

VELO

A Velocity Valued Synthetic Asset

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Abstract

People have lived, live and will continue to live in social communities. People are interested in other people, whether they are aware of it or not. Human ideas, creativity, stories, insights and knowledge have a magical attraction for other people. The interaction between individual people that leads to a wide variety of collaborations is the foundation of human society. This also applies to economics - all past and current economic systems exist because of the fact that people interact with each other. This paper introduces a new type of tokenized and synthetical asset called VELO, whose value is directly affected by the transactional behaviour, and thus velocity of the issued tokens. The VELO protocol fits seamlessly into the vibrant DeFi ecosystem of liquidity providers, investors, speculators, arbitrageurs and traders through an innovative and unique set of incentives for utilization of the token.

“You have to really stretch your imagination to infer what the intrinsic value of Bitcoin is. I haven’t been able to do it. Maybe somebody else can.”

– Alan Greenspan, former FED chairman, 4 December 2013

1 Introduction

The first form of paper money that we would recognize as such from today's view was introduced in China during the reign of Hien-Tsung (806-821 A.D). Marco Polo – the Venetian merchant, explorer, and writer who travelled through Asia along the Silk Road in approximately 1271 A.D. had reported on the use of paper money in China in great detail.

Today, the global monetary fiat systems are primarily a debt-based currency regime that has gradually evolved as a matter of self-evidence, particularly in response to the needs of the emerging industrial age. Before that time, capital and (human-) labor were directly and inseparably linked. It was only through the ever-increasing demand for capital due to industrialization that a gradual separation between labor and capital developed.

From today's perspective, the purpose of capital and thus currency was to finance the production process primarily of goods - what we call the “real economy” today. The current financial systems are characterized above all by the fact that the vast majority of capital is not invested in the production and consumptions of goods or services, but primarily allocated in the capital markets.

While the debt-based nature of fiat currencies has been utilized extensively and profitably over many decades by the financial industry, another directly linked characteristic of any currency, namely the velocity of circulation, has been researched but not yet explicitly used for further developments. In the publication "On the Minting of Coin" (Copernicus, 1526), investigations have already been made on the velocity of the circulation of currency.

Decentralized Finance (DeFi) is a gradual development within the cryptocurrency industry, which is partly based on the knowledge and experience of classical economics, but which also breaks new grounds. DeFi can be seen as a maximally efficient capital allocation network that enables unexpected concepts and experimental product developments – the VELO protocol is such a product.

The protocol applies the property of velocity of circulation on its own tokenomics, which is inseparable for each currency and which is well known for a long time but not explicitly used, as it could not be utilized efficiently and practicably before.

1.1 The most overlooked hidden feature

There's one incredible feature of crypto currencies that almost everyone seems to have missed, including Satoshi himself. The true potential of crypto currencies is the power to create and distribute value without a central authority.

This sounds almost ordinary at first, but the consequences are immense. In short, this means that entire economic models can be "turned around". This statement is so simple, but so far-reaching and, as a final consequence, so incredibly powerful that whole economic systems can be built on this principle.

This means that for the first time since the beginning of mankind it is possible to create value fully decentralized and directly there, where interaction between two parties takes place. Value can occur even when people do not know and do not trust each other. No other coordinating, supervising, regulatory or governing party is required.

1.2 Something very simple

The economical interaction of people results in business transactions that are directly related to the velocity of circulation of currency and thus determine the valuation and value of that currency.

This fundamental relationship is also known as the *equation of exchange*. The purchasing power of currency depends exclusively on four define factors: 1) the volume of currency in circulation; 2) its velocity of circulation; 3) the volume of bank deposits subject to check 4) and the volume of trade (Fischer, 1911).

The velocity of currency is the frequency at which one unit of currency is used to purchase produced goods and services within a given time period. In other words, it is the number of times \$1 is spent to buy goods and services per unit of time. If the velocity of money is increasing, then more transactions are occurring between participants in an economy (FED, 2020).

