

Automated Market Makers

Anthony Lee Zhang

April 14, 2024

Introduction

This lecture's topic: automated market makers

- ▶ Intermediation in traditional (financial) markets
- ▶ Automated market makers: mechanics, “impermanent loss”
- ▶ History, state of the market, and future directions
- ▶ Regulation

The Bazaar

- ▶ Suppose you want to sell a durable good like a:
 - ▶ Car
 - ▶ Clothes
 - ▶ Stock, bond
 - ▶ House
- ▶ In classical economic theory, trade happens when there is mutual coincidence of wants
- ▶ You have a car and want money, I have money and want a car, we meet and we trade
- ▶ How well does this work IRL?

Buy and sell to Hyde Park and beyond.



POST



Industrial Clothes Rack with Shelves & Shoe Bench, Heavy Duty Clothes Organizer

\$ 50.00

13 minutes ago



IKEA table

\$ 30.00

18 minutes ago



Wheelchair

\$ 30.00

19 minutes ago



Mattress

\$ 30.00

19 minutes ago



Mat foundation, bed frame

\$ 30.00

22 minutes ago



Enormous mirror

\$ 20.00

16 minutes ago

antiques

[all](#) [owner](#) [dealer](#)

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- has image
- posted today
- bundle duplicates
- include nearby areas

MILES FROM LOCATION
miles from zip

PRICE
\$ min - \$ max
avg \$154



MAKE AND MODEL
make / model

condition

- cryptocurrency ok
- delivery available

language of posting

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search antiques



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<< < prev 1 - 120 / 3000 next >

SEE ALSO

\$25 [Vintage Tennis Rackets](#) \$25 (Chicago)

\$45 [Vintage Typewriter Supplies: Ribbons, Oil, Brush, Carbon Paper](#) \$45 (sweet chicagoland)

\$30 [Vintage Star Brand 1/2 Inch Brass Escutcheon Pins](#) \$30 (sweet chicagoland)

\$20 [Vintage Pelouze Mfg. Co. Hanging Scale](#) \$20 (sweet chicagoland)

\$25 [Vintage Kranz's Taffies Advertising Axe Hatchet](#) \$25 (sweet chicagoland)

\$5 [Baseball or such Plastic Bins](#) \$5 (Skokie)

\$35 [Drexel Heritage Cane Back Dining Chair](#) \$35 (Northwest side)

\$20 [Vintage Black Lacquered Chinese Wood Jewelry Box](#) \$20 (sweet chicagoland)

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 - ▶ Stocks/bonds? Big banks, hedge funds. . .
 - ▶ Houses? Flippers...?
- ▶ Intermediaries provide immediacy, at a price
- ▶ An asset is liquid if it can be sold quickly, and at a good price
 - ▶ Intermediaries are in the business of providing time liquidity, at the cost of dollar liquidity
- ▶ While ignored in classic theory, most durable goods markets are intermediated!

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- ▶ What kinds of cars should have high “bid-ask spreads”?
- ▶ When should you set high vs low prices for a used Toyota?

Intermediation in financial markets

- ▶ “Complex” financial assets for institutions generally traded “over-the-counter” with intermediators
 - ▶ Bonds, derivatives, swaps, repo. . .
- ▶ Stocks trade on “limit order books”, so look like they’re traded in a “bazaar”
- ▶ However, generally, the best bids/asks come from professional intermediaries (Jane St. Citadel. . .)
- ▶ Behavior quite similar to car dealers
 - ▶ Higher spreads for riskier stocks
 - ▶ Lower (raise) prices when inventory is high (low)

Why AMMs?

- ▶ Large proliferation of different tokens on Ethereum
 - ▶ Besides ETH, stablecoins (USDC, USDT, etc), governance (UNI, MKR), meme tokens (SHIB)...
- ▶ Can buy on Binance, Coinbase, etc. . .
- ▶ But could we buy MKR using ETH, fully on-chain?
- ▶ Automated market makers are “trader bots”, which let you trade tokens for other tokens fully on-chain

Building an Intermediation Robot

Suppose you want to build a videogame bot to trade apples for oranges

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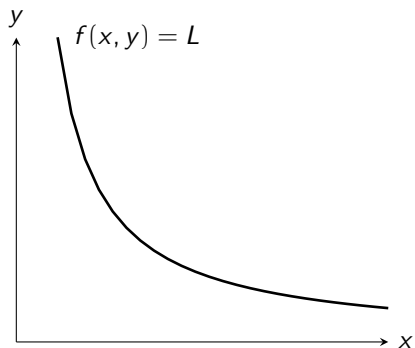
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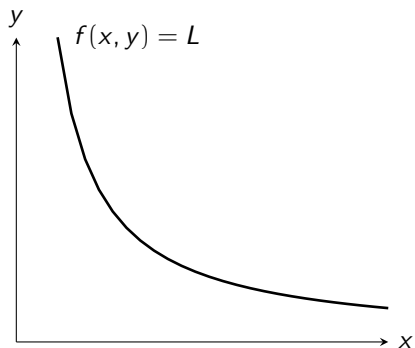
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- ▶ Apple price depends on relative share of apples vs oranges

