Game Theory of meToken Bonding Curves

A Summary of the Market Behaviors which Emerge when Collateralizing Person-Centric Tokens with Public Bonding Curves by Chris Robison

Introduction

The Collateralized Personal Tokens primer identified two classes of *personal tokens*: those that (1) provide utility in relationship to a person, and those that (2) allow people to speculate on the value of a person. The primer stated that the strongest and most **well-designed *personal tokens* should implement both classes simultaneously**. In the same document, the Bonding Curve Model was understood to achieve this when used in combination with *collateralized personal tokens* – AKA "meTokens."

The purpose of this Game Theory Paper is to examine the function of the meToken, the incentives of the primary stakeholders (meToken owners, utility seekers, market speculators), the parameters of the Bonding Curve Model, and the various circumstances of the Bonding Curve Model which can modify the stakeholders' behavior.

The Asset	meTokens
The Players	Owners, Users, Speculators
The Game	Bonding Curve
The Gameplay	see "Scenarios" section

meTokens

Synthetic Labor

meTokens are an implementation of a new kind of digital asset, called *synthetic labor*. Synthetic labor is a fungible commodity, which effectively represents a deed to the productivity of an individual (or group of people). The value of a meToken as synthetic labor is basically assured by two crypto-economic mechanisms: collateralization and a final-state design.

Collateralization

The meToken is always collateralized by another cryptocurrency, such as DAI or Ether. The collateral pool of a meToken operates as a type of escrow. The protocol of the collateral pool guarantees the underlying asset (Ether, DAI, etc.) can only be unlocked in the event of a meToken's final state.

Final State

The meToken's final state is always that they be burned by their owner. When an owner burns their meToken, they are then permitted to unlock a corresponding amount of collateral. For example, if they burn 5% of their meTokens, they can withdraw 5% of the locked Ether or DAI. The final-state value of the meToken, therefore, constructs an assumption that one person – the meToken owner – will ultimately be incentivized to work harder than anyone else to acquire their token. This ensures that the value of a meToken is tethered to a single individual.

Operations

How meTokens Function

In total, there are four base operations which impact the value of a meToken market: (1) when meTokens are minted with fresh collateral, (2) when meToken are collateralized further with additional funds, (3) when meTokens are sent, exchanged, programmed, or otherwise used, and (4) when meTokens are burned by their owner in exchange for the underlying collateral (see the Collateralized Personal Token Primer for more details). Later in this document, we will explore how the mint, collateralize, and issue (send) operations are autonomously managed by a Bonding Curve.

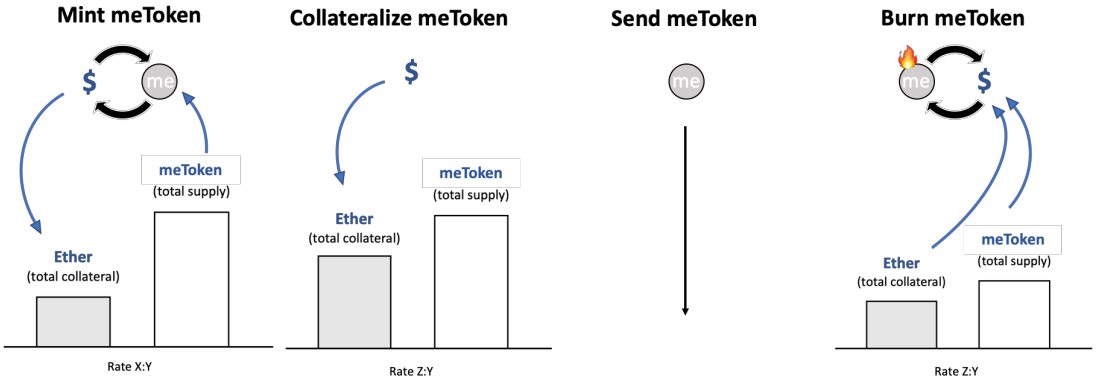

Figure 1: The Four Operations of a meToken - mint, collateralize, use/send/exchange, and burn

Stakeholders

meToken Owners

Synthesizing Labor

The meToken owner has two desired outcomes. They want their meToken to reach the highest value possible, and they want to be able to capture as many opportunities as possible to accept their meToken from the market in exchange for their own labor. If both occur, a meToken Owner will be able to generate a significant income from their meToken market.

