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Bitcoin: The Future of Digital Payments?

Far from a mere libertarian fairy tale or a simple Silicon Valley exercise in hype, Bitcoin offers a sweeping vista of opportunity to reimagine how the financial system can and should work in the Internet era, and a catalyst to reshape that system in ways that are more powerful for individuals and businesses alike.

— Marc Andreessen¹

If I can't put it in my pocket, I have some reservations about that. . . . I do not think it fits the definition of money, which has been around for 6000 years. People want to see something they can know what it is, they can define it, touch it and put in their pocket.

— Ron Paul²

In May 2014, five and a half years after Satoshi Nakamoto had published a paper that proposed Bitcoin,³ the virtual currency's future was unclear. Bitcoin advocates pointed out that the past year had been a breakout period. The value of a single bitcoin^a had appreciated from \$13 in early January 2013 to \$438 16 months later (see **Exhibit 1**), and the value of all bitcoins in circulation had grown from \$141 million to \$5.6 billion.⁴ During that same time, venture capital firms (VCs) had invested \$147 million in Bitcoin-related startups.⁵ Coinbase, one of the leading firms in the Bitcoin ecosystem and a company often compared to PayPal, had grown the number of consumers using its Bitcoin "wallet" from just under 13,000 at the beginning of 2013 to over 1 million just 14 months later.⁶ Overstock.com, a major Internet retailer known for its deep discounts, reported \$1 million of bitcoin-denominated sales in its first month of accepting the digital currency (the company's annual revenues were about \$1.3 billion).⁷

On the other hand, skeptics were quick to point out that Bitcoin's rise had been accompanied by significant setbacks and negative publicity. The value of a single bitcoin had peaked at \$1,126 on November 30, 2013, and had since fallen 61% to \$438 just five months later.⁸ In October 2013, the FBI shut down Silk Road, an online marketplace for illegal products and services, on which transactions were exclusively conducted in bitcoin.⁹ In February 2014, Mt. Gox, a once-dominant Bitcoin exchange, went bankrupt after reporting that it had lost roughly 750,000 of its users' bitcoins and 100,000 of its own, representing almost half a billion USD.¹⁰ China, India, and Russia had all

^a Following common practice in the industry, "Bitcoin" (with a capital "B") refers to the technology and its ecosystem, while "bitcoin" (with a lower case "b") refers to the currency and its units.

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outlawed or severely constrained the use of Bitcoin within their borders, and a U.S. senator had demanded that government regulators outlaw Bitcoin, noting it was “unregulated and unstable, and has been used in illicit activity, including drug trafficking and money laundering.”¹¹ Although a complete ban on Bitcoin in the U.S. appeared unlikely in the near future, several executives from Bitcoin companies had already been arrested on money-laundering charges, which exacerbated perceptions of the legal ambiguity surrounding the digital currency.¹² Furthermore, the number of daily Bitcoin transactions had remained roughly flat over the last 12 months at approximately 68,000 (see **Exhibit 2**).¹³ To some, bitcoin looked like a niche currency used largely by libertarians who disliked central banks, and by purchasers of illicit goods who placed a premium on anonymity.

Established Digital Payment Systems

Credit and Debit Cards

While a credit card transaction appeared simple to a consumer, a complex network of intermediaries made credit card transactions possible. Consumers obtained credit cards from card issuers such as Bank of America, Capital One, and Citibank. Merchants processed credit cards through relationships with acquirers, which processed charges, obtained authorizations, and remitted payments. Between issuers and acquirers sat the credit card network, e.g., Visa or MasterCard or Discover, setting certain policies that applied throughout the system. The parties communicated through standardized electronic systems to confirm a consumer’s ability to make a purchase, to report and describe purchases, and to transfer funds appropriately. American Express was different, in that it operated a proprietary credit card network in which it was the only issuer and acquirer. In contrast, Visa and MasterCard had thousands of issuers and acquirers (see **Exhibit 3**).

MasterCard and Visa had been founded as nonprofit associations by their member banks, but became for-profit corporations in their respective IPOs in 2006 and 2008. American Express had been a for-profit corporation since its inception.

At the end of 2012, Visa had 277 million U.S. credit cards in circulation (49% market share), followed by MasterCard with 178 million (31%), Discover with 61 million (11%), and American Express with 52 million (9%). Visa also led in purchase volume with a 44% share, followed by American Express (27%), MasterCard (24%), and Discover (5%). Total credit card purchase volume was \$2.2 trillion in 2012.¹⁴

For consumers, paying by credit card was largely considered “free”: only about a quarter of all credit cards carried annual fees.¹⁵ Cards added fees for late payments or exceeding a credit limit, but careful consumers could avoid most of these fees.

To accept credit cards, merchants paid “discount fees,” which were deducted from the consumers’ payments and were shared between three parties: card associations (Visa or MasterCard), card issuers, and merchant acquirers. American Express did not share its fees with anyone else. These discount fees—negotiated between merchants and acquirers—were deducted from the consumer’s payment. Typical fees ranged from 1.5% to 3%. For small merchants, fixed costs (such as equipment and monthly minimums) could push fees as high as 5%.¹⁶

For consumers, credit cards presented four major benefits:

- **Delayed payment.** Consumers typically had 20 to 30 days after the close of a billing period to pay their bills.

