

A decorative graphic on the left side of the slide, consisting of a network of light blue lines and circles, resembling a circuit board or a data network. The lines are vertical and horizontal, with some diagonal connections, and the circles are small and spaced out along the lines.

# THE ECONOMICS OF CRYPTO-TOKENS AND INITIAL COIN OFFERINGS

**JOHN P. CONLEY**  
*VANDERBILT UNIVERSITY*

Business and the Blockchain  
Rice University Jones Graduate School of Business  
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## THE PLAN:

- What is an ICO?
- Are ICOs important?
- Money and Tokens
- Valuation Models
- Implications
- Lessons
- Conclusions

# WHAT IS AN INITIAL COIN OFFERING?

Crypto-tokens are similar to bitcoins in the following ways:

- They are notional or fiat digital objects created by a fixed protocol.
- Ownership is attached to PPK public keys, not biological humans or an account number.
- Ownership is determined by a record of transfers and transactions kept in a ledger, usually a distributed public blockchain validated by some consensus protocol

# WHAT IS AN INITIAL COIN OFFERING?

Crypto-tokens can be much more than AltCoins

- Tokenize or represent real assets such as gold, real property, bonds, and securities.
- Medium of exchange used to facilitate transactions within platform
- Give rights to shares of certain revenue streams or profits on a platform
- Proportional voting rights over certain aspects of a platform
- Proof of stake for block validation or other platform functions

# WHAT IS AN INITIAL COIN OFFERING?

## Typical pattern

- Produce a white paper that describes
  - Technical approach
  - Business model
  - Functions that the crypto-tokens will perform on the platform
  - Process of token creation
- The tokens are offered for sale in an auction.
- The proceeds are used to fund the project.

## ARE ICOs IMPORTANT?

- ICOs provide early funding at very low transactions costs to small startups.
- About \$250M was raised through ICOs in 2016 out of \$1.4B estimated to have been invested in blockchain companies in total that year.
- Several hundred tokens are actively traded on coin exchanges
- Are crypto-tokens currency? → Know Your Customer and Anti-Money Laundering (KYC and AML compliance).
- Are crypto-tokens securities → Securities and Exchange Commission regulation
- Are crypto-tokens something else or a combination? → ?

# MONEY: WHAT IS IT GOOD FOR?

- Absolutely nothing!
- I'll say it again: Fiat currencies are just pieces of paper blessed by the

⚡ Treasury Gods ⚡

- Money as two main functions:
  - Medium of Exchange
  - Store of Value



# MONEY: A MEDIUM OF EXCHANGE

## *Money is Trust*

- We take paper tokens in exchange for things of real value because we trust that others will take the same pieces of paper in exchange for things of value in the future.
- Solves the **mutual coincidence of wants** problem.
- This is good. I find that it is surprisingly difficult to exchange economics lectures for Big Macs or gasoline.



# MONEY: A STORE OF VALUE

- If a currency that has a relatively stable value over time, it can also be used as a **store of value**.
- We can hold the tokens, secure in the knowledge that their value in exchange will not decrease in the future.
- If we do not trust in stable future value, we exchange any tokens we have for real goods as quickly as we can. No one wants to hold them.

## FIVE VALUATION MODELS: QTM

- If tokens are currency, then the **Quantity Theory of Money (QTM)** applies.
- This is an **accounting identity** saying the value of transactions in a period (T) equals the amount of money in the economy (M) times its velocity (V) (which is the number of times a unit of currency changes hands in a given period):

$$T = MV$$

- This means that if there are a total M tokens issued, they must each have a value of  $T/M$ .

## FIVE VALUATION MODELS: PV

- If tokens are a security, then they should be worth the **Present Value (PV)** of the associated flow of dividends.
- If  $\pi_t$  is the dividend a token holder expects in period  $t$  and the opportunity cost of capital is  $r\%$ , then the value of the token must be:

$$\sum_{t=0}^T (1 - r)^t \pi_t$$

## FIVE VALUATION MODELS: EMT

- Efficient Market Theory (EFT) says that the best predictor of tomorrow's price is today's price.
- Put another way, the current price of any a security or currency should incorporate all publicly available information that might affect it.
- More formally:

$$p_t = E(p_{t-1})$$

- This means that prices are heavily dependent on expectations and the arrival of new information.

