

THE **Financial** METaverse

TOKENS,
DERIVATIVES
AND OTHER
SYNTHETIC
ASSETS



Albin Spinner



The Financial Metaverse

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Tokens, Derivatives and Other Synthetic
Assets

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Albin Spinner
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Preface

Derivative trading? That's something for Wall Street types, right? Maybe, but it also affects everyone else in ways that are still little appreciated. Understanding how this obscure corner of financing works (and what happens when it doesn't) is a key pillar of financial literacy today. If you are interested in money, whether as a financial markets practitioner, everyday investor, academic, regulator, policy maker or kitchen-table economist, you need to know how financial derivatives work and the inherent promises and pitfalls of the market.

There is no shortage of promises. Two decades of abundant liquidity, coupled with two rounds of unprecedented stimulus spending have broken new grounds in financial exuberance. It is high time for financial derivatives and risk management to regain their credentials. Derivatives can help solve difficult problems, like creating a global market for carbon credits, which are critical in the fight against global warming.

Pitfalls are equally abundant. Options trading has overwhelmed the world's stock markets, once places where investors had just two options: "buy" and "sell". In recent years, options have driven meme stocks to unjustified heights and unfathomable lows.

In 2022, futures traders paralysed the global trade of nickel, a key component in the battery of your neighbour's Tesla. For a few minutes one trading day during the pandemic, sellers of crude oil were paying buyers to take the stuff, defying the very notion of trading, in an episode straight out of "Alice in Wonderland". Thank the futures market.

Derivative trading has also changed the course of economic cycles for individual countries and the world. In the fall of 2022, the UK pension system buckled under the turbulence caused by a derivatives strategy known as liability driven investing, costing a prime minister and chancellor of the exchequer their jobs. Collateralised Debt Obligations on subprime mortgages served as a decisive trigger in the global financial crisis and the Great Recession.

The financial press casually portrays globally recognised, universal financial assets like “gold”, “interest rates” or “oil” every day. The familiarity with which those concepts are evoked often overlook deeper complexities. We are all complaisant with the apparent simplicity of headlines which distil the complexities of the world in a few internationally traded financial assets. Behind the conveniently crisp façade, lies a complex financial system powered by financial derivatives, securitisations, Exchange Traded Funds or electronic warrants. They are financial instruments whose value is derived from the performance of a secondary source, such as the price of a bond, a currency, an equity, a commodity or a carbon credit. Collectively, the book refers to this class of financial instruments as “synthetic assets”. This publication provides an original unifying framework of what synthetic assets are, how they function and what purpose they serve. They are presented as a system of signs that sit on top of more traditional markets. They “refer” to other assets.

A fitting metaphor for a synthetic asset could be likening it to digital twin in a mixed reality context. Digital twins are virtual clones which are operated in a virtual, industrial environment that mirrors the physical world. They are used to simulate physical objects, like an industrial turbine, that would be impractical to test in physical life. Similarly, by providing a generic vector to trade the risk, synthetic assets transcend the peculiarities of the underlying cash market.

Synthetic assets are signs that “refer” to other more traditional financial assets. By analysing the referential relations and their associated complexity, the ambition of this publication is to give a sense of the complexity of “high finance” and in particular its link to real assets. While giving a helicopter view of systematically organised trading, the book also explores intricate case studies, highlighting situations where the relationship between the sign and its underlying breaks down.

The book also lays out a unique imaging of the financial metaverse, or the intersection of traditional market-based derivative trading and the

emerging digital innovations that have made the metaverse and cryptocurrencies possible. Finance is an interdisciplinary field that intersects with economics, the study of sign systems, sociology and technology.

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The analyses, comments and opinions contained in the work are the author's own and do not reflect the views and opinions of the author's employer.

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1

Financial Metaverse: Trading Tokens, Derivatives and Other Digital Twins

Synthetic assets surround us in our daily lives. Look around you. The number 18 token that the cloakroom girl gave you in exchange for your coat? That is a synthetic asset. Its intrinsic value is nil. It is simply a small plastic disc, too large even to insert in the anti-theft system of your supermarket's trolley. Instead, its value is as a sign. Only imagine the drama that would accompany its loss: a brand new coat! The cloakroom girl owns the other half of the key, an identical token, with the same number 18 emblazoned in gold. She also understands the convention. The person who offers her the matching token will be handed the corresponding coat. No further explanation is required. While a small tip might change hands, this is far from compulsory. Such an example might sound trivial. An unintentional exchange cannot be ruled out if the girl has a moment of absence. In general, however, the process leaves little room for confusion. On the other hand, when synthetic assets are meant to represent classes of objects, some of which can be abstract, things can become a little more confusing (Illustration 1).

