Background

In March 2023, Gauntlet received a grant from the Uniswap Foundation to help research and recommend usage for a portion of the $20m grant budget allocated to help promote the growth of the Uniswap Protocol. As a first step of this grant, Gauntlet created and published a quantitative objective framework for the Uniswap Foundation and the broader community to use in deciding on and comparing potential proposals.

In this post, we provide a recommendation for how the Uniswap Foundation should use at least a portion of its allocated budget through the introduction of a liquidity incentives program which we will call “Liquidity Bootstrapping.” This recommendation aims to drive long-term growth at a positive ROI relative to token spend.

To generate this proposal Gauntlet performed 3 novel pieces of background research on the dynamics of on-chain liquidity providers and traders, which we used to decide our final recommendation.

Through this research, we were able to validate a series of assumptions to determine which types of programs made the most sense between direct trading incentives, direct liquidity provider incentives, or a hybrid approach incentivizing both Traders and LPs at the same time.

How to quantitatively select an incentives program?

In Gauntlet’s original objective function framework, we outlined the main users of the Uniswap Protocol as Traders and Liquidity Providers (LPs). First, we aim to decide which of these user types should be the focus of the growth strategy. We identified three potential design directions for incentive programs to pursue:

- Trade Mining - reward traders directly for volume
- Payment for Order Flow (PFOF) - reward routing networks for routing favorable traders
- Liquidity Mining - reward LPs directly for supplying liquidity to the protocol

The goal of any incentives program is not simply to generate a temporary boost for Uniswap but to generate long-term growth of the protocol. Thus, we identified two primary research questions which can help decide what type of incentives program makes the most sense:

- To what extent are traders in the DEX ecosystem elastic to price execution?
- To what extent are liquidity providers in the DEX ecosystem elastic to trading returns?

The rationale behind these questions is that all incentive programs achieve their effect by improving either price execution for traders or returns for LPs. The elasticity or “stickiness” that users exhibit with respect to these factors on the Uniswap Protocol dictates the long-term efficacy of the program. We aim to design a program that targets specific user types that will continue generating gains for the protocol after the program has ended. The remainder of this analysis will walk through each type of program and evaluate them in light of user elasticity data.

Trade Mining

One type of program that we have seen other protocols employ is direct trading incentives. Through these programs, a DEX may provide direct incentives to traders or fund development grants which improve the trading interface through a nicer user interface or developer experience.

The goal of this type of program would be to onboard new traders onto the Uniswap ecosystem through subsidized execution costs with the hope that they will stay and continue trading on Uniswap after the program has ended. This type of program has been employed on several smaller dexes such as JSwap and YuzuSwap but their small size and limited traction make them poor examples as a case study.

How did this fare for LooksRare?

A better example of this type of program working at a larger scale is LooksRare, which is a decentralized NFT exchange that in January 2022 launched a trading rewards program. LooksRare provided traders a claim on LOOKS tokens depending on their trading volume relative to market volume on a 24-hour basis. At the time, the program looked to be a strong success as it attracted many users to the LooksRare platform, which launched with a high degree of success based on its strong trading volume.

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Source: https://dune.com/hildobby/LooksRare-VS-OpenSea

This program ultimately proved to be highly controversial however, as on-chain analysis concluded that due to the incentives program, a large amount of the trading volume on LooksRare turned out to be wash trading volume (NFTs traded between a single user in order to “farm” rewards, and not actual organic usage of the protocol).

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Source: NFT Wash Trading on Ethereum

This program ended in March of 2023 after significant pushback from the community around the wash trading taking place to earn these rewards and a severe reduction in all trading volume and the value of the LOOKS token.

What would a successful Trade Mining program require?

