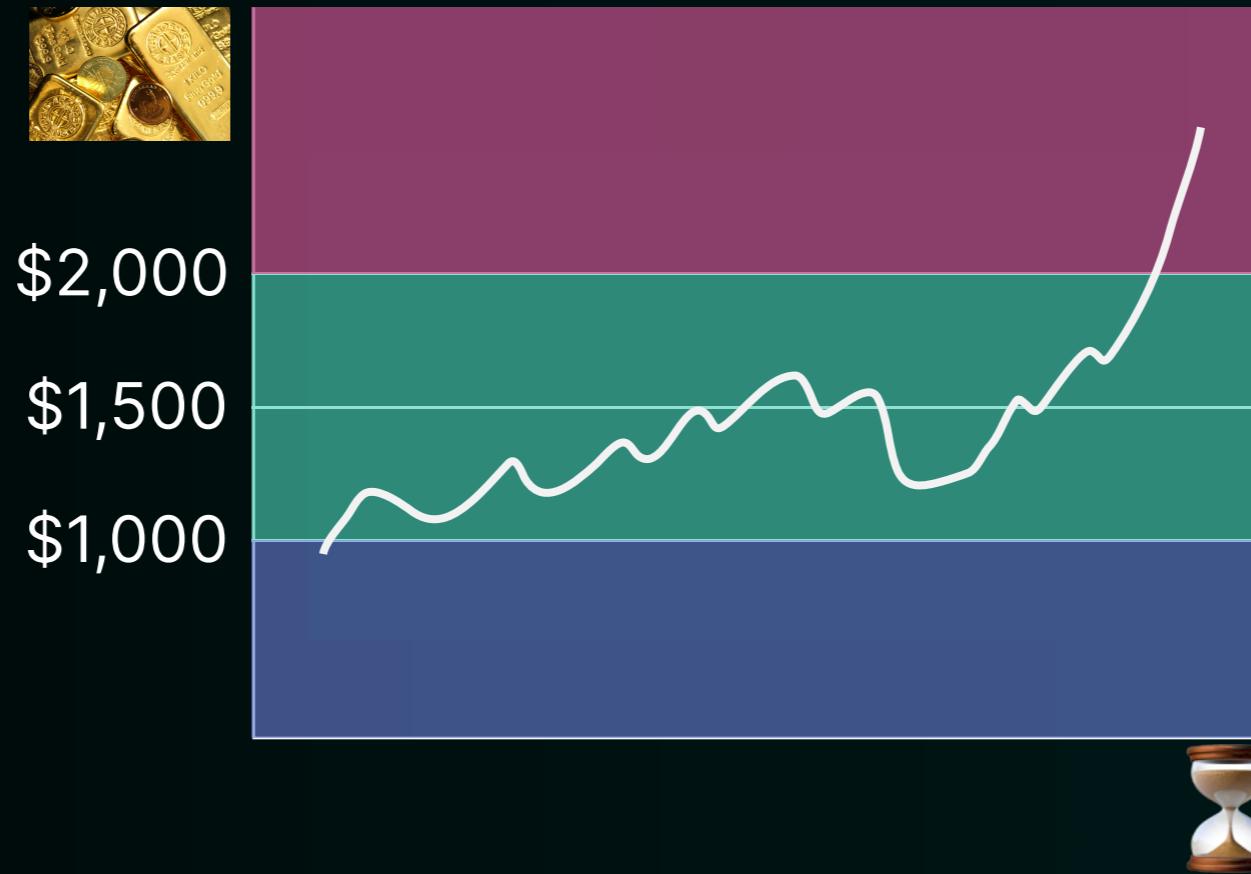


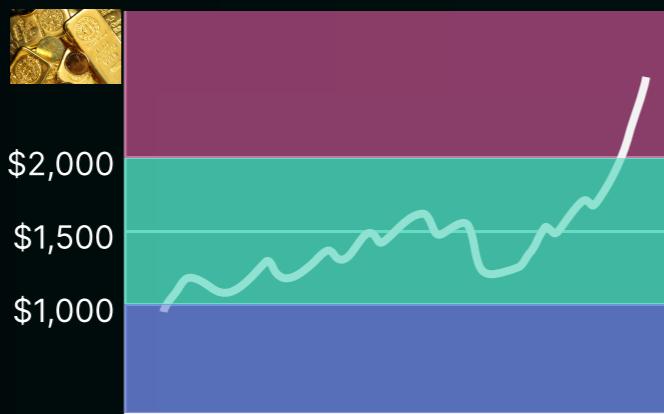
Beating Uniswap

- Concentrating Liquidity
- Structure of a v3 Position
- 2 Parameter Optimization
- ETH/WBTC Example
- R Package
- Next Steps