In the context of the system of thoughts of finance, “a means of framing and solving complex problems about money, time and value” (Goetzmann), synthetic assets facilitate the manipulation of other financial assets. A metalanguage is a specialised set of symbols used when describing the structure of a language. For example, algebraic notation is a metalanguage of arithmetic. One can extrapolate synthetic assets to refer to a set of financial products that are used to manipulate other financial assets. A synthetic asset is a financial representation of a financial representation. They are meta-assets.

Signs manipulating signs is not finance's prerogative. Consider arithmetic which is at the heart of any financial transaction. Brian Rotman gives a vivid



Illustration 1 Cloakroom token (Illustrator: Tejasvita Negi)

example: “In the period between the tenth and the thirteenth centuries the abacists, who wrote Roman numerals but calculated with abacus, were in conflict with the algorists, who both recorded and calculated with Hindu numerals” (Rotman, 1988). The number 706 is written DCCVI with Roman numerals. Unlike the case with Hindu numerals, no Roman numeral ever had to register the absence of some particular power of ten. Introducing “0” to Roman mathematics could easily be done (e.g. DCC_VI). The abacist had an issue with the use of zero, “a sign which affected values of numerals wherever it occurred but had no value itself”. The presence of zero declares a specific absence, namely the absence of the signs 1, 2, ..., 9 at that place. Rotman concludes: “Zero is thus a sign about signs, a meta-sign”.

Content aggregation on the internet is another example of signs of signs. In a prescient article in 2006, Jaron Lanier announced a “frantic race taking place online to become the most “Meta” site, to be the highest level aggregator subsuming the identity of all other sites”.¹ He was talking at the time of Wikipedia, where texts get cloned from original sites at universities or labs.

¹ Jaron Lanier, DIGITAL MAOISM: The Hazards of the New Online Collectivism, Edge.org, 2006.

At the time, search engines were already more likely to reference the wiki-fied version. The “Meta” page became the reference rather than the original source. This frantic race has obviously taken a new turn with the development of AI. Large language models are being trained on massive amount of original work. Some argue that writers and artists should get compensation from AI firms as they scrape copyrighted material. They take the view that chatbots have become the latest higher level aggregator. This is raising very tricky copyright issues. Are large language models digesting or copying material?

Leaving aside the subject of where the creative agency truly resides, it is fair to say that AI’s output results from the processing of a primary learning set. In that sense, it is like a meta-language, secondary to its primary learning set. Readers of the FT can ask the chatbot to report on some content rather than accessing the newspaper’s website. “The aggregator is richer than the aggregated”.² AI as a metalanguage is a parasitic system and it may kill its host. When new generative models start training on AI-generated content, they gradually degenerate as a result. ChatGPT 99 and other generative bots of the Nth generation might not work as well when the net is mostly populated with AI-generated stuff.

This book proposes to analyse the conventions and the structures that underlie financial representations. Just as “the word is not the thing” and “the map is not the territory”, a synthetic sign must be set against the full presence of its underlying. This distinction, behind its apparent simplicity will lead the investigations of this study. Returning to our cloakroom token, its number corresponds to the code that allows to retrieve one’s coat back. What happens if you lose your token? Under what conditions are you permitted to give your token to another person? Can you instead sell the token for money? Can you swap tokens? This study of synthetic assets will attempt to distillate the common themes of those mechanisms. Arabs numerals, chemical formulas, musical notes and IT languages help us to manipulate the real. Semantics is the study of how signs signify, in other words, the fiduciary relationship between language and its referent. Should financiers analyse financial synthetic assets in a similar manner?