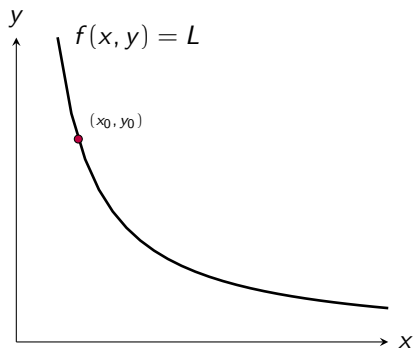
Constant Function Market Makers



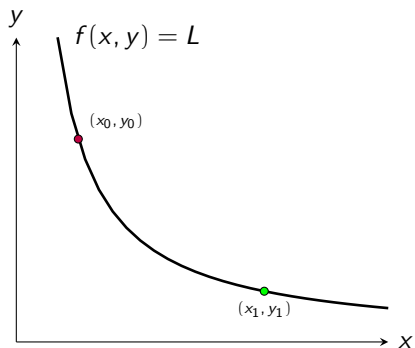
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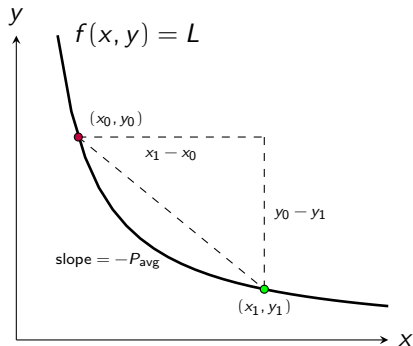
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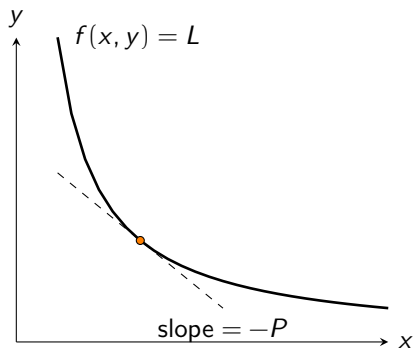
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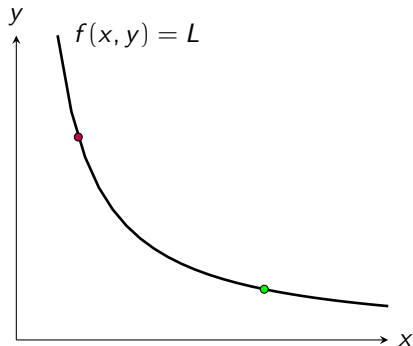
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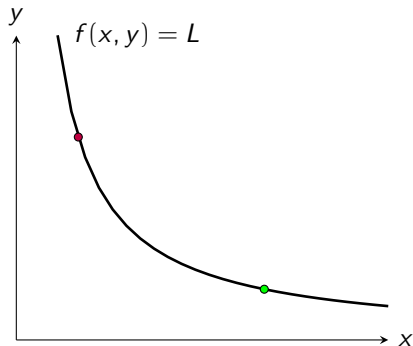
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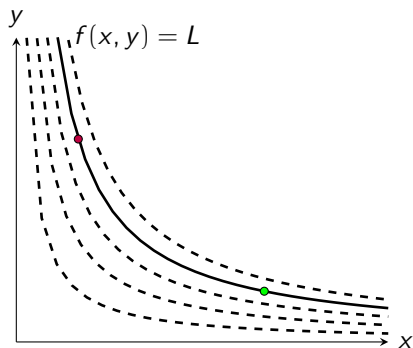
Constant Function Market Makers: liquidity provision



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- ▶ Most famous AMM function:

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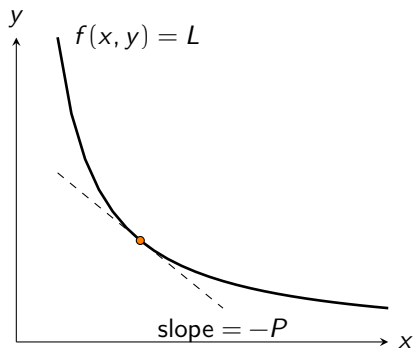
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- ▶ Like our car dealer, the price of B increases when we start running out of B


Constant Function Market Makers: Prices and Trade Size




User Experience

Swap Pool Vote Charts  Ethereum ▾

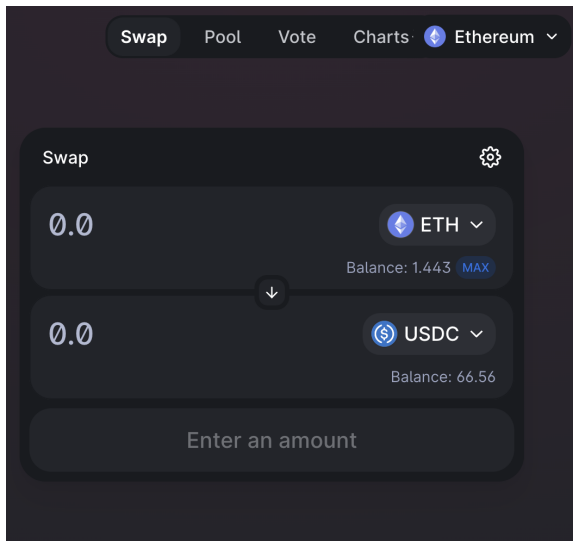
Swap 

0.0  ETH ▾
Balance: 1.443 [MAX](#)

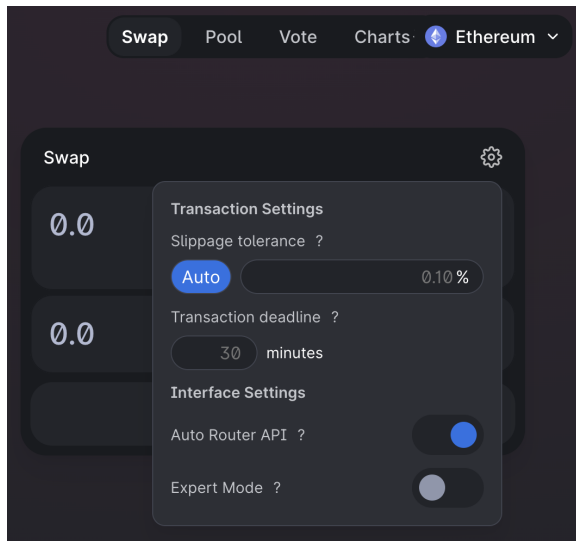
↓

0.0  USDC ▾
Balance: 66.56

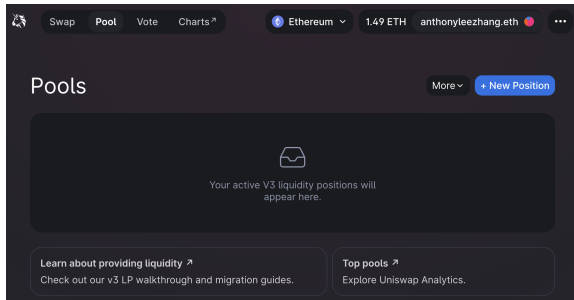
Enter an amount



User Experience



User Experience



User Experience

The screenshot shows the 'Add Liquidity' interface for the ETH/USDC trading pair. At the top, navigation options include Swap, Pool, Vote, Charts, and Ethereum. The user's account information shows 1.44 ETH and the username 'anthonyleezhang.eth'. The main title is 'Add Liquidity' with a 'Clear All' button and a settings icon.