Alice & Bob sell gold



Alice trades “Open”



\$2,000+



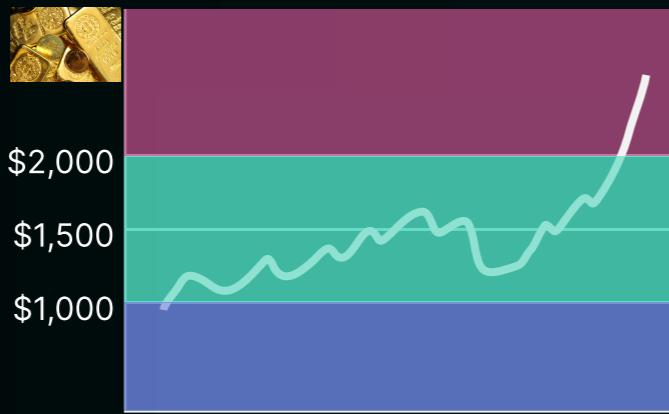
\$1,000-\$2,000



\$0-\$1,000

At \$2,001 she's low on gold
At \$999 she's low on cash

Bob Trades “Closed”



\$2,000+



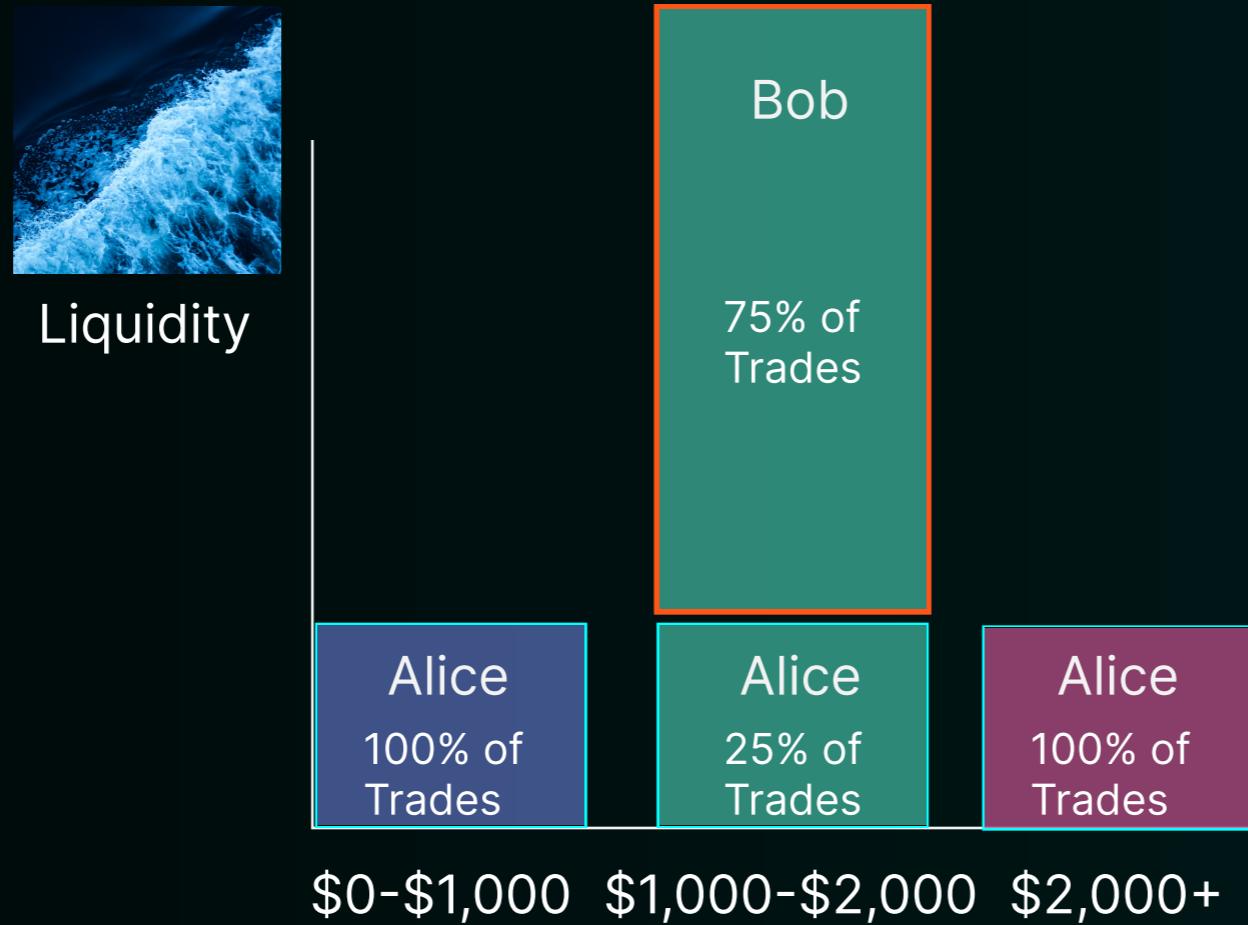
\$1,000-\$2,000



\$0-\$1,000

At \$2,001 he's **out** of gold
At \$999 he's **out** of cash

Same Budget Different Strategy



[flipside](#)

Add Liquidity

Select Pair

token0 token1

WBTC ETH

0.3% fee tier
72% select

Edit

Deposit Amounts

amount0 WBTC Balance: 0

amount1 ETH

Set Price Range

current_price

Current Price: 15.6224 ETH per WBTC

0 10 20 30 40

Min Price: 7.7904 ETH per WBTC

Max Price: 31.338 ETH per WBTC

Full Range

price_lower price_upper

Enter an amount

Liquidity is calculable

Address	0xcbcdf9626bc03e24f779434178a73a0b4bad62ed	<input type="button" value="🔍"/>
Mint (address sender, index_topic_1 address owner, index_topic_2 int24 tickLower, index_topic_3 int24 tickUpper, uint128 amount, uint256 amount0, uint256 amount1) View		
Name	Source	
Topics	0 0x7a53080ba414158be7ec69b987b5fb7d07dee101fe85488f0853ae16239d0bde 1 Dec → 0xC36442b4a4522E871399CD717aBDD847Ab11FE88 2 Dec → 257760 3 Dec → 258900	15.6248 ETH/BTC price_lower 17.51144 ETH/BTC price_upper
Data	sender : 0xC36442b4a4522E871399CD717aBDD847Ab11FE88 amount : 1429022393248418 amount0 : 100000000 amount1 : 16117809468717422382	1 BTC amount0 16.11 ETH amount1



token0



token1



flipside

Positions are self-consistent

$$\begin{aligned} L &= F(a_0, a_1, P, t_l, t_u) \\ a_0 &= H(a_1, P, t_l, t_u) \\ t_u &= K(a_0, a_1, P, t_l) \\ [a_0, a_1] &= B(L, P, t_l, t_u) \end{aligned}$$

⋮

- *get_liquidity()*
- *match_tokens_to_range()*
- *price_all_tokens()*
- *get_position_balance()*