There may be practical reasons why the synthetic asset might now be able to fully represent its underlying. For example, consider an exchange traded fund (ETF) replicating an equity index, an apparently straightforward and generic index ETF. To the best of her ability, the ETF asset manager attempts to replicate the performance of a basket of listed equities. However, such replication is never perfect, and there are always some discrepancies

² Jaron Lanier, DIGITAL MAOISM: The Hazards of the New Online Collectivism, [Edge.org](https://www.edge.org/), 2006.

between the performance of the ETF and its reference index. The manager will face prohibitive transaction costs if she tries to replicate all the adjustments in the composition of the index. The basket of equities is typically rebalanced regularly based on an algorithmic rule (for example, the weightings can be linked to the respective market capitalisation). The asset manager must select a reduced set of names which will replicate her reference index as optimally as possible. Transaction costs linked to the simple cost of liquidity are not the only reason to dread index rebalancing. She must also need to be mindful of dedicated hedge fund managers who will attempt to front-run her programmed behaviour by anticipating her transactions.

Consider once more the slightly farfetched cloakroom token example. When I hold my token, I lose a certain intuition that I actually own a coat. I might easily lose it and not realise the consequences. The discrepancy between the sign and its underlying can be better illustrated by the alleged role of the sub-prime market securitisation in the 2008 Global Financial Crisis. The level of abstraction of the securitisation market certainly contributed to the crisis. Institutional investors were relying on specialised rating agencies without truly understanding the risks inherent to mortgage subprime credit. The market was traditionally the preserve of banks as part of their ordinary course of business. The transformation of these receivables into securities facilitated access to those assets for a larger investor base (e.g. institutional funds, and insurance companies). It is, of course, easier to purchase a financial asset than to open a mortgage bank. Similarly, it is easier to hold the cloakroom token than the coat during the theatre performance. However, this operation has taken a toll on my intuitive understanding of the risks of loss involved.

Investment funds, bills of lading, exchange traded funds (ETF), financial derivatives, financial benchmarks, securitisation, grain elevator receipts, gold electronic warrants and voluntary carbon credits are all declinations of synthetic assets. I could even add Non Fungible Tokens (NFT) to the list to catch the cryptocurrency wave. Their underlyings come in a wide variety. Those semiotic constructions are the financial representations of physical commodities, real estate, abstract financial strategies, mortgages, carbon credits, or other financial assets. As Russian dolls, these representations come together in a financial “mise en abyme”. Some of those signs represent other financial instruments. The famous example of the laughing cow designed by Benjamin Rabier for a cheese brand comes to mind. This mascot cow is depicted wearing earrings shaped like two of the cheese boxes used by the brand; the earrings are naturally illustrated with the same cow wearing the same earrings. These financial tools have become the backbone of market finance. They represent a kaleidoscopic variety of materials including gold,

crude oil, equity, voluntary carbon credits, interest rates or the credit worthiness of a company... The concentration of financial liquidity, initially at the large stock exchanges or the foreign exchange market, has increasingly focussed on synthetic assets.

This book is organised in 5 separate chapters. It is probably better to read them in order, but they can be considered separately. The following section gives an overview of each chapter.

Chapter 2: Introducing the Financial Metaverse

Chapter 2 simply introduces the financial metaverse. It contrasts market finance with another widely used risk paradigm, namely actuarial finance. It shows that the global financial infrastructure fundamentally relies on the generic definition of universal assets.

The chapter goes on to introduce the financial metaverse as a set of financial tools that acts as an additional layer overlaid on traditional market mechanisms. These essentially represent financial derivatives but also financial tools like ETFs, or electronic warrants.

Chapter 3: Synthetic Assets Play a Standardisation Role

Central to the “derivative” system of thoughts, is asset specification. Commodities come with different quality. Even financial assets come in a surprising diversity. Synthetic assets play a standardisation role. Asset specification typically involves pooling individual assets together to create a composite asset. It is a surprisingly difficult process. Human limbs are separated by articulations. Spain is separated from France by the Pyrenees. But a natural boundary does not always exist.

The process of dematerialising an asset through the creation of a financial product relies on the thorough definition of its specifications. The precise formulation of the underlying is an exercise of standardisation and classification. Some assets are more easily defined than others. For example, gold is one of the basic elements in Mendeleev’s periodic table. It is also perfectly chemically stable. However even this basic element poses problems when attempting to define a consistent standard. For instance, gold comes in different shapes and bars. It turns out the delivery specifications under the major futures contract on the COMEX does not match the London bullion market. Equally the location of the delivery represents another source of ambiguity.

