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MAKER

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Maker Network Overview

Since launching Single-Collateral Dai (SCD) in December 2017, Maker has become one of the most widely used protocols on Ethereum. A diverse ecosystem of borrowers, currency users, keepers, and speculators continues to drive rapid growth of the system. This report presents Maker as a network of heterogenous actors, examining the activity of each of its key stakeholders in an attempt to isolate the key economic drivers of the system. The focus will be on analyzing SCD's first fourteen months of operation, while providing a few projections on the network's future. The analysis is broken down by stakeholder group: CDP Creators, Keepers, MKR holders, and dai users.

This is not intended as an introduction to the inner workings of the Maker system. Readers unfamiliar with the Maker system should consult the MakerDAO Whitepaper and Placeholder's Maker Investment Thesis prior to reading this report.

1. CDP Creators

Collateralized debt position (CDP) creators drive initial activity on the Maker network through the creation of Dai. As CDPs are the core unit of the Maker network, it's necessary to introduce some transaction terminology that will be used throughout the analysis. Users add collateral to their CDPs through a *lock* transaction, after which they may *draw* dai against that collateral, ultimately paying it back through a *wipe/shut* transaction. Dai can also be removed from the system when a *keeper* instigates a *bite* transaction to liquidate an *unsafe* (under 150%-collateralized) CDP.

Figure 1A shows cumulative draw, wipe/shut, and bite activity on the network, expressed in dai terms. Summing dai across all draw transactions, we see the system has issued a total of $237 million in debt to date as of Feb 7th, 2019. CDP debt has lower interest rates than traditional loans, partially driving such impressive lending activity over Maker's first fourteen months of operation. That said, higher than average collateral requirements counteract the enticement of lower interest rates.

As a complement to 1A, Figure 1B depicts (non-cumulative) pooled ETH (PETH) and dai outstanding for each day since December 2017. While PETH has grown almost monotonically over the last year, declines in ETH value have induced sharp drops in the otherwise linear growth of dai outstanding.

There were six major dai declines throughout 2018, as seen in Figure 1B. In each of these cases, the contractions in dai were accompanied by spikes in CDP liquidations. More specifically, in three of those periods (mid-March, early September, and mid-November), liquidations accounted for the entire decline in dai supply. While liquidations were a significant contributor to the mid-August, late November, and early December contractions, so were increased wipes and shuts (net of draws), pointing to proactive CDP holder activity. Such behavior highlights the dual effect of ETH price declines on outstanding dai: Liquidations brought about by keepers directly remove dai from circulation, but can also lead CDP holders to wipe debt to limit their risk of liquidation.

Notwithstanding these periods of contraction in 2018, dai supply has grown rapidly to nearly $85 million as of writing. Meanwhile, the system is approaching 2 million PETH locked in collateral, which represents approximately 1.95% of all ETH in existence and nearly $300 million at current prices.

FIGURE 1A ***Cumulative Debt & Collateral***

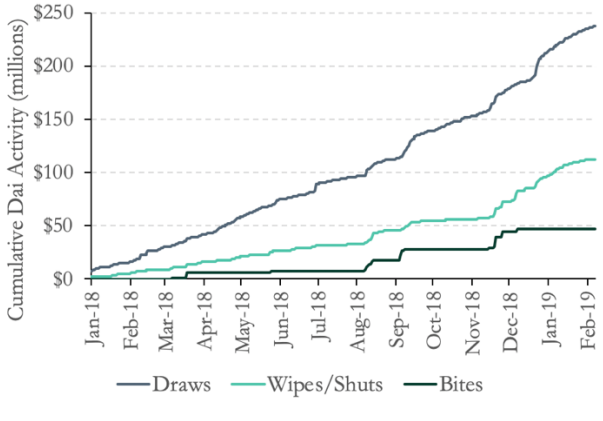
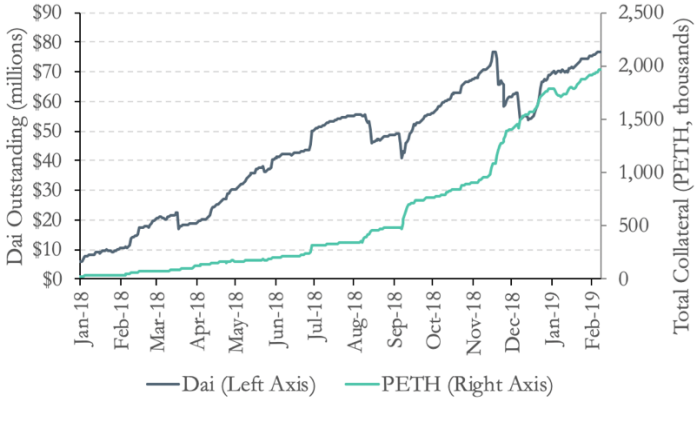