An intuitive example that illustrates the impact of a velocity of currency on the creation of value within an economy: a \$10 bill is assumed that is in a wallet versus the same \$10 bill that was used to tip a waiter; the waiter had used it to pay the cab driver, who had ordered a pizza with that same \$10 bill within the same day. The latter \$10 bill created (or have caused) \$30 value during the day while the \$10 bill in the wallet did not create any value; it has simply kept its monetary value which is ultimately based on debt.

From this example it is obvious, that the velocity of circulation of a currency has a direct influence on the value of the same currency in an economy; the velocity of circulation is an inseparable and inherent characteristic of every currency and is a key aspect that effects present and future value.

The VELO token is the *tokenized velocity of its own token*. Owning 1 unit of the VELO token is equal to the valuation of 1/supply. The velocity of the VELO token is an expression of the interaction of two or more token owners within the DeFi ecosystem. Velocity of circulation is a limited and scarce virtual commodity; the limiting factors are:

- The willingness and ability to interact between the participants.
- Agreement on the value of the VELO token between at least two participants.
- Inverse elasticity of the allocation supply curve of the VELO token; the higher the velocity is, the scarcer the VELO token supply is.
- Transaction fees for the VELO transaction as well as the infrastructural (gas-) costs.
- Technological and infrastructural uncertainties and limitations.

1.3 What is new?

In summary, the following factors make the VELO protocol new and unique:

- Tokenization of the circulation velocity within the VELO token economy.
- The use (transact) of the VELO token is rewarded.
- Unique volatility footprint that correlates only moderately and time-delayed with the main crypto currencies.
- Inverse and elastic token supply curve with a unique supply momentum and price signaling.
- This results in unique incentives to hold, trade arbitrage and speculate with and on VELO tokens.

1.4 A factsheet for the busy ones

For those who know that time is money, and for the VELO token this applies literally, here is a summary of the key points:

The VELO token...

- .. is suited for liquidity providers, investors, speculators, arbitrageurs and traders.
- .. is a synthetic and elastic commodity in a similar asset class as AMPL and YAM.
- .. uses the community governance approach as COMPOUND.
- .. utilizes the so-called automated market makers (AMMs) like Uniswap and Balancer.
- .. is based on clear, valid, simple and well-known economic principles.
- .. rewards transaction activity.
- .. has no VC investors, nor token pre-mined, same rules for everyone.
- .. is open to all.

In summary, the core properties of the VELO token are:

Property	Value
Website	https://velotoken.fi/
Target Blockchain	Ethereum
Token Type	ERC20
Asset Class	Synthetic Asset
Symbol	\$VLO
Token Value	None, \$VLO has no value on issuance
Governance	Decentralized Autonomous Organization (DAO)
Source of Yield	Utility, Speculation and Transactions Fees
Supply Type	Fixed with elastic and invers allocation
Supply Quantity	100'000'000 \$VLO
Distribution Type	Fair Farming and Distribution via Staking Pools
Distribution Price	1ct
Distribution Duration	4 Weeks

2 Protocol

In economic history, early attempts have been made to govern the supply of currency within an economy using deterministic rules that are applied regardless of business cycles. Milton Friedman proposed his well-known k-percent rule, providing for a constant growth rate of the monetary base (Friedman, 1963). Another attempt was made with the MONIAC) analog computer (Monetary National Income Analogue Computer) to represent an economy as a rule-based flow of currency (Bill Phillips, 1947).

2.1 From Velocity to Price

According to Irving Fisher, who is one of the most prominent supporters of the quantity theory of money – “Other things remaining unchanged, as the quantity of currency in circulation increases, the price level also increases in direct proportion, while the value of money decreases and vice versa” (Fischer, 1911). This process is also known as currency inflation; the reverse process is called deflation. If, on the other hand, the price level, quantity of good and services and the currency supply remain the same and the velocity of circulation is increased at the same time, the value of currency will increase. This relationship is the core statement of the equation of exchange.