Select Pair: ETH / USDC

0.3% fee tier: 53% select. A 'Hide' button is present.

Fee Tiers:

- 0.01%: Best for very stable pairs. 0% select.
- 0.05%: Best for stable pairs. 44% select.
- 0.3%: Best for most pairs. 53% select. (Selected)
- 1%: Best for exotic pairs. 3% select.

Set Price Range: Current Price: 1329.15 USDC per ETH. A histogram shows the price distribution with a vertical line at the current price and two vertical lines defining the price range.

Deposit Amounts:

- 0.01 ETH: \$13.31. Balance: 1.443 MAX.
- 13.2673 USDC: \$13.26. Balance: 66.56 MAX.

Price Range Controls:

- Min Price: 665.19 USDC per ETH
- Max Price: 2659.8 USDC per ETH
- Full Range

Preview button

10 gwei

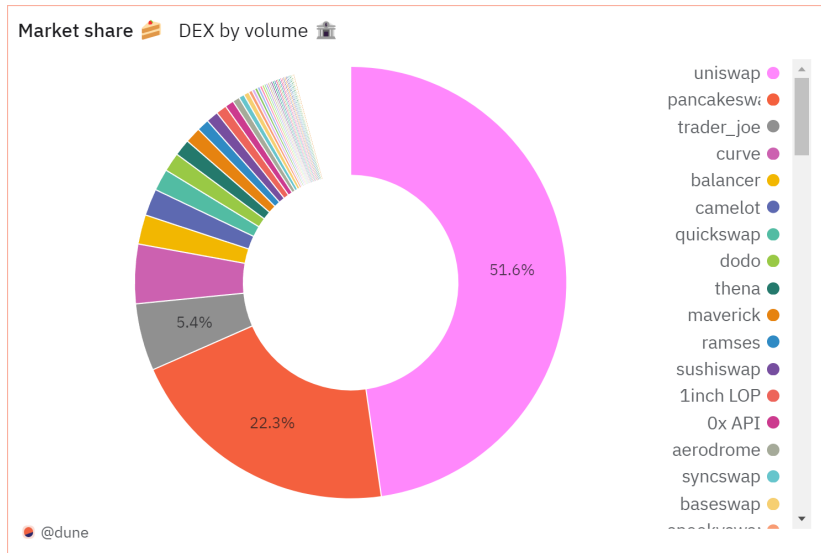
Constant Function Market Makers: Example

Uniswap trading, liquidity provision example

History

- ▶ 2012-ish: **Minecraft plugins** build AMMs for in-game shopkeepers
- ▶ 2016: Vitalik Buterin posts about constant product AMMs on **Reddit**
- ▶ 2018: <https://uniswap.org/> implements constant product AMM, gains massive success
- ▶ Today: **massive market** with many players

State of the Market

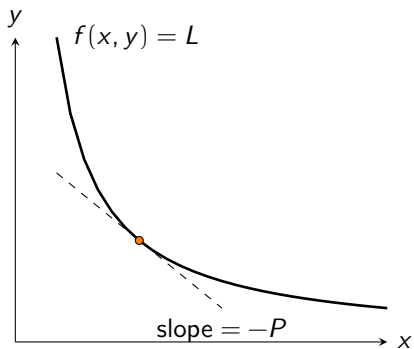


See [Dune](#)

“Impermanent loss”

- ▶ We can make markets even though we don't see prices!
- ▶ But, when prices move, we suffer a kind of loss...
- ▶ The AMM always learns about prices “the hard way”, through seeing that it's trading in the wrong direction
 - ▶ Car dealer analogy: if everyone's buying your cars, raise prices
- ▶ See [Twitter thread](#)

“Impermanent loss”



“Impermanent loss” ... ?

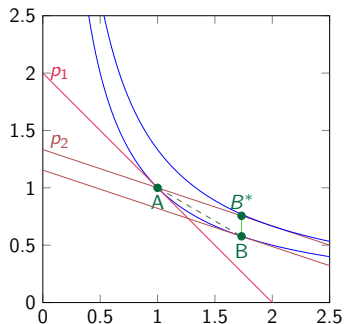
- ▶ In a **recent paper**, with Jason Millionis, Ciamac Moallemi, & Tim Roughgarden, I argue there's a cleaner concept: loss versus rebalancing
- ▶ AMM LP returns have three components:
 - ▶ Fees, when people trade with me
 - ▶ “Rebalancing profits”, from price exposure to underlying assets
 - ▶ “Loss versus rebalancing” (LVR): “Sniping” losses from trading at bad prices
- ▶ LVR is the true “loss” of an AMM

Loss Versus Rebalancing (LVR)