FIGURE 1B ***Outstanding Debt & Collateral***



1.2 CDP Size Distribution

Figures 2A and 2B depict unit-level metrics for CDPs, excluding those with zero outstanding debt. These figures refer to the debt (i.e., dai created by the CDP), not the collateral.

As shown in Figure 2A, the average non-empty CDP declined from above $60K dai in debt at the start of 2018 to just over $30K at the start of 2019. Meanwhile, the median CDP by debt grew from under $500 in debt at the start of the year, reaching around $4K in August, before declining sharply to around $500 by early February.

The significant delta between mean and median debts highlights the power law distribution across CDPs. While small CDPs dominate by number—with over 80% of CDPs drawing less than $10K of dai—they represent just over 3% of total debt in the system. On the other end of the spectrum, about 90 CDPs (less than 4% by number) individually have more than $100K in dai outstanding, representing nearly 84% of all debt in the system. Note that these numbers may under-represent the true concentration of debt, as a single entity may control multiple CDPs. On the other hand, some interfaces may pool user funds into single CDPs, masking more dispersed ownership.

Such concentration in debt can be problematic for dai supply. For example, four of the six periods of dai contraction discussed in the previous section were associated with CDPs that had over$ 500K in debt being liquidated. For example, CDP 614 had over 4.3 million in debt at liquidation on March 18th, accounting for much of the contraction in outstanding dai at the time. More dramatically, the liquidation of CDPs 3228 and 3164, on November 20th and 25th respectively, amounted to a contraction of over $10.7M in dai, making these two CDPs the primary culprits of the largest contraction in dai supply of 2018 (i.e. mid-to-late November as shown in Figure 1B).

Analyzing Figures 1B and 2A together allows us to infer the primary growth driver of dai outstanding. As average debt per CDP has been shrinking in size, we should look to the creation of new CDPs as the primary driver of dai's growth over the last fourteen months.

Overall, the trend of CDP sizes getting smaller over the last few months is positive for the system, as it spreads out liquidation risk across more users and may lessen liquidity risk for keepers, as is discussed in section 2.

FIGURE 2A ***Average & Median CDP Sizes***

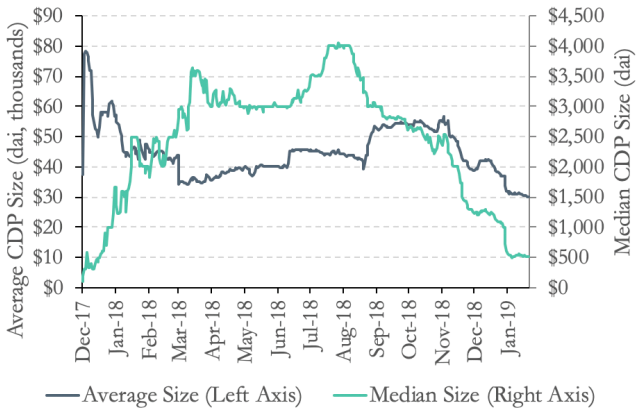
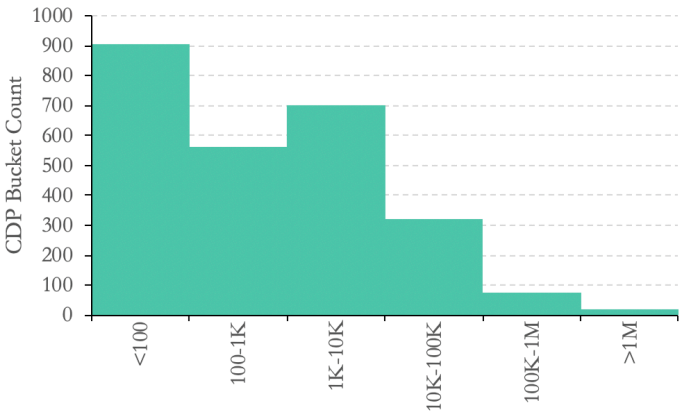


