

Delphi Digital

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Empty Set Dollar (ESD) is an elastic, algorithmic stablecoin that uses in-built monetary incentives to maintain its peg. The protocol is still experimenting with the overall mechanism design with an active community that's spearheading governance initiatives.

Empty Set Dollar: A Game Theoretical Approach to Elastic Stablecoins

Ashwath Balakrishnan · Thursday, November 12th, 2020

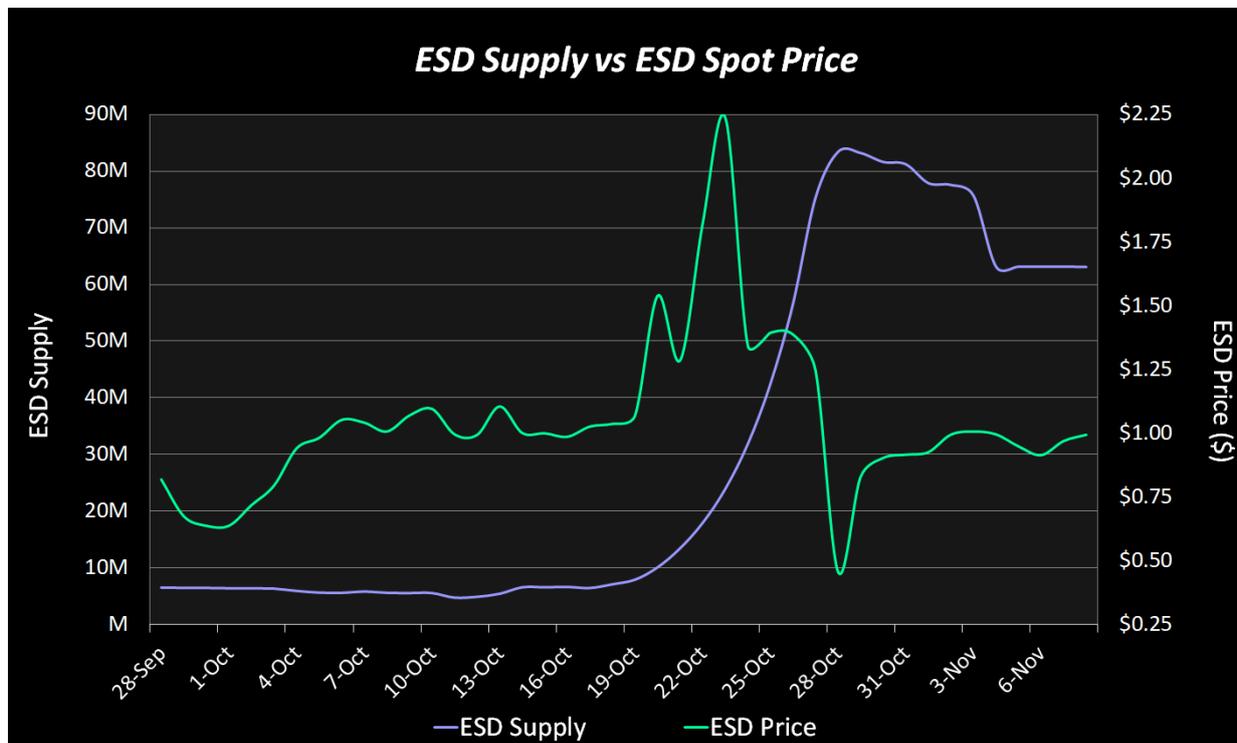
Crypto trading volumes have seen a momentous shift towards stablecoins. The rise of DeFi further augmented this phenomenon, with over \$245 billion of blockchain transactions [settling](#) via stablecoins in H1 2020.

While designs vary amongst different coins, one notable project, Ampleforth, attempted to change what it means to be a "stablecoin" all together. Its token, AMPL, is an algorithmic cryptocurrency that introduced the concept of rebasing. Simply put, a rebase is a mechanism where tokens are printed and issued by the protocol when the price of the token is above a certain threshold (i.e. if $X\text{-price} > \$1$ then increase $X\text{-supply}$). For all intents and purposes, AMPL is not a true stablecoin despite having an explicit price target.