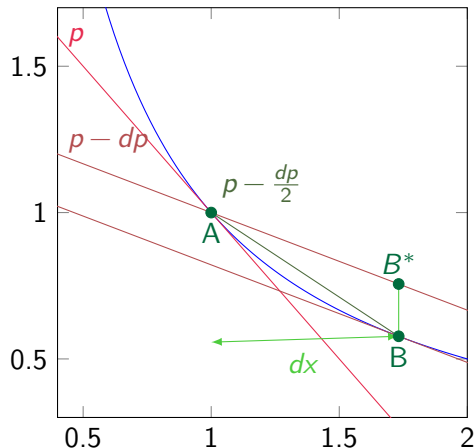
- ▶ Suppose, in t , price p_t , AMM sells ΔX_t at $p_{t,AMM}$
- ▶ Intuitively, **Loss Versus Rebalancing (LVR)** from $t-1$ to t is:

$$\Delta X_t (p_t - p_{t,AMM})$$

- ▶ Distance between B and B^*
- ▶ Exactly equal to profits from DEX-CEX arb



LVR and Marginal Liquidity



- ▶ After price change of dp , AMM trades dx
- ▶ $p_{AMM} = p + \frac{dp}{2}$
- ▶ Hence, AMM loss from LVR is:

$$\underbrace{dx(p + dp)}_{\text{CEX Price}} - \underbrace{dx\left(p + \frac{dp}{2}\right)}_{\text{AMM Price}}$$

$$= \frac{dx dp}{2} = \frac{dx (dp)^2}{2 dp}$$

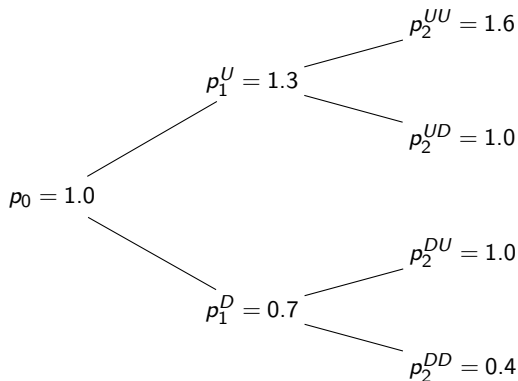
Loss Versus Rebalancing

- ▶ LVR in a small amount of time is:

$$I(P) = \frac{1}{2} \underbrace{\sigma^2 P^2}_{\text{Volatility}} \underbrace{\frac{dx}{dP}}_{\text{Marginal Liquidity}}$$

- ▶ Depends on price volatility σ , and “marginal liquidity” $\frac{dx}{dP}$
 - ▶ How much prices move, and how many cars I sell at the old prices before I update

Binomial Tree



▶ Consider AMMs on a **binomial tree**

▶ Compare 3 strategies:

▶ Hold (1,1)

▶ “Rebalancing strategy” trading at market prices

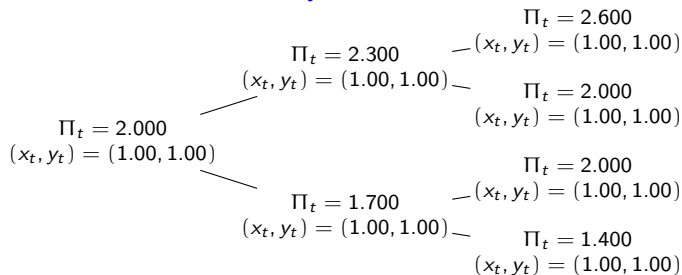
▶ CFMM LP

▶ Calculate inventory and payoffs of each strategy:

$$\Pi_t \equiv y_t + p_t x_t$$

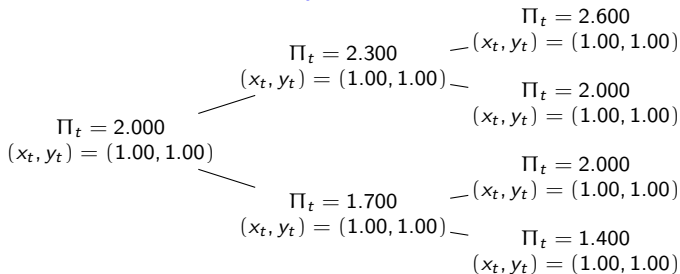
Buy and Hold vs Rebalancing Strategy

Buy and hold

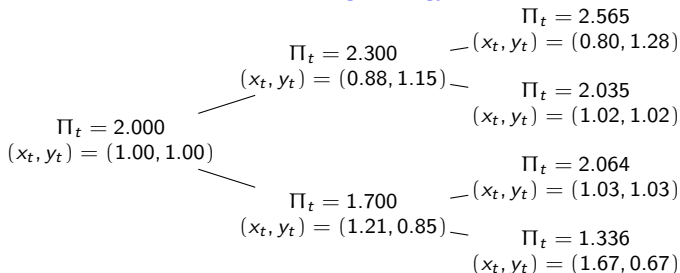


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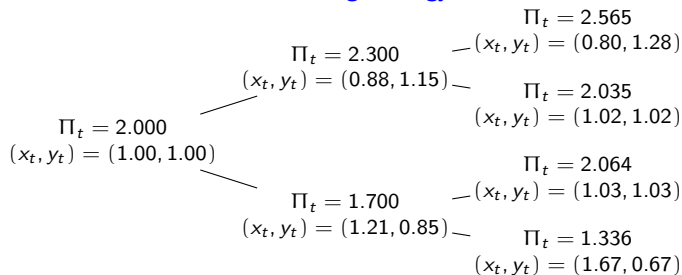


Rebalancing Strategy

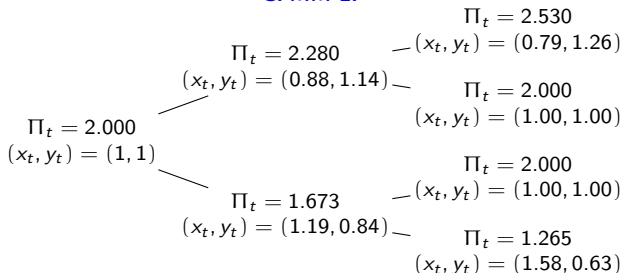


Rebalancing Strategy vs Simple AMM

Rebalancing Strategy



CFMM LP



Binomial Tree: Takeaways

- ▶ When we talk about “impermanent loss”, we often compare the simple AMM to a buy-and-hold strategy
- ▶ This confounds two concepts:
 1. Buy-and-hold vs Rebalancing Strategy: the volatility exposure of “rebalancing” strategy (buy dips, sell rises)
 2. Rebalancing Strategy vs CFMM LP: **Loss Versus Rebalancing (LVR)**: Slippage from executing at worse-than-market prices
- ▶ “Market making” strategies do not systematically lose money in fair markets! 1. should not be called a “loss”!
- ▶ AMM’s loss should be defined as only 2, the “slippage” from systematically trading at worse-than-market prices
- ▶ We talk about details in paper

LVR protection?