While trade mining has historically been unsuccessful at jumpstarting the usage of a protocol, there are Web2 examples of user-level usage incentives programs which are quite successful and ubiquitously acknowledged as having positive ROI. One can look at credit card points or coupons offered by ride-sharing apps like Uber or Lyft as successful examples of a company paying its users to use their product often taking an up-front loss. A successful “Trade Mining” program requires the two following statements to hold true:

- Sybil Resistance - The incentives program must be difficult or impossible to exploit
- Inelastic Users - Users tend to be “sticky” and continue using the product after incentives are removed

Sybil resistance requires good mechanism design and is likely achievable simply by ensuring that the cost of doing a trade is greater than the incentive for doing the trade. This type of program could be thought more of as a “subsidy” rather than an incentive since the returns for doing a trade are still nominally negative or close to zero. Sybil-resistant mechanisms that provide excess incentives are difficult to implement due to the anonymous nature of crypto but may be possible through some complicated wallet tagging schemes. However, such programs are usually not 100% effective at deterring adversarial users, as we can see from the case of LooksRare as well as the difficulties experienced both by Uber (see fake users gaming the system) and credit card companies alike (seecredit card churning).

In addition to the difficulty of designing a Sybil-resistant system, this type of program would also require the users (traders in Uniswap’s case) to be “sticky” in that they will continue to prefer to use Uniswap after incentives are shut off. If this were the case, we would expect that there exist traders in the DeFi space who are currently routing their orders “inaccurately” in that they are making a swap at an exchange that results in sub-optimal price execution, likely as a result of some “brand” effect of preferring to use the exchange they had previously onboarded to.

Due to the challenges laid out above, it would be difficult for Uniswap to create an effective trade mining program that is sybil resistant and targets inelastic users. To make the program sybil resistant, the following options could be considered:

- Identity Verification: Users would be required to undergo a thorough identity verification process, linking their accounts to verified identities, making it difficult to create multiple accounts and exploit the program. However, requiring identity verification compromises user privacy and goes against the decentralized nature of blockchain protocols, potentially deterring users who value anonymity and imposing legal and compliance challenges.
- Proof of Stake: Users would need to lock up a certain amount of tokens as collateral to participate in trade rewards, increasing the cost for adversaries to create multiple accounts. However, implementing a PoS mechanism introduces barriers to entry, favors users with larger token holdings, and may discourage smaller traders, limiting program effectiveness, while determined adversaries with substantial holdings may still find it economically viable to exploit the program.
- Activity Patterns Analysis: Trading patterns and other behavioral data would be analyzed to identify suspicious accounts engaged in exploitative behaviors using statistical models. However, building a model that could reliably identify adversaries is challenging when malicious users can continuously adapt their behavior to mimic normal users.

To make the program encourage user stickiness, the following options could be considered:

- Novice User Targeting: Uniswap could advertise this program to retail traders who are new to DeFi, who may be less likely to seek out DEX alternatives to Uniswap after the incentive period is over. However, user stickiness is not guaranteed through this method, and it is unlikely that these novice users would provide significant trading volume relative to more experienced traders.

- Loyalty Rewards Program: Uniswap could introduce a loyalty rewards program where users earn additional benefits or privileges (such as lower trading fees) based on their trading volume or length of engagement with the platform, incentivizing them to continue trading on Uniswap even after the trade mining program ends. However, while a loyalty rewards program may encourage user stickiness, it may also create an expectation of ongoing incentives, and once these rewards are removed, users may be less inclined to continue trading exclusively on Uniswap, especially if competing platforms offer more attractive features or lower fees.

- Community Engagement: Uniswap and the Uniswap Foundation have historically engaged with users through forums, events, and governance mechanisms. Uniswap could further invest in these efforts, which could cause users to feel a deeper connection with Uniswap and thus develop stronger brand loyalty. However, cost savings and financial incentives offered by competing platforms likely outweighs any achievable sense of community ownership, potentially leading them to explore alternative options.

Considering the challenges involved in designing a sybil-resistant system and the uncertainty surrounding user stickiness, it becomes increasingly difficult to envision a trade mining program for Uniswap that would achieve lasting success beyond the subsidy period.

Measuring Swapper Price Elasticity

In order to determine the efficacy of a Trade Mining program, Gauntlet assessed the elasticity or “stickiness” of traders relative to their price execution. If traders tend to perform swaps outside of Uniswap that could have received a better price on Uniswap, this would imply the existence of “sticky” traders who may be induced to enter the Uniswap ecosystem through Trade Mining rewards.