Before AMPL, however, the pioneer of the elastic token concept was Basis. In late 2018, Basis was [shut down](#) by the SEC for having too many security-like instruments. Basis had 3 tokens: a stablecoin whose supply was elastic, share tokens that played an equity-like role in the ecosystem, and bond tokens that represented a future claim on Basis' stablecoin.

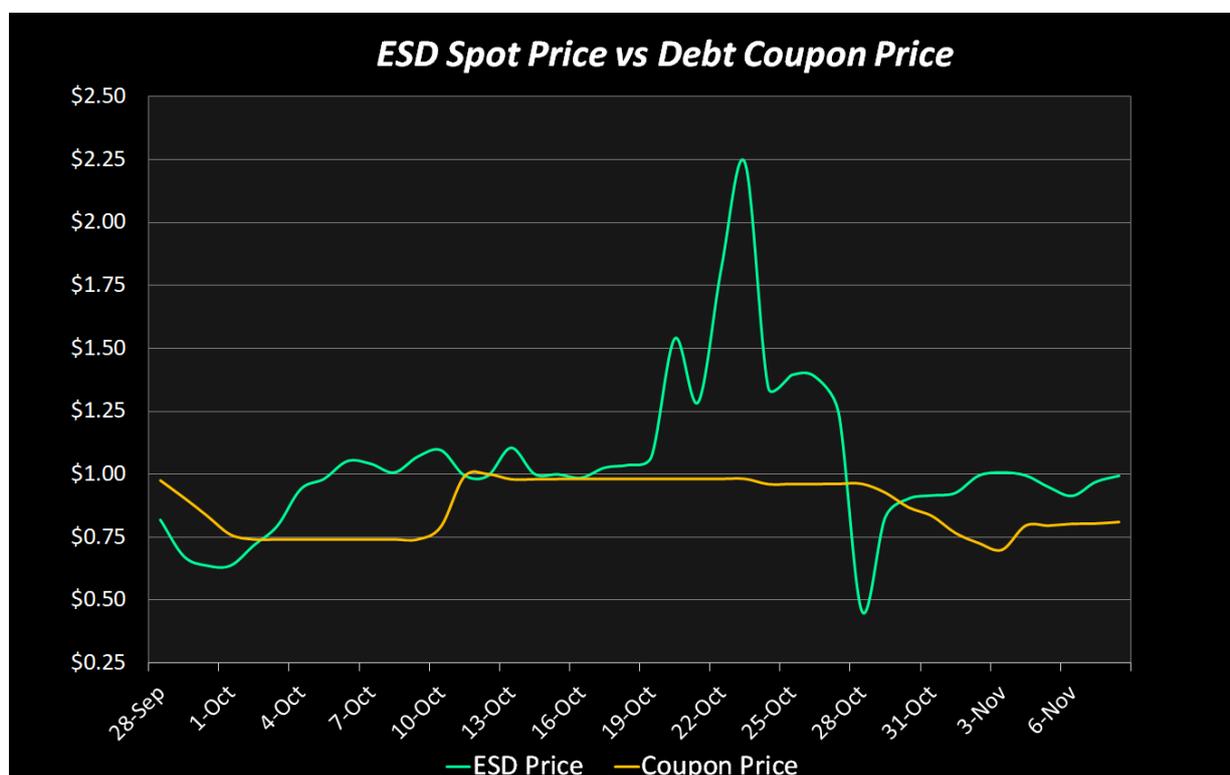
[Empty Set Dollar](#) (ESD) is an attempt to build an algorithmic stablecoin, borrowing a few concepts from projects like Basis. ESD has an elastic supply; new tokens are minted when the token is trading above \$1.

But unlike AMPL it doesn't mindlessly print money for token holders. Freshly printed tokens are used as an incentive to maintain the peg. The objective of ESD is to be a stablecoin, but it remains to be seen if it can maintain stability over extended periods of time. ESD was created by a team of pseudonymous developers, so the risk of being forced to shut down by regulators is much less tangible compared to Basis (this is not legal or financial advice).



Coupons are a concept introduced by Empty Set Dollar that work similar to Basis' bond tokens. Coupons can be obtained by burning ESD and are priced at a discount to ESD. They represent a claim on future ESD that's minted. You can think of them as call options with a strike price slightly above \$1. The coupon is only in the money (profitable) once ESD is trading above a \$1 and minted tokens can be claimed against them.

