_{v,f}) \\ b_{r,c} \cdot q_{v,f} + b_{v,f} \cdot q_{v,f} &= b_{v,f} \cdot q_{r,c} + b_{v,f} \cdot q_{v,f} \\ b_{r,c} \cdot q_{v,f} &= b_{v,f} \cdot q_{r,c} \\ q_{v,f} &= \frac{b_{v,f} \cdot q_{r,c}}{b_{r,c}} \\ q_{v,f} &= \frac{b_{v,f} \cdot (m_a - c_e \cdot p_s)}{c_e} \end{aligned} \quad (21)$$

For $p_h = p_s$, substituting (15) and (21) yields:

6.5 Initial LP tokens

Define L_i as the geometric mean of $q_{r,c}$ and r_e , substituting (15) and (17):

$$\begin{aligned}
L_i &= \sqrt{q_{r,c} \cdot r_e} \\
L_i &= \sqrt{(m_a - c_e \cdot p_s) \cdot \frac{m_a - c_e \cdot p_s}{p_s}} \\
L_i &= \sqrt{\frac{(m_a - c_e \cdot p_s)^2}{p_s}} \\
L_i &= \frac{m_a - c_e \cdot p_s}{\sqrt{p_s}}
\end{aligned} \tag{42}$$

References

- [1] Emojicoins. Retrieved April 11, 2024 from https://x.com/alnoki_/status/1776323147874119915.
- [2] Pump. <https://www.pump.fun/board>, <https://x.com/pumpdotfun>. Retrieved April 11, 2024.
- [3] Hayden Adams, Noah Zinsmeister, Moody Salem, River Keefer, and Dan Robinson. 2021. *Uniswap v3 Core*. Retrieved April 11, 2024 from <https://uniswap.org/whitepaper-v3.pdf>.
- [4] <https://aptos.dev/reference/glossary/#gas-unit-price>. Retrieved April 11, 2024.
- [5] Hayden Adams, Noah Zinsmeister, and Dan Robinson. 2020. *Uniswap v2 Core*. Retrieved April 11, 2024 from <https://uniswap.org/whitepaper.pdf>.