Behavior of Liquidity Providers in Decentralized Exchanges

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Centralized exchanges (CEXes)
Decentralized exchanges (DEXes)
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### Decentralized exchanges (DEXs)

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Constant product market makers (CPMMs)

Liquidity Pool (BTC ↔ ETH)

liquidity pool for every token pair
Constant product market makers (CPMMs)

Liquidity Pool (BTC ↔ ETH)

- Liquidity pool for every token pair
- Liquidity providers deposit reserves in pools
Constant product market makers (CPMMs)

- Liquidity pool for every token pair
- Liquidity providers deposit reserves in pools
- Pool holds reserves for both tokens
Constant product market makers (CPMMs)

price curve: \( x \cdot y = k \)

trading along price curve
Constant product market makers (CPMMs)

price curve: \( x \cdot y = k \)

start: 90 A, 180 B

trading along price curve

\( T: \text{trade A} \rightarrow \text{B} \)
Constant product market makers (CPMMs)

price curve: $x \cdot y = k$

trading along price curve

$T$: trade $A \rightarrow B$

input: $30 A + 0.3\%$ fee

output: $45 B$
Constant product market makers (CPMMs)

price curve: \( x \cdot y = k \)

start: 90 \( A \), 180 \( B \)
end: 120.09 \( A \), 135 \( B \)

trading along price curve

\( T \): trade \( A \rightarrow B \)

input: 30 \( A \) + 0.3% fee
output: 45 \( B \)

fees received by liquidity providers for every trade in liquidity pool
Expected slippage

price curve: $x \cdot y = k$

start: $90 \ A, 180 \ B$

end: $120.09 \ A, 135 \ B$

expected slippage
expected decrease in price based on trading volume and available liquidity
Unexpected slippage

price curve: $x \cdot y = k$

unexpected slippage
unexpected increase or decrease in price based on previous trades
Unexpected slippage

Price curve: \( x \cdot y = k \)

Start: 75 A, 216 B

Unexpected slippage: unexpected increase or decrease in price based on previous trades
Unexpected slippage

price curve: $x \cdot y = k$

input: $30 A + 0.3\%$ fee
output: $62 B$

$T$: trade $A \rightarrow B$

unexpected slippage
unexpected increase or decrease in price based on previous trades

start: $75 A, 216 B$
end: $105.09 A, 154 B$
Unexpected slippage

price curve: \( x \cdot y = k \)

start: 105 A, 154 B

unexpected slippage
unexpected increase or decrease in price based on previous trades
Unexpected slippage

price curve: $x \cdot y = k$

start: $105$ A, $154$ B

end: $135.09$ A, $120$ B

unexpected slippage
unexpected increase or decrease in price based on previous trades

$T$: trade $A \rightarrow B$

input: $30$ A + $0.3\%$ fee

output: $34$ B
Unexpected slippage

price curve: \( x \cdot y = k \)

start: 105 A, 154 B

end: 135.09 A, 120 B

slippage tolerance specifies maximum acceptable price movement
Unexpected slippage

price curve: \( x \cdot y = k \)

start: \( 105 A, 154 B \)
end: \( 135.09 A, 120 B \)

slippage tolerance specifies maximum acceptable price movement

trade fails if slippage tolerance exceeded
Liquidity pools
Liquidity pools
Liquidity providers
Liquidity providers
most liquidity providers only participate in single pool
Liquidity movements

Mint and burn events are symmetric
Liquidity provider movements between pools
Liquidity provider movements between pools

liquidity movements are rare
Liquidity provider movements between pools

liquidity movements are rare
liquidity movements are symmetric
Liquidity provider movements between pools

- Liquidity movements are rare
- Liquidity movements are symmetric
- Liquidity movement high among six largest pools
Liquidity provider movements between pools
Liquidity provider movements between pools
Returns and risks
Returns and risks

\[ p(\text{Bob})_{t_1} = 1 \quad p(\text{Alice})_{t_1} = 1000 \]
Returns and risks

\[ p(\text{ dime})_{t_1} = 1 \quad p(\text{ dollar})_{t_1} = 1000 \]
Returns and risks

Alice holds her assets and hopes for the crypto price to increase.
Returns and risks

Alice holds her assets and hopes for the crypto price to increase.
Returns and risks