Utilitarians

Purchasing and Using Synthetic Labor

The meToken utilitarians are actors in the market who are purely interested in acquiring meTokens for the sake of using them. They value the labor of the person who owns the meTokens and have a desire to summon the owner's attention or behavior in some way. They may program a person's meTokens into a smart contract, like a predictions market, or they may open a chat channel with the person 1v1 to negotiate an OTC transaction.

Utilitarians have an aversion to the utility value of their token depreciating. As an example, utilitarians do not want to buy $100 worth of meTokens only to have them decrease in value so that their holdings are only worth $75 to the meToken owner. At the same time, they would be perfectly okay with the value of their meTokens appreciating in value so that their $100 worth of meTokens is suddenly able to purchase $150 worth of labor from the owner.

Speculators

Leveraging Synthetic Labor

The speculators are purely focused on making money by buying and selling meTokens. They would ideally like to find underappreciated individuals with a lot of potential, buy their meToken, and then cash out on them once the market discovers their talents and they rise in popularity. Speculators may also operate on shorter timelines, day trading the meTokens of controversial or volatile figures.

Bonding Curve Model

Issuing Synthetic Labor

The Bonding Curve Model is a market mechanism which mints, collateralizes, and issues new meTokens and operates as a means of price discovery. Utilitarians and speculators can go to the bonding curve to buy and sell meTokens. A bonding curve has a price ceiling and a price floor.

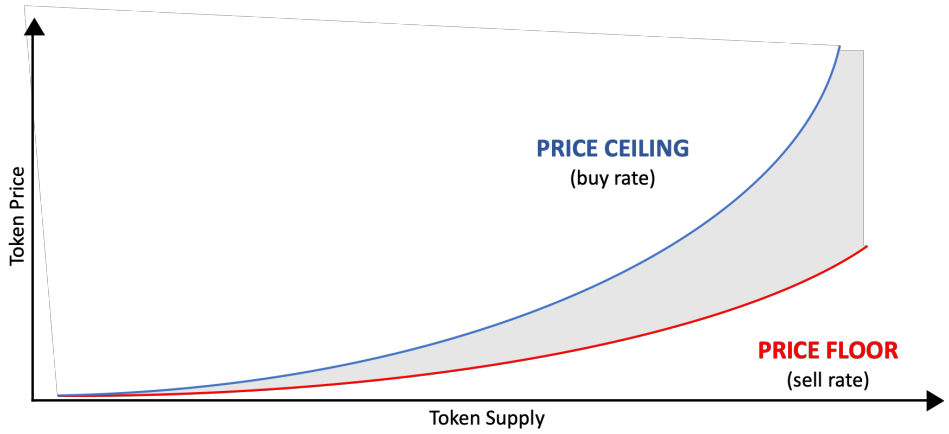

Figure 2: Example Bonding Curve

The price ceiling is the buy rate of the market - the price at which newly minted meTokens can be purchased at. This price increases at a fixed and deterministic rate according to the amount of meTokens in circulation.

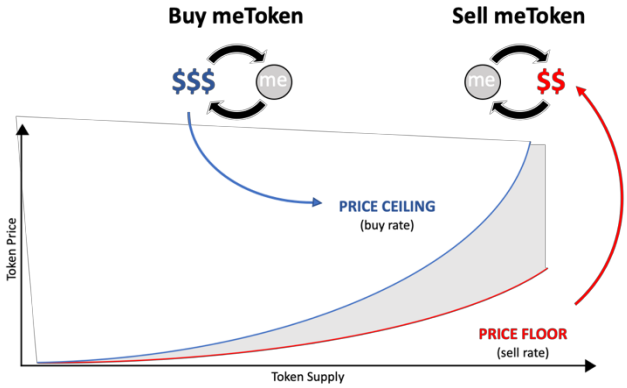

Figure 3: Buying and Selling meTokens against a Bonding Curve

The price floor is the sell rate of the market - the guaranteed price at which meTokens can be sold back to the bonding curve. This price is also fixed and deterministic according to the amount of meTokens in circulation. When meTokens are sold back to the bonding curve, they are removed from the total token supply. Note: this is different than when an owner burns their meTokens.

