COINDESK RESEARCH NOTE

Total Value Locked: A Proxy for Investor Interest

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INTRODUCTION

The metric "Total Value Locked" (TVL) sounds relatively straightforward. It adds up the value of all the collateral deposited in decentralized finance (DeFi) protocols, which in theory indicates the amount of money supporting DeFi applications. If it's going up, DeFi is attracting users and growing in relevance. Simple, right?

Not quite. Like most crypto asset metrics, TVL is beset by confusing definitions and misinterpretations.

In spite of limitations to its utility, however, TVL is a useful gauge of the total value deposited in the DeFi ecosystem.

In this note, we'll dive deeper into what TVL represents, look at some of the weaknesses of the metric, as well as how these weaknesses can be overcome.

This is not intended to be a mathematical paper. We will look at some simple formulas, but it is intended for those who are not statisticians. We aim to make the measurement and understanding of DeFi accessible to everyone, as well as to underscore its importance to crypto assets and their potential role in investment portfolios.

We will refer mainly to ether, as it is the most often used as the gateway asset to access dapps and Ethereum-based crypto assets called ERC-20 tokens. When we use ether with lowercase, we are referring to the asset ETH, and when we use bitcoin with lowercase, we are referring to the asset BTC. Ethereum and Bitcoin with uppercase refer to the blockchain or the protocol. Dollars throughout are U.S. dollars.

TVL: WHAT IS IT?

TVL represents the dollar value of tokens locked in DeFi smart contracts.

A "smart contract" is a software program that executes automatically when certain conditions preset by the developer get triggered on the blockchain. In decentralized finance, this event is usually the deposit of an amount of tokens into a smart contract account. (For more information on smart contracts, read our research note on blockchain accounts.)

Decentralized finance platforms encompass a variety of functions and use cases, such as exchanging one type of token for another, issuing loans in exchange for deposited collateral and prediction markets that allow for the betting on outcomes.

For example, MakerDAO allows me to deposit ETH and take out a loan in the stablecoin DAI, which I can then move to other applications – this means I have a token I can use to pay for things, but I don't lose any potential upside on my ETH holding. Compound, a decentralized lending protocol, will pay me interest on my USDC (since USDCs are Ethereum-based representations of U.S. dollars, this is effectively an interest-bearing deposit account). On Uniswap, a decentralized exchange, I can exchange my FOAM tokens for DONUTs.

One of the more popular types of DeFi applications over the past few months, responsible for much of the growth in TVL, is "yield farming," in which users token-hop between platforms looking for opportunities to earn yield on deposits.

So, if I deposit 100 ETH into the account I just opened at Compound, the TVL for that contract goes up by 100 ETH x $460 (approximate price at time of writing) = $46,000. Add up the market value of all the crypto assets deposited in all smart contract accounts, and you have the industry's aggregate TVL.

Growing value

The above TVL chart from Defi Pulse, who introduced this metric, shows the astonishing growth in value pouring into decentralized finance applications so far this year. As you can see, the total size of the industry is still tiny relative to traditional finance, but even if the rate of growth dwindles to a fraction of its current rate, DeFi is on track to become a meaningful area of focus, in economic terms, for both the blockchain industry and traditional finance participants.

RISKS AND WEAKNESSES

Appreciation

A possible risk is misinterpreting a TVL increase. It's worth remembering that the TVL can go up because the dollar value of the deposited assets is going up, rather than because new funds are entering the system.

For instance, if the ETH price increases to $600 over the next two weeks, my aforementioned 100 ETH deposit will show a TVL increase of approximately 30%. This represents an appreciation of value, however, not new money coming into the system.

We need to continue using the U.S. dollar (USD) value rather than the number of tokens, however, since TVL takes into account a range of Ethereum-based tokens, including ETH, DAI, USDC and others, each with a different USD price.

Focusing on the USD value makes it impossible to separate price fluctuations from value inflows. This is significant, given the relative volatilities of the prices of most Ethereum-based tokens.

DappRadar has developed a related metric in a bid to partially adjust for price swings: adjusted TVL, or aTVL.

This takes the current TVL and values it at the market prices of the tokens as of 90 days ago. While this does still leave the metric vulnerable to price movement, it removes the impact of price on recent inflows, and gives a clearer picture of new money supporting the system.