## FIVE VALUATION MODELS: BEHAVIORAL

- In some cases, we find that agents don't follow what we might call strictly rational behavior patterns (e.g. framing, confirmation bias, loss aversion).
- Behavioralists are sometimes accused of telling “just so stories”.
- We have strong empirical and experimental validation in some cases.
- If we can predict regularities, then behavioral models can be useful
- Blockchain is new, exciting, attractive, and mysterious, thus:

$$p = ?$$

## FIVE VALUATION MODELS: METAGAME VALUE

- Whatever the value of token might be in the context of its intended use, it may be more valuable when repurposed in some way.
- Startups should be careful to think about how the functions and attributes they give their tokens could be used for unintended purposes that might harm their platforms or benefit their competitors.
- For example, hostile takeover, industrial sabotage, or selfish use.

# IMPLICATIONS: CRYPTOCURRENCY

What determines velocity?

- Expectations of future value
- Fractional reserve requirements
- Transactions costs of converting to other assets
- Physical or electronic delays in completing transactions



## IMPLICATIONS: CRYPTOCURRENCY

- In principle, each bitcoin could be transacted once each time a block was written.
- With 10 minute blocks, this means 144 transactions per coin, per day (Ripples could trade thousands of times).
- This implies a total of 2.3B coin transactions per day.
- With about \$400M in dally transactions and 16M bitcoins a bitcoin price as low as **17 cents** is consistent with the QTM.

## IMPLICATIONS: CRYPTOCURRENCY

- Given that bitcoins are actually worth about \$1100, the QTM tells us that velocity must be about 0.023.
- This means about 2% of bitcoins trade each day,
- Equivalently, each bitcoin changes hands once every 44 days.

# IMPLICATIONS: CRYPTOCURRENCY

- The QTM is consistent with any token value between 17 cents and \$1100 and even values far above.
- Expectations and behavior drive the actual market price
- In the real world, we see that exchange rates between major currencies such as the Dollar, Pound, and Euro are quite volatile.
- Currency crisis in Asia and Latin America, hyperinflatons, stagflations, etc..
- This is with currencies with huge capitalizations and the best expertise available deciding monetary policy.

## IMPLICATIONS: CRYPTOCURRENCY

- The basic problem is that there are **multiple equilibria** in money markets, in the real world, and for cryptocurrencies.
- Should we turn to experts to for guidance?

**Alan Greenspan:**

*“I guess I should warn you, if I turn out to be particularly clear, you've probably misunderstood what I've said.”*

## IMPLICATIONS: CRYPTOCURRENCY

Better advice might come from **Gildor Inglorion**, as quoted in the Fellowship of the Rings:

*“Do not meddle in the affairs of wizards, for they are subtle and quick to anger.”*

## IMPLICATIONS: CRYPTOCURRENCY

- One bad practice is retaining a share of coins for founders or to endow non-profit portions of a project.
- Often, about 20% is held back, though about 70% of Ripple coins are held by Ripple Labs and associated groups and people.
- This is inherently destabilizing. Anyone with a large position (think George Soros) can manipulate a currency's value. If founders sell their coins, it can be taken as a sign of a loss of confidence or that costs are unexpectedly high.
- Selling coins could also qualify as insider trading – Don't go there!
- Instead, sell all the coins and use the money to reward founders and pay costs.

## IMPLICATIONS: PROFIT SHARING

If tokens are more like a security with profit sharing, PV provides a **lower bound** on price. However:

- Hard to estimate dividend streams if white papers are unclear or nonexistent.
- No SEC rules mean that the definition of profits may be unclear
- No SEC rules make it uncertain what guarantees and enforceable promises founders make to token holders. **A white paper is not a contract!**
- Platforms may evolve, and legacy use revenue streams may dry up



## IMPLICATIONS: PROFIT SHARING

- Generally, investors demand a premium to hold risky assets. Risky should cause token or stock prices to be less than the true PV of dividends.
- With blockchain startups, investor may systematically fill in any information gap with optimistic guesses.
- Over exuberance, bandwagon effects, the winner's curse, animal spirits, and other behavioral factors may be important in exciting and not very well understood markets.
- Full information might actually lower the value of tokens.

## IMPLICATIONS: VOTING CONTROL

- Stockholders typically are allowed to vote over who is on a company's board of directors in proportion to their holdings.
- In the ICO world, token holders are sometimes given collective control over a variety of aspects of a project, but almost never full control or proportional sharing of profits.
- Unfortunately, when any aspect of control is separated from profit sharing, serious incentive problems are created.