Tokens can trade on secondary markets when their value falls between the floor & ceiling.

When meTokens are purchased from the bonding curve (see "$$$→"), the funds used to make the purchase are divided into two pools: the refund pool and the collateral pool. The amount of ETH or DAI that remain in the refund pool is determined by the rate of the price floor. If a person ever sells their meToken back to bonding curve, their refund comes from the refund pool (see "→$$"). The rest of the ETH or DAI (the Δ between the ceiling & floor) is sent to the collateral pool (see "$$$-$$").

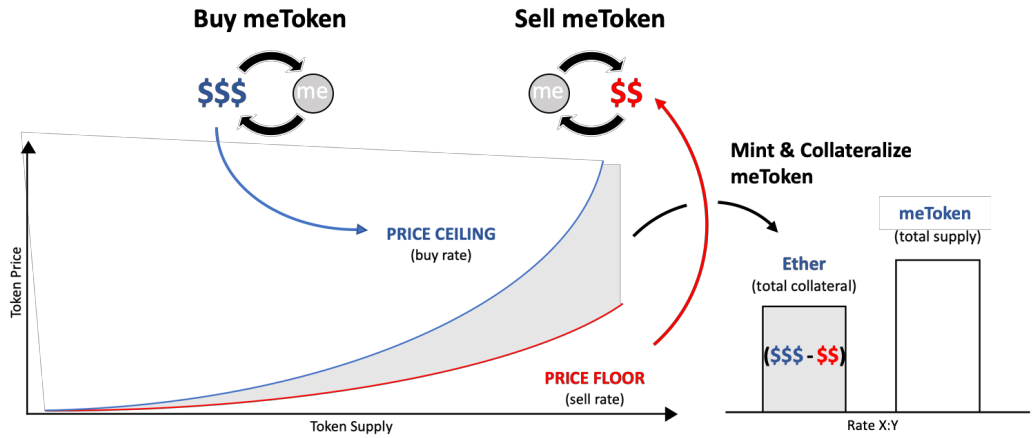

Figure 4: Bonding Curve Collateralizing a meToken

The collateral pool always increases whenever new meTokens are minted along the Bonding Curve. meTokens, which are sold back to the Curve, are never available for sale again. This means the collateral pool can grow indefinitely high, even when the tokens supply is low.

Bonding Curve Parameters

The Various Types of Bonding Curves

Multiple types of Bonding Curve can be deployed to manage meToken markets. They are comprised of six parameters: issuance, supply, collateral, objective, function, and pricing.

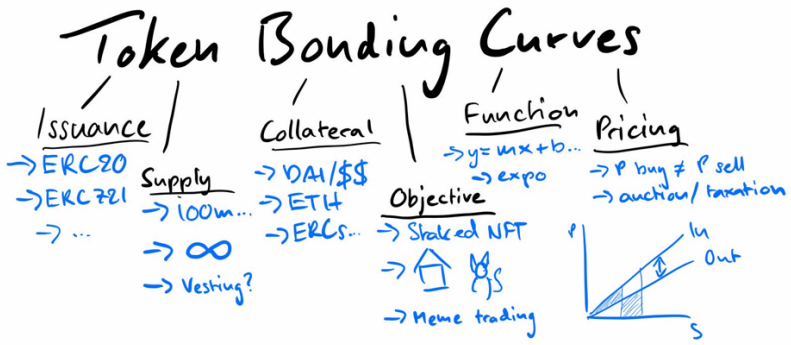

Figure 5: Bonding Curve Taxonomy (Kohlhaas, 2019)

Issuance and Objective

The *issuance* and the *objective* of this particular meToken Bonding Curve application are fixed. A meToken owner will never need to alter these. The *objective* of the bonding curve is to issue and discover the fair market value of a person's synthetic labor, ie meTokens. The *issuance* is, thus, the meTokens, which follow the ERC20 standard.