FIGURE 2B ***Distribution of CDP Sizes***



1.3 CDP Counts, Age & Collateral

Figure 3A shows the trend in the number and age of (non-zero dai) CDPs, which had grown to over 2,500 by February 2019. As discussed in the previous section, new CDP creation activity is the primary driver of growth in dai outstanding.

Meanwhile, the average non-empty CDP's age grew steadily in the first 11 months of 2018 (as should be expected for a new system), exceeding four months in the fall of 2018. However, CDP age declined towards the end of the year as older CDPs were liquidated or shut. In recent weeks, the average age for CDPs has hovered around the three-month range. This would indicate that CDP creators are using the debt for medium-term leverage/working capital.

Figure 3B gives further insight into the behavior of CDP holders by plotting aggregate collateralization ratios against ETH price. The system collateralization ratio declined from above 400% in early 2018 to around 250% in November and early December. Aggregate collateralization never dropped below 200%, despite ETH's extreme volatility during 2018. The lowest aggregate collateralization ratio occurred during the most recent liquidation spike on December 6th, where the ratio reached 217%, but quickly rebounded to 252% the following day.

Towards the end of 2018, collateralization spiked to nearly 400%, perhaps due to heightened risk-aversion on the part of CDP holders, but has recently declined back to ~270%, slightly under the system's average of ~300%.

Comparing collateralization to ETH price shows a very strong positive correlation between the two series in the early part of 2018, but a weakening of the relationship in the second half of the year. In particular, the correlation coefficient between the two series from December 2017 to August 2018 was around 0.85, but dropped to nearly zero after August 2018 to the end of the dataset. This decoupling is a positive indicator of network health, as CDP holders have converged on collateralization ratios of comfort, despite the downward pressure of ETH price drops.

FIGURE 3A ***CDP Counts & Average Age***

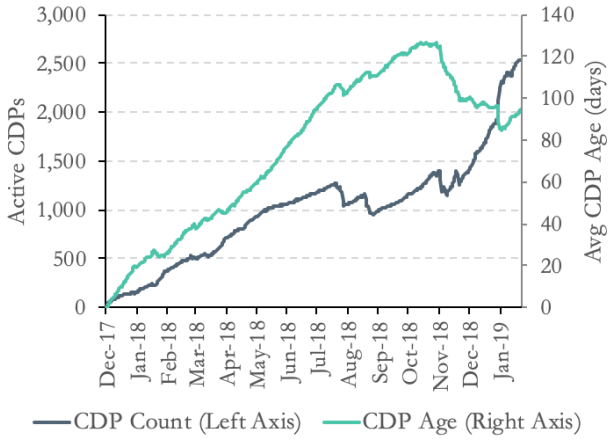


FIGURE 3B ***Collateralization Ration & ETH Lockup***

2. Keepers

Keepers ensure system health by liquidating unsafe CDPs before they become toxic (below 100% collateralization). Their effectiveness was heavily tested in 2018 given ETH lost over 93% of its value. Figure 4A depicts aggregate liquidation (bite) transaction counts to date, delineating between large (greater than median) and small (below median) CDPs. Nearly 2,200 liquidations have occurred to date, compared to a cumulative 6,102 CDPs opened (note that a single CDP can be liquidated multiple times, as users may take out new debt). By using the median as the dividing line, we can see that "small CDPs" are more prone to default, with nearly 20% more liquidations than "large CDPs." This may simply be the result of these contracts having lower stakes for their owners.

Figure 4B shows keepers earning significant revenues to date, collecting over $1.4 million in discounts. These discounts are obtained when the keeper "repays" a liquidated CDP's debt by purchasing its collateral PETH at a 3% discount. The keeper makes the purchase with dai in a *bust* transaction, allowing that dai to be removed from circulation. Note that while there were nearly 500 bites in January 2019, nearly all liquidated CDPs were small, which explains why discount revenue did not increase alongside bite transaction count in early 2019. Comparing cumulative discounts with keepers' expenditures on gas (i.e., cumulative gas used in both bite and bust transactions), reveals that discounts received far exceed the ~$25K in gas expended in acquiring them. In a competitive market for liquidations, we should expect keepers to bid up the gas price of liquidation transactions to where their expected economic profits approach zero.