Vitalik Buterin uses a very similar definition for the derivation of the equation of exchange (Buterin, 2017):

$$P_t^{Velo} * T_t^{Velo} = M^{Velo} * V_t^{Velo}$$

- P_t^{Velo} is the price level. This is the weighted average price of goods and services in terms of tokens per unit time (also called epoch) at time t .
- T_t^{Velo} is the quantity of goods and services for which a token at the time t has been used.
- M^{Velo} is the total supply of the token.
- V_t^{Velo} is the velocity of the token; the average number of times that a token changes hands per unit time, at time t .

The right-hand side of the equation is the economic output of the token economy, means this is something that economic participants do. If nobody choses to use the platform, this value is zero and the exchange rate for a token is entirely speculation position on future network activity.

The right-hand side is the number of tokens transacted at a time; if the circulation velocity V_t^{Velo} increases with otherwise unchanged conditions, the price for the token has to rise.

If we multiply the left side by the number of tokens per dollar,

$$\frac{1}{S_{Velo}^{\$}} = \frac{P_t^{Velo}}{P_t^{\$}}$$

and substitution and algebraic rearrangement results to:

$$S_t^{\$} = \frac{(P_t^{VELO} T_t^{VELO})}{M^{VELO} V_t^{VELO}}$$

It is obvious to see that the velocity V_t^{VELO} in the denominator is proportionally affecting the dollar per token ratio (Bank of Canada, 2016). Simple example that illustrates this relation – assume that $S_t^{\$} = 1$, which means that 1 VELO is equal to \$1, further assume all other values of the equation of exchange are constant, $P_t^{VELO} = T_t^{VELO} = M^{VELO} = V_t^{VELO} = 1$. If now the velocity increases to $V_t^{VELO} = 2$, the ratio $\frac{\$}{VELO}$ changes to $\frac{1}{0.5}$, means \$1 per 0.5 VELO, or \$2 per 1 VELO.

The equation is a form of double-entry accounting, where each transaction is simultaneously recorded on both sides of the equation, that says that the token flow of expenditures is equal to the market value of what those expenditures buy (Friedman, 1982). Whether the effect should be observed in M, V, P or Q is arbitrary. Until now, the measurement of V was notoriously erroneous and challenging and could only be deduced retrospectively. The VELO protocol solves exactly this problem by *measuring the circulation velocity of its own token*. The other side of the equation, which means the market value, can only be solved by the market itself.

Furthermore, the equation of exchange is a steady-state or equilibrium model that assumes that the number of users is constant. In reality, however, the quantity of users may change, so the price may change as well.

2.2 From Price to Value

The price¹ of \$1 in dollars is \$1 and therefore it is obvious to say that a currency has no price in the same currency. In addition, production costs of \$1 within the banking sector are much lower than \$1.

As the French writer, historian and philosopher François-Marie Arouet known as Voltaire already recognized in 1729,

“Paper money eventually returns to its intrinsic value – zero.”

– Voltaire, 1729

Where does the value of a currency come from, or more specific - what is the value of 1 VELO?

One of the most important aspects of economic theories is the relation between *prices* in units of currencies and *value*. Economics often highlight that when anything – whether of material nature or not – is both *desired* and *scarce*, it then has a value and thus is economically relevant.

However, the historical quest of economists for the universal objective cause and thus an objective measure of value was not fruitful and failed in the end due to internal contradictions and logical flaws.

¹ Debt and other exchange agreements excluded here.

Another much simpler approach is to look for value not in things but in human interaction and collaboration. A prominent representative of the so-called "Austrian School" was Ludwig von Mises (1881–1973), who described the concept of value as follows:

“Value is not intrinsic; it is not in things. It is within us; it is the way in which man reacts to the conditions of his environment. Neither is value in words and doctrines. It is reflected in human conduct. It is not what a man or groups of men say about value that counts, but how they act.”