- ▶ Simple proposal: AMM fees should adjust based on market volatility
 - ▶ Gains from fees = LVR loss from vol
 - ▶ When vol is higher, fees should increase to compensate
- ▶ More ambitious proposal: could we eliminate LVR with better AMM design?
 - ▶ What if AMM had access to high-frequency CEX prices?
 - ▶ What if AMM “auctioned the right to arb” the pool? (See [am-AMM](#))
 - ▶ “Batching” trades in auctions can help (See [CoW Swap](#))
 - ▶ See also [Titania research](#), [Atis E](#)

Arbitrage

If there are multiple AMMs for the same coin pair (e.g. USD-ETH), how are prices kept in line?

- ▶ Arbitrage: buy low, sell high!
- ▶ Draw picture. . .

Arbitrage

- ▶ **On-chain:** Just trade with both AMMs
 - ▶ Can do it in same transaction! (Though have to write code...)
 - ▶ Can do it without owning the funds, using flash loans! (Will cover in lending lecture)
- ▶ **Off-chain:** Buy from Binance, sell to AMM
 - ▶ This is what happens in our LVR model
 - ▶ Can't do at exactly same time, so face some risk!
- ▶ In both cases, arbitrage dominated by funds/HFTs. Don't try this at home!
 - ▶ Competition over AMM arbitrage makes up a large part of the "MEV" (miner extractable value) ecosystem: will discuss briefly in later classes

The Ease of Launching a Token on AMMs

Suppose I want to launch a token, ALZcoin:

1. Make an ERC-20 contract, mint a bunch to myself
2. Get Uniswap to start a ETH/ALZ pair, send some ETH + ALZ to LP it

That's it! Compare to IPOs in tradfi. . .

NOTE: Not legal advice! ALZ is not a lawyer and does not know whether launching a token this way would constitute an illegal securities offering! DYOR!

Why Would You Use an AMM?

- ▶ Reasons to use AMMs over Binance?
 - ▶ Binance doesn't let you trade
 - ▶ Binance doesn't list ALZcoin
 - ▶ Anonymity/privacy
 - ▶ Trust, custody (hands-off transaction)
 - ▶ Lower fees?

Liquidity and Market Depth: AMMs vs CEXs

All else aside, do you get a better deal trading on AMMs or CEXes?

- ▶ **Lehar & Parlour (2021):**
 - ▶ Prices on AMM vs CEXs are very close, not many arbitrage opportunities
 - ▶ When markets are crashing, AMM liquidity seems more stable (why?)
 - ▶ Price impact – effective cost-per-trade – sometimes lower on Uniswap than Binance!
- ▶ **Barbon & Rinaldo:** DEXes competitive with CEXes for large (> \$100k) transactions (why?)
 - ▶ Gas fees!

Liquidity and Market Depth: AMMs vs CEXs

All else aside, do you get a better deal trading on AMMs or CEXes?

- ▶ **Lehar & Parlour (2021):**
 - ▶ Prices on AMM vs CEXs are very close, not many arbitrage opportunities
 - ▶ When markets are crashing, AMM liquidity seems more stable (why?)
 - ▶ Price impact – effective cost-per-trade – sometimes lower on Uniswap than Binance!
- ▶ **Barbon & Rinaldo:** DEXes competitive with CEXes for large (> \$100k) transactions (why?)
 - ▶ Gas fees!
- ▶ **Liao & Robinson:** Uniswap “deeper” than any CEXs for ETH/USD!*

Disclaimer: Liao was at Uniswap, Robinson at Paradigm, when paper was written

Decentralization and centralization

- ▶ Simple AMM model has the elegant property of “egalitarianism”
- ▶ Simple to describe; everyone's on a level playing field as a trader/LP
- ▶ Can this persist?

Tradfi market making is very concentrated!

What We Do / Equities

Equities

Reliable and Competitive

As the industry's top market maker, we are a trusted source of liquidity in both tranquil and turbulent times. Our technologies seamlessly connect broker-dealers and institutions to our liquidity ecosystem.

1

Destination for U.S. retail order flow¹

23%

U.S. equity market volume executed through our platform²

27K⁺

Securities in which we make markets globally³

Top 15

Equity exchanges, representing 88% of global market capitalization, on which we trade⁴

Source for options paper, source for FX concentration

Tradfi market making is very concentrated!

Retail Trading in Options and the Rise of the Big Three Wholesalers

Svetlana Bryzgalova,* Anna Pavlova,[†] and Taisiya Sikorskaya[‡]

September 3, 2023

Forthcoming in the Journal of Finance

Abstract

We document a rapid increase in retail trading in options in the U.S. Facilitated by payment for order flow (PFOF) from wholesalers executing retail orders, retail trading recently reached over 60% of the total market volume. Nearly 90% of PFOF comes from three wholesalers. Exploiting new flags in transaction-level data, we isolate wholesaler trades and build a novel measure of retail options trading. Our measure comoves with equity-based retail activity proxies and drops significantly during U.S. brokerage platform outages and trading restrictions. Retail investors prefer cheaper, weekly options, with the average bid-ask spread of a whopping 12.6%, and lose money on average.

Tradfi market making is very concentrated!

on average. A large fraction of retail order flow is serviced by very few wholesalers: The share in PFOF of the top three has grown to nearly 90% as of the second quarter of 2021.