It's important to note that the difference between discount revenue and gas cost does not represent risk-free profit, as the PETH earned from the liquidation discount must be converted back to the keeper's preferred currency, requiring several additional transactions as well as paying fees/spreads on exchanges. Furthermore, keepers take ETH price risk in-between earning PETH and taking profits. They also take liquidity risk in offloading ETH during periods with potentially thin buying volume. Despite these risks, the current delta between discount revenue and gas costs likely represents a significant profit margin for Keepers.

FIGURE 4A ***Liquidation Transaction Counts***

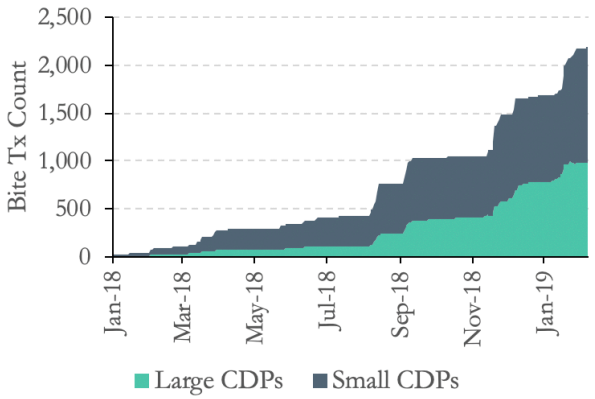
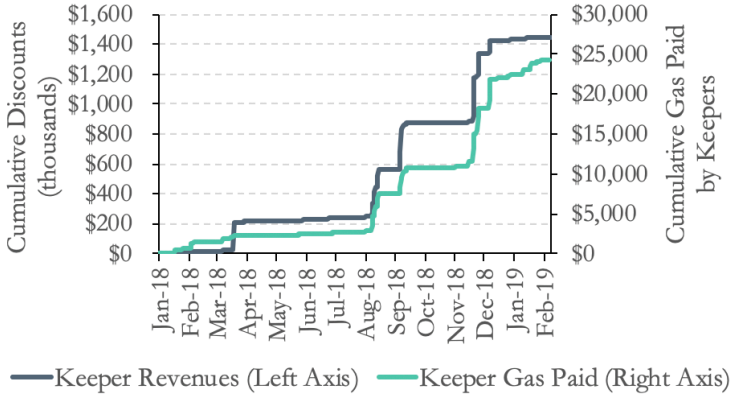


FIGURE 4B ***Keeper Discounts vs Gas Expenditures***



2.2 Liquidation Efficiency

In Maker, price feeds for ETH are submitted by a set of 14 oracles. The final price is determined by the median submitted value. Extrapolating from oracle-submitted ETH prices, Figure 5A plots the collateralization ratios at the time of liquidation for all CDPs liquidated between January 2018 and February 6th, 2019. It is important to note that these figures are the result of estimations that may be prone to slight errors.

As previously seen in Figures 4A and 4B, large numbers of liquidations occurred in mid-March, early August, early September, mid and late November, early December (2018), and early January (2019). Overall, the majority of bites are clustered near the 150% collateralization level, with variance in collateralization ratios increasing during periods of heightened liquidations (i.e. concurrent with spikes in ETH volatility). One exception is January 2019 where the collateralization ratios of liquidated CDPs exhibit lower variance, likely due to lower ETH volatility compared to the other four periods mentioned.

The key insight from Figure 5A is that keepers have been highly effective in preventing CDPs from reaching dangerous collateralization levels. As shown in Figure 5B, the average collateralization of CDPs at the time of liquidation has been increasing over time, to approximately 149% by early February. The median has been slightly higher, approaching 149.5%. Most notably, despite severe ETH volatility, no CDPs ever dropped below 135% collateralization. In fact, only four CDPs have ever reached a collateralization ratio below 140%. Collectively, these four accounted for a mere $340 dai in debt.