– Ludwig von Mises, Human Action, 1949

The simple and yet far-reaching idea is, that value is entirely subjective, rather than something objective. Value is a relative concept, between two people (e.g. buyer and seller). The economic decisions of two people, e.g. at what price things are bought and sold, can be considered irrational for other people; or even as a miracle or foolish. And yet, if these people have made their decisions by their own **free will** and on **free markets**, and they have carried out the **exchange of things** for currency, these two people have, by their actions, given **value to currency** (Mises, 1949).

All historical attempts to enforce the value of a currency through central planning, governmental power and authority or even violence have failed in the end.

For this reason, the VELO protocol governs *solely and only* the relationship $V_t^{velo} \rightarrow M^{velo}$ which means, depending on the velocity of circulation of the VELO token, the supply is elastically expanded or contracted. Velocity is thus considered as an indicator of economic activity and the VELO protocol responds by expanding or contracting elastically from token holders.

At which prices (P_t^{velo}) or in which quantities (T_t^{velo}) this economic activity took place is completely unknown to the VELO Protocol.

So, what is the value of 1 VELO? This is completely and exclusively dependent on you, the potential token holder. You, and only you, decide if and at what price you are willing to buy or sell 1 VELO.

The following key factors of the VELO protocol are also decisive for price determination:

- There is only a fixed amount of VELO tokens that represent the own velocity; no matter how extensive the network and the activity of the tokens will be.
- VELO token is the tokenized velocity of its own token, thus velocity as value which is created by human interaction. The higher the velocity is, the scarcer the VELO token.
- Speculation on future network activity and higher prices for the scarce VELO token.
- Absorption² of Ethereum gas due to transaction fees; the longer the VELO Protocol is on the market, the greater its value, solely through the accumulated transaction fees, even without a further use value or speculative price.

² See Chapter “Transaction Fees and Incentives”

2.3 Rule based Supply

The VELO protocol implements a simple rule-based inverse and elastic supply curve that expands and contract supply in one of two ways. This process is called *rebase*. Given the velocity of VELO tokens per time unit called epoch at time t and velocity V_t ,

1. *if* the velocity within the current epoch is greater than the velocity in the previous epoch, $V_t > V_{t-1}$, the protocol responds by contracting to token holders.
2. *if* the velocity within the current epoch is lower than the velocity in the previous epoch, $V_t < V_{t-1}$ the protocol responds by expanding token holders.

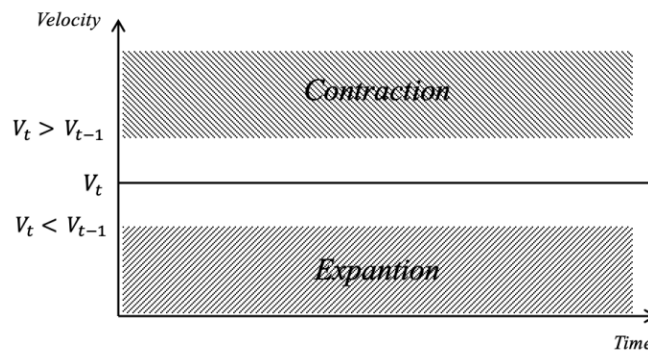


Figure 1: Contraction and Expansion in relation of Velocity

The protocol responds therefore directly to an increase or decrease of the economic activity of its own token by either contracting or expanding the allocation of the supply. An example of that relationship:

- *Time 1:*
Alice has 2 VELOs with an equilibrium market price P_t^{VELO}
- *Velocity decreases:*
Alice has 2 VELOs
- *Time 2:*
Alice has 3 VELO with an equilibrium market price P_{t+1}^{VELO}

The VELO protocol propagates the information about the change of the relation to all token owners at the same time, so that nobody gets a temporal advantage.