Stripping out recent price appreciation

Source: DappRadar

Compounding

Another weakness of the TVL measure is double counting.

For instance, in the example above, I deposited 100 ETH (TVL = $46,000 at time of writing) to take out a loan of USDC. Let's say the algorithm allowed me to borrow 35,000 USDC (this is an estimation; the actual formula can vary).

Now, let's say I deposit my 35,000 USDC in an account on Aave to earn 3% interest (also an estimation, rates vary). This is counted as an increase in TVL of 35,000 USDC x $1 = $35,000.

Technically, however, it is not new money coming into the system. New money was created *in the system* by my original deposit, and that value stays in the system. When I unwind the loan and move my original 100 ETH back to my wallet, the drop in TVL will be around $80,000 – but

the money actually leaving the system will be whatever the value of my ETH tokens are at the time. This could be $46,000 if the price has remained stable (unlikely, with ETH), or it could be significantly higher or lower.

The metric gets even more fraught with complexity if I used my USDC on Aave as collateral to borrow another token, which I then moved to Uniswap, which would represent another bump in TVL, and so on.

DeFi Pulse does try to remove double counts that are obviously double counts, such as with interoperability application Instadapp, which mirrors accounts held on other platforms. But the measurement issue does not have a clean solution – it's much like trying to keep a tight grip on the exact amount of money in circulation in a fractional reserve economy.

Netting

Almost the inverse of the compounding problem, netting can also give an inaccurate view of value in the system, by undercounting economic activity.

Let's say I deposit 100 ETH in my account in Compound, and I use it to borrow 40 more ETH, which I deposit back into Compound. Compound records 140 ETH in deposits, and 40 ETH in borrows. DeFi Pulse just records the initial 100 ETH deposit.

If I take my 40 borrowed ETH and move them to a different platform such as Aave, however then DeFi Pulse adds that to the total, to give 140 ETH of new deposits.

This netting of borrows goes some way to explain the difference between TVL attributed to individual platforms, and what the platforms themselves claim to have locked up. For example, at time of writing, the TVL on Compound is approximately $1.33 billion, according to IntoTheBlock. The Compound website, however, claims to have total deposits of $3.1 billion.

UTILITY

Economic health

We've looked at what TVL represents, as well as at the weaknesses inherent in the metric.

So, why even pay attention to TVL if it doesn't faithfully represent new value entering the system?

Because it is a useful indicator of economic interest. Even if only half of the TVL represents actual new money entering, and the other half is from price appreciation and compounding, it still represents economic value. If that is rising, then economic investment in the concept of decentralized finance – whether from new entrants or not – is becoming more meaningful. And if it becomes more meaningful, it will attract more attention. This should continue to enhance liquidity and scrutiny, which could gradually push decentralized finance towards more mainstream interest.

On the other hand, a declining TVL would show that the concept peaked too early, and investors have either lost faith in the utility, or have decided that the risk inherent in betting on unaudited software is not worth the return.

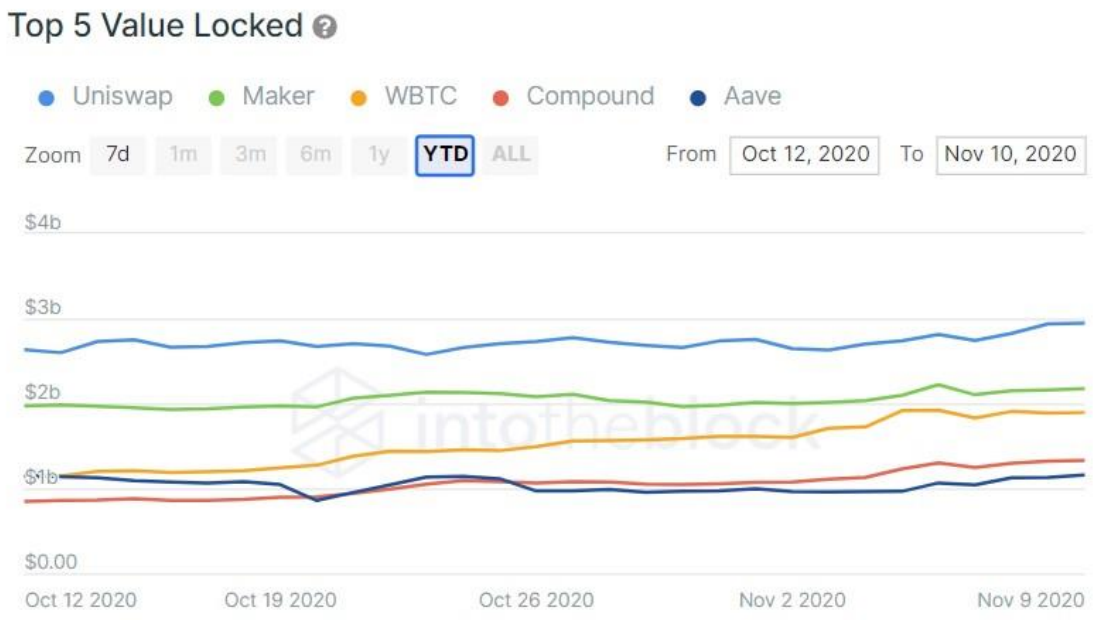
Also, given the compounding effect described above, should the TVL start to decline, it would probably decline quickly. This could push the prices of many of the DeFi tokens down, which would accelerate the decline further.

Application health

Breaking down TVL by application can give insight into the characteristics and health of individual platforms.

For instance, the below chart from IntoTheBlock shows that Uniswap leads the market in terms of TVL.

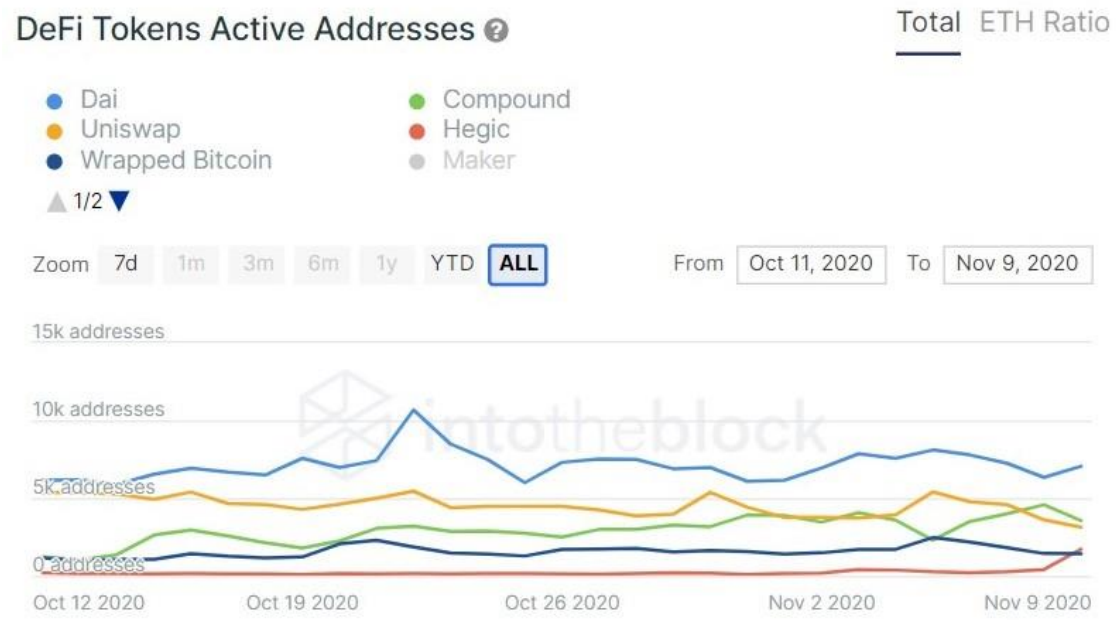
TVL by platform



Source: IntoTheBlock

But it is trailing behind DAI and Compound in terms of number of addresses. This implies that Uniswap users see it more as a savings account than an active application, which could have implications for the value of the platform's UNI token.

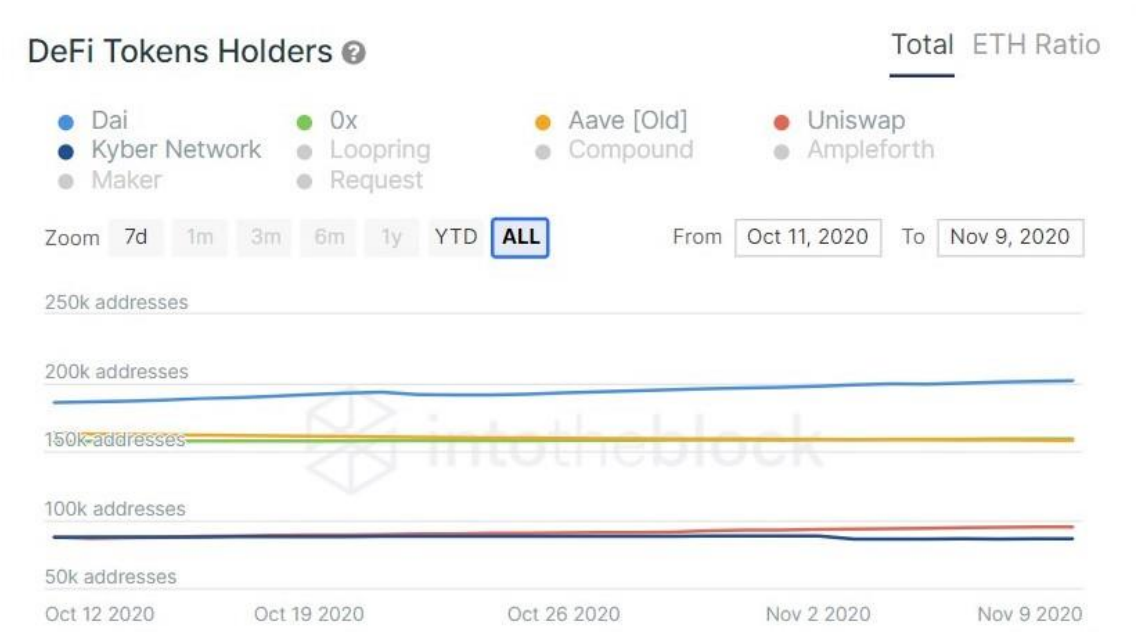
Active addresses



Source: IntoTheBlock

Looking at the total number of addresses shows us that Uniswap has fewer than Compound and DAI, even though its TVL is higher. This reinforces the thesis that Uniswap is seen more as a savings account than a high-turnover deposit account, and implies that Uniswap holders tend to be more invested in the Uniswap platform than 0x holders are in decentralized exchange 0x, for instance. (This does not mean that the 0x platform is less important, many other factors need to be taken into consideration for that judgement call.)

Total number of addresses



Source: IntoTheBlock

Market significance

Keeping an eye on individual dapp TVL also allows us to follow market trends and identify rising platform significance.

To help with this, DeFi Pulse calculates platform "dominance," or the percentage of TVL that it contributes to the total. Earlier this year, MakerDAO was the leader – then it was Compound, then Aave, and now it is Uniswap.

CONCLUSION

The TVL metric is a key indicator of the value supporting decentralized finance applications on the Ethereum blockchain. It has its limitations, but if we bear these in mind we can still get an idea of the industry's growth, and the relative strength of its components.

Given the importance of decentralized finance to the Ethereum ecosystem, the evolution of TVL can lend insight into the value building for ETH as well.

Obviously, the ETH price has many other factors influencing its direction. But TVL has a relevance similar to that of a balance sheet for a listed company. A strong and growing balance sheet bodes well for a share price, even though it is not the only factor influencing a share's value.

Looking at TVL also highlights another feature of Ethereum: its modularity. Just as Ethereum has many value drivers and an almost infinite array of potential applications and use cases, so does TVL have a vast range of components.

It's not just the number of platforms emerging. It's not just the number of users and the number of tokens, nor is it just the market value behind them. It's also that each component of TVL strengthens other components. Liquidity on one can support liquidity on another, and interoperability can open up new applications and flows.

Ethereum is not just limited to financial applications, however, and so it takes that modularity and interoperability to a larger scale. This is an underappreciated feature of the network, and while untested code has risks, and while many applications fail to gain traction, the success of one component tends to spill over into others.

WHERE TO FIND TVL METRICS:

DeFi Pulse

DappRadar

IntoTheBlock

DeFi Rate

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