Business Opportunity:
Digital Assets Algorithmic Trading

alan.tobin@lynxx.com

15 December 2022

Introduction

The first blockchain-based digital asset (bitcoin) was launched in 2009, and the markets to trade it emerged in 2010. In late 2022, there are over 20,000 digital assets traded on approximately 500 centralized exchanges (CEXs) and 300 decentralized exchanges (DEXs). Due to their decentralized nature, these markets are global and much less regulated than the traditional financial markets. They also operate non-stop 24 hours a day, 7 days a week. Participants in these markets range from unsophisticated individuals to the world's prime financial institutions.

Many digital asset markets are young and immature. Some of them exhibit signs of inefficiencies, and, therefore, potential profit opportunities. In addition, new digital assets get listed on centralized and decentralized exchanges all the time, thus creating new immature markets for those assets.

Dr. Alan Tobin has been professionally involved in trading and investing in both traditional and digital asset markets for over two decades, with nearly ten years of experience in the blockchain arena. He has recently developed a systematic approach for exploring different types of profit opportunities in cryptocurrency markets, starting with simplest and least risky ones and progressing sequentially to the more complex. Moreover, he has created a functional computer code base and has performed preliminary tests of the profit opportunities present in the markets. This document describes the business opportunity which arises from it.

The Business Opportunity

In order to take advantage of the profit opportunities that exist in the markets for digital assets (and potentially other markets as well), an algorithmic trading business is proposed. It will use a disciplined quantitative data-driven approach without the need for manual human intervention during the operation of its trading algorithms. Notably, such business model satisfies a majority of the criteria for "The Perfect Business" from the eponimous classical article[1], such as

- low capital tie-up
- low overhead
- unregulated
- portable
- scalable - income not limited by personal output.

There are no client or customer related risks, marketing expenses, etc., in this business model

Such business can enjoy great synergies with the Lynxx's existing business lines such as quantitative and statistical data analysis, machine learning, artificial

1 "The Perfect Business" by Richard Russell, https://healthywealthywiseproject.com/2012/11/the-perfect-business/

intelligence, etc., both providing and obtaining various benefits. It can also be viewed as an opportune way of probing other (non-trading) business opportunities based on the blockchain and other related cutting edge technologies.

The Team

The minimal/bootstrap team could initially consist of only three roles:

1. **Lead Researcher** (trading, crypto, quant)
   to spearhead and direct the business efforts in the right direction,
   assess the opportunities, ensure successful and timely execution.

2. **Programmer** (Python+)
   to implement trading models and related processes.

3. **Sys Admin** + InfoSec
   to create, secure and manage the servers computer infrastructure on which the trading algorithms will be executing.

Some of these roles could initially be part time, but it is ultimately determined by the preference for how fast the business should develop. At a later stage, additional roles such as Data Scientist / Quant Modeller, Tester, etc. could also be considered as the needs arise. Dr. Tobin is a candidate for the Lead Researcher role.

Trading Strategies

The overall approach is to start with the simplest and least risky strategies, and then systematically progress to the more complex algorithms, once the previous profit opportunities have been exhausted. The initial focus should be on near-riskless arbitrage strategies such as triangular arbitrage[2], cross-market arbitrage and the like. The triangular arbitrage strategy is an especially good starting point due to its

- fast completion of all the trades in each separate run cycle of the algorithm
- low capital requirements
- low risk.

It is especially suitabile for the cryptocurrency markets where all trades can be executed on a single exchange.

2 https://en.wikipedia.org/wiki/Triangular_arbitrage

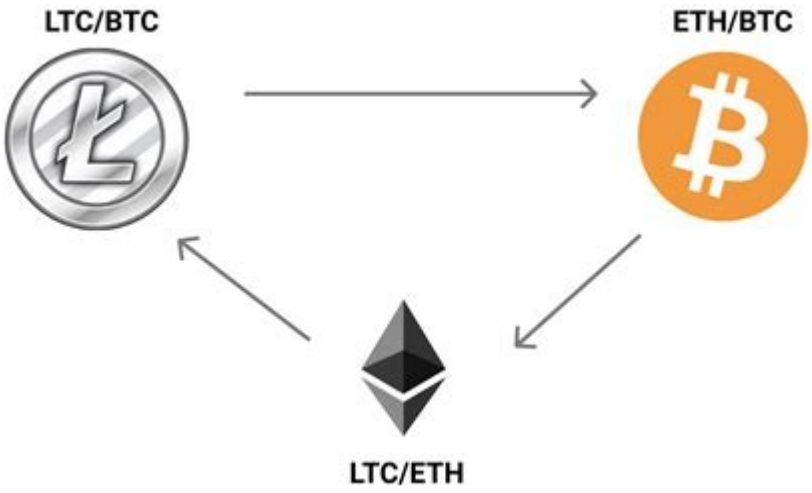

Figure 1. Triangular arbitrage illustration for the cryptocurrency markets.