When it comes to hydrocarbons, which are organic materials, the plot thickens even more. The market has tended to gravitate towards benchmark grades with certain characteristics, including large production volumes, stable

market environments and consistent quality characteristics. From a technical high ground, experts can broadly agree on characteristics such as the acceptable rate of sulphur. On the other hand, what happens when the production volumes of the reference wells fall? Those wells have finite lifespans. It is easy enough to realize that one should choose new reference wells, but which ones? These problematic issues are currently being experienced by Brent, one of the major global reference grades. As a market practitioner, one often experiences the “unbearable lightness” of financial specifications.

Chapter 4: The Economics of Financial Infrastructure

The cloakroom token example is useful to illustrate the relationship between a synthetic asset and its underlying. However, it has limited metaphoric utility when it comes to illustrating the network effects that go with any financial network. A cloakroom is hopelessly anchored in reality. It has a limited capacity due to the limited size of the real estate. In economic term, it has decreasing returns. Networks, including financial networks, in contrast, exhibit increasing returns. This simply means that a network is more valuable, the more users are connected to it. The fixed costs can be high, but the costs of adding a new user are small. “When [Whatsapp] was acquired by Facebook, it had 35 engineers and reached more than 450 million users”.³ As of 2015, it employed only about 50 engineers, although the number of Whatsapp users had doubled. A similar network effect exists for financial networks, including the market participant of a synthetic market. Markets operate more effectively at high volume of transactions.

Networks are prone to “lock-in” where technically sub-optimal solutions can be adopted by the market. QWERTY keyboards have become the obvious example of lock-ins. The more QWERTY keyboards in circulation, the more useful is the layout to a user, rather than a ABCDF keyboard. In turn, the more users, the more keyboards will be sold. Leaving the network leads to a switching cost. Once one has gone through the effort of learning a particular typing layout, switching to another type of keyboard is pain. The technology in itself is not more efficient when it is more widely used. But the network is more valuable. This publication will use this network economics’ lens to study synthetic assets’ markets.

³ Cade Metz, Why WhatsApp Only Needs 50 Engineers for Its 900 M Users, Wired, 15 September 2015.

Chapter 5: The Motivation of Synthetic Assets

I am always puzzled when I hear in the London underground the announcement: “The next station is closed”. The literal part of my brain correctly interprets the information; but the part that read “Alice in Wonderland” is sensitive to the paradox: the next station cannot possibly be closed, or it would not be called the “next” station. Lewis Carroll had a gift of making us revisit our certainties with those playful ambiguities. If one looks at financial markets long enough, similar cracks can start to appear in the conventional paradigms. How does a sign (the word “next station”) evolve with its referent (the station “Saint Paul” is closed).

Similarly, one needs to think about how financial instruments undergo evolution through time as their underlying asset evolves. Imagine that the same (now proverbial) cloakroom has misplaced your garment and now offers you money as compensation at an amount equivalent to the value of the coat. Many obvious technical issues thus arise. What is the price of the coat? Who decides the coat’s monetary value? The token then becomes orphaned. In other words, it has no underlying. Similarly, financial assets evolve. ISDA, various international exchanges, price assessment agencies and other benchmark administrators spend a significant amount of effort to manage the indexical relationship between derivatives and their underlying. For example, the French Franc disappeared when the Euro was introduced. Synthetic assets need to adapt to those changes.

It is also interesting to study the mechanisms that link financial instruments to their underlying. In linguistics, the process of inference describes the extraction of the underlying (the signified) from the sign (the signifier). One infers the signification of a sign. In a financial context, this process can apply to the settlement of a contract. The terms of a contract settlement underlie the realisation of the sign. The contract is typically realised by a cash payment linked to the price of the underlying, or through physical delivery. The physical delivery often implies a smaller gap between the sign and its underlying. Synthetic contracts typically include an effective price convergence mechanism, like physical delivery or an ETF type dynamic issuance strategy. At the same time, the ability to close a contract early for cash is a critical element of synthetic markets. The ability to close a contract before physical settlement maximises the participation of financial investors. It is not always easy to design contracts that include embedded price convergence mechanisms, but which also allow for early cash exit.

The concept of motivation refers to the reliability of a message. For example, the written press has lower motivation than televised news. We mistakenly take footage as evidence of our own eyes whereas the events

are mediated by the camera of journalists. In a similar fashion, synthetic assets are not neutral when they represent their underlying. It makes sense to understand their motivation as a financial sign.

Financial representations are not impotent signs. They are designed to manipulate their underlying. Like financial Voodoo dolls, manipulating a financial representation has an influence on its underlying. The motivation of a financial representation reflects an indexical relationship with its physical counterpart. Synthetic assets are capable of “hooking into” other financial assets.

For physical commodities especially, it is necessary to understand how the underlying physical matter is stored. Returning to the now over-extended cloakroom story, a potential customer must consider its opening hours (hopefully it does not close before the show is over) as well as its cost. The coat’s owner might be socially expected to leave a pre-agreed tip. Such storage considerations are particularly interesting in the context of base metals markets. For neophytes, the exact mechanisms of a London Metal Exchange (LME) warehouse resemble an impenetrable maze. Aluminium holders are paid for putting metal in an LME warehouse, as the metal is used as the underlying of the derivative trading of the exchange. Given a complex network of obscure incentives, holders typically immediately join a queue to retrieve their metal. In 2014, the amount of time required to obtain metal grew to two years. Some actors worried that the obscure scheme would lead to tons of metals being removed from the physical market and stored in warehouses to feed the financial demand. This possible dislocation between the price of physical aluminium and the LME futures led to an official investigation by the U.S. Senate’s Permanent Subcommittee on Investigations. It is difficult, at first, to see how dull metal bars, patiently gathering dust in a warehouse and awaiting use as beer cans can suddenly give rise to an exciting financial drama. I am afraid it is one of the stories of this book, staging derivative processes as star characters, thus giving life to often obscure financial systems.

Chapter 6: Quantifying Synthetic Assets

The list of conventions would not be complete without mentioning that the damn token might have to be valued. A gap between the synthetic asset and its underlying can sometimes be observed as a simple difference in price. What is the influence of the conventions that underlie financial products on their valorisation? In the now abused cloakroom example, a customer might be prepared to pay a premium to retrieve her coat if she has missed the cloakroom’s closing time. She could consider selling the token at a lower price than

the coat itself if the cloakroom has permanently closed and she can no longer access the garment. There is the possibility of a fraud and perhaps, another token exists with the same number. She could pay a higher price than the coat for the token if it is impractical for her to store the coat and she views the cloakroom as some form of coat custody service.

Such continuous challenges to fiduciary duties between the financial representation and its underlying have an important impact on the financial valuations of derivatives. In financial derivatives jargon, this discrepancy is called the “basis”. The basis describes the price difference between the underlying and its financial representation, between the index and the sum of its parts, between the cash and the derivative, between the physical and its corresponding electronic warrant...

This basis is a double-edged sword. If the underlying shapes the sign, the latter is not neutral. Rather, it has a retroaction effect on its object. Both interact incestuously. The introduction of a financial contract on crude oil has completely revolutionised the energy market. The term structure of prices has traditionally been in backwardation. The future price was lower than the spot price, which reflected storage cost. Market participants were confined to producers and consumers. The introduction of financial derivatives accessible by purely financial investors in the 2000s changed this market structure. The term structure of prices increasingly began to take into account prices previsions, rather than the pure supply and demand of the physical commodity.

Financial practitioners are careful not to put too much reliance on financial models. Models are critical decision-support tools. But financial history is littered with catastrophes linked to uncritical acceptance of model output. The park rangers at Death Valley National Park in California call it “Death by GPS”.⁴ There has been a series of incidents involving car navigation systems (road models in our context). In a famous occurrence, a couple left British Columbia for Las Vegas in their Chevrolet Astro, but never arrived at destination. They started with a pretty good road, but uncritically following their GPS, gradually migrated to dirt tracks, before they were completely lost in the wild. The subsequent manhunt through the high desert did not manage to locate the man in time, and the woman was rescued two months after they had disappeared. Blind trust in quantitative models is not restricted to finance.

⁴ Greg Milner, Death by GPS, *Ars Technica*, 3 May 2016.