## IMPLICATIONS: VOTING CONTROL

- Voters vote in their own interests.
- They may choose fees or protocols that maximize their own return but harm the platform as a whole.
- They may choose directions for future development that benefit the use cases they have in mind, but are not of general interest.

## IMPLICATIONS: VOTING CONTROL

- The PV of the tokens is only equal to value that holders can capture from whatever voting rights they have. This is less than the capitalized value of profits.
- Undervalued tokens might be purchased by a competitor who then uses his power to weaken the company or move it into other less profitable markets.
- This is an example of how tokens might have value in a metagame that is higher than their value within the platform.

# IMPLICATIONS: PROOF OF STAKE

Proof of stake can take many forms:

- Confer a degree of voting control (e.g. voting over who is allowed to joins a trusted set of verifiers).
- A surety bond for the good behavior of agents charged with carrying out various functions on the platform.
- Determining profit share in concert with providing services to a platform such as processing transactions, connecting users to markets, helping form consensus over the outcomes in prediction markets, sports and online games, and transaction disputes.

## IMPLICATIONS: PROOF OF STAKE

- At best, the value of the tokens is the PV of the revenue coming from the proof of stake.
- If there are costly duties that token holders must perform, all these costs are deducted from the PV of dividends, and so form the value of tokens.
- This means that the services of token holders over the lifetime of the platform are being paid for **upfront** in lower capitalized value of tokens
- This is like a startup paying its expected electricity bill 20 years in advance instead of using the money to develop the platform more quickly.

## LESSONS: FOR STARTUPS

1. Monetary systems are hard to run and inherently unstable. There are multiple equilibria in money markets, and so it is simply not accurate to say that the value of a token will increase in proportion to platform use.
2. Consider setting aside a fund to stabilize token prices, especially if the token is primarily a transactional currency.
3. Don't hold back tokens in an ICO.
4. Avoid burdening token holders with work. Pay for work separately.



## LESSONS: FOR STARTUPS

5. If token holders can control any aspect of your platform, be aware that they will use this power to further their own interests and not the ecosystem's. Think about their incentives within the platform and also how hostile actors might use such power to profit in the metagame.
6. Startups don't have to disclose or commit to anything when launching an ICO. Being free of constraints allows more flexibility. All else equal, this is a good thing, especially in a dynamic market like blockchain.
7. In general, making the value proposition clear to investors increases their willingness to pay for tokens (or securities). To the extent that you are committed to a plan and believe it to be a good one, you should disclose, explain, and bind yourself as much as you can.

## LESSONS: FOR INVESTORS

1. Hope of Token value appreciation is a poor reason to buy into an ICO. Prices of transactional tokens are built on expectations of future prices which are inherently fragile. There will be tears.
2. The fact that the value of your portfolio of tokens seems to keep going up every month does not mean that you have made good bets. It means that you have gotten lucky. (Examples of markets where bubbles eventually burst are too numerous to mention. )
3. Tokens that come with claims on clearly laid out revenue streams are a safer investment, especially if you think the business model and technology of a firm are sound.

## LESSONS: FOR INVESTORS

4. Tokens almost never come with full voting control over a company. Make sure that founder's incentives align with yours.
5. Make sure the commitments have made to token holders cannot be diluted or ignored.
6. Make sure that the interests of the other voting token holders agree with yours on the dimensions they control.
7. A confusing, incomplete, or nonexistent white paper suggests:
  - A lack of clear vision on the part of the founders.
  - The project is immature.
  - The company hopes you will invest without much disclosure or commitment.
  - Something else, but nothing good.

# CONCLUSION

- Without question, blockchain is a game-changing technology. We are still in the very early stages of figuring out how it will be used.
- Many startups are working in a variety of creative ways to bring applications to markets. Most of them will probably fail.
- Blockchain applications seem to exhibit significant network externalities and this tends to make for a winner-take-all environment.
- There will be winners, however, and their impact is likely to be huge.

# CONCLUSION

- The main point of this paper is that designing a successful token must take into account aspects of monetary theory, financial economics, and game theory.
- Failing to do so can put an otherwise excellent project at risk.
- Each company's technological vision may call for a token with unique properties and uses. We hope that this paper provides a framework that allows companies to follow their vision while avoiding structural mistakes that might be harmful to their chances of ultimate success.

# CONCLUSION

A white paper with more details is available at:

<https://jpconley.files.wordpress.com/2017/04/the-economics-of-crypto-tokens-and-icos2.pdf> ,

or go to

[www.jpconley.com](http://www.jpconley.com).

or look me up on LinkedIn.



Thanks very much