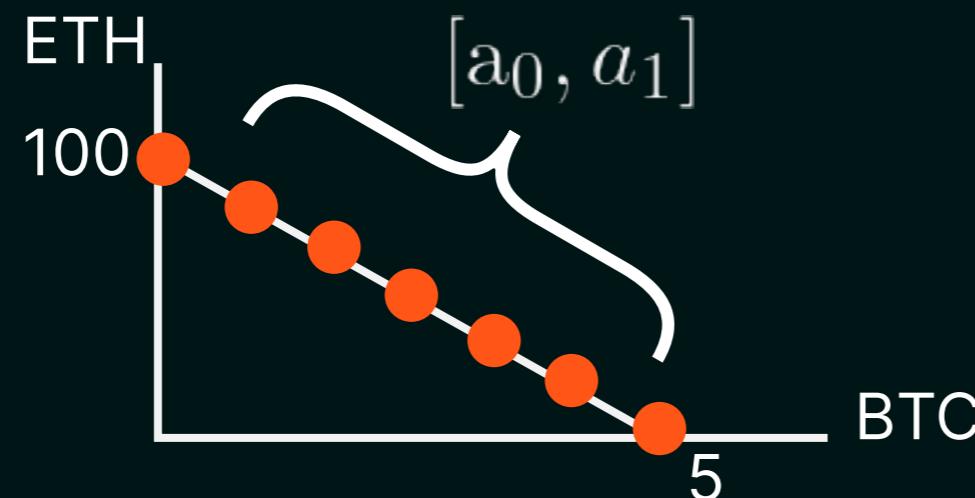
Optimization given a Budget

$$P = P_1$$

$$t_l = t_l[i]$$

$$a_0[i] = (Budget - a_1[i])/P$$

Bob has 100 ETH Budget
Price is 20 ETH/BTC



Bob can have
[0, 100 Eth]; [5 Btc, 0]
or anything in between

Budget + Baseline + Formula

Budget	Price	a1	a0	tick_lower	tick_upper	liquidity
100	20	100	(B-a1)/P	200000	K(a0, a1, P, tl)	F(a0, a1, P, tl, tu)
100	20	100	0	200060	260280	1.75071E+14
100	20	100	0	200120
100	20	100	0
100	20	99	0.05	200000
100	20	99	0.05	200060
100	20	99	0.05	200120
100	20
100	20	0	5	200120

$$P = P_1$$

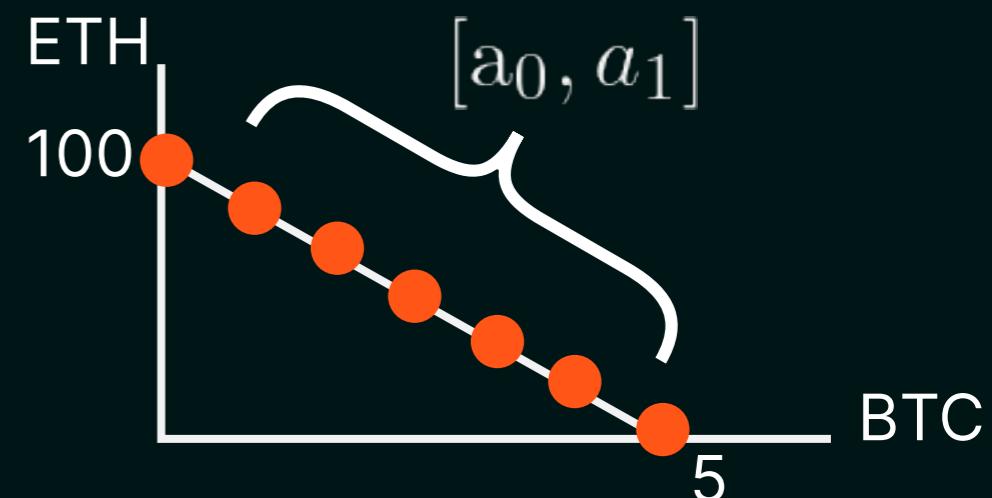
$$t_l = t_l[i]$$

$$a_0[i] = (Budget - a_1[i])/P$$

$$t_u = K(a_0, a_1, P, t_l)$$

$$L = F(a_0, a_1, P, t_l, t_u)$$

For any {budget, price} you can simulate all possible positions and their liquidity.



Combining Everything

ETH/WBTC Blocks 16,000,000 - 16,010,000

- 169 Trades, here, as a **Trades** table
- Start Price: 13.73664 ETH/BTC
- End Price: 13.71331 ETH/BTC

block_number	tick	amount0_adjusted	amount1_adjusted	liquidity
16000011	256472	0.00218466	-0.029919927	1973816766006860032
16000022	256472	0.00276731	-0.037899578	1973816766006860032
16000036	256472	-0.11975550	1.650000000	1973898298280219904
16000038	256472	0.00218471	-0.029920743	1973898298280219904
16000117	256472	-0.17781779	2.450000000	1973898298280219904
16000133	256472	-0.11975417	1.650000000	1973898298280219904
16000213	256472	0.00307005	-0.042046380	1973902206034119936
16000265	256472	-0.19233135	2.650000000	1973902206034119936
16000338	256481	-23.55929059	324.751916582	1973900648700119808
16000338	256481	-1.14272495	15.759147078	1973900648700119808
16000468	256490	-22.63126133	312.243750000	1973900648700119808
16000468	256489	2.07200234	-28.427152966	1973900648700119808
16000509	256489	-0.00941905	0.130000000	1973900648700119808
16000743	256494	-14.72682128	203.313084280	1973914825761230080

Setting up Simulation

ETH/WBTC Blocks 16,000,000 - 16,010,000

- 169 Trades
- Start Price: 13.73664 ETH/BTC
- End Price: 13.71331 ETH/BTC

Simulate Possible Positions:

- Budget: 100 ETH
- Limit price_lower to range of (2 - 13.70)
- Limit amount1 to range of (0.01 - 99.9)
- Calculate amount0

$$a_0[i] = (Budget - a_1[i])/P$$

- Calculate price_upper & liquidity

$$t_u = K(a_0, a_1, P, t_l)$$

$$L = F(a_0, a_1, P, t_l, t_u)$$

Assessing the Strategy

ETH/WBTC Blocks 16,000,000 - 16,010,000

- 169 Trades
- Start Price: 13.73664 ETH/BTC
- End Price: 13.71331 ETH/BTC (-0.17%)

Budget = 100 ETH

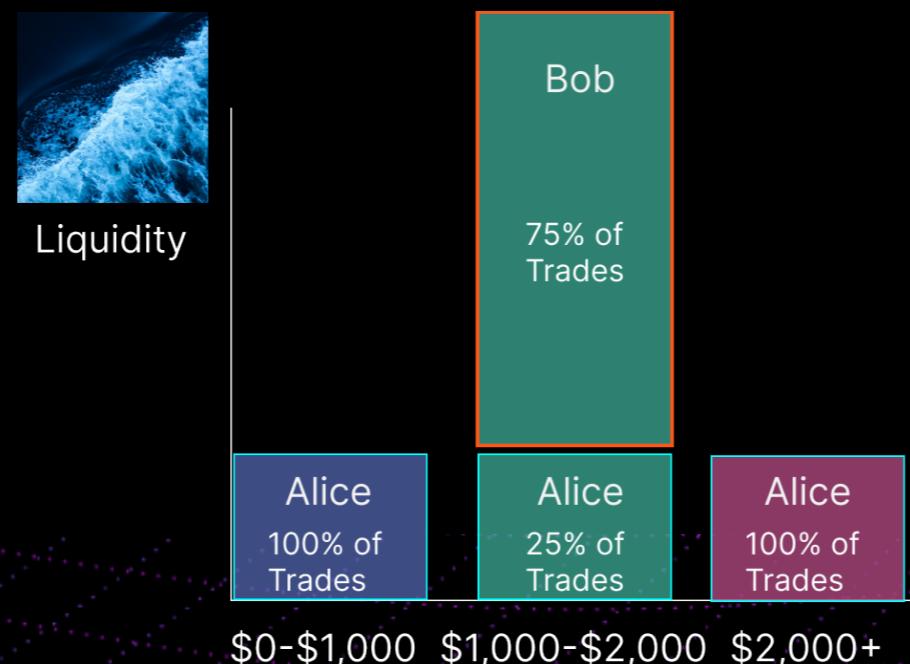
*Revenue = liquidity % * Trades * fee*

$$R = C(L, t_l, t_u, \text{Trades}, \text{fee})$$

Divergence = Budget - End Position (ETH)

$$[a_{0\text{end}}, a_{1\text{end}}] = B(L, P_{\text{end}}, t_l, t_u)$$

Strategy Value = Revenue - Divergence



Methodology

ETH/WBTC Blocks 16,000,000 - 16,010,000

- 169 Trades
- Start Price: 13.73664 ETH/BTC
- End Price: 13.71331 ETH/BTC (-0.17%)

Max (Strategy Value) over ranges of amount1 and tick_lower using Budget, Prices, and Trades.

$$\max(\text{sv}) = \text{O}(\text{a}_1[i], t_l[i], \\ \text{a}_1 \in (0, 100), t_l \in (0, 13.70), \\ \text{B} = 100, \\ P_1 = 13.73664, P_{\text{end}} = 13.71331, \\ \text{Trades, fee})$$

Result

Block 16,000,000 - “Perfect” Position

- 91 ETH + 0.655 BTC
- 13.529 - 13.757 ETH/BTC
- $L = 32391087272403693$

Block 16,010,000 - Result

- Balance: 80.688 ETH + 1.398 BTC
- Fees: 1.530 ETH + 0.0151 BTC
- Strategy Value (Price 13.71331 ETH/BTC)
 - 101.60 ETH

Benchmark “Perfect” LP
1.6% gain in 33 hours = 400% APY

Now Open Source

- R Package
- LiveQuery
- UI / App / API



fsc-data-science/
uniswap



fsc-data-science

 Flipside Crypto Data Science
The Data Science playground sub-org of Flipside Crypto

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