Triangular arbitrage on YEL's wrap market

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What is arbitrage?

There are various types of arbitrage strategies. One of the most basic form is the **cross-exchange arbitrage** where the arbitrageurs exploit price mismatches between marketplaces. And there are various kind of marketplaces such as centralized exchanges (CEX), decentralized exchanges (DEX), peer-to-peer (p2p), etc. For instance, an arbitrageur scouts the crypto market and discovers that the Ether token (ETH) is cheaper on a particular CEX than elsewhere. Hence, the ETH is bought at this CEX and sold to another marketplace for a net profit. Thus, the price mismatch between this CEX and the other marketplaces is equalized. This means that ETH is back at fair price across all marketplaces. That is a benefit for buyers and sellers.

If the marketplaces are separated between countries, then this type of arbitrage is called **spatial arbitrage** or geographical arbitrage. For instance, a typical cross-border business could be the buying of a stock from the New York Stock Exchange (NYSE) and then selling of the same stock on the London Stock Exchange (LSE) for a net profit.

Notice that it is not always straightforward to distinguish between these two types of arbitrage. In decentralized finance (DeFi) for example, a DEX might not have a geographical border because of its decentralized architecture.

Finally, if an arbitrage business involves three different assets to make a net profit, then it is called **triangular arbitrage** because each vertex of the triangle represents an asset and each side of the triangle represents one asset pair, as shown in Figure 1, where A, B, C represents the assets and q, r, s the quotes of the asset pairs.

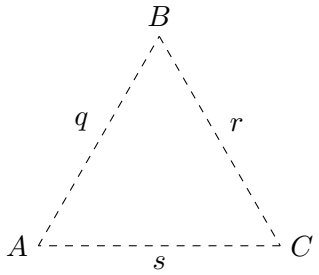

Figure 1: Triangular arbitrage

This type of arbitrage can be executed on the same marketplace, on different marketplaces or cross-border to extend the opportunity spectrum.

Let's analyse an example on the crypto market using three different crypto tokens such as Ether (ETH), BLAST and the stablecoin USDB. Then, a typical arbitrage route might be build as follow:

$$\text{USDB} \to \text{ETH} \to \text{BLAST} \to \text{USDB}.$$

Figure 2 illustrates the triangle of this arbitrage route.

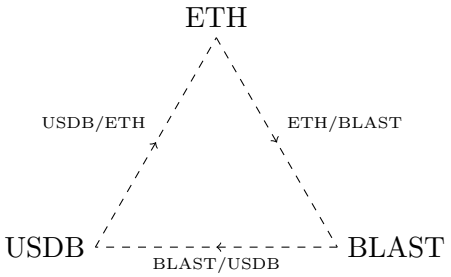

Figure 2: Triangular arbitrage on tokens

The quotes[1] for each token pair are reproduced in Table 1.

Pair	Quote
USDB/ETH	0.000324023801403183
ETH/BLAST	194,155.051254402171656715
BLAST/USDB	0.01588175410880999384

Table 1: Quotes from a DEX

Multiplying all quotes together gives 0.99913 (to 5 d.p.). An arbitrageur cannot make money with these quotes because the product of all quotes is less than one,

$$0.99913... < 1.$$

To be profitable, the product of all quotes must be greater than one,

$$q \times r \times s > 1.$$

where q, r, s are any three quotes.

[1] In crypto, a quote A/B means that token A is sold for token B.

How much is the loss? Let's assume the arbitrageur has 100,000 USDB,

$$100,000 \text{ USDB} \times 0.99913... = 99913.48 \text{ USDB (to 2 d.p.)}.$$

Hence, the arbitrageur loses 86.52 USDB (to 2 d.p.); excluding gas fees[2].

Next, let's suppose that a large market participant (whale) made a transaction and due to this activity the quote for ETH/BLAST increased by 0.21% from 194,155.05 to 194,555.05 (all to 2 d.p),

$$194,155.05... + 500 = 194,555.051254402171656715.$$

Hence, the product of these new quotes is 1.00119 (to 5 d.p.). In this case, an arbitrageur can make money because the product of all quotes is greater than one,

$$100,000 \text{ USDB} \times 1.00119... = 100,119.32 \text{ USDB (to 2 d.p.)}.$$

Thus, the arbitrageur gains 119.32 USDB (to 2 d.p.); excluding gas fees.

The start point of the arbitrage route only matters for the revenue account. If an arbitrageur wants to make money in ETH rather than USDB, then the arbitrage route might be build as follow:

$$\text{ETH} \to \text{BLAST} \to \text{USDB} \to \text{ETH}.$$

This means that there is no difference on the revenue curve because the product of all quotes is the same. The next section covers the practical aspect of triangular arbitrage using YEL's wrap market.