2.4 Supply Adjustments

Adjustments for the allocation of supply always take place within an epoch; one epoch is *12 hours*. The rebase function ς is public and can be called by any participant at any time, but the velocity is always accumulated over an epoch and can only be executed at most once every 12 hours. There is no dedicated announcement about supply adjustments. Velocity is based on transactions and is aggregated as a weighted average of the last epochs.

The VELO protocol requires no external prices or other information and is therefore robust against external manipulations. Only transactions that are publicly available on the blockchain are used so that any third party can calculate the supply adjustments independently of the VELO protocol.

2.5 Transaction Fees and Incentives

The following relationship gives immediate incentives for trade activities:

$$S_t^{\$} = \frac{(P_t^{VELO} T_t^{VELO})}{M^{VELO} V_t^{VELO}}$$

In simple terms, transaction activity leads because of the $V_t^{VELO} \rightarrow M^{VELO}$ relation to an increase in price per 1 VELO under otherwise constant conditions. The price for the virtual commodity velocity is the current market price as well as the transaction fees.

The VELO project leverages the CHI³ GASTOKEN, which is itself an ERC20 token and was developed by the 1inch exchange. CHI is tokenized gas on the Ethereum network and is pegged to the Ethereum network's gas price. When the gas price is low, the CHI price is also low, and the opposite.

The transaction fees for the VELO token are dependent on the a) transaction volume, b) the average velocity as well as the 3) gas price. The following definitions apply:

- Minimum VELO transaction fee is 2⁴ CHI.
- Maximum VELO transaction fee is 135 CHI, gradually increasing by transaction volume.
- The maximum transaction fee depends further on the average velocity of the VELO token; as a principle, the lower the velocity, the lower the VELO transaction fee.

Since the transaction fees are calculated for each transaction, the implementation must be particularly efficient. For this reason, the following transaction fee calculation relation is applied:

$$F_{ratio} \rightarrow \frac{M^{VELO}}{Q_{class}}$$

The F_{ratio} is a ratio factor that is derived from the relationship of the current transaction quantity to the supply M^{VELO} . The quantity class Q_{class} are discrete numerical values representing transaction quantity classes⁵.

³ <https://www.coingecko.com/en/coins/chi-gastoken>

⁴ The amount is equivalent to ~ \$2.35 or ~ 89000 GAS at the time of writing.

⁵ See the source code for the concrete pre-computed values.

Transaction fees are calculated as follows:

$$CHI_{fee} = \frac{F_{ratio}}{100} * \frac{F_{discount}}{100} * F_{governance} * CHI_{max}$$

The CHI_{fee} are the CHI fees for a specific VELO transaction, $F_{discount}$ is the factor of the long-term velocity and $F_{governance}$ is a factor which can be parameterized by the community.

Example 1:

- Total supply $M^{Velo} = 100'000'000$ VELO
- Average velocity $F_{discount} = 10$ (%)
- Alice sends Bob 100'000 VELO tokens
- Alice needs to pay 2 CHI in fees

Example 2:

- Total supply $M^{Velo} = 100'000'000$ VELO
- Average velocity $F_{discount} = 100$ (%)
- Bob sends Alice 1'000'000 VELO tokens
- Bob needs to pay 50 CHI in fees

The accumulated CHI tokens can be considered as collateral for the VELO protocol and are under the control of the DAO so that the community can vote on the future use. The longer and more frequent VELO tokens are moved through transactions, the more CHI tokens are accumulated.

For VELO token holders, the transaction fees are completely *transparent*, as they are applied together at the Ethereum fee level and are therefore compatible with the peripheral infrastructure such as wallets.

2.6 Governance

To create unstoppable, upgradable financial infrastructure, the VELO protocol leverages the successful and widely accepted Compound (COMP) governance⁶ approach. This means that the VELO token holders are part of a community who can both submit proposals and vote on the activation.