A lower ESD price implies a higher yield on coupons. Say a trader burns an ESD when price is at \$.95 and the trader is issued coupons at \$.90. They receive 1.056 coupons for their ESD [$$.95/$.90$]. A few days later, ESD is trading at \$1.03 and the trader redeems their coupons for 1.056 ESD. They've now made a gross profit of 14.5% [$(1.056 * \$1.03) / $.95$].



The discount to coupons is not a direct effect of ESD's spot price decreasing, but rather a byproduct of system debt increasing. More debt makes coupon discounts deeper, offering participants a stronger incentive to burn their ESD. For example, if ESD hits \$.70 over two weeks and rebounds back to \$1 in a single day, the price of coupons won't increase till some debt has been wiped off (either redeemed or expired).

But what role do coupons play in the ecosystem? Dealing with peg stabilization when ESD rises above \$1 is fairly straightforward. Issue new tokens, distribute them to relevant parties, and natural selling pressure kicks in. But dealing with peg breaks to the downside (below \$1) is a bit more difficult.

Note: ESD only inflates when it trades above \$1.

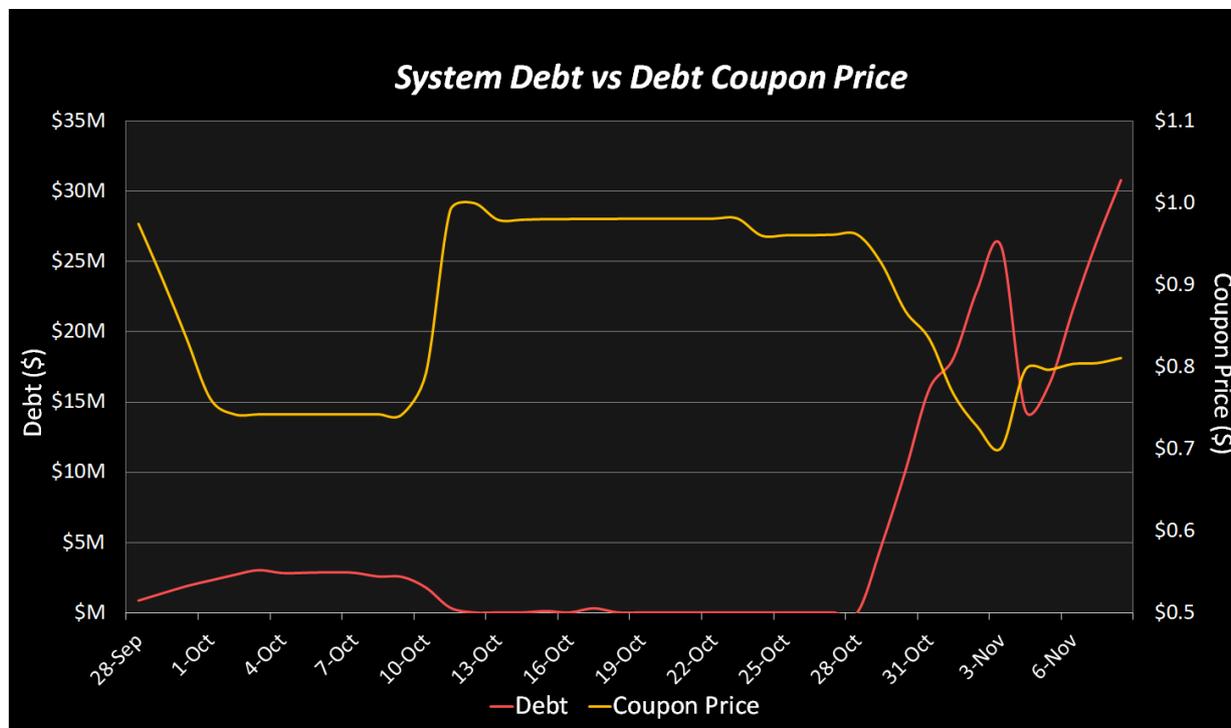
As the peg deviates further away from \$1 and further towards \$1, the discount on coupons increases. This acts as an incentive for traders to burn their ESD for coupons then replenish their ESD reserves.