[2]The amount of the gas fee depends on the blockchain.

Arbitrage in action

Recently, a new marketplace was launched, the YEL's wrap market[3]. It is part of Potion's ecosystem[4] and offers new opportunity for arbitrageurs. On this marketplace, tokens and liquid tokens can be wrapped[5] and unwrapped[6] to make an instant net profit. The advantage of this market is that wrap and unwrap fees are included. You only have to consider the gas fees on the blockchain to cover the transaction costs.

For instance, recently, two liquid tokens, lWETH and lBLAST, had an instant profit opportunity with the stablecoin USDB. Using the USDB as revenue account, the arbitrage route were build as follow:

$$\text{USDB} \to \text{lWETH} \to \text{lBLAST} \to \text{USDB}.$$

Figure 3 illustrates the triangle of this arbitrage route.

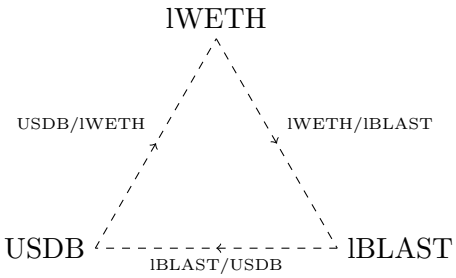

Figure 3: Triangular arbitrage on liquid tokens

The quotes for each token pair are reproduced in Table 2.

Pair	Quote
USDB/lWETH	0.000311415349472096
lWETH/lBLAST	191,906.520064700313155469
lBLAST/USDB	0.017029023530201857

Table 2: Quotes from YEL's wrap market

[3]https://yel.finance/wrap-market
[4]https://yield-enhancement-labs.gitbook.io/.../potions
[5]https://yield-enhancement-labs.gitbook.io/.../potions/wrap
[6]https://yield-enhancement-labs.gitbook.io/.../potions/unwrap

Hence, the product of all quotes is 1.01770 (to 5 d.p.). Thus, we can make money,

$$100,000 \text{ USDB} \times 1.01769... = 101769.93 \text{ USDB (to 2 d.p.)}.$$

Our profit is 1,769.93 USDB (to 2 d.p.); excluding gas fees.

How do you find such quotes? At the time of writing, there is no arbitrage bot active. This means that the arbitrage can be done manually on YEL's wrap market. For instance, open three tabs on the web browser for each quotation. If we take our last example, then we could use the first tab to quote USDB/lWETH. This means that we select USDB for the top textfield and lWETH for the bottom textfield. Next, we type the number one in the top textfield and let YEL's wrap market calculate the first quote to the bottom textfield, as illustrated in Table 3.

1	USDB
0.000311415349472096	lWETH

Table 3: Wrap USDB for lWETH

Then, copy this quote and switch to the second tab. There, select lWETH for the top textfield and lBLAST for the bottom textfield. Next, paste the first quote into the top textfield and let YEL's wrap market calculate the second quote to the bottom textfield, see Table 4.

0.000311415349472096	lWETH
59.762636011922451098	lBLAST

Table 4: Wrap lWETH for lBLAST

Then, copy this quote from the bottom textfield and switch to the third tab. There, select lBLAST for the top textfield and USDB for the bottom textfield. Next, paste the second quote into the top textfield and let YEL's wrap market calculate the final quote at the bottom textfield, see final result in Table 5.

59.762636011922451098	lBLAST
1.017699334873916286	USDB

Table 5: Wrap lBLAST for USDB

This final quote must be greater than one to make a profit,

$$1.017699334873916286 \text{ USDB} > 1 \text{ USDB}.$$

If you found a profitable arbitrage route like we did in this example, then try to increase the USDB value on the first tab from one to 10, then from 10 to 100 etc. and repeat the steps until you recognize that the final quote is less or equal to one. You may execute such an arbitrage route once you found the best USDB value that covers all costs for maximum profit.

After all, you may ask what's the risks of arbitrage. There is an execution risk of the arbitrage route. Competitors may join the same arbitrage opportunity and be faster. This means that the product of all quotes could be less or equal to one. As mentioned in the previous section, you need to have a product greater than one to be successful, inclusive gas fee coverage. Furthermore, there is a risk at the liquidity pool layer. Each token pair belongs to a liquidity pool. Unexpected liquidity inflow or outflow affects the balance of the pool. This may have positive or negative effects on the quotation and the slippage. For that reason, YEL's wrap market offers an option called **slippage tolerance setting** to reduce the slippage risk.

On the other hand, the advantage of the arbitrage business is the instant profit chance. And if you hold YEL tokens or liquid tokens at the same time, you may also profit from the Potion ecosystem as well (volatility farming).