⁶ <https://compound.finance/governance>

3 Quantifying Velocity

The velocity of circulation of a token is an inherent and causally related factor to the value of any currency, but has not been directly applied, due to the challenges in observability and instant economic applicability.

For this reason, the VELO protocol translates the otherwise *subjectively* perceptible velocity of circulation of its own VELO token into an *objectively* measurable allocation of the supply of its own token. Simply put, one cannot see a token, what its current velocity is. If, however, the velocity of circulation is translated into a quantifiable amount, the effect of the velocity is immediately observable.

Therefore, in case of a high velocity the supply gets *contracted* and therefore the VELO token becomes *scarcer*. If, however the velocity of circulation decreases, the supply is *expanded* so that more tokens are available, and a new economic cycle can emerge.

3.1 From Transaction to Velocity

The protocol determines transaction quantities by counting the unit sizes in VELO of transactions T_1, \dots, T_n accumulated within an epoch, $T_{vol} = \sum_{i=1}^n T_i$, $T_{vol} \leq M_t^{Epoch}$. This volume of accrued transactions is compared with the current supply M_t and expressed as normalized percentage of the moved VELO tokens within the epoch:

$$V_t = \frac{\sum_{i=1}^n T_i}{M_t^{Epoch}} * 100$$

Accordingly, if two transactions are executed within an epoch, namely $T_1 = 20$ VELOs and $T_2 = 30$ VELOs and the supply $M_t = 1000$ VELOs, then the velocity within the epoch is $V_t = (20 + 30 / 1000) * 100 = 5$. This algorithm is repeated for each epoch. Within an epoch, the transaction volume up to the amount of the current supply M_t^{Epoch} is included for the evaluation of the velocity V_t .

Only those transactions that can be captured by the Ethereum infrastructure can be included in the velocity determination. These are mainly decentralized exchanges and the DeFi market itself. However, the volume of central exchanges cannot be observed. This fact has the same effect as the withdrawal of capital from the real economy to the capital markets.

3.2 Adjusting Supply

Transaction volume and the resulting velocity of the VELO token is interpreted as indicator of economic activity. Economic activity leads to an expansion or contraction in the supply. The determined velocity is smoothed by an exponential moving average (EMA) function that places a greater weight and significance on the most recent data points to avoid overcorrection and supply shocks.

The EMA function is recursive and defined as:

$$EMA(V_t) = \alpha V_t + (1 - \alpha) * EMA_{V_{t-1}}$$

In total, two EMAs with different significance coefficient α are applied as trend followers - $EMA_1(V_t)$ discounts the older velocity values faster than the $EMA_2(V_t)$.

In addition, a rebase function $\varsigma : T_{vol} \rightarrow V_t^{velo} \rightarrow R_t$ is defined, which implements algorithmically the transformation from velocity to supply allocation. This function compares the velocity and thus the economic activity from epoch to epoch on an ongoing basis. This velocity trend is translated by a logistic function into the rebase factor R_t . Logistic functions based on the generalized Richards' ⁷ curve are widely used in the description of biological and economical growth processes.

$$R_t = 1 + \varphi * \left(-0.5 + \frac{1}{1 + e^{\frac{-EMA_1(V_t) + EMA_2(V_t)}{k}}} \right)$$

The φ constant represents the golden⁸ ratio number that often appears as a constant proportional number of natural objects as well as man-made systems such as financial markets. The now available rebase factor R_t , which represents the economic activity as a trend, is recursively applied on the supply M_t .

$$M_t = \frac{1}{R_t} * M_{t-1}$$

Hence the desired relation $V_t^{velo} \rightarrow M_t^{velo}$ is achieved. This relation will be continuously updated and adapted to the economic activity.

⁷ See https://en.wikipedia.org/wiki/Generalised_logistic_function

⁸ The golden ratio is an irrational number with a value of $\varphi = \frac{1+\sqrt{5}}{2} = 1.6180339887$

3.3 Expansion

The expansion of the supply takes place in relation to the velocity of circulation and the adjustment of the supply is effective after the velocity has been determined at the rebase event R_e .