We start by documenting a stylized fact that, although only a fraction of investors trade options, most of the PFOF received by retail brokerages comes from options, not equities. For example, in 2021, U.S. brokerages received \$2.4 billion in PFOF for options and only \$1.3 billion for equities. The lion's share of PFOF for options came from only three wholesalers: Citadel, Susquehanna, and Wolverine.

[Source](#) for options paper, [source](#) for FX concentration

Tradfi market making is very concentrated!

FX Survey 2022: Press release

Euromoney magazine has released the results of its 44th annual foreign exchange ranking, the most comprehensive quantitative and qualitative annual study available on the FX markets.

Among the key findings:

1. Deutsche Bank take the top volume ranking
2. Bank of New York Mellon takes the Customer Satisfaction (CSAT) rankings
3. Three new regional winners
4. Slight increases to the combined market share of top 5 and top 10 to 44% (2021 - 39%) and 66% (2021 - 64%) respectively



Top 10 overall global market share

Overall volume (adjusted swaps*)

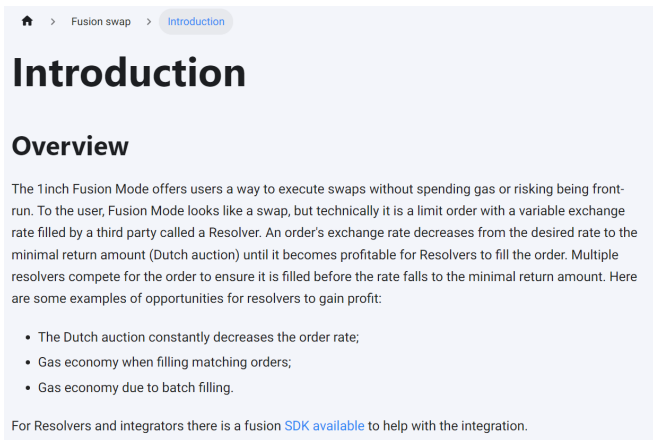
2022	2021	Bank	Market Share %
1	3	Deutsche Bank	10.89%
2	2	UBS	9.69%
3	1	JPMorgan	8.67%
4	9	State Street	7.66%
5	4	XTX Markets	7.14%
6	6	Jump Trading	5.60%
7	5	Citi	4.54%
8	13	Bank of New York Mellon	4.30%
9	8	Bank of America	3.73%
10	7	Goldman Sachs	3.65%

Source for options paper, source for FX concentration

Aggregators/routers

- ▶ Uniswap is a smart contract which is natively “open” to build on
- ▶ Idea: build a system, which routes to whatever pool has best price
- ▶ **Liquidity aggregators** build on DEXes, routing orders
- ▶ Example of “native composability” at work!
- ▶ As of 2024Q1, largest few on Ethereum include **1inch**, **CoW Swap**, **Paraswap**
- ▶ But are they really decentralized?

The emergence of “centralization”



Home > Fusion swap > Introduction

Introduction

Overview

The 1inch Fusion Mode offers users a way to execute swaps without spending gas or risking being front-run. To the user, Fusion Mode looks like a swap, but technically it is a limit order with a variable exchange rate filled by a third party called a Resolver. An order's exchange rate decreases from the desired rate to the minimal return amount (Dutch auction) until it becomes profitable for Resolvers to fill the order. Multiple resolvers compete for the order to ensure it is filled before the rate falls to the minimal return amount. Here are some examples of opportunities for resolvers to gain profit:

- The Dutch auction constantly decreases the order rate;
- Gas economy when filling matching orders;
- Gas economy due to batch filling.

For Resolvers and integrators there is a fusion [SDK available](#) to help with the integration.

Sources: 1inch [1](#), [2](#), Paraswap, Cowswap [1](#), UniX [1](#), [2](#)

The emergence of “centralization”

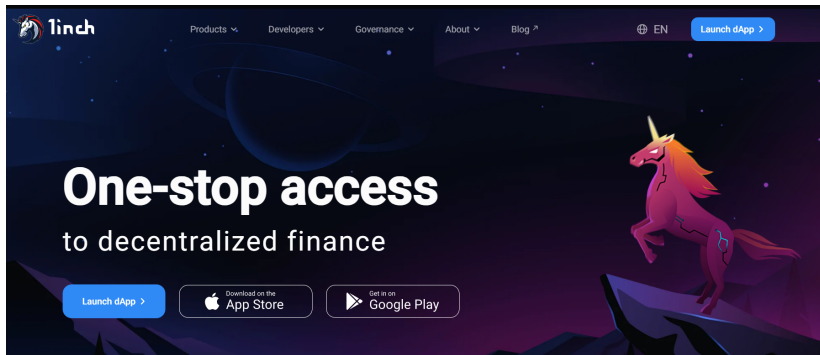
How to become a resolver

To fill an order, a resolver must be whitelisted and have a sufficient balance to pay the order fee. Follow these steps to begin resolving:

1. [Gain enough unicorn power](#) to be listed among the top 10 registered resolvers. There are two options available to grow your unicorn power:
 - i. Stake more 1inch or lock your stake for a longer period.
 - ii. Attract more delegates through farming to delegate their unicorn power to you.
2. [Register as a resolver](#) in the whitelist and delegation, and set up a worker address.
3. [Deposit 1inch](#) into the FeeBank to cover resolving fees.
4. Start [resolving swaps](#).

Sources: 1inch [1](#), [2](#), [Paraswap](#), Cowswap [1](#), UniX [1](#), [2](#)

The emergence of “centralization”



Sources: 1inch 1, 2, Paraswap, Cowswap 1, UniX 1, 2

The emergence of “centralization”

AugustusRFQ API Specification

Want to become a market maker on ParaSwap? This document describes the API you need to provide to us to make that happen!

Objectives

This is intended to be a common API format for all market makers to use, substantially reducing the amount of work we have to do to integrate a new market maker, and most of the back and forth agreeing a protocol between us.