The collateralization ratios of liquidated CDPs appear to have no correlation to CDP size at the time of liquidation. In theory, however, extreme sizes for CDPs (too small or too large) may complicate the liquidation process. Keepers may be reluctant to liquidate large CDPs as they may not have confidence in their ability to offload a large amount of collateral without dropping prices, eating into the discount that they purchased the collateral at originally. Profits from extremely small CDPs, on the other hand, may not justify the gas costs of bite/bus transactions for keepers.

Overall, not only have there been no toxic CDPs in the life of Maker, but keepers have done an impressive job preventing any CDPs from even getting close.

FIGURE 5A ***CDPs by Bite Collateralization Ratio***

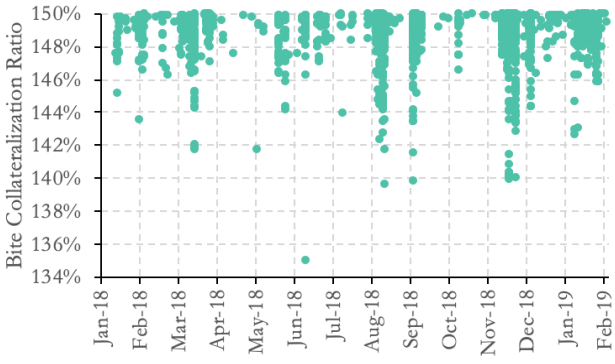
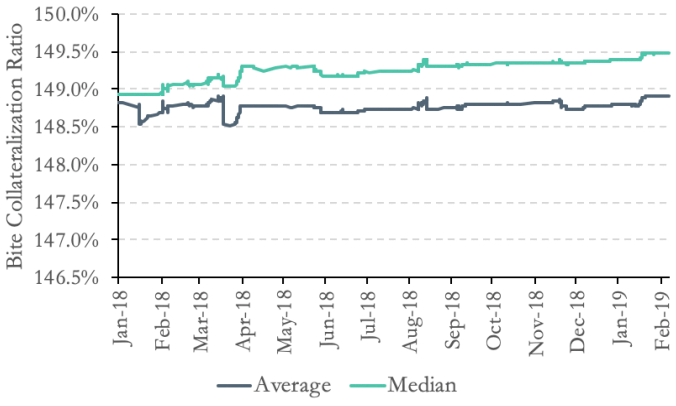


FIGURE 5B ***Average & Median Bite Coll Ratios***



3. MKR Holders

MKR serves as the governance asset of the Maker system, allowing holders to vote on issues affecting the network, including the risk parameters of the system (such as stability and liquidation fees). In the future, MKR will also function as a backstop should CDPs become toxic (sub 103% collateralization), whereby new MKR will be minted and auctioned off for dai to pay down the bad debt until the collateralization shortfall is met. Symmetrically, proceeds from liquidation fees levied on unsafe CDPs will be used to purchase and burn MKR.

For their efforts, MKR holders are currently compensated by the deflation of MKR supply through the stability fee. Figure 5A plots (MKR-denominated) stability fees paid to date, which amount to slightly over 500 MKR burned (5 bps of total supply). The second series in Figure 5A depicts theoretical liquidation fees, if liquidation fees had been used to purchase and burn MKR (instead of PETH) at prevailing prices. At nearly 11K MKR, these liquidation fees would have been roughly twenty times higher than stability fees (> 1% of total supply).

Note that when a CDP is bitten, MKR holders currently forfeit all accrued stability fees associated with that CDP, though this will change in Multi-Collateral Dai (MCD). Thus far, these forgone fees have totaled nearly 40% the value of fees actually collected.

Figure 5B shows accrued (latent) stability fees, denominated in MKR. These latent fees have yet to be levied as the CDPs they correspond to haven't been closed. They tend to increase linearly during periods of lower ETH volatility, where there are fewer liquidations or voluntary CDP closures, such as mid-March to mid-August, as well as mid-September to mid-November. The latter period exhibits a steeper slope due to a higher stability fee (2.5% vs 0.5%).

Since then, MKR holders have voted on three further changes to the stability fee, first bringing it back to 0.5% on December 21st, 2018, adjusting it back up to 1% on February 9th and 1.5% on February 23rd, 2019. Decisions surrounding stability fee changes have been triggered by minor, but sustained departures from the dollar peg of dai, and accumulation (or decumulation) of dai inventories by market makers. An area of concern has been MKR holder apathy, with less than 10% of supply participating in voting on the two recent stability fee changes.

FIGURE 6A ***Stability and (Hypothetical) Liquidation Fees***

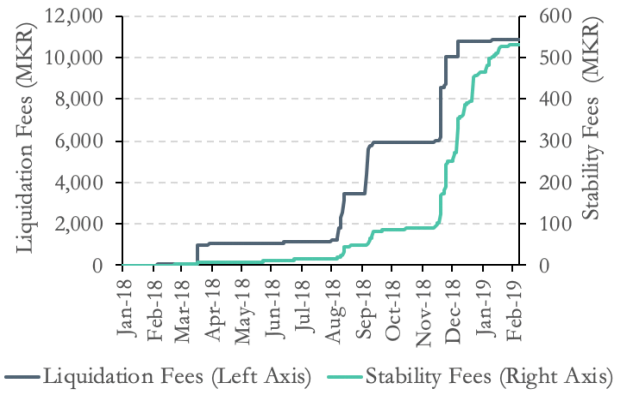
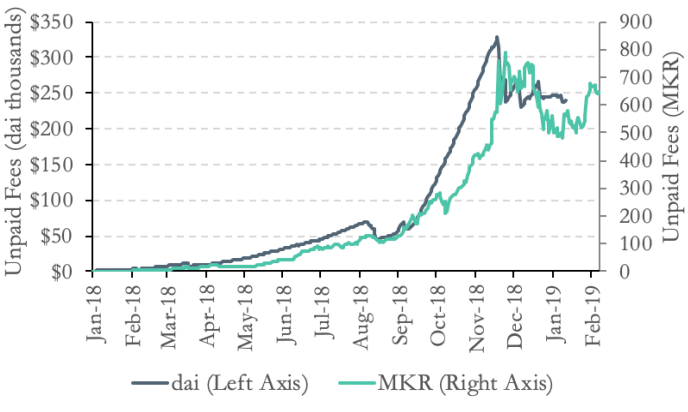


FIGURE 6B ***Accrued (latent) Stability Fees***



4. Dai Users

Once CDP creators draw debts and bring dai into existence, other users are then able to make use of the stablecoin, bringing us to another major area of activity on the Maker network. Over the last 14 months, dai has seen sustained growth in new users and independent sources of demand.

Figure 6A shows daily active addresses and daily transaction counts for dai over the last fourteen months. Daily active addresses have increased from under 100 in early 2018 to an average of 735 in the first three weeks of January 2019. Monthly active addresses are about an order of magnitude higher, now over 7,500 and increasing by an average of 20% month-over-month. Transaction count has increased at a similar rate, to an average of nearly three thousand transactions per day during January 2019. Note that some services can appear as a single active address despite servicing a far greater number of users.

As daily addresses and transaction counts have increased in tandem, daily transactions per active address have stayed relatively flat at ~4 transactions per day for each active address. Beyond active addresses, there are nearly 15K addresses that hold dai, with the average address holding approximately 5.2K dai. In recent weeks, the median amount of dai held has been significantly lower at around 5 per address. The delta between the average and median again points to a power law distribution in dai holdings across addresses, similar to what we saw with debt distributions of CDPs. In particular, the top 150 addresses (1%), hold nearly 80% of all dai outstanding.

Figure 6B shows *daily velocity* (daily transaction volume divided by outstanding dai), giving more insight into how dai is being used. In early 2018, the entirety of dai supply turned over almost daily, representing extremely high velocity for the young asset. In fact, for its first year of operation, dai's annual velocity exceeded 140. Over the course of 2018, though, velocity declined significantly to an average of ~0.1 per day in recent weeks (36.5 annualized). This number remains significantly higher than the USD M1 velocity of 6.

We expect velocity to continue declining as dai is used to collateralize contracts in the broader world of DeFi (e.g. Augur and UMA) and Maker institutes an interest rate on dai holdings. Furthermore, if dai continues to show resilience despite collateral volatility, users may become more comfortable storing value in the asset for longer period

FIGURE 7A ***Dai Active Addresses & Transaction Counts***

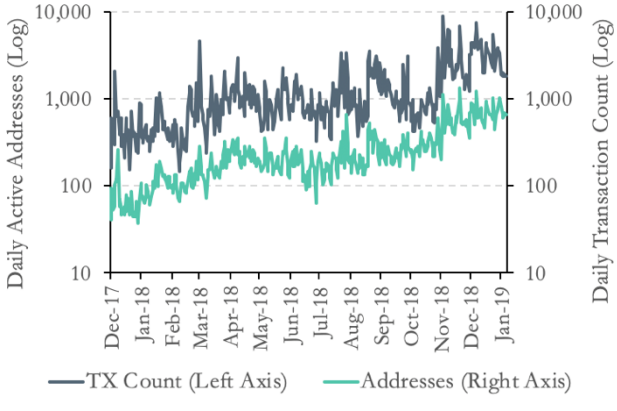
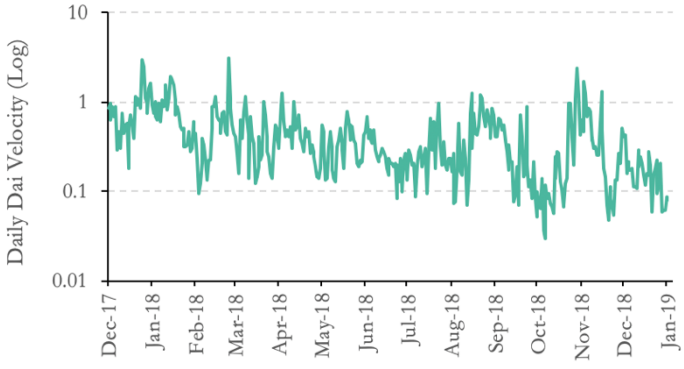


FIGURE 7B ***Dai Daily Velocities***



4.2 Keepers

Figure 7A depicts on-chain transaction volume for dai. Daily transaction volume averaged 10 million in January 2019, up approximately 50% from January 2018. While on-chain daily transaction volume for dai has increased modestly, dai outstanding has grown roughly one order of magnitude faster, leading the decline in velocity observed in Figure 6B.

Figure 7A also plots estimated trading volume for dai from CoinMarketCap (these estimates are to be used with some caution). Daily trading volume appears to have increased ten-fold to an average of around $10 million. It is important to note that trading volume and on-chain transactions have some overlap as volume on Oasis (a decentralized exchange built by the MakerDAO team) is counted in both. If dai is to be used as a currency, continued growth in both liquidity and on-chain transaction volume will be important metrics to watch.

Figure 7B provides a breakdown between four sources of on-chain transactions for dai: CDPs (draws, wipes, shuts, and bites), Oasis (trading), Compound (lending), and dYdX (ETH derivatives and margin trading). Collectively, these four protocols account for 80% of all on-chain activity for dai to date, with direct address-to-address trading and smaller DEXs making up much of the remaining 20%. For most of 2018, Oasis dominated dai volume, with approximately 78% of cumulative volume by October 2018. Compound and dYdX both incorporated dai into their protocols in late 2018 and have noticeably grown their share of on-chain volume.

Compound launched dai support in late November 2018 and had accounted for over $35 million in cumulative dai transaction volume by January 23rd, 2019. Similarly, dYdX accounted for over $7 million in cumulative dai transaction volume through January 23rd.

Overall, in the last three weeks of the dataset, Compound accounted for nearly 4.5% of dai on-chain transaction volume, dYdX nearly 1%, and Maker CDPs around 10% (up from 5% in 2018). Oasis' share (combined with that of its successor eth2dai) had declined to under 40%. A longer tail of protocols and DEXs also made up noticeable volume. For instance, Uniswap had done nearly $1 million in dai volume by January 23rd.

There is a clear trend of dai-demand moving from Oasis to a broader set of DeFi applications.