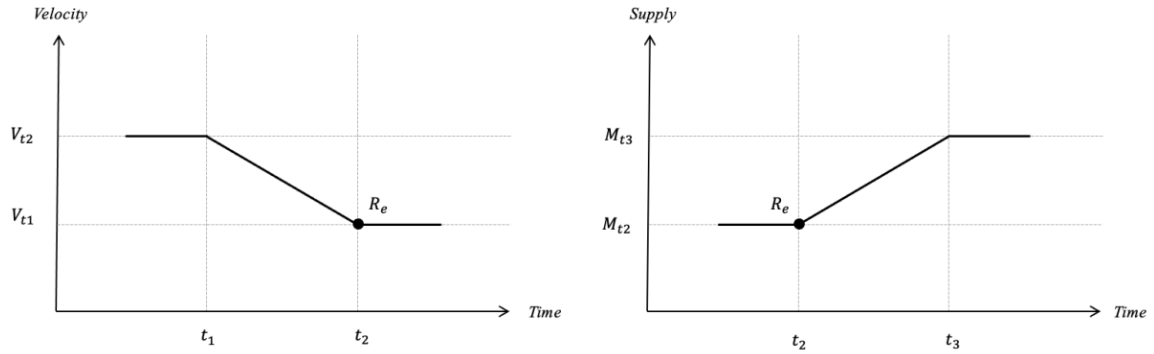


Figure 2: Supply Expansion Cycle

It is assumed and possible that the market will respond to the increase in supply with a rational decrease in price P_t^{Velo} . It can further be assumed that price discovery is associated with increased volatility and therefore price oscillations.

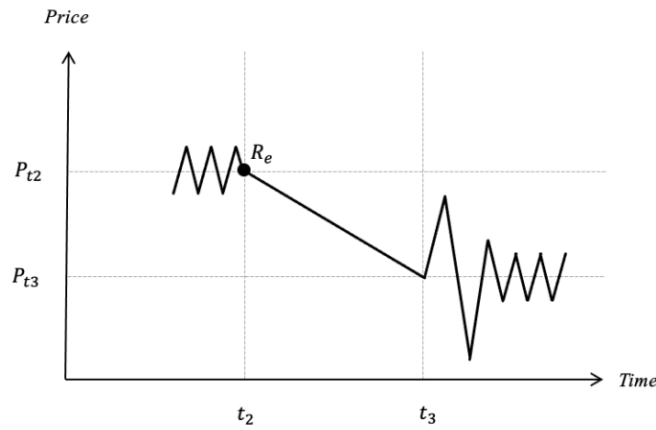


Figure 3: Expansion Cycle with rational market price equilibrium

3.4 Contraction

Analogous to the expansion, the contraction of the supply takes place after the velocity has been determined at time R_e .

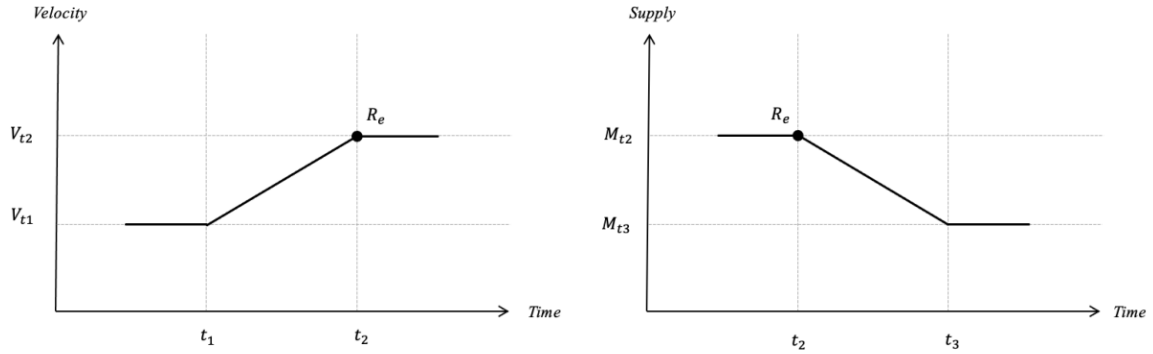


Figure 4: Supply Contraction Cycle

Similar to expansion, it can be assumed and is possible that pricing is rational and associated with increased volatility.