This specification is newly created for new market makers wanting to integrate against ParaSwap via our efficient AugustusRFQ protocol smart contracts.

How does it work?

In ParaSwap, market makers are enabled by them providing us with an API (one for each chain) to get information on what tokens they support, which base/quote pairs, and the price grid containing something akin to an order book with lists of bids and asks defining the pricing curve.

Sources: [1inch 1, 2](#), [Paraswap](#), [Cowswap 1](#), [UniX 1, 2](#)

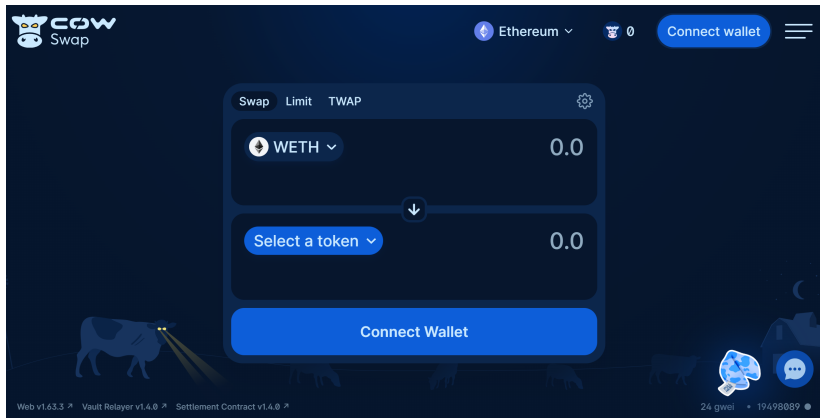
The emergence of “centralization”

What are CoW Protocol's Solvers?

In CoW Protocol, instead of using a central operator or a constant function market maker to determine trade settlements, the protocol uses a party called a "solver", who is the party in charge of providing the settlement solution to the batch auctions. Solvers compete against each other to submit the best possible batch settlement solution. Each time a solver submits a successful batch settlement solution, the protocol rewards them with tokens, meaning that the protocol rewards solvers for solving the batch auction optimization problem. By meeting certain requirements, anyone can become a solver:

1. To become a solver, an Ethereum address needs to deposit a bond in the form of tokens. Asset type and amounts are pending to be defined by the CoW DAO.
2. Once the tokens have been staked (locked up), CoW DAO must vote to approve or reject the Ethereum address that will identify the solver. If the vote is successful, the solver Ethereum address will be included in the allowlist (verification) solvers contract.
3. Additionally, a solver must have the technical knowledge to create the appropriate batch settlement solutions, or take the risk of being slashed by the CoW DAO for wrongdoing.

The emergence of “centralization”



Sources: 1inch 1, 2, Paraswap, Cowswap 1, UniX 1, 2

The emergence of “centralization”

Gas-free swapping — and no cost for failed swaps

With UniswapX, swappers sign a unique offchain order, which is then submitted onchain by fillers who pay gas on swappers' behalf.

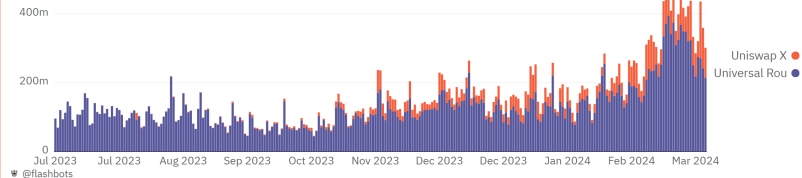
Because swappers don't have to pay gas, they don't need a chain's native network token (e.g. ETH, MATIC) to trade or pay anything for a failed transaction. Fillers price the gas fee into the swap price, but can lower transaction costs by batching multiple orders to compete for the best price.

Users still need to pay gas under specific circumstances, such as for the initial token approval of Permit2. Additionally, native network tokens need to be wrapped when selling, which costs gas.

The emergence of “centralization”

Uniswap Volume breakdown (frontend dedup)

only includes Uniswap frontend user requested volume: other routers' (including MEV Bots) volume sourcing Uni pools are not included, and router Multihops are deduped.



Sources: 1inch 1, 2, Paraswap, Cowswap 1, UniX 1, 2

Aside: gas design in an RFQ system

How RFQ smart contract works:

- ▶ You approve UniX to spend MKR from your wallet
- ▶ You sign an “order” allowing selling MKR at max price \$3200, next 5 minutes
- ▶ Order is not a tx! But lives in a “mempool” that market makers can see
- ▶ Market makers bid for best execution on your order
- ▶ Winning MM submits a “transaction”, which must include your signed order, that interacts with smart contract to trade
 - ▶ Since tx is MM-initiated, MM pays gas, and you don't
 - ▶ (Not that this economically matters...)

Constant Function Market Makers: Architecture?

- ▶ CFMMs are a response to blockchains being slow and expensive!
- ▶ “Limit order books” need to be updated frequently, hence are too expensive
- ▶ As blockchains get faster, however, moving towards this
 - ▶ Uniswap v3: “concentrated liquidity” hybrid LOB/AMM model
 - ▶ Serum is a limit order book on Solana
- ▶ Ongoing debate: will AMMs or LOBs win in the long run?