Supply and Collateral

While the *supply* and *collateral* parameters are technically flexible, this Bonding Curve application document reccomends default settings for both. It is recommended that the *supply* be set to continuous (∞ supply) and the *collateral* be set to either ETH or DAI.

Function and Pricing

The *function* and *pricing* parameters are entirely flexible and do not carry any specific recommendation. They are left entirely to the discretion of the meToken owner. The *function* of the Bonding Curve determines the angle of the curve, itself. A curve can be linear, exponential, quadratic, or some other deterministic, rule-based *function*.

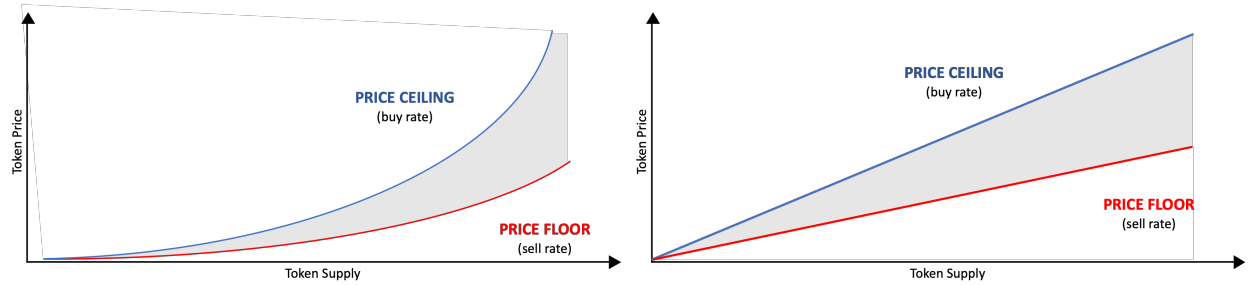

Figure 6: Examples of a Quadratic Bonding Curve vs a Linear Bonding Curve

The *pricing* parameter is the differential between the price ceiling and price floor. It represents the total allocation of market funds which are allocated to the collateral pool. The greater the *pricing* differential, the greater the collateral allocation.

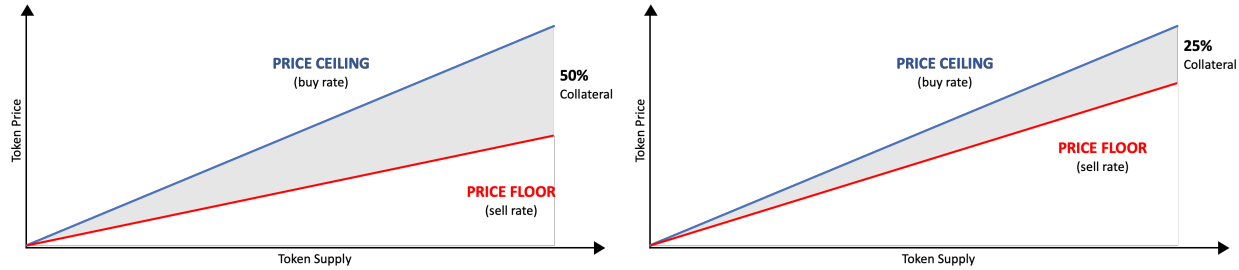

Figure 7: Examples of a 50% and 25% Ceiling-Floor Pricing Differential

The *function* and *pricing* of a Bonding Curve significantly affect the predictive behavior of both utilitarian and speculative market participants. Both parameters influence the expected rate of return for speculation, as guaranteed by the price floor, while the *pricing* parameter mostly impacts the just utility rate of the token (see upcoming *Scenarios* section for more info).

