

WILL BLOCKCHAIN CHANGE EVERYTHING?



Cryptocurrencies like Bitcoin have been garnering lots of attention, but the real story lies below the headlines. Understanding the impetus for digital currencies' creation is essential. Not for investment purposes—but to appreciate their underlying blockchain technology.

BITCOIN AND BLOCKCHAIN BASICS

Bitcoin was designed as a digital currency that would allow two people to transact online securely, and **privately**, without a trusted middleman like a bank. However, removing the middleman introduced the risk of fraud—particularly double spending the digital currency.

The solution? Blockchain. It's the game-changing, underlying technology that makes cryptocurrencies possible.

Blockchain is an accounting innovation. Think of it as a chronological list of transactions, essentially a really long ledger. Cryptographic

techniques ensure its accuracy by providing computational proof of the order in which transactions took place—preventing fraud and double spending. In addition, the Bitcoin blockchain is broadly distributed across a large number of computers that compete to process transactions. This means that no central authority can control or manipulate it.

Because the blockchain is so reliable, it solves the trust problem that previously prevented digital currency systems from gaining any traction.

DISPLAY 1: BLOCKCHAIN ENABLES BITCOIN

Blockchain 

- Chronological list of transactions (a really long ledger)
- Uses cryptographic techniques to maintain accuracy
- Provides proof of transaction order

Bitcoin 

- A digital currency
- Allows two parties to transact online directly, securely, and **privately**
- Eliminates the “middleman”

Makes Bitcoin possible

Made possible by Blockchain

Source: AB

DIGITAL CURRENCIES: WHY THE FUSS?

Towards the end of 2017, a burst of euphoria gripped cryptocurrencies. Yet since those lofty heights, Bitcoin’s price has dropped dramatically. What does this mean for digital currencies? In our view, while one or more may endure, their investment popularity appears speculative in nature. Even advocates can’t agree on how they should be valued, as dramatic price volatility has undermined their use as “currencies” at all.

We consider digital currencies unlikely replacements for existing payment mechanisms. They do allow people to trade anonymously online, but slowly and at some considerable cost compared to traditional payment systems (*Display 2*). The few compelling use cases hinge on the privacy angle. Because cryptography ensures anonymity, digital currencies have become a preferred medium of exchange for illicit drugs or companies and countries seeking to evade government sanctions.

Given these flaws, it’s no surprise that few Bitcoin transactions are used as a payment mechanism. Based on survey data, we estimate that no more than one quarter—and perhaps less than 10%—of all

We consider digital currencies unlikely replacements for existing payment mechanisms

Bitcoin transactions are for goods and services.¹ Most of the rest are speculative, where buyers hope to sell their coins later at a higher price.

VALUATION IS TRICKY

If cryptocurrencies like Bitcoin aren’t about to displace existing currencies, why are some of them worth so much and how can we value them? All value is driven by supply and demand. The supply of some cryptocurrencies like Bitcoin is ultimately fixed. There are about 16.7 million bitcoins in existence, and only 21 million can be created in total. While this makes bitcoins rare, not all rare things are valuable.

DISPLAY 2: DIGITAL CURRENCIES FACE SIGNIFICANT HEADWINDS

	Cryptocurrency Systems	Visa/Mastercard Systems
Scalability	Currently process, on average, ~10 transactions/second	Capacity of 56K transactions/second
Transaction Time	Transactions bundled and processed every 10 minutes (confirmation may take hours)	Real-time authorization
Cost	~140 basis points*	~10 basis points per debit/~20 basis points per credit transaction*
Brand	No consumer or merchant acceptance; no brand	Accepted at ~40 mil. merchant locations; >2 bil. cards issued†

For illustrative purposes only.
 *Other processing costs (including payments to exchange and wallet providers for Bitcoin; and interchange fees between Visa/Mastercard and the banking system) may add another 2% for both systems.
 †~50 mil. acceptance points and 5 bil. cards when other payment networks are included.
 Source: AB

¹ Cambridge Center for Alternative Finance at the University of Cambridge Judge School of Business, Global Cryptocurrency Benchmarking Study, 2017.

What about the demand side of the equation? Forecasting the demand for cryptocurrencies is more difficult. However, there are three basic reasons why people demand things:

- A compelling use case. For instance, a commodity like steel is valuable because it can be used in so many different ways.
- The asset generates a stream of cash over time (as with stocks and bonds, businesses, and real estate)
- For things without compelling uses, and which don't generate a stream of cash, demand usually rests on some sort of aesthetic or cultural appeal

A STORE OF VALUE?

So where do digital currencies fit into this framework? They have questionable use for buying goods and services, and lack a stream of cash flows. Increasingly, therefore, much of the demand for digital currencies is driven by the idea that, like art or gold, they are a potential store of value. However, art and gold are valuable because of some compelling aesthetic or cultural appeal.

Cryptocurrencies have no tangible presence—you can't hold one in your palm like a gold coin, and appreciate its color and weight. And, it's too early to say that any particular cryptocurrency will have lasting cultural appeal, like a painting from a renowned artist. For these reasons, we find future values for cryptocurrencies highly uncertain and do not recommend them for investment purposes.

Blockchain could disrupt any business model where a middleman facilitates trust

KEEP YOUR EYE ON THE BLOCKCHAIN PRIZE

So where does that leave blockchains, and ledger technologies like it? They are likely to impact business well beyond the world of cryptocurrencies. Here's the key insight: a blockchain can record changes in ownership of anything—not just digital currencies.

DISPLAY 3: THE DRIVERS OF DEMAND



A Compelling Use

The source of “demand” for commodities and consumer goods.



A Stream of Future Cash Flows

The source of “demand” for stocks and bonds, businesses, and real estate.



Aesthetic or Cultural Appeal

For things without compelling uses, and which don't generate a stream of cash, demand usually rests on some sort of aesthetic or cultural appeal.

For illustrative purposes only.
Source: AB

In other words, the idea of a permanent record of transactions, held on a number of computers, that can be examined by anyone has all sorts of applications. In theory, blockchain technology could disrupt any business model where a middleman facilitates trust.

The last great accounting innovation was the advent of double-entry bookkeeping in Italy in 1494. Yet, we don't talk about the rise of "double-entry bookkeeping companies" in the centuries that followed. Instead, we see how it facilitated the rise of new and larger firms that were able to attempt more complex business operations.

Blockchain is similar. Rather than see the rise of "blockchain" companies, the real impact of blockchains will be as an enabler for trade and business opportunities that are either impossible today, or significantly constrained by the expense of overcoming trust issues.

Blockchain technology is likely to be disruptive. Technological advances used by companies like Uber and Airbnb are already changing which activities are performed within firms versus those handled via market transactions (often by independent contractors). Economic theory notes that costs—such as the expense associated with trust concerns—are among the determinants of this division of labor.² By providing a new way to bridge the trust divide, blockchain technology is likely to further shift the boundaries between the firm and the market. In particular, it's likely to cause existing trust

facilitators—like custodians, brokers, securities exchanges, lawyers, and accountants—to decline in importance.

Where might this occur? Blockchains can be used to record changes in the ownership of all sorts of assets, including real estate, stocks and bonds, copyrights, and patents. And blockchains can be used to record each step in a product's pathway through a company's supply chain. In fact, that is precisely the approach Walmart is taking with its food safety initiative.

Blockchain's real impact will be as an enabler for trade and business opportunities

BLOCKCHAIN ON THE MENU

Walmart has been an early adopter of blockchain because it immediately recognized the value that the accounting device could bring to the essential management of its perishable food supply chain (*Display 4*). Seeing the potential, the company launched a pilot tracing pork in China. Initial results then prompted Walmart to replicate the tests on a larger scale by tracing sliced mangoes in Central America.

DISPLAY 4: BLOCKCHAIN COULD DISRUPT THE FOOD INDUSTRY

Current Challenges and Opportunities:



128,000

US hospitalizations for foodborne illnesses per year



400 lbs.

Amount of annual food waste per person in the US



\$872.7 Bil.

Forecasted global market value of ethically labeled packaged foods by 2020

Potential Blockchain Benefits:



Increased transparency



Accurate tracking



Cost reduction

Source: CDC Estimates of Foodborne Illnesses in the United States, Wasted: Second Edition of NRDC's Landmark Food Waste Report, Statista: Sustainable Food Industry Statistics and Facts, and AB.

²"The Nature of the Firm" by R. H. Coase, *Economica*, 1937.

If successful, Walmart's blockchain initiative could profoundly change the way the food and retail industry secures, stores, and shares information. By adopting blockchain, Walmart is aiming to promote trust and collaboration in a complex global food supply chain that is currently siloed, cumbersome, and surprisingly manual.

The company is especially motivated by food safety concerns because disconnected, highly fragmented inventory management systems prevent producers and retailers from seamlessly tracking and reliably tracing food's origin.

To address these challenges, Walmart could impose a traditional inventory management system on all its suppliers. For instance, the entire chain of custody of a box of tomatoes—from the farm where they were grown until the time they were placed on the shelf—could be embedded in a QR code and read with a simple scanner. But a blockchain solution may be particularly well suited because it fosters collaboration, coordinating the activities of disparate members of a supply chain.

Blockchain may also overcome consumers' skepticism about the provenance of food marketed as "organic" or grown in an "environmentally responsible" way. A blockchain, with its secure, open, and distributed record from farm to the retailer, could ensure authenticity for those consumers willing to pay a premium for such ethically labeled food.

A SEA CHANGE IN GLOBAL SHIPPING

Like the food industry, the global shipping industry appears to be ripe for distributed ledger technology like blockchain. The parallels between

the shipping and food industries help explain why. Global trade hasn't evolved much since the first cargo container was introduced in 1956.³ It's a global labyrinth that's paper intensive, disjointed, and prone to fraud and miscommunication. One study noted that a single container shipped from Kenya to Amsterdam involved up to 30 different parties and nearly 200 distinct communication steps.⁴

Like the food industry, the global shipping industry appears to be ripe for distributed ledger technology like blockchain

Maersk and IBM have formed a joint venture to create a platform to streamline the global shipping ecosystem using blockchain. Today, over 90% of our everyday goods—totaling more than \$4 trillion annually—are transported across oceans.⁵ Some estimate that the cost of the documentation to process and administer these goods can reach about 20% of the actual physical transportation costs.⁶

One of the cost drivers is paperwork shuffled back and forth between shippers, receivers, and customs agents—paperwork that could be eliminated with blockchain technology. But that's not the only potential savings. Like many industries, shipping relies on brokers who are compensated for inserting trust into the equation.

³ Source: IBM and Maersk demo: Cross-border supply chain solution on blockchain, [<https://www.youtube.com/watch?v=tdhpYQCWnCW>], accessed February 2018.

⁴ Source: "Maersk and IBM Unveil First Industry-Wide Cross-Border Supply Chain Solution on Blockchain," IBM press release, March 5, 2017, on IBM website, [<http://www-03.ibm.com/press/us/en/pressrelease/51712.wss>], accessed February 2018.

⁵ Source: Ibid.; "IBM, Maersk bring blockchain to cargo shipping," Supply Chain Dive, January 17, 2018.

⁶ "Maersk and IBM to Form Joint Venture Applying Blockchain to Improve Global Trade and Digitize Supply Chains," Maersk press release, January 16, 2018, on Maersk website, [<https://www.maersk.com/press/press-release-archive/maersk-and-ibm-to-form-joint-venture>], accessed February 2018.

Currently, broker fees are among the most expensive variables in shipping costs: they earn a commission, but can also be the source of unwelcome delays and human errors. Solving the trust deficit through blockchain—instead of a human intermediary—could lower costs further still (*Display 5*). The World Economic Forum projects that minimizing barriers within the international supply chain could boost global trade by nearly 15%, while stimulating economies and creating jobs.

CURB APPEAL

Perhaps the best example of how blockchains might change daily life are real estate registries. Today, when you buy real estate you take out title insurance to protect against the possibility that the person selling you the property doesn't truly own it, or that liens against the property could subsequently emerge. What's missing is an accurate and tamper-resistant register of who owns each parcel of real estate today along with any valid liens, and how those parcels change hands over time.

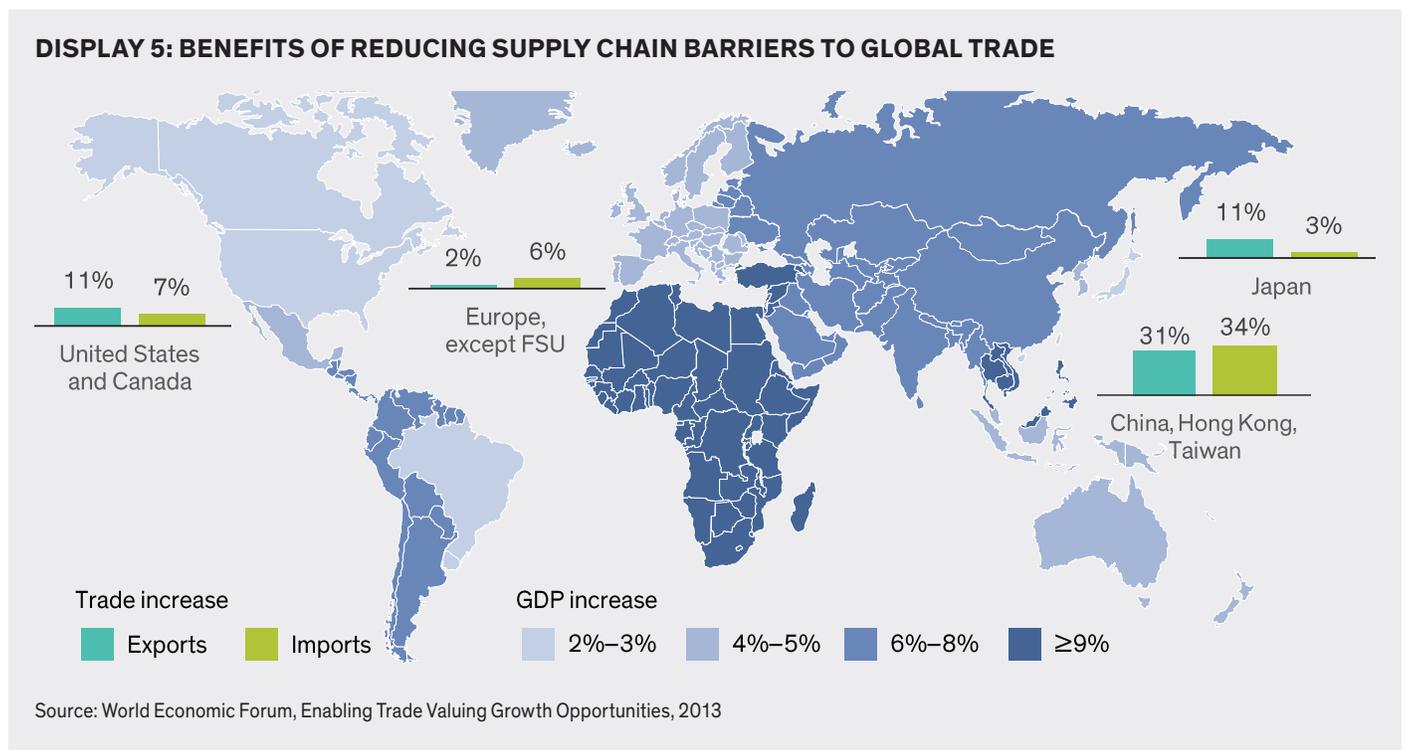
With blockchain, we can solve this problem once and for all—a possibility that's already been embraced in Sweden. The country's

four-century-old land mapping and registration authority is in the lead to become the first government agency to experiment with blockchain technology for property sales. While hurdles remain, proponents are attracted to the potential time savings and facility for transactions where one party is abroad.

BLOCKCHAIN'S INVESTMENT IMPLICATIONS?

Blockchain will likely prove to be ground-breaking for many industries. A host of blockchain applications are being proposed today, but not all will stand the test of time. Some investors are pursuing opportunities in the providers of infrastructure for cryptocurrency systems and blockchain implementations.

We think the real key to investment success will be finding those applications that truly fill a widespread need—one that brings together fragmented groups with different data systems, business processes, and no reason to trust one another, but who nonetheless wish to do business. Those investors who identify these opportunities, and the first movers who can bring these groups together around blockchains, will be richly rewarded.



CRYPTOCURRENCIES AND CRITICAL THINKING

Warren Buffett has warned of the “extraordinary excesses that can be created by combining an initially sensible thesis with well-publicized rising prices.” In these situations, “an army of originally skeptical investors” can succumb “to the ‘proof’ delivered by the market.”⁷ This phenomenon appears to have taken hold in the world of cryptocurrencies.

We remain skeptical of some of the rationales for cryptocurrencies’ elevated prices. For instance, some investors have proposed treating the marginal cost required to mine the next bitcoin (i.e., datacenter, networking, and energy costs) as a measure of its fair value. To us, this logic seems circular. The value of the bitcoin reward that miners receive for processing transactions is derived from Bitcoin’s price. If the price is \$1, very few miners will be active and very little electricity will be consumed. If the price is \$19,000 the reverse will occur. Hence, the cost to mine a bitcoin is itself a function of its price.

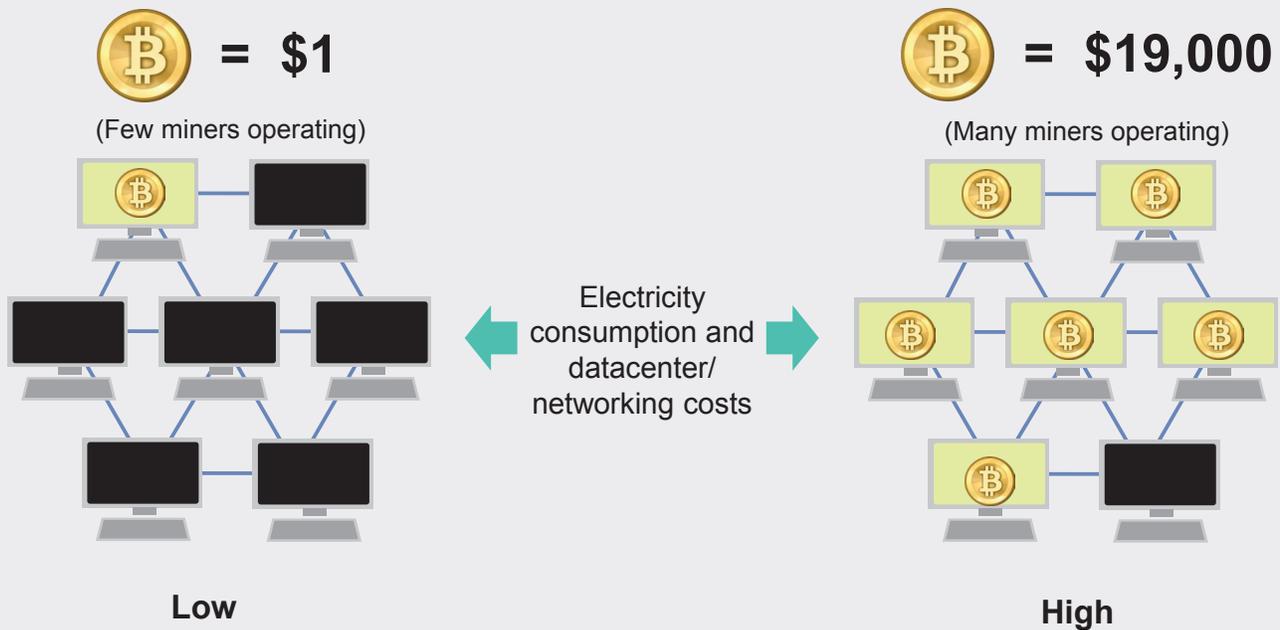
Others attempt to explain Bitcoin’s price by valuing the network as a payment system. This is done by multiplying the average transaction value by the number of possible unique connections between bitcoin holders. In practice, however, network members only interact with a

fraction of other members (just as Facebook users only interact with their friends and family—not every Facebook user around the world). And, most transactions don’t use the network as a payment system, but to speculate on future price increases. These shortcomings may explain why the theory has only accounted for Bitcoin price changes over certain periods, while falling short in others.

Some advocates suggest that cryptocurrencies might replace existing fiat currencies someday. We consider this extremely unlikely. Early cryptocurrency systems were not designed for this purpose, as evidenced by their inherently deflationary supply caps. Plus, Greece’s recent woes offer a cautionary tale: By adopting the euro, Greece lost control, borrowed too much, and today its lenders dictate taxes and government spending. Seeing this unfold makes it inconceivable that large debtor countries like the US, Japan, or the UK would surrender control of their currencies, too.

Ultimately, we remain dubious of some of the less-exacting analysis that tends to surround cryptocurrencies. Blockchain, on the other hand, holds considerable promise. In the end, deep research can bring clarity while avoiding crowd following.

DISPLAY 6: COST TO “MINE” A SINGLE BITCOIN INFLUENCED BY PRICE



Source: AB

⁷ Berkshire Hathaway Letter to Shareholders 2011.

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