For example, if coupons are priced at a 20% discount, whales have an incentive to burn their ESD and then buy it back from the open market to push the price of the token up. Once ESD's time-weighted average price rises above \$1, fresh ESD issuance is first served to coupon holders who trade their claims for actual tokens. Once network debt has been wiped out, any new issuance is directed to bonders (token holders who bond their ESD in the DAO to vote on governance proposals) and liquidity providers for the ESD-USDC Uniswap pool.

Now here's the most important thing with coupons: they expire at the end of a set period. Right now, an epoch is 8 hours long and coupons expire after 90 epochs (30

days). If your coupon expires, that portion of system debt is reduced and your coupons are worthless.

The coupons themselves are not a stabilizing mechanism, but rather a neat psychological integration that creates an incentive for whales to push the price of ESD back up.



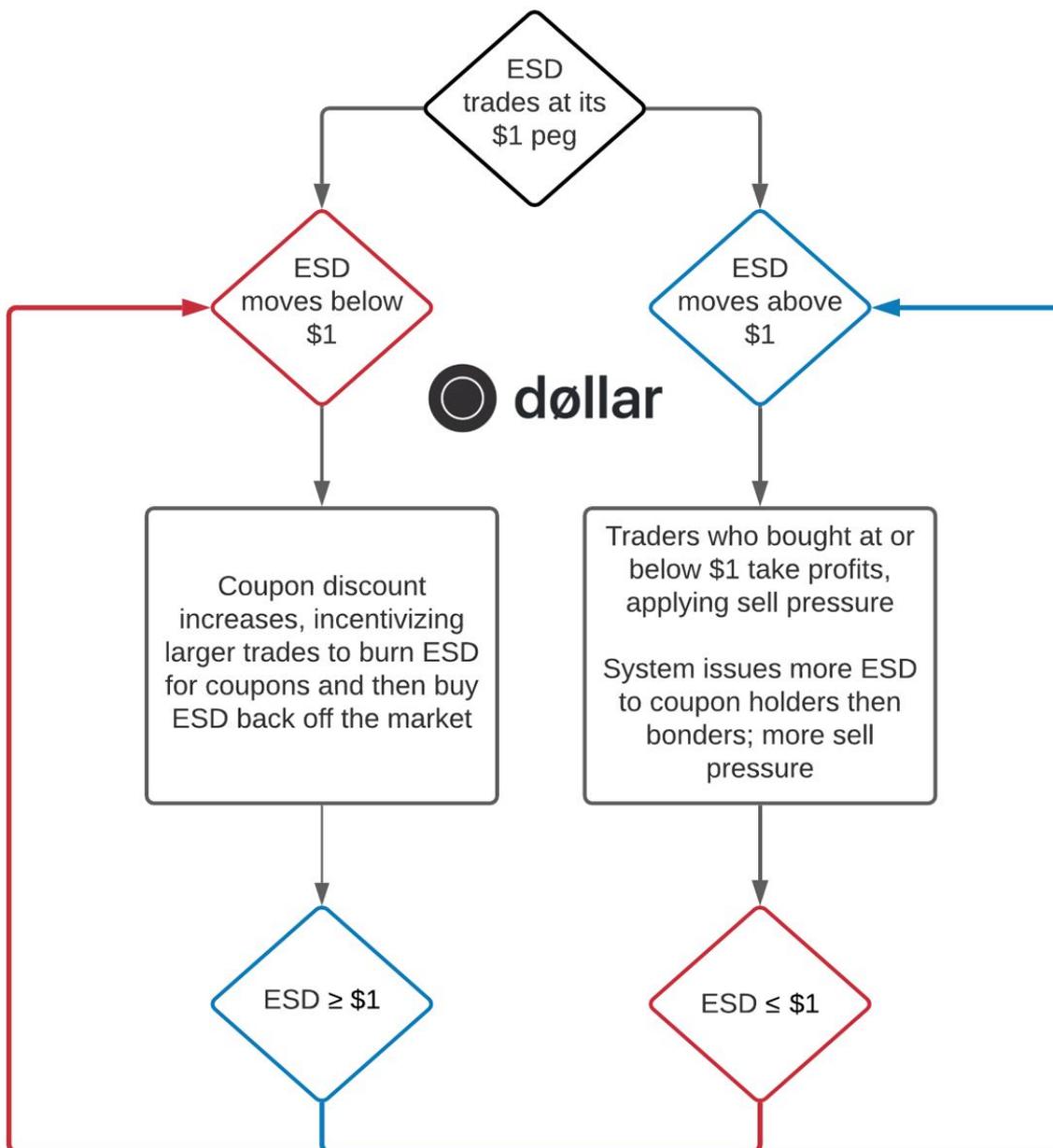
The lower the coupon price, the stronger the incentive, via [Dune Analytics](#)