Issuance	ERC20	Fixed
Objective	meTokens (*synthetic labor*)	Fixed
Supply	Continuous (∞ *supply*)	Recommended
Collateral	ETH (*or DAI*)	Recommended
Function	undetermined	Flexible
Pricing	undetermined	Flexible

Scenarios

How the Market and Stakeholders Behave

Utilitarian Assurance

The Utility Value of meTokens are Shielded from the Speculative Value

One of the biggest threats to a meToken market is that a Bonding Curve is deployed with *function* and *pricing* parameters which cannot secure the stability of a meToken's utility. That is to say, utilitarians will not want to purchase meTokens from a Bonding Curve which can result in a total loss of utility value during volatile markets (as described in the *Utilitarians* section).

Fortunately, **the meToken Bonding Curve Design is constructed in a way that two values for the token exist simultaneously**: the speculative value and the utility value.

The speculative value follows the fair market price of the meToken as it's traded along the Bonding Curve and any other secondary market. This value really only matters to the speculators – the people who are only interested in profiting from the market and will not actually be using the meToken. This speculative value can rise and fall as high or low as the market will tolerate. The speculative market is potentially subject to extreme volatility.

The utility value, however, only follows the open market price loosely. It more strictly follows the supply of the collateral pool. The collateral pool is funded by the differential funds captured between the price celling and the price floor. These collateral funds are never depleted by market activity. So in the event there is a massive or total selloff, the meTokens, which remain in circulation, always maintain an assured utility value – a value at which they can be cashed in to the meToken owner in exchange for labor – which is significantly higher than the price floor.

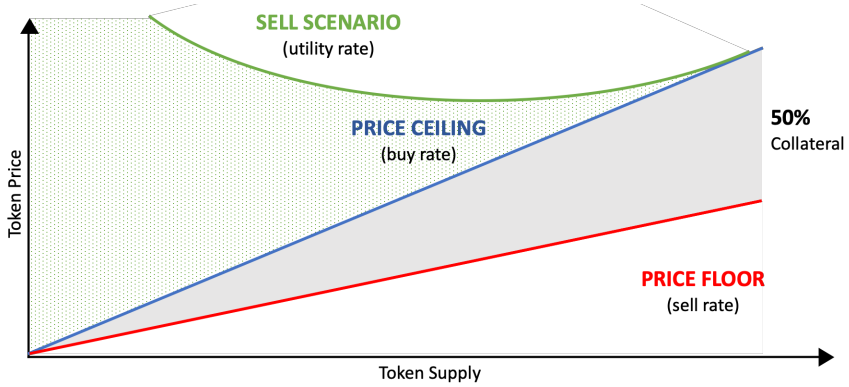

Figure 8: Utility Rate Example - as the meToken supply decreases, the utility rate breaks away from the speculative market

For the utilitarians, this provides a significant amount of assurance that the purchase of their meTokens will always retain utility and have a guaranteed limited downside. What's even more interesting is that in the event of a total selloff scenario – where a utilitarian buys at the top, everyone else sells their meTokens, and the utilitarian is left as the only meToken holder – the utility value of the remaining meTokens will actually increase with a radical appreciation; the last utilitarian can actually end up with a dramatically higher utility value than when the speculative market was at its peak.

Utilitarian Leverage

Utility Rates Always Recover More Quickly than Speculative Rates

Another interesting consideration is that even if the utility rate of a meToken hits its lowest possible value during a selloff, the utility market is still leveraged in a way that it will return to its peak value well ahead of the speculative market. Imagine ① a meToken is heavily bought in a bull market, uninterrupted (without any speculators selling meTokens back to the Bonding Curve). Then one day ② a huge selloff occurs, which drops the utility value of the meToken to its lowest possible rate. For the meToken to return to its peak utility rate, ③ the token supply would only need to increase a fraction of its previous all-time high.