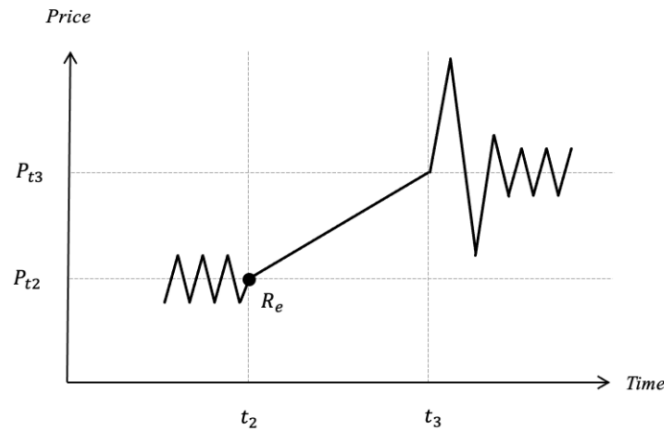


Figure 5: Contraction Cycle with rational market price equilibrium

Both expansion and contraction lead to a new pricing discovery cycle due to the change in supply. Whether the market follows a rational pricing is unknown for the VELO protocol. This results in incentives for arbitrage as well as speculation for future market pricing.

3.5 Market Dynamics

The relation $V_t^{velo} \rightarrow M^{velo}$, means the translation from velocity of circulation to supply is performed by the VELO protocol. The causal resulting relation $M^{velo} \rightarrow P_t^{velo}$ that means the pricing of the supply by a market price can only be performed by the market itself.

Deterministic smart contract protocols and applications have allowed to design and implement decentralized versions of traditional financial primitives. Decentralized financial primitives allow censorship-resistant participation in a number of digital markets and use cases, such as lending, stable assets and decentralized exchanges.

Geometric mean market makers (G3Ms) are popular class of generalized automated market makers (AMMs) defined by the following so-called *constant product rule*: the reserves of the AMM before and after each trade must have the same (weighted) geometric mean. AMMs are often used in the context of Decentralized Exchanges (DEXs), such as Uniswap and Balancer (Evans, 2020).

The VELO token embeds these AMMs directly into its own protocol for the following reasons:

- *Liquidity* - the AMMs mentioned above have solved the incentivized based providing of liquidity and thus tradability of the VELO token.
- *Pricing* – AMMs provides deterministic pricing and market clearance and thus immediate equilibrium between supply and price.
- *Signalling* - direct propagation of the information about price discovery to the peripheral DeFi market.

In addition to the above-mentioned aspects, one of the main advantages of AMMs is the immediate identification of the market's response to changes in velocity. The AMMs enabled the VELO protocol to let the market determine a price depending on the current velocity.

Finally, the desired relation between $V_t^{velo} \rightarrow P_t^{velo}$ means *velocity* to *price* by utilizing free, transparent and decentral markets has been achieved - *quod erat demonstrandum*!

4 Conclusion

The VELO token is my contribution to the emerging DeFi market. It is a financial-economic experiment based on facts, knowledge and principles that have been known for a very long time, but which have not yet been put into practice. I hope that the VELO token will find a vibrant community that appreciates its unique features and enthusiastically utilize the token for trading, speculation, arbitrage, experiments or just for fun.

We would also like to thank the people who made the project possible - without you, the VELO token would not have been created, thank you very much!

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