A further expansion of the set of trading strategies may include the following:

1. cross-asset statistical relationships exploitation (statistical arbitrage)
   - similar assets in the same or different markets
   - derivatives versus the underlying asset
     (may rely on mathematical finance models)
   - other

2. market making (being a liquidity provider - requires price distribution forecast)

3. lead-lag relationships (markets where price discovery happens) and information cascades

4. momentum strategies

5. seasonality effects (calendar effects; weekend effects, time-of-day, etc.)

6. multi-factor models (also conditional on the market regime, e.g. fear/grid)

7. Behavioral strategies (exploiting psychological biases of various categories of market participants[3])

8. AI-based strategies.

3 An example of a behavioral bias is a human tendency to over-react to bad news and under-react to good news, which can be exploited using event-driven trading strategies.

Risks

Among the many risk types typical of any new business project, the following deserve a special mention in our case.

Delays and blockages in implementation
During the initial stage of the project, any non-trivial delays (e.g., inability to quickly obtain the required resources of find the needed employees) or blockages (e.g., obstacles in satisfying the formalities for company formation or hindrances in opening any needed accounts) would lead to accumulated costs without tangible output, and could have negative impact on the pace of progress, team morale and perception of the project viability.

Model risk
If our models fail to correctly capture the relevant aspects of the complex market dynamics, the actual financial outcomes could differ from those inferred from the models, which may result in losses in some cases.

Market risk
If we employ strategies which are not fully market-neutral, then assets price moves may result in losses. Also, if capital needs to be held in an asset (e.g., a cryptocurrency) being ready for deployment at any moment by our strategies, the value of such capital will be subject to fluctuations with the price of the asset.

Counterparty default risk
If custody of our assets is done by a third party, then a potential failure of that entity represents our counterparty default risk[4]. Using decentralized venues may help to neutralize this risk type to a large degree.

4 A recent example of such exposure is the default of the second largest centralized cryptocurrency exchange FTX.com.

Company Establishment

At present, there is an open question of whether it is optimal to establish a new legal entity for the proposed business or to trial it "in-house" by Lynxx. The following (potentially incomplete) list of pros and cons of each approach has been noted:

PROS	CONS
• Incorporation in a more optimal jurisdiction, e.g. for profit taxation and other considerations. • No impact on Lynxx's core consultancy business. • Ownership structure from clean slate (now and prospectivel, e.g. should external capital be considered in the future). • Cleaner accounting, separation of financials, and 'trading' of various resources between Lynxx and the new company.	• Costs of company establishment. • Potential delays.

The initial 'To Do' list is followed after an authoritative source[5], and includes the following steps:

1. Build a **team** (founders).
2. Agree on an idea, the **end goal** and **exit strategy** now.
3. Agree on **intellectual property** ownership.
4. Agree on the **time and money** each founder will contribute.
5. Agree on founder **compensation** and **equity** allocation.
6. Agree on **vesting**.

5 https://www.reddit.com/r/startups/comments/7gpty7/startups_the_essential_to_do_list_2000_words/

7. Agree on whether **external financings** will be considered.
   If yes, then agree on the **capital structure** after a couple of financing rounds.

8. Check that all of the above is **fair** and **equitable** now and in 1-3 years.

9. Confirm the above by signing **Employment Agreements** and **Protection of Corporate Interest Agreements**.

10. Agree on **company Articles**, including 51% vote requirement to sell the company.

11. Select a corporate **jurisdiction**.

12. Agree on the company **officers** and **directors**.

13. **Incorporate** the company.

14. Agree on the amount of **equity for future employees** and directors.

15. Create a legal **share register** (strict legal requirement).

16. Create a **1-year budget** and **3-year financial projections**.

17. Open a **bank account**.

18. Get a simple **subscription agreement** for the founders' investment, so that they now can contribute startup capital.

19. Set up **accounting system**.

20. Learn about all **taxes** the company will have to pay.

Timelines and Action Steps

The initial period of the business growth is envisioned to unfold in three stages:

Stage 1:	**Quick Start**	3-6 months
Stage 2:	**Scale Up**	3-6 months
Stage 3:	**Expand**	Ongoing business as usual.

Stage 1: Quick Start

Target outcome: The first algorithm (triangular arbitrage most likely) is running live in 3 markets (3 sets of assets) on a most suitable centralized exchange.

Duration: 3-6 months.

1a. Prior work revival and existing code re-launch. Preliminary profit opportunities report.

- Triangular arbitrage theory and best practices brief review.
- Competitive environment brief review (triangular arb in crypto).
- Triples identifier app - code review and refactoring. Report results for Binance.
- Opportunity scanner app - code review and refactoring. Launch. Trading fees/costs estimates. Report results for Binance. Sufficient profit opportunities? If not, then 3 possible directions:
  - WebSocket API may uncover better opportunities?
  - Other exchanges explore (e.g., regional exchanges where mispricings are more likely to occur during certain time of day)?
  - Switch to the next algorithm/strategy?