Bob invests his assets in the DAI ↔ WETH liquidity pool.
Returns and risks

Bob invests his assets in the DAI ↔ WETH liquidity pool

1000 🏎️ 1 💰
Returns and risks

1000 🏷️
1 🥇

1460 🏷️
0.73 🥇
Returns and risks

\[ p(\text{₿})_{t_2} = 1 \quad p(\text{биткоин})_{t_2} = 2000 \]
Returns and risks

\[ p(\text{₿})_{t_2} = 1 \quad p(\text{♦})_{t_2} = 2000 \]
Return: compares the value of the liquidity to holding the assets from the initial injection
Return

\[ \text{return}_{t_1 \to t_2} \approx -1\% \]
Fees

**fees**: received by liquidity providers for every trade in liquidity pool
Fees

\[ fees_{t_1 \rightarrow t_2} \approx 3\% \]
Impermanent loss:

Impermanent loss describes the risk for liquidity providers of seeing the value of their reserved tokens decrease in comparison to holding the assets.
Impermanent loss

\[ \text{impermanent loss}_{t_1 \rightarrow t_2} \approx -6\% \]
Pair types

**stable pair:** both tokens traded in the pool are stable coins
Pair types

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**normal pair:** both cryptocurrencies traded in the pools are established currencies, liquidity in pools is generally high
Pair types

**stable pair:** both tokens traded in the pool are stable coins

**normal pair:** both cryptocurrencies traded in the pools are established currencies, liquidity in pools is generally high

**exotic pair:** the price of at least one trading token is extremely volatile
Stable pairs
Stable pairs

liquidity provider returns correspond to fees due to negligible impermanent loss
Normal pairs

- UNI-WETH
- DPI-WETH
- LINK-WETH

Percentage [%]

Date

2020-10 2020-11 2020-12 2021-01

return fees impermanent loss

Percentage [%]

Date

2020-10 2020-11 2020-12 2021-01

return fees impermanent loss

Percentage [%]

Date

2020-10 2020-11 2020-12 2021-01

return fees impermanent loss
Normal pairs

impermanent loss significantly impact on returns, but returns are generally positive
Exotic pairs

[Graphs showing percentage changes over time for MOON-WETH, KIMCHI-WETH, and KIMCHI-SUSHI, with categories for return, fees, and impermanent loss.]
impermanent loss impacts returns to the point that they are highly negative
Fees

stable pairs
- USDC-USD (μ = 0.03%)
- DAI-USDC (μ = 0.03%)
- DAI-USDT (μ = 0.04%)

normal pairs
- UNI-WETH (μ = 0.07%)
- DPI-WETH (μ = 0.03%)
- LINK-WETH (μ = 0.07%)

exotic pairs
- MOON-WETH (μ = 0.06%)
- KIMCHI-WETH (μ = 0.06%)
- KIMCHI-SUSHI (μ = 0.02%)
Fees

Fees similar across pair types
Return

stable pairs
USDC-USDT (μ = 0.03%)
DAI-USDC (μ = 0.03%)
DAI-USDT (μ = 0.04%)

normal pairs
UNI-WETH (μ = 0.04%)
DPI-WETH (μ = 0.00%)
LINK-WETH (μ = 0.04%)

exotic pairs
MOON-WETH (μ = -0.59%)
KIMCHI-WETH (μ = -0.65%)
KIMCHI-SUSHI (μ = -0.76%)
stark difference in returns across pair types
Conditional value at risk (CVaR) quantifies tail behavior of an investment.
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Exotic pairs are an unattractive investment.
Conditional value at risk (CVaR) quantifies tail behavior of an investment.

CVaR at 5% level is the expected return on an investment in the worst 5% of cases.

Exotic pairs are an unattractive investment.

Stable and normal pairs may provide attractive opportunities.
Outlook: Uniswap V3

- **0.05% fee tier**: best for stable pairs
- **0.3% fee tier**: best for most pairs
- **1.0% fee tier**: best for exotic pairs
Outlook: Uniswap V3

fee tiers

- **0.05% fee tier**: best for stable pairs
- **0.3% fee tier**: best for most pairs
- **1.0% fee tier**: best for exotic pairs

concentrated liquidity

- liquidity providers choose price range $[p_a, p_b]$ in which they would like to provide liquidity
Outlook: Relay services

private transactions

- dependent on level of adoption unexpected slippage higher or lower for traders
- affects liquidity provider returns
Thank You!

Questions & Comments?

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Volatility

volatile returns generally present greater risks to investors
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