To assess the price efficiency of DeFi swappers, Gauntlet carried out an analysis of 1.9 million swaps spanning four decentralized exchanges (dexes) - Uniswap v2/v3, Sushiswap, Balancer, and Curve. This analysis covered ten major trading pairs, including ‘STETH_WETH’, ‘OHM_WETH’, ‘SYN_WETH’, ‘DAI_USDC’, ‘DAI_USDT’, ‘WBTC_WETH’, ‘USDT_WBTC’, ‘FRAX_USDC’, ‘USDC_USDT’, and ‘USDT_WETH’. These pairs represent a trading volume of $69.473 billion from September 14, 2022, to February 27, 2023.

Harnessing the Gauntlet Simulation Platform, we reran the 1.9 million swaps on a simulated version of Uniswap v3, using detailed liquidity data from the exact minute each swap originally occurred. To ensure the accuracy of our simulation, we tested the calibration by re-routing the real swaps through the simulated v3. In an ideally calibrated simulation, we’d anticipate no difference (0% error) between the actual and simulated outcomes of a swap.

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Our simulation proved to be well-calibrated, with less than 10 basis points (bps) of error in 99% of swaps and less than 1 bp of error in 90% of swaps. The observed error likely stemmed from complex swaps involving sandwich attacks or other miner extractable value (MEV) issues that impact the execution price due to transaction order within the block. We used Nansen’s MEV tagging to filter out MEV tagged swaps in this calibration step.

Applying this method, we then determined the percentage difference between trades executed on rival exchanges (Curve, Balancer, and Sushiswap) and the predicted outcomes from our simulation had the volume been routed through corresponding Uniswap v3 pools.

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We identified several swaps on competing exchanges that were executed outside our 10bps error margin, totaling $633m in trading volume that seemed to be sub-optimally routed. Overall this represents about 1% of the total DEX trading volume on ETH mainnet, which is not significant in our analysis.

The lack of inefficient volume is compounded when we examine the types of users trading on these exchanges. To do so, we grouped users into cohorts first by tagging MEV originating swaps as MEV, then bucketing wallets by overall trading volume across our 6-month dataset as Whale (>$1m), Heavy (>$1k), and Retail (<$1k).

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Despite whale or MEV-tagged addresses making up only 8% of users, about 94% of the volume originates from these addresses. To eliminate the possibility of incorrectly tagged MEV addresses, we also performed the same analysis with MEV removed as a possible cohort and found similar results. Whale traders represented only 1% of overall users but 91% of the overall trading volume.

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This finding raises concerns about the presence of “sticky” traders. With most Mainnet swap volume originating from large whales (> $1m over six months) or MEV bots, it’s improbable that these groups would consistently use Uniswap due to a one-off onboarding incentive program. However, it’s worth noting that order routing protocols like 1Inch and Matcha, which route all orders from the same address, would fall into the whale category.

We revisited our initial analysis of reroutable volume by exchange, adding the user cohort dimension. This helps us identify where this reroutable volume originates, using 10bps as our significant marker based on our earlier established error threshold.

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Our analysis shows that 92% of the reroutable volume originates from MEV or Whale traders, with only ~$53m of potentially misrouted volume originating from retail or heavy traders. MEV or Whale traders in general are unlikely to show high loyalty to specific exchanges leaving us with a very small amount of volume that could be enticed to move to Uniswap and remain sticky.

This leaves us with only $53m in inefficiently routed volume from retail or heavy dex traders, which Uniswap could likely attract long term through some trader-mining rewards program, only 0.07% of the overall dex volume we observed. Traders on ETH mainnet seem to be very efficient at routing their orders for best execution and not “sticky” in any material way that we could observe.

Does trade mining make sense on Uniswap?

Our analysis strongly suggests that running a trade mining or trader onboarding program for Uniswap currently isn’t warranted. We found no significant volume from users likely to be “sticky” on alternative exchanges that Uniswap could attract through such a program.

It is possible that there are traders who exist outside of the DeFi DEX ecosystem who may be induced to join as a result of trading mining incentives, but absent evidence that this cohort of traders exists and given the past failures of trade mining programs, it is unlikely that a trade mining program will be effective for Uniswap.