It's important to note that "whales" is the key word there. Retail investors may be allured by high yields and the prospect of making a double digit return with minimal effort. But these high yields are not without significant risk. The point of coupons is to create an incentive to prop up ESD's price. So if one doesn't have the ability to help push ESD price up, coupons are a risky play.

The risk with coupons is especially pronounced because of the expiry component. This effectively makes it a game between whales who either time their coupon and ESD purchases with each other or attempt to front-run one another. Getting involved in this as a retail investor is incredibly risky without analyzing address balances and on-chain flow, incentives of the other players, or significant capital to deploy of your own.

Of course, there will be scenarios where thoughtful speculators with minimal capital can burn ESD for coupons and ride on the coattails of larger traders. But the risk in these situations is very high and shouldn't be attempted by those who aren't in the know.

So far, ESD's cycles have been long drawn but the incentives have clicked together well. How this works at a larger scale is uncertain, but the results thus far are promising. The community is very active in the governance module, pushing for changes in the incentive structure and parameters like coupon expiry period.



Primary Concerns

One flaw that stood out to me was how ESD bonders in the DAO had little incentive to allow ESD to float above \$1 and let coupons be redeemed against new issuance. DAO bonders and Uniswap LPs receive new inflation, but only after the system reaches 0 debt i.e. all coupons are paid off.

This creates a weird situation, where bonders and coupons buyers are pitted against each other. Bonders want the price to float above \$1 for an extended period of time while coupon buyers want the price to start breaking below \$1 soon after to buy more coupons and cash in on juicy yields.

Further, whales who double up as bonders are actually incentivized to keep ESD below its peg till the coupons expire. By doing this, coupons expire worthless, and when ESD returns above its peg, all rewards go to bonders and LPs. The counter-argument to this is that coupons continuously expiring worthless can deteriorate

public perception of the protocol, which isn't in the best interest of somebody holding a significant amount of ESD.

Coincidentally, there's a [proposal](#) in the governance forum to remedy this by diverting a constant amount of issuance to bonders and LPs at all times - including times of coupon redemption. When ESD is trading about \$1 and system debt is nil, all fresh ESD issuance is diverted to bonders and Uniswap LPs. This eases the problem, but doesn't completely negate the game theory between bonders and coupon buyers.

Coupons have no seniority. There's no hierarchy for redemption, making it a first-come-first-serve model. Coupon buyers who jumped into the price contraction cycle early on receive a lower yield than buyers who bought coupons when system debt was higher. Early buyers should ideally have their debt mature first, especially because they have a higher risk of their coupons expiring worthless. Introducing debt maturity will make this mechanism much fairer and encourage people to attempt to fix the peg sooner.

Another concern is on the topic of algorithmic stablecoins vs collateralized stablecoins. While having an incentive to maintain the peg without any collateral backing is capital efficient, it also introduces new drawbacks. To be blunt, algorithmic stablecoins are not as safe as collateralized stablecoins.

USDC, for example, is always backed by an actual dollar sitting in a bank account custodied by CENTRE. Arbitrageurs are always willing to step in, because even if USDC trades below its peg, it can always be redeemed for \$1. This has created faith in the stablecoin, and USDC hasn't deviated more than 1% from its peg in over a year.

But USDC, as we know, is a centralized token. CENTRE can blacklist addresses or even shutdown the smart contract at its discretion.