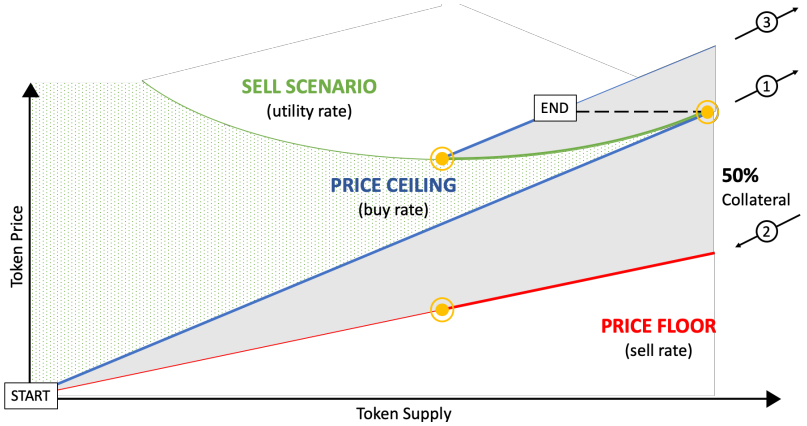

Figure 9: Worst Case Scenario for Utilitarians – the utility rate of a token can rebound quicker than the speculative rate

Setting the Pricing Parameter

Optimizing Between Utility and Speculation

The *function* and *pricing* parameters of the Bonding Curve significantly affect the stability of a meToken's utility rate. The pricing parameter affects this most dramatically. The narrower the pricing differential, the less assured or stable the utility rate is during volatile markets (fig. 10).

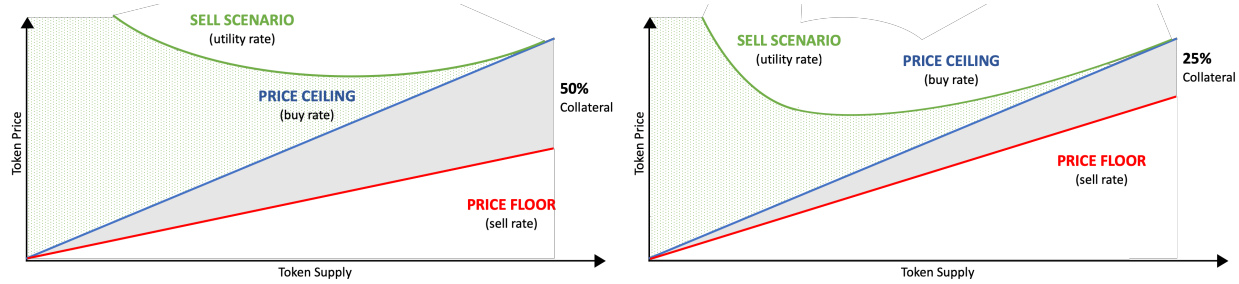

Figure 10: The Influence of the Pricing Parameter on the Utility Rate - the greater the pricing Δ, the more stable the utility rate

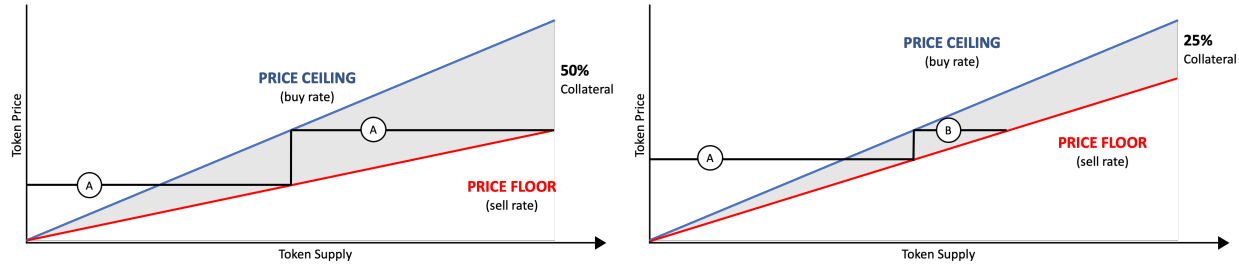

Figure 11: The Influence of the Pricing Parameter on Speculative ROI - the narrower the pricing Δ, the more stable the ROI

Unfortunately, the tradeoff of creating a more stable utility rate with a higher collateral differential is that the speculative market becomes less assured. When the differential is narrower, the speculators are forced to trade within a narrower orderbook on secondary markets. That is to say, market activity depends more on the Bonding Curve with a narrower pricing differential. And when the market depends more on the Bonding Curve, less buying pressure is required to drive the market upward. This results in a faster realization of price floors which guarantee ROI for speculators (see figure 11).