FIGURE 8A ***Dai On-Chain TX & Trading Volume***

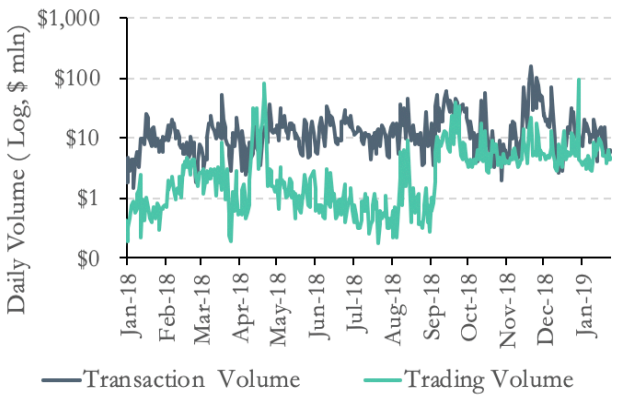
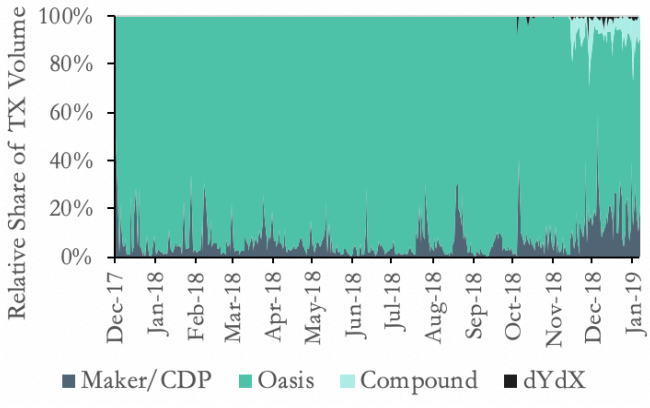


FIGURE 8B ***Relative Share of On-Chain TX Volume***



Reviewing the Maker System

Over the last 1 months, the Maker system has withstood a greater than 90% contraction in the price of its sole collateral asset. Remarkably, dai has had no major sustained deviations from its target price, liquidations have continued smoothly, and system collateralization ratios have remained healthy. Concurrently, dai outstanding has recorded sustained growth, quickly recovering from periods of heightened liquidations, and collateral locked in CDPs has grown almost without interruption, nearly 40x YTD between February 2018 and 2019.

The average CDP is currently three months old and has been declining in size, distributing liquidation risks across a larger set of users. Nonetheless, debt remains highly concentrated in a small number of large CDPs, which exposes the system to greater risks when those positions are liquidated. As CDPs have gotten smaller, growth in dai supply has been driven by the creation of new CDPs, which have rapidly increased in number to over 2,500 unique positions.

Another healthy indicator for the system has been the decoupling of collateralization ratios from ETH price. Even during ETH's most aggressive declines in late 2018, overall system collateralization never crossed below 200%. When large numbers of bites have occurred, keepers have prevented any toxic debt from forming in the system, allowing no CDPs to reach collateralization below 135%. The average and median collateralization ratios of liquidated CDPS have been trending upwards, currently around 149%, underscoring Keeper vigilance over the network. The liquidation market has room for efficiency gains, as keepers are generating significant profits from liquidations, with over $1.4 million in revenue coming from gas expenditures totaling below $25K.

MKR holders have benefited from over 500 MKR units burned from stability fees. While liquidations have caused PETH holders to capture more fees than any other stakeholder, both the benefits and responsibilities of liquidations will be shifting to MKR holders in MCD. MKR holders have successfully voted on a series of stability fee adjustments, but voter abstinence remains high, with under 10% of MKR outstanding participating in votes.

Dai active addresses are increasing at 20% month-over-month, while on-chain transaction volume has increased modestly, as has trading volume, improving dai's utility as a currency. Early dai activity was dominated by trading on Oasis DEX and managing CDPs, but volume appears to be shifting towards financial protocols such as Compound and dYdX. This is expected to continue as more protocols such as Augur and UMA incorporate dai into their products. Furthermore, the tendency to hold dai is expected to accelerate as the dai savings rate comes into effect.

Overall, Maker has shown utility for a permissionless stablecoin on the demand side and an on-chain credit facility on the supply side, with both sides showing impressive growth over the last fourteen months. In many ways, SCD can be seen as a highly successful beta for MCD, which will bring with it a new set of challenges and opportunities for the Maker network.