- **Revolving credit.** Rather than pay a bill in full, a consumer could make a small minimum payment and defer additional amounts. Credit card interest rates were higher than some other sources of funds (such as home equity loans); however, a credit card's revolving credit feature avoided many of the transaction costs, delays, and risks associated with other forms of borrowing.¹⁷
- **Rewards.** Many cards offered consumers bonuses proportional to the amount they spent. Typical bonuses included frequent flyer miles, cash refunds, and merchandise credits.
- **Consumer protection.** The 1986 amendments to the Truth in Lending Act (TILA) granted substantial rights to consumers paying by credit card, and card issuers' policies extended these rights further. If a charge was made without a consumer's authorization (e.g., after the card was stolen), or if a consumer had any other defense that would be valid against the underlying merchant (e.g., merchandise not as described), the consumer did not have to pay any resulting charges. Furthermore, a consumer did not have to pay a disputed charge while the charge was under investigation.¹⁸

Credit cards also offered benefits to merchants:

- **Fast payment.** When a consumer paid by credit card, the resulting funds ordinarily appeared in the merchant's account in two to three days, which was faster than checks.¹⁹
- **Assurance of payment.** For ordinary in-person transactions, a merchant could be confident of receiving payment if the merchant swiped the consumer's card and obtained electronic authorization from the credit card network. Even if the card was stolen, the merchant was still paid. (By contrast, mail-order, Internet, and other card-not-present transactions were subject to the opposite liability rule: if a card-not-present charge turned out to be unauthorized, the merchant did not receive payment from the card network – even when the merchant had already shipped the ordered merchandise.)
- **Increased consumer spending.** Credit card networks and merchants observed that consumers who paid by credit card spent more than those who paid cash. Because credit cards allowed consumers to delay or finance payment, they also likely induced additional spending. Visa told would-be merchants that "the average ticket for Visa purchases is considerably higher than cash."²⁰

While debit cards appeared very similar to credit cards (they were the same size, served the same payment function, and often carried the same Visa or MasterCard logo), they functioned quite differently. Unlike credit cards, debit cards withdrew funds from a consumer's bank account immediately. Many debit cards offered no rewards for usage and those that did tended to offer far less than the 1% or more that was common among credit cards.

Consumers liked debit cards because they offered a simple way to avoid going into debt (a transaction would be denied if the consumer's bank account lacked sufficient funds) and because there were no monthly bills to pay. For merchants, the appeal of debit cards was the lower transaction fees associated with them. The fee charged to merchants depended upon whether, after swiping the debit card, the consumer signed a sales receipt or entered a personal identification number (PIN). Fees on signature-based debit cards were almost as high as those of credit cards, whereas fees for PIN-based transactions were capped by the Federal Reserve at just \$0.22 plus 0.05% of the transaction amount.

PayPal

Founded in 1999 and acquired by eBay in 2002, PayPal was viewed as the dominant alternative to credit cards for digital payment on the Internet. PayPal enabled both person-to-person money transfers and person-to-business payments for goods and services. Despite being over 15 years old, PayPal continued to expand rapidly: during 2013, the total transaction volume processed by PayPal was \$180 billion (up 24% relative to the previous year), and PayPal's revenues were \$6.6 billion (up 20% relative to the previous year).²¹ In early May 2014, PayPal had 148 million active registered accounts, and over half a million websites accepted PayPal for payment.²²

When a consumer purchased a product from a merchant using PayPal, the company charged merchants a fee of 2.9% plus \$0.30 per transaction, declining to 2.2% plus \$0.30 per transaction for merchants with large monthly sales volumes.²³ Consumers did not incur a fee when purchasing from a merchant using PayPal and could fund their PayPal accounts using their checking accounts or credit or debit cards.

Since January 2014, speculation had been rampant that PayPal would offer some level of support for Bitcoin, at least in the form of accepting Bitcoin deposits into a PayPal account.²⁴

Others

Google Wallet In September 2011, Google had launched a mobile payment application called Wallet that used near-field communication (NFC) hardware on Android smartphones.²⁵ The application allowed users to store credit and debit cards, loyalty cards, and gift cards in a single digital account that could be used to pay at participating online merchants, as well as some physical stores. Although Google invested over \$300 million in developing the service, Google Wallet met with limited adoption—the app had been downloaded fewer than 10 million times after two years.²⁶ Furthermore, several top executives from Google Wallet left the company.²⁷

In spite of the setbacks, Google continued its efforts to make Wallet appealing for merchants and consumers. In 2013, Google Wallet was enhanced with Instant Buy, an API that offered faster checkout service to merchant sites and apps. And Google also integrated Wallet with Gmail so that users could send each other money using their e-mail accounts.²⁸

Amazon Payments In August 2007, Amazon announced Amazon Flexible Payments Service to compete directly with PayPal.²⁹ Amazon Payments' fees were similar to those of PayPal: 2.9% plus \$0.30 per transaction, declining to 1.9% plus \$0.30 (Amazon) or 2.2% plus \$0.30 (PayPal) per transaction for merchants with high monthly transaction volumes.³⁰

Since Amazon had credit card information on file for all of its 215 million Amazon.com customers, CEO Jeff Bezos felt that digital payments was an area in which the company ought to be able to succeed, and he had been pushing the team to "go faster."³¹ Despite its advantage, Amazon Payments had struggled to gain traction, with fewer than 1,000 participating websites by 2014.³²

Apple As of May 2014, Apple did not offer a digital payments product, but widespread speculation predicted the company's move into the digital payments market, leveraging iTunes' 800 million accounts, each of which had a credit card on file.³³

Bitcoin and Its Ecosystem

On October 31, 2008, Satoshi Nakamoto, a pseudonym used by a person or a group of people,^b published a paper proposing the Bitcoin protocol, describing it as “a new electronic cash system that’s fully peer-to-peer, with no trusted third-party.”³⁴

Technology

The critical invention underlying Bitcoin was that no central party was required to verify the validity of transactions. Bitcoin was, in this way, similar to cash or gold. Instead of having a trusted third party fulfill this verification role (e.g., the issuer for credit cards, PayPal, or Amazon for their respective digital payment products), Bitcoin relied on an open, distributed network of computers and cryptographic algorithms to confirm the validity of transactions.

A shared, public ledger (called the **blockchain**) recorded the number of bitcoins possessed by each **address**, which was a long, unique number. Individual users could create as many addresses as they wished in order to protect their privacy (there was no requirement to identify the user of any given address).³⁵ Each address was protected by a lock (called a **public key**). To transfer possession of bitcoins to another address (i.e., to pay someone in bitcoin), the payer had to prove ownership of those bitcoins, which could be done by proving possession of a **private key** that alone was able to unlock the public key for the bitcoins in question. Proof of the transfer of ownership—i.e., of the validity of the private key that unlocked the public key—was verified by an open, distributed network of computers (called **miners**).³⁶ A transaction was considered valid when a significant majority of miners all independently verified the transaction and collectively updated the blockchain. Thus, the basis of trust was distributed consensus rather than an identifiable third-party entity (e.g., a central bank).

To incentivize users to invest in the computing infrastructure necessary to verify transactions, miners were rewarded with bitcoins. After a block of many bitcoin transactions had been validated and added to the blockchain by a consensus of miners, the miners who had done the validation work were rewarded with newly created (or “minted”) bitcoins. Miners could also be compensated if the sender of bitcoin chose to attach an optional miner’s fee to the transaction. A sender might do so in order to incentivize miners to validate the transaction more quickly.³⁷

Miners were rewarded with a predetermined number of newly created bitcoins, and bitcoins were never removed from circulation. As a result, the Bitcoin algorithm determined in a predictable manner the number of bitcoins that would be in circulation given the total number of transactions conducted up to a certain point in time. As of May 2014, there were over 12.7 million bitcoins in circulation, and miners were rewarded with 25 bitcoins for each block (or set of Bitcoin transactions) added to the blockchain. The reward had started at 50 bitcoins per block, dropped to 25 after the number of bitcoins in circulation reached 10.5 million (50% of 21 million), and would be halved again to 12.5 once 15.75 million bitcoins (75%) had come into circulation. This pattern would continue until the total number of bitcoins in circulation asymptotically converged to 21 million.³⁸

Some economists argued that this predetermined money supply, which increased at a diminishing rate, caused Bitcoin to be a deflationary currency.³⁹ As an example, one of the earliest recorded

^b The identity of Nakamoto remained somewhat of a mystery. The most prominent speculation came in the form of a *Newsweek* cover story claiming that a man residing in Temple City, California, named Dorian Prentice Satoshi Nakamoto was the face behind Bitcoin. However, Dorian “unconditionally den[ied]” the report, claiming he had never heard of Bitcoin until mid-February 2014. Source: Leah McGrath Goodman, “The Face Behind Bitcoin,” *Newsweek*, March 6, 2014.

commercial Bitcoin transactions had occurred on May 22, 2010, when a Bitcoin enthusiast had paid 10,000 bitcoins for pizza worth about \$25.⁴⁰ Nearly four years later (on May 3, 2014), 10,000 bitcoins were worth approximately \$4.4 million. Economist Peter Coy created a Bitcoin Consumer Price Index that mirrored the U.S. Bureau of Labor Statistics' Consumer Price Index, and showed that during the first 11 months of 2013, the price of goods denominated in bitcoin dropped an astonishing 98.5%. By comparison, prices denominated in USD had never dropped by more than 10%-15% a year during the Great Depression.⁴¹

Critics of Bitcoin claimed that this unprecedented deflation incentivized hoarding and speculation: "Why spend bitcoins today when they might be worth much more tomorrow?"⁴² As of May 2014, over 94% of all bitcoins in circulation, worth a combined total of over \$5.5 billion, were held by just 0.33% of all Bitcoin addresses.⁴³ At that time, there were approximately 12.7 million bitcoins in existence, but researchers estimated that 64% of all bitcoins had never once been spent, implying that the effective number of bitcoins in circulation was closer to 4.5 million.⁴⁴

Wallets

A consumer's Bitcoin wallet was to Bitcoin what a physical wallet was to cash. Consumers could store all of their bitcoins (possibly from multiple addresses) in their digital wallets. The wallet was software that handled the details specified in the Bitcoin protocol and was responsible for keeping the private keys secret. Most Bitcoin wallets also performed for Bitcoin the same function that magnetic stripes performed for credit cards: they simplified and sped up the transaction process.

Since Bitcoin was open source, anyone could create a wallet simply by implementing the Bitcoin protocol. Coinbase, a prominent startup that had raised over \$31 million from investors like Andreessen Horowitz and Union Square Ventures, offered a cloud-based Bitcoin wallet with easy support for Bitcoin payments on the web and via an Android app.^{45,46} (Coinbase had also offered an iPhone app, but after less than four weeks in the App Store, Apple removed the app. This furthered speculation that Apple planned to enter the mobile payments market.⁴⁷) Over 1.2 million consumers had created Coinbase accounts by May 2014.⁴⁸ Coinbase charged its wallet users a transaction fee of about 1% for converting between bitcoin and a fiat currency (e.g., U.S. dollars).⁴⁹ Coinbase wallet users could transfer bitcoins to other users for free, regardless of whether recipients had their wallets with Coinbase.

Circle, a prominent startup founded by serial entrepreneur Jeremy Allaire, had also announced its forthcoming consumer wallet, which would be entirely free to consumers while providing enhanced security features, telephone support, and theft insurance.

Some consumers did not want to store their Bitcoin private keys (their sole means of proving ownership of their bitcoins) in the cloud, often for security or anonymity reasons. As a result, some Bitcoin wallets could be installed on a user's personal computer, where they stored the user's private keys and the bitcoins protected by those keys. Two of the most popular of these wallets were MultiBit⁵⁰ and Armory,⁵¹ both of which were open-source wallets available for Windows, Mac, and Linux.

To assuage consumers' security concerns, other companies offered "cold storage" services, i.e., the ability to store their Bitcoin private keys on servers not connected to the Internet. This made it all but impossible for those bitcoins stored offline to be stolen even if the servers of a Bitcoin wallet provider were compromised. Cloud-based Bitcoin wallets emphasized that most of their customers' bitcoins were stored offline. Coinbase advertising claimed that "[u]p to 97% of customer funds are stored offline."⁵² Circle boasted its cold storage vaults, theft insurance, and physical security systems.⁵³

Xapo, a Bitcoin startup that had raised \$20 million in funding from firms such as Benchmark Capital, went much further: “We are the first Bitcoin vault fully protected and insured against hacking and bankruptcy.”⁵⁴ Xapo stored customers’ Bitcoin private keys encrypted on external drives spread across physical vaults protected by armed guards. For these services, Xapo charged customers annual fees equal to 0.12% of their funds.⁵⁵

Eaze, one of the most innovative Bitcoin wallets released, was built for Google Glass. The wallet was activated by aiming Glass’s camera at a QR code that contained the recipient’s Bitcoin address and then nodding twice to make the payment.⁵⁶

Given the decentralized nature of Bitcoin, it was difficult to determine how many Bitcoin wallets were in existence, but four of the largest Bitcoin wallet providers collectively reported having 5 million wallets as of April 2014.⁵⁷

Merchant Services

In order to accept Bitcoin as a means of payment, a merchant faced numerous challenges, including implementing the Bitcoin protocol to facilitate the consumer-to-merchant transfer of bitcoins, converting the bitcoins received into **fiat currency** (e.g., the US dollar) in a process known as “cashing out,” and integrating the Bitcoin purchase flow into an online shopping cart system or an in-store point-of-sale system (similar to the way PayPal had to be integrated). Numerous startups were providing services that enabled merchants to accept Bitcoin, similarly to the way acquirers enabled merchants to accept credit cards.

Merchants almost always quoted prices in fiat currency—say, \$100. If a consumer chose to pay a merchant with bitcoin, the merchant’s service provider quoted the price in bitcoin based on the current exchange rate available from one of the Bitcoin exchanges (see the “Exchanges” section below). The consumer could then use his or her Bitcoin wallet to transfer the specified amount of bitcoin to the merchant’s account, maintained by the service provider. The service provider then instantly converted the bitcoin transferred into fiat currency by automatically scouring the top exchanges for the most favorable exchange rate. Indeed, all merchant service providers offered instant “cash out,” and virtually all merchants took advantage of this offer, both because they paid their suppliers and employees in fiat currency and because they did not want to be exposed to Bitcoin currency risk.

Coinbase offered merchant services in addition to its consumer wallets. The company had signed up over 30,000 merchants, including Overstock.com, the Chicago-Sun Times, Reddit, CheapAir.com, and OkCupid.⁵⁸ Coinbase performed Bitcoin transactions at no cost but charged merchants 1% to cash out (convert their bitcoins into a fiat currency). To encourage merchants to select Coinbase, the company waived the 1% fee on the first \$1 million converted from Bitcoin.⁵⁹ Because Coinbase was both a consumer wallet and a provider of merchant services, the company was able to provide its wallet users with an optimized two-click checkout flow at all Coinbase merchants (see **Exhibit 4**).

In contrast to Coinbase, BitPay, which had raised \$30 million in Series A funding, focused exclusively on merchant services.⁶⁰ BitPay offered three primary plans with progressive levels of service (Professional, Business, and Enterprise); each of the plans had a flat, all-inclusive monthly fee, with no transaction fees or cash-out fees. BitPay also offered a fourth plan, Starter, designed to allow merchants to try BitPay before enrolling for a monthly plan. The Starter plan had no monthly fee but charged a 1% fee on each transaction.⁶¹ BitPay had signed up over 30,000 merchants, including TigerDirect, Virgin Galactic, WordPress, Shopify, and Gyft.

Like BitPay, BIPS, based in Copenhagen, Denmark, provided merchant services only, but focused on international Bitcoin transactions and supported conversions into over 150 fiat currencies. This made the service especially popular among merchants outside the U.S. BIPS charged no fee on the Bitcoin transaction itself, offered free conversion from bitcoin into euros for businesses anywhere in the European Union,⁶² and charged a flat rate (\$9 per transaction) to convert bitcoin into any non-local fiat currency.⁶³ See **Exhibit 5** for a comparison of the fee structures of BIPS, BitPay, and Coinbase.

Many other firms were eager to get into the Bitcoin merchant services business. For instance, merchant acquirer Stripe, known for its simple APIs that made integration with the merchant's website easy, had begun a beta test of Bitcoin on its platform.⁶⁴

Accepting Bitcoin provided several benefits to merchants relative to credit cards: transaction fee savings between 1% and 3%, the ability to accept micropayments in a cost-effective way, easy international payments, and reduced fraud and chargebacks.^c Many merchants chose to return to consumers the 1% to 3% they saved in credit card fees. For instance, mobile gift-card startup Gyft rewarded customers who used Bitcoin with Gyft Points worth 3% of their purchase value,⁶⁵ while Overstock.com gave consumers Club O points worth 1% of their Bitcoin purchases.⁶⁶

Some merchants viewed accepting Bitcoin as an important differentiator that could attract new customers. In April 2013, food delivery service Foodler became the first such service to adopt Bitcoin, which distinguished it from competitors Seamless and GrubHub.⁶⁷ Overstock.com reported that 60% of its customers who made purchases using Bitcoin were first-time customers.⁶⁸ In less than two months, Overstock.com had completed more than \$1 million of sales in bitcoin with an average order size greater than that of customers paying in USD.⁶⁹ Similarly, computer electronics retailer TigerDirect received \$500,000 worth of Bitcoin orders within three days of accepting the digital currency.⁷⁰

Exchanges

A number of exchanges had developed on which buyers and sellers of bitcoin could trade. During Bitcoin's early years, Mt. Gox, a Bitcoin exchange based in Tokyo, had grown to handle 70% of all Bitcoin trades.⁷¹ However, its platform proved unable to keep up with the growing demand for transactions; many customers complained that it took weeks or months for Mt. Gox to process customer requests to withdraw funds.⁷² As a result, Mt. Gox's market share gradually declined throughout 2013 until it became only the third-largest exchange.

On February 7, 2014, Mt. Gox stopped funding customer withdrawals entirely. As speculation became widespread that Mt. Gox was broke, many traders who held bitcoins with Mt. Gox sought to sell them on other exchanges. Within two weeks, the price of bitcoin on Mt. Gox fell below \$100, whereas it was about \$537 on other exchanges at the time.⁷³ At the end of February 2014, Mt. Gox filed for bankruptcy, admitting that it had frozen withdrawals because it had no money. The exchange claimed that 750,000 of its customers' bitcoins and 100,000 of its own bitcoins had vanished, worth a total of \$477 million, or 7% of the total bitcoins in circulation at the time.⁷⁴

^c Credit card issuers allowed consumers to contest a charge sometimes months after it occurred and to force the merchant to reverse the transaction, returning the funds to the consumer. Overstock.com CEO Patrick Byrne explained that retailers disliked chargebacks because a consumer could "order a television online, wait for it to arrive, then call Visa and tell them there's a dispute with the charge and not to pay it." Source: Dylan Love, "Overstock CEO: We're Doing \$20k-\$30k In Bitcoin Transactions Per Day," *Business Insider*, March 12, 2014, <http://www.businessinsider.com/bitcoin-and-overstock-2014-3>.

Mt. Gox's place was taken by three other exchanges: BTC-e, based in Bulgaria; Bitstamp, based in England; and Bitfinex, based in Hong Kong, which by May 2014 were processing 27%, 23%, and 22% of all Bitcoin trades, respectively.⁷⁵ Funding an account on an exchange with fiat currency and withdrawing fiat currency from an account could each take from one to five days.⁷⁶ Most exchanges charged similar transaction fees for trading (between 0.2% and 0.5%⁷⁷), but the price of bitcoin could vary significantly across exchanges. For example, on May 27, 2014, the bid/ask on one bitcoin was \$551/\$553 at BTC-e and \$567/\$569 at Bitstamp.⁷⁸

By late 2013, several firms had started providing physical Bitcoin ATMs, which essentially performed the function of a one-way exchange for users. Specifically, a user could insert physical fiat currency (e.g., \$20 bills) in the machine and buy bitcoins, which were then stored in the user's digital wallet of choice or recorded on a receipt that could be printed out with a private key corresponding to a Bitcoin address.⁷⁹

International Remittances

Many Bitcoin startups claimed a bright future disrupting the international remittances market, which was estimated at \$500 billion a year by the World Bank.⁸⁰ Western Union, which had over 500,000 agent locations and close to 10,000 employees worldwide, transferred \$82 billion in person-to-person payments during 2013.⁸¹ Western Union and MoneyGram, the two largest remittances providers, charged fees averaging about 8.5% of the total amount being transferred, and the recipient often had to wait days before the money was available.⁸²

Bitcoin-based remittances startups like Kipochi and BitPesa promised to make remittances easier and faster. Kipochi, which targeted remittances to African nations, created a Bitcoin wallet that required nothing more than SMS and a feature phone to use: "We do that by modeling it very much on how mobile money systems work in Africa. There, you can send money with your mobile number[;] if you send money to someone, a wallet gets created in the background and [they] can just access it. So, there's no sign-up," said Kipochi cofounder Pelle Braendgaard.⁸³

In fact, Kipochi had integrated with the highly successful Kenyan mobile money service M-Pesa. Users could easily purchase bitcoin with their M-Pesa balance or sell bitcoin and have the proceeds credited to their M-Pesa account.⁸⁴ Thus, a person in the U.S. could send money to a relative in Kenya in two steps: (1) create a Bitcoin wallet and convert the money to be sent into bitcoin; and (2) transfer the bitcoin to the Kenyan relative's Bitcoin wallet, identified by their phone number. The recipient could then claim the bitcoin simply by verifying ownership of their phone number via SMS and convert the incoming bitcoin into M-Pesa credits.

Braendgaard explained that Kipochi's next priority was to integrate with Bitcoin exchanges in other countries throughout Africa so that using fiat currency to purchase bitcoin was just as easy elsewhere in Africa as it was in Kenya.⁸⁵

BitPesa, an angel-funded startup that had not yet launched as of May 2014, promised end-to-end same-day delivery of funds for a flat 3% transaction fee.⁸⁶ Unlike Kipochi, which required the sender to exchange fiat currency for bitcoin prior to sending the funds to the receiver's Kipochi wallet, BitPesa promised to handle the end-to-end transfer of funds between fiat currencies—in effect making the use of Bitcoin almost entirely hidden from the sender and receiver.

The Currency of the Future?

A series of incidents had created a negative perception of bitcoin as a currency associated with illegal activities. The first prominent commercial use of Bitcoin had occurred on the marketplace Silk Road, launched in February 2011 and known as the “eBay for illegal drugs.” Silk Road provided complete anonymity for both buyers and sellers, in part by relying exclusively upon Bitcoin for payments. In October 2013, Silk Road was eventually shut down by the FBI, who also arrested its alleged owner.⁸⁷ Within a month of the February 2014 Mt. Gox collapse, the CEO of First Meta, a Bitcoin exchange, was found dead in a suspected suicide,⁸⁸ and Flexcoin, a cloud-based Bitcoin wallet service, shut down after reporting that it had been attacked by hackers who stole 896 bitcoins belonging to its customers, worth over \$500,000 at the time.⁸⁹

As a result of these and other events, Bitcoin had attracted significant regulatory scrutiny by governments around the world. On the positive side, Bitcoin’s single biggest regulatory breakthrough was a November 2013 hearing about the digital currency by the U.S. Senate Committee on Homeland Security and Governmental Affairs. Leading up to the hearing, Federal Reserve Chairman Ben Bernanke had written to the committee to explain that digital currencies like bitcoin “may hold long-term promise, particularly if the innovations promote a faster, more secure and more efficient payment system.”⁹⁰ During the hearing itself, several senior government law enforcement officials provided positive testimony about the need for the government to balance the potential for illicit activities with legitimate uses.⁹¹

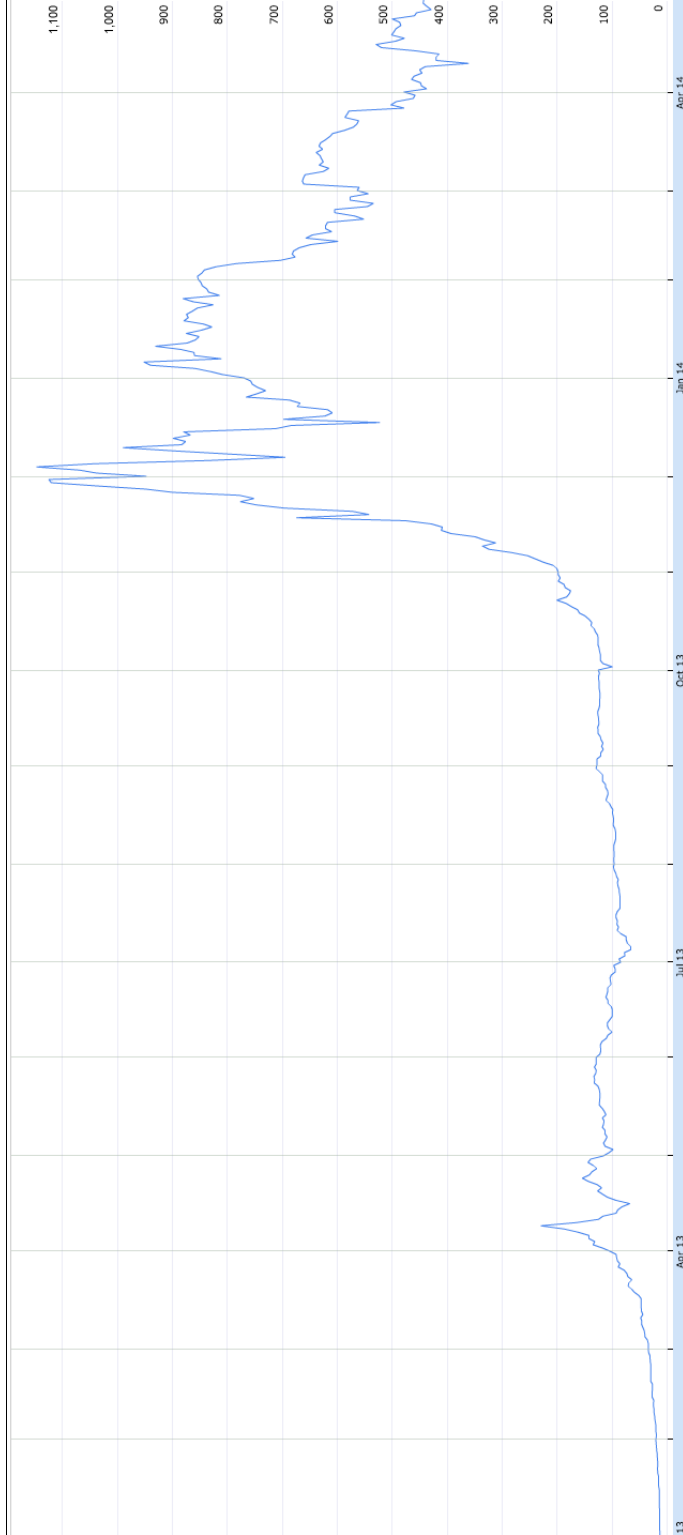
On the negative side, other governments issued warnings about and bans against the cryptocurrency. One day before Mt. Gox halted withdrawals, the Russian Prosecutor General’s Office declared the use of Bitcoin illegal.⁹² Four days later, the governor of India’s central bank questioned the stability and credibility of the virtual currency.⁹³ And during April 2014, three of China’s largest state-owned banks moved to forbid their account holders from engaging in Bitcoin transactions.^{94,95} These actions in China, viewed as having been instigated by the nation’s central bank, caused the value of bitcoin to drop over 10% as traders feared a wider crackdown against Bitcoin would ensue across China, which during 2013 had accounted for “more than half of the world’s trade in Bitcoin.”^{96,97}

Despite regulatory uncertainty that continued to hover around Bitcoin, many entrepreneurs and advocates saw a bright long-term future for digital currencies like bitcoin and focused their efforts on speeding up its adoption. For instance, two students in the MIT Bitcoin Club raised \$500,000 in donations from alumni and Bitcoin enthusiasts to give \$100 worth of bitcoin to each of MIT’s 4,528 undergraduate students enrolled for the fall of 2014.⁹⁸ The hope was that the sudden concentration of consumers with bitcoins to spend on MIT’s campus would incentivize local restaurants and retailers to accept the currency.

The alternative view was summarized by the *Weekly Standard*: after the Mt. Gox fiasco, it proclaimed that Bitcoin was “probably functionally finished as a serious hope of ever achieving mass acceptance as a currency.”⁹⁹

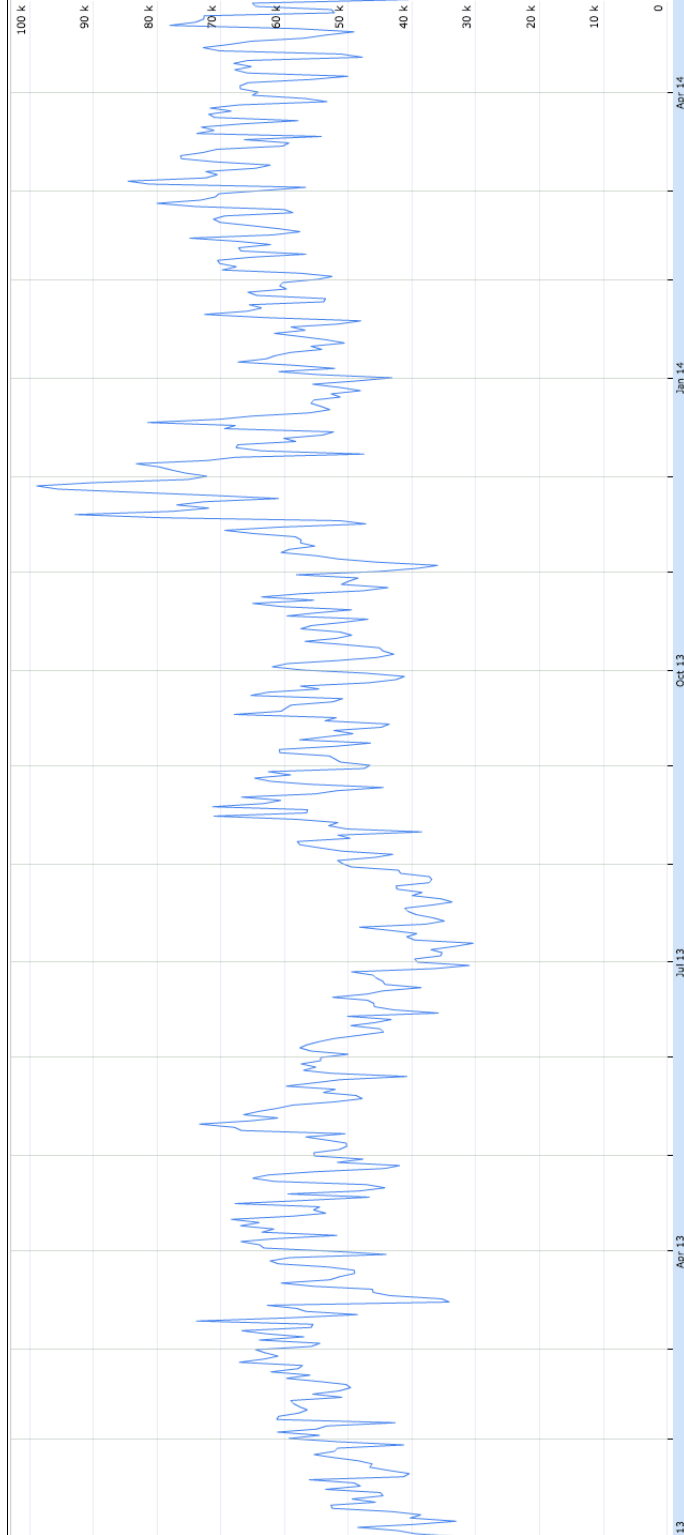
Widespread antipathy among businesses toward credit card processing fees meant they had ample incentives to adopt Bitcoin. But would consumers ever be convinced to make a massive switch from using credit cards to relying upon Bitcoin as a medium of exchange? If Bitcoin became mainstream, what type of competitive advantage would protect early Bitcoin firms like Coinbase, BitPay, and Kipochi against the almost certain entry into Bitcoin by established giants like PayPal, Google, Amazon, and Apple?

Exhibit 1 Price of a Bitcoin (USD)



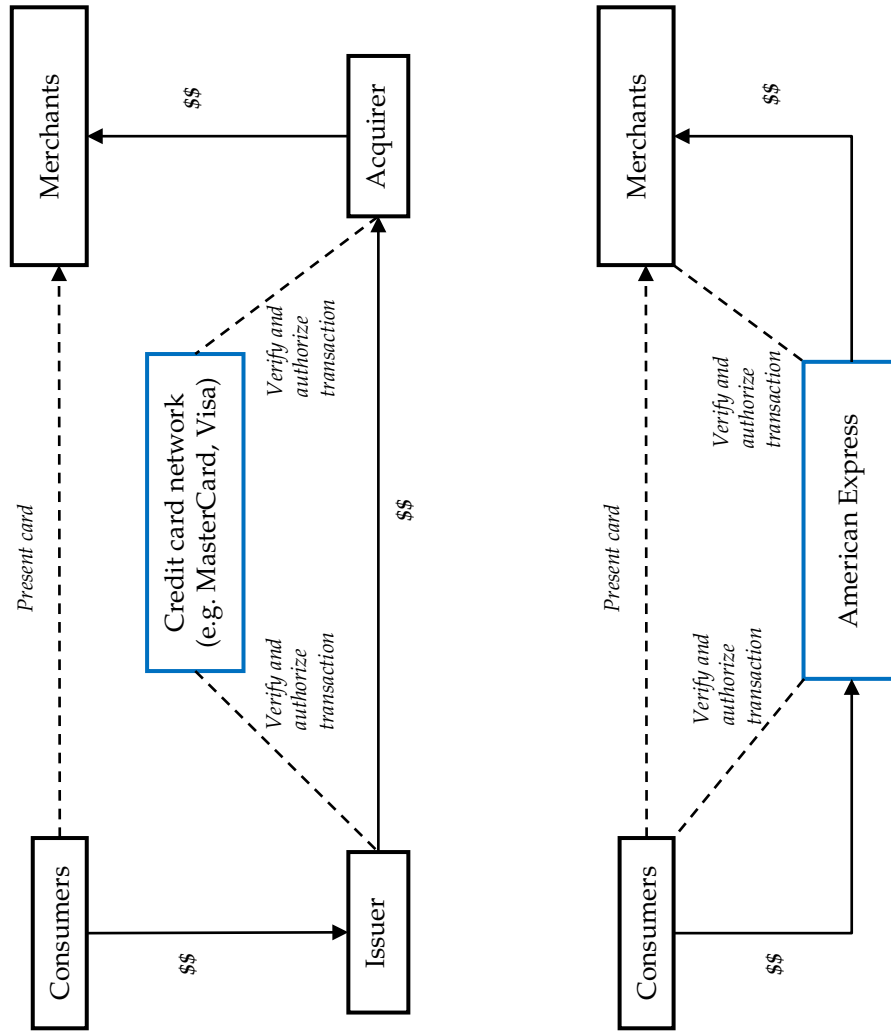
Source: "Bitcoin Price Index Chart" CoinDesk, <http://www.coindesk.com/price>, accessed May 1, 2014.

Exhibit 2 Number of Bitcoin Transactions per Day



Source: "Bitcoin - Daily Number of Transactions," CoinDesk, <http://www.coindesk.com/data/bitcoin-daily-transactions>, accessed May 1, 2014.

Exhibit 3 Credit Card Payment Flow – Networks (Discover, MasterCard, Visa) vs. American Express



Source: Casewriters.

Exhibit 4 Coinbase Optimized Checkout Flow