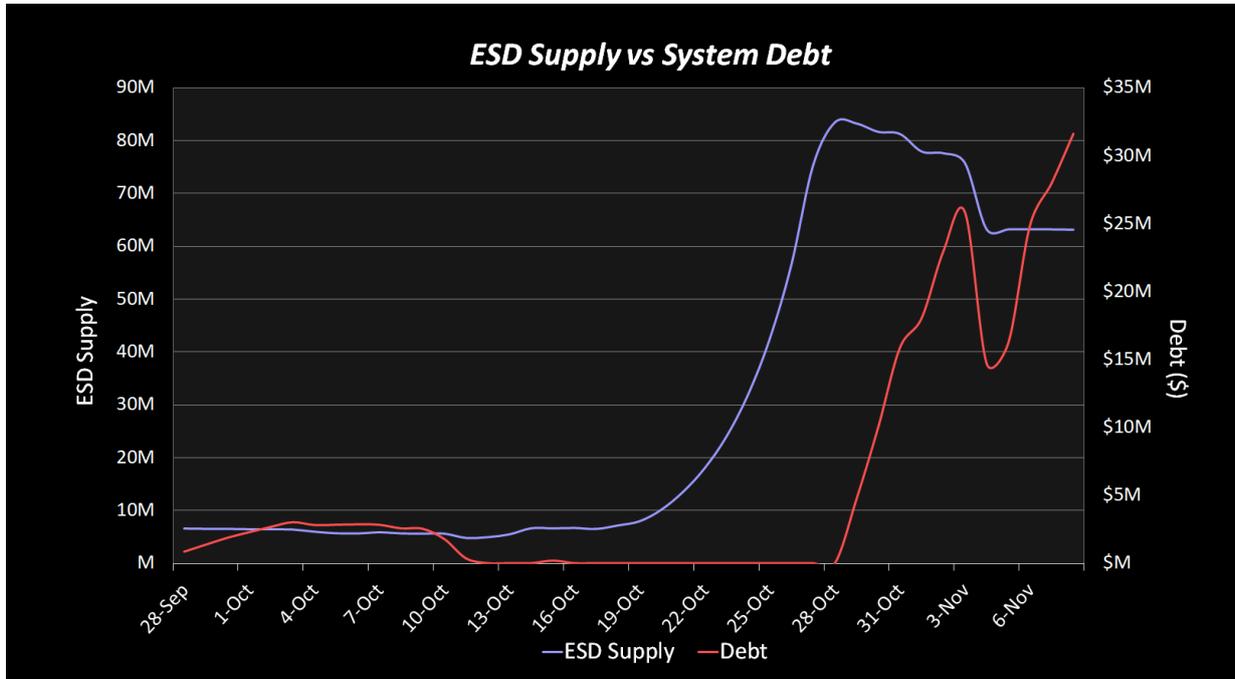
With algorithmic stablecoins, a single Black Thursday like event can permanently cripple the network. All it takes is one bad day, and the stablecoin will become anything but stable as traders and investors flock to safer alternatives. Eventually, faith in the network is destroyed as it enters a death spiral.

Luckily, the Empty Set community is thinking ahead and outlining a proposal to create a backstop or insurance fund to absorb any protocol level losses that could occur during flash crashes or otherwise.

The End Game

Since October 28, ESD has mostly traded below \$1 with occasional spikes above the peg. At the time of writing, [about](#) 70% of the supply is in liquid ESD tokens while 30% exist in the form of coupon claims.

ESD is now within striking distance of the peg, but coupons are still trading at a deep discount since system debt is still high. Currently, over \$30 million of system debt needs to either be paid off by ESD issuance or wiped out by expirations.



Source: *Dune Analytics*

In the coming days, or weeks, it seems reasonable to expect the price to remain above \$1 till the network's debt has been repaid. On the flipside, we could also see price suppression from players who want to see the current cycle of debt to expire worthless (though less likely, as previously discussed).

At the heart of the Empty Set ecosystem is a coordination game between all of its participants, but mainly whales. As the network matures and attracts more whales, the game theory kicks into overdrive and it becomes a race to pick up coupons for the deepest discount and hold ESD price above \$1 until your coupons have been successfully redeemed.

Empty Set has further iterated on the concept of algorithmically rebasing money. But there's still a long way to go before it can be deemed a reliable stablecoin.

Thanks to *Dan Elitzer* and *Daryl Lau* for feedback