Spending meTokens

A Race Among Utilitarians

The only time that the markets are affected equally for both utilitarians and speculators is when a utilitarian successfully spends a meToken by "cashing it in" with its owner. When a meToken is successfully spent, the owner unlocks corresponding funds from both the collateral pool *and* the refund pool. The appropriate token volume is then removed from circulation as the owner burns the "spent" meTokens. The price ceiling and floor (and utility rate) are then adjusted according to the new token supply.

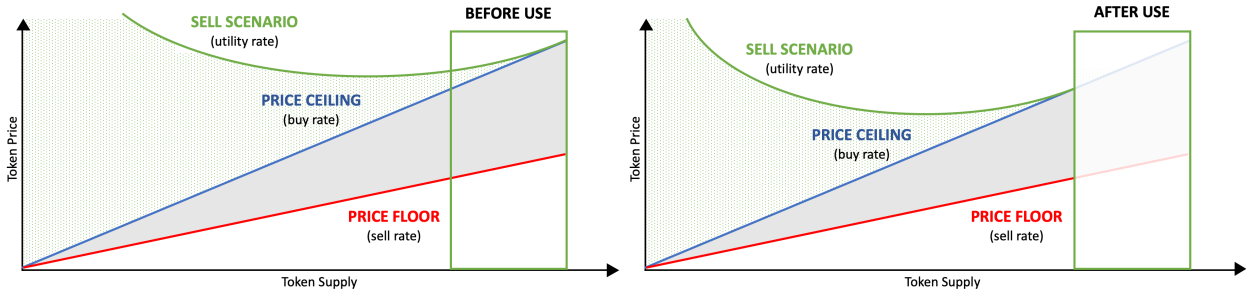

Figure 12: pending meTokens - meTokens are removed from circulation when spent; market rates adjust accordingly

When meTokens are spent, only the owner and the single utilitarian "spender" benefit. The owner gets paid and the spender gets their utility. All other utilitarians and speculators are hindered by a temporarily depreciated market; both the utility and speculative rates decrease in the immediate aftermath of a successful "spend." Thus, it stands to reason that the market is constructed in a way that utilitarians are all, in some capacity, in direct competition with each other to spend their meTokens with the owner for the best "spend" (or "utility") rate.

Hodling meTokens

Synthetic Labor, Not Real Labor

A utilitarian should always purchase meTokens to hodl on a medium to long term time scale. After all, meTokens are a *deed* to a person's labor – not their actual labor. If a utilitarian purchases meTokens with the intent of spending them right away, they will always run the risk that someone else will spend their meTokens first and depreciate the utility market well below their recent purchase rate. Only if possible, the better alternative for a meToken utilitarian who is intent on buying a person's labor in the short to immediate term is simply to outright offer them a standard bounty or payment.

Accepting meTokens

Discovering the Fair Market Value of a Person's Labor

When a meToken owner accepts meTokens as payment, they are providing the market with information about their fair market value. The more often they accept payments in meTokens, the more information they provide. On their own, a single successful "spend" doesn't tell the market very much. But a collection of successful "spends" over time demonstrates a trendline for how much value a person can accumulate and produce over a given period. This might loosely translate to equate a person's weekly, monthly, or annual salary.