Different Invariants? Stableswap

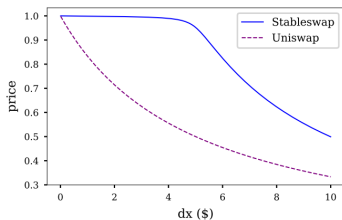
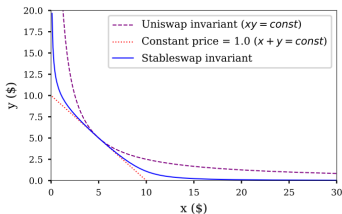
- ▶ Constant product market maker:

$$Q_A Q_B = k$$

- ▶ Can construct an invariant which is more “linear”:

$$\chi(Q_A + Q_B) + Q_A Q_B = k$$

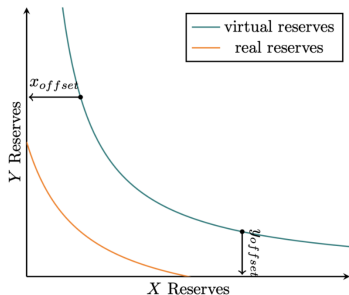
- ▶ Trades more aggressively (i.e. less price slippage) around $p = 1$
- ▶ This is the idea behind **Stableswap**, used in Curve to trade stablecoins pairs



Source: [Stableswap whitepaper](#)

Different Invariants? Concentrated Liquidity

- ▶ v2 of Uniswap used the constant product MM
- ▶ v3 uses concentrated liquidity, like a hybrid of limit-order books and CFMM
- ▶ Idea: use “chunks” of concentrated liquidity, to approximate any other CFMM function



See [Uniswap v3 Whitepaper](#) and [Dan Robinson blog post](#)

Different Invariants?

Our view from LVR:

- ▶ Curve design doesn't matter: “marginal liquidity” is all that matters
- ▶ Concentrated liquidity is good because locked up liquidity is used more efficiently

Other Technical Directions (slightly outdated)

- ▶ Multi-product AMMs (e.g. for options, see [Premia](#))
- ▶ Impermanent loss (LVR!) protection (A [not super successful attempt](#))
- ▶ Dynamic fee/curvature mechanisms (e.g. [Trader Joe](#))
- ▶ Flash liquidity provision
- ▶ [MEV-frontrunning and prevention](#)
- ▶ Dark pools, workup mechanisms? (RFQs already have substantially market share. . .) Which market structure will win out in the long run?

Legal Issues: Exchange Regulation

- ▶ SEC's Reg ATS, "alternative trading systems" definition:
- ▶ ATs must file with the SEC, obey certain other regulations

Alternative trading system

Alternative trading system means any organization, association, person, group of persons, or system:

(1) That constitutes, maintains, or provides a market place or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange within the meaning of § 240.3b-16 of this chapter; and

(2) That does not:

(i) Set rules governing the conduct of subscribers other than the conduct of such subscribers' trading on such organization, association, person, group of persons, or system; or

(ii) Discipline subscribers other than by exclusion from trading.

Legal Issues: Exchange Regulation...?

- ▶ Financial market regulation thus far presupposes that there are humans behind any system: if human stops, system stops
- ▶ AMMs, once deployed, are simply pieces of code! Don't require human intervention to keep running
- ▶ Hard to shut down (without shutting Ethereum down!)
- ▶ How do we regulate pieces of code?

Who is Responsible for Uniswap?

| BUSINESS 19 APRIL 2022

Steve Kaaru



Uniswap Labs, Andreessen Horowitz sued for securities violations over worthless tokens

Uniswap Labs, the company behind the Uniswap exchange, along with its founder and backers are culpable for losses that investors have incurred from fraudulent and worthless tokens traded on the platform, according to a proposed class-action lawsuit.

A California resident has sued Uniswap Labs, founder Hayden Adams and the company's backers which includes prominent venture capital firms Andreessen Horowitz, Union Square Ventures, Paradigm and AH Capital Management.

Plaintiff Nessa Risley, individually and on behalf of others similarly situated claims that the defendants engaged in "unlawful promotion, offer, and sale of unregistered securities on that exchange, in the form of crypto' tokens."

Who is Responsible for Uniswap?

A class action complaint against Uniswap was tossed on Tuesday, Aug. 29 after the judge found that some of the claims were “devoid of factual support.”

Judge Katherine Polk Failla oversaw the case — she is also overseeing the US Securities and Exchange Commission’s case against Coinbase — and issued the ruling on the dismissal.

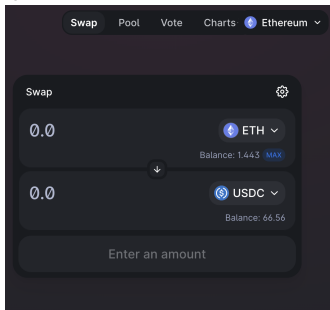
“Due to the Protocol’s decentralized nature, the identities of the Scam Token issuers are basically unknown and unknowable, leaving Plaintiffs with an identifiable injury but no identifiable defendant,” the judge wrote.

Read more: [SEC sues Coinbase for alleged securities violations](#)

She added that the plaintiffs launched the suit “hoping that this Court might overlook the fact that the current state of cryptocurrency regulation leaves them without recourse.” But that does not allow them to blame [Uniswap](#) for their injury.

Uniswap and Regulation

- ▶ Uniswap smart contract code is decentralized, but. . .
- ▶ Uniswap UI is just a website on someone's computer somewhere!
- ▶ Uniswap Labs maintains Uniswap's website
- ▶ Solution:
 - ▶ Uniswap Labs removes illegal coins from Uni website
 - ▶ AMM is still there! Just need to write code to interact with it
 - ▶ Nothing's stopping anyone from building another UI to interact with Uniswap. . .



AMMs: Regulation Project Ideas

- ▶ How should exchange regulation apply to AMMs?
- ▶ What reporting/data/etc. requirements should apply to AMMs?
- ▶ To what extent are AMM developers responsible for AMM behavior?
- ▶ If the goal is to prevent certain assets from being traded in a jurisdiction, how does one impose this requirement on AMMs?

AMMs: Technical Project Ideas

AMMs are a pretty technical area: best fit for people with some finance/markets experience

- ▶ Design a new AMM/trading system!
 - ▶ LOB hybrid?
 - ▶ Oracle AMM?
 - ▶ Workup, RFQ, make/take fees, etc.?
- ▶ Look into AMM investing strategies!
- ▶ AMM data visualization
 - ▶ When is it worth it to provide liquidity?
- ▶ AMM design for protocols
 - ▶ Sometimes, there's a goal other than fees...
 - ▶ See Luna's "virtual AMM"