Payment for Order Flow

Another option we evaluated was incentive spending via paying aggregators such as 1Inch or Matcha to preferentially route orders to Uniswap, using a mechanism common in the traditional finance world known as “Payment for Order Flow”.

What is Payment for Order Flow?

Payment for Order Flow (PFOF) is a practice in the financial industry where brokerage firms receive compensation for routing their clients’ orders directly to market makers for execution. Essentially, it is a fee paid by market makers for the right to execute client orders from specific brokerage platforms.

A market maker who engages in PFOF does not earn money by providing bad price execution, as this is not long-term sustainable after traders wisen to the game. Instead, market makers engage in PFOF in order to avoid executing unfavorable trades, which are statistically less likely to originate from certain venues. To see how this works, consider two identical-looking orders from two different traders:

Order 1

Size: $100,000

Side: Sell

Asset: TSLA

Trader: Elon Musk

Order 2

Size: $100,000

Side: Sell

Asset: TSLA

Trader: A dentist who didn't like one of Elon Musk's recent tweets

While the orders may appear identical (a $100k sell order of TSLA), the market maker should be much more fearful of executing Elon Musk's order than the dentist's order.

A sell order from an insider like Elon Musk is much more likely to be important to the future price of TSLA. For example, this may be only the first of many sell orders that will move the price lower. In some cases, an insider sell order may itself be impactful, as other traders closely watch reported holdings and trades. This increases the risk that the price will drop before the market maker can liquidate their new inventory, so buying TSLA stock from Elon Musk is a risky proposition.

The dentist's order, on the other hand, likely does not represent any important information and is essentially random. There is no particular risk of the price dropping in reaction to the dentist's order and thus less risk in trading with the dentist than with Elon Musk. Formally, this phenomenon is known as "Order Toxicity", which represents the increased risk of trading with highly informed counterparties versus random flow.

In traditional finance, orders on public exchanges are matched anonymously, so it is impossible for a market maker on a public exchange to differentiate between informed insiders like Elon Musk and uninformed traders like day-trading dentists. To execute more trades, some market makers will pay brokerages known for having uninformed traders to route orders directly to the market maker. The market maker can then provide price execution equal to or better than the public market, since order flow routed through PFOF is materially less risky to trade against.

PFOF is profitable for market makers because it allows them to reduce the risks related to highly-informed traders. The market maker can earn a higher expected value from executing trades through PFOF even after accounting for price execution and the fees paid to the broker. The ability to differentiate between informed and uninformed traders is the core reason PFOF is practiced in traditional finance.

Payment for Order flow on Uniswap

On Uniswap, the exchange mechanisms are different – instead of market makers, Uniswap has Liquidity Providers (LPs). However, these LPs face similar risks as traditional market makers concerning the toxicity of flow. Highly-informed traders who trade against the liquidity on Uniswap are more likely to generate losses for the LPs. In this context, informed traders can be anything from market insiders to arbitragers taking advantage of price discrepancies between exchanges. These trades on Uniswap are generally unprofitable to LPs and reflect a risk that must be compensated by non-toxic flow from "random" traders.

In general, increasing the share of non-toxic flow to liquidity pools on Uniswap would benefit LPs by providing a source of fee revenue that is not associated with increased risk.

What would PFOF look like on Uniswap?

Max Holloway, on behalf of Xenophon Labs, wrote a[paper](paper) quantifying the value that LPs get from additions to non-toxic flow (Section 2 Nontoxic Orderflow's Value to LPs), various methods to increase non-toxic flow through developer mining (Section 4.1/2/3 How to Incentivize Nontoxic Orderflow), ultimately suggesting that a developer mining program doesn't make sense (Section 3.1-3 Nontoxic Orderflow's Value to the Protocol and Sections 4.1-5 Recommendation) until the Uniswap fee switch is turned on.

As Max points out, paying to increase non-toxic flow on Uniswap would increase expected LP returns and likely increase available liquidity on the Uniswap Platform. If we assume that LPs are elastic to changes in returns, this would drive increased amounts of liquidity to the Uniswap DEX. Increased liquidity begets more volume, increasing potential future revenue or governance for the Uniswap protocol and UNI token. This provides a quantitatively calculable benefit to the Uniswap protocol that can be derived from PFOF.

An additional benefit may exist in incentivizing additional integrations from routing protocols. In a world where traders are currently not getting the best price execution, paying some platforms to integrate with Uniswap may induce them to begin correctly routing their orders. This one-time cost to induce more integrations may lead to the long-term benefit of Uniswap by

reducing the existence of orders poorly routed to alternative venues. Given our evidence of highly efficient traders discussed earlier this benefit is unlikely to move the needle long term as traders ultimately route their volume efficiently rather than to the venue that they currently have an integration with.

Payment for Order Flow vs. Liquidity Mining on Uniswap?

If the primary goal of PFOF on Uniswap is to use re-routed volume to incentivize more liquidity, we can also consider a more direct way to incentivize liquidity – Liquidity Mining Incentives. With Liquidity Mining, Uniswap could directly distribute UNI tokens to LPs to subsidize the risk they take by providing liquidity. The pros and cons of Liquidity Mining versus PFOF include several dimensions:

Efficiency

Using PFOF, there are several intermediaries that must be paid before benefit ultimately accrues to LPs. The interface which is re-routing the order to Uniswap must be paid to set up integrations, as well as on a per-trade basis. The trader whose trade is re-routed must either receive price improvement or be compensated with some form of incentive for using the program.

The LPs can also achieve higher returns from the reduced risk of toxic order flow and increased fees. However, they will likely not receive 100% of the possible benefit since there will still be some toxic flow that occurs through PFOF.

It is unlikely that $1 of incentives spent on re-routing orders towards Uniswap will accrue at least $1 in value to LPs unless a significant portion of orders are currently poorly routed. This is due to the fact that any order which is re-routed by a PFOF program must receive price improvement or incentives to make it economically viable. Unless a significant amount of mis-routed flow exists, this will be reflected as lower efficiency in incentivizing liquidity through PFOF versus through direct liquidity mining.

Targeting

With PFOF, liquidity is incentivized through increased and less-toxic order flow. However, this benefit is spread broadly across all the resulting trades and cannot be targeted to any specific type of LP. Because of this, we would expect certain LPs to benefit from PFOF more than others. Sophisticated LPs capable of providing JIT liquidity or actively managed price ranges will likely be able to capture more trades and more value from PFOF programs.

This is not necessarily a bad thing, but makes it difficult to target incentives to where they produce the maximal impact. It is likely that certain characteristics of LPs give more value to the protocol, such as passively providing liquidity versus actively.

With a direct liquidity mining program, Uniswap can pick and choose exactly where and how incentives are spent, directing incentives only to LPs that it thinks are most long-term beneficial for the protocol. With PFOF, this targeting does not exist, as all liquidity can be used to execute any given order.

Long Term Integrations

In a world where aggregators like 1Inch or centralized brokers are routing orders poorly and could obtain price improvement on Uniswap, paying these parties to rectify the situation could make sense. The startup cost of setting up a Uniswap integration may be high relative to the improvements in price execution, and so using PFOF as an incentive could be a reasonable way to overcome this burden.

This benefit relies heavily on the assumption that trades are currently being routed poorly. If trades are currently being routed optimally, paying for integrations is unlikely to move the needle since the integrations either already exist or are not economically viable in the first place.

Even assuming trades are being routed poorly, it is questionable that PFOF is the most cost-effective way to rectify this issue. Alternatively, a one-off incentive to aggregators may also work to cover the integration cost without incurring the longer-term costs of a PFOF program.

Given our earlier conclusion that trades seem to be routed fairly efficiently on Mainnet, there is little evidence to support a substantial benefit from PFOF through this mechanism.

Does PFOF make sense on Uniswap?

PFOF on Uniswap has potential benefits, such as incentivizing additional integrations from brokers and increasing LP returns, which could lead to increased liquidity and volume on the platform long term. However, it also comes with several drawbacks, such as reduced efficiency in incentivizing LPs and a lack of targeting ability to direct incentives to specific LPs with dubious returns to creating new integrations based on our finding that DEX volume is already routed accurately.

(Continued below)