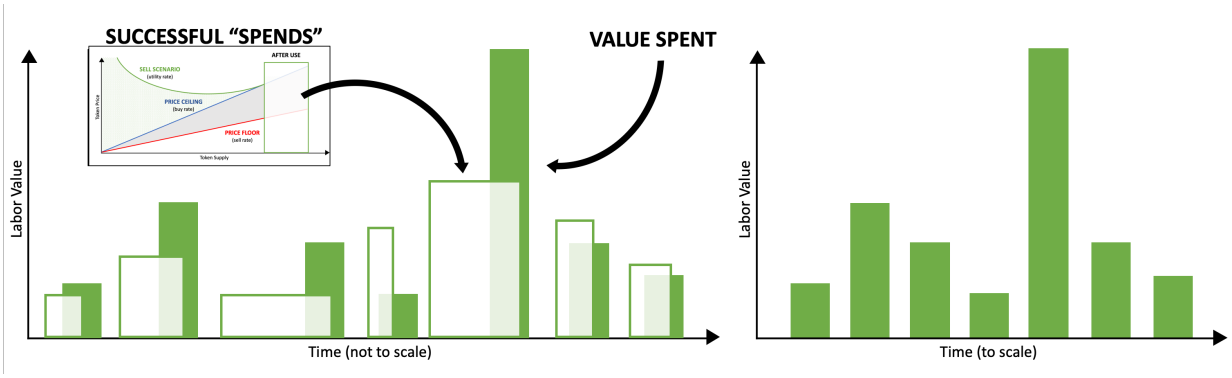

Figure 13: A Trendline of the Value of a Person's Labor – enough data provides an accurate depiction of a person's value

In the most extreme scenario, a person would develop enough market demand to generate their entire income from their meToken market. If this actually happened, a person would eventually begin to hit bottlenecks in their output capacity, namely a limit in their workable hours. If a person is spending all their available working time generating income from meToken utilitarians, then (like in any traditional freelance or flexible job market) a person would begin to demand a higher value for their labor. This would drive up both the utilitarian and speculative markets, as well as the meToken owner's income; a productive individual (owner) benefits all meToken stakeholders. Thus, the market is optimized to output productive individuals.

Manipulating meToken Markets

The Dangers of Tokenizing One's Self

All deregulated, decentralized markets are subject to the risk that unpredictable activity, including manipulation, may occur. meToken markets are no different. There is a possibility that a speculator may have the opportunity to profit from the radical depreciation of an owner's meTokens. The means to depreciate a token may range from coordinated pump-n-dump schemes to character assassinations to actual biological assassinations. While the foremost means of manipulation (pump-n-dump) would hardly affect the utility market stakeholders (as demonstrated in the *Utilitarian Assurance* section), the latter two means have the potential to cause unreconcilable harm to the owner, including death.

It should be noted that all stakeholders, therefore, always assume the inescapable risk that in the event an owner passes away or becomes seriously injured, their meTokens may become altogether worthless, both in utility and speculation. A possible, albeit only partial, solution may

be for an owner to enable an insurance or dead man's switch to migrate their meToken ownership to another owner or guild. Unfortunately, this could further exasperate the risk that someone else – in this case, the potential new owner and their mutual stakeholders – could now have a vested interest in seeing the death of the original owner come to fruition. While it could be argued this is not too different than any other type of circumstance regarding inheritance, one must keep in mind that in this scenario pseudonymous stakeholders may enter and exit the market at any time.

Conclusion

A First in Multiple Categories

This Game Theory document demonstrates the ability of a Bonding-Curve-issued meToken to support the two identified classes of *personal tokens* simultaneously: (1) utility-centric, and (2) speculative-based. The primary crypto-economic methods implored to achieve this are (A) collateralization, and (B) final-state design. These two methods, paired with a Bonding Curve, ensure all stakeholders – (i) owners, (ii) utilitarians, and (iii) speculators – benefit from the optimized market output: productive owners. The sum of this design produces an emergent, new digital asset: *synthetic labor*.

This Bonding Curve model of meToken issuance pioneers a number of new primitives and signifies the first time that:

1. A person can tokenize themselves with a meaningful degree of trustless, crypto-economic obligation; not just through memetic or social means.
2. A token can verifiably maintain two distinct values simultaneously, which are determined on the basis of intended use of the token – utility vs speculation.
3. A token's utility value can be prioritized in the market over its speculative value.
4. A bonding curve pricing differential operates to collateralize, or provide any specific value to, the asset which it, itself, is issuing.

Ultimately, a person who owns their own successful meToken becomes an employee of "the market." Compared to an employee of a company, a successful meToken owner would coordinate openly with their community of stakeholders. In this way, open industries or sectors, such as those involved with Ethereum and other blockchains, could fully or partially consolidate around productive individuals and market demands, rather than capital rich projects.