1b. Infrastructure setup.

- Server set up and prepared for algorithm deployments.
- Server security - initial basic setup.

1c. Improved implementation.

1. Trading automated?
2. WebSockets API replaced RESTful?
3. Use CCXT to replace exchange-specific code?

Stage 2: Scale Up

Target outcome: The proven algorithm is deployed across all opportunities in the current exchange(s). Repeat on other centralized exchanges.

Duration: 3-6 months.

2a. All opportunities at the initial exchange exploited (e.g., all triples on Binance).
2b. Replicate success on other centralized exchanges.
2c. Test other promising leads encountered during prior work.

Stage 3: Expand

Target outcome: The rate of adding new algorithms and augmenting profitability of the operations is attractive.

Duration: Ongoing business as usual.

3a. Decentralized exchanges explore (DEXs' API access worse?)
3b. Additional strategies beyond triangular arbitrage.

Budget, Financial Projections and Capital Requirements

This business opportunity description document is accompanied by a spreadsheet file in which business costs and revenues are detailed on a monthly basis for the first year, and annually for the two subsequent years. Profit estimates have been performed and sensitivities to different parameters can be easily assessed by changing the values or formulas in the spreadsheet. Below are a few relevant snippets from the file.

All dollar values are in thousands.					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Year 1	Year 2	Year 3
				Profit Cumulative	-$54	-$94	-$127	-$143	-$141	-$120	-$94	-$50	$12	$71	$148	$244	**$244**	**$2,403**	**$7,482**
				Profit	-$54	-$40	-$33	-$16	$2	$21	$26	$44	$62	$59	$77	$96	$244	$2,159	$5,079
			$3.7	**Revenues**	$0	$4	$11	$37	$55	$73	$92	$110	$128	$147	$165	$183	$1,005	$3,301	$6,602
				Costs	-$54	-$44	-$44	-$53	-$53	-$53	-$66	-$66	-$66	-$88	-$88	-$88	-$761	-$1,142	-$1,522
				Strategies Deployed	0	1	3	10	15	20	25	30	35	40	45	50	50	100	200
				Costs multiplier	1.0	1.0	1.0	1.2	1.2	1.2	1.5	1.5	1.5	2.0	2.0	2.0	2.0	3.0	4.0
			$2.0	**Capital Required**	$0	$2	$6	$20	$30	$40	$50	$60	$70	$80	$90	$100	**$100**	**$200**	**$400**
		1.3	gross/net factor (on-costs)																
%time	net, $k p.a.	gross $k p.a.	gross $k/mo	**SALARIES**															
		-$497	**-$41**	TOTAL Salaries															
75%	-$200	-$195	-$16	Lead Researcher															
100%	-$140	-$182	-$15	Programmer															
33%	-$140	-$60	-$5	Sr. Sys Admin + InfoSec															
33%	-$140	-$60	-$5	Data Scientist															
0%	-$100	$0	$0	Tester															
				COMPANY COSTS															
			-10.0	ESTABLISHMENT COSTS															
			-2.5	RUNNING COSTS /month															
			-2.0	office / co-working space															
			-0.5	servers, misc, etc.															
			0.0	misc															

Monthly profit from each running algorithm (trading bot).

Capital required per algorithm (trading bot). In the case of triangular arbitrage this is per triple of assets traded.

The business is forecast to achieve profitability (the break-even point) after 9 months of operation, profiting $244k in year 1.

The table below estimates profitability of each trading bot by taking into account the following:

- Typical asset mispricings encountered in the crypto markets
- Size of the profit opportunity, i.e. a typical depth at the best quoted price
- An approximate frequency with which profit opportunities may arise
- Percentage utilisation of the profit opportunities under competitive pressures from other traders (% seized opportunities)
- Execution costs, e.g. trading fees and bid-ask spread

PROFIT ESTIMATE PER BOT (running algorithm)												
	%mispricing	size	profit/trac	frequenc	potential	%seized	profit/day	fees	BAS	$tx_cost	profit/day	**profit/month**
									.5%-2%			
		0.5										
min	*0.5%*	$50	$0	*1*	$0	10%	$0.0	0.1%	1.0%	-$0	-$0	-$4
p25	*1.0%*	$250	$3	*5*	$13	25%	$3	0.1%	1.0%	-$1	$2	$71
mean	***1.5%***	**$500**	**$8**	***50***	**$375**	**33%**	**$124**	0.1%	1.0%	-$2	**$122**	**$3,668**
p75	*2.0%*	$1,000	$20	*100*	$2,000	50%	$1,000	0.1%	1.0%	-$3	$997	$29,910
max	*3.0%*	$2,000	$60	*200*	$12,000	100%	$12,000	0.1%	1.0%	-$6	$11,994	$359,820

Once the business processes stabilize successfully in year 1, the profitability in subsequent years increases substantially - $2.4 million in year 2, and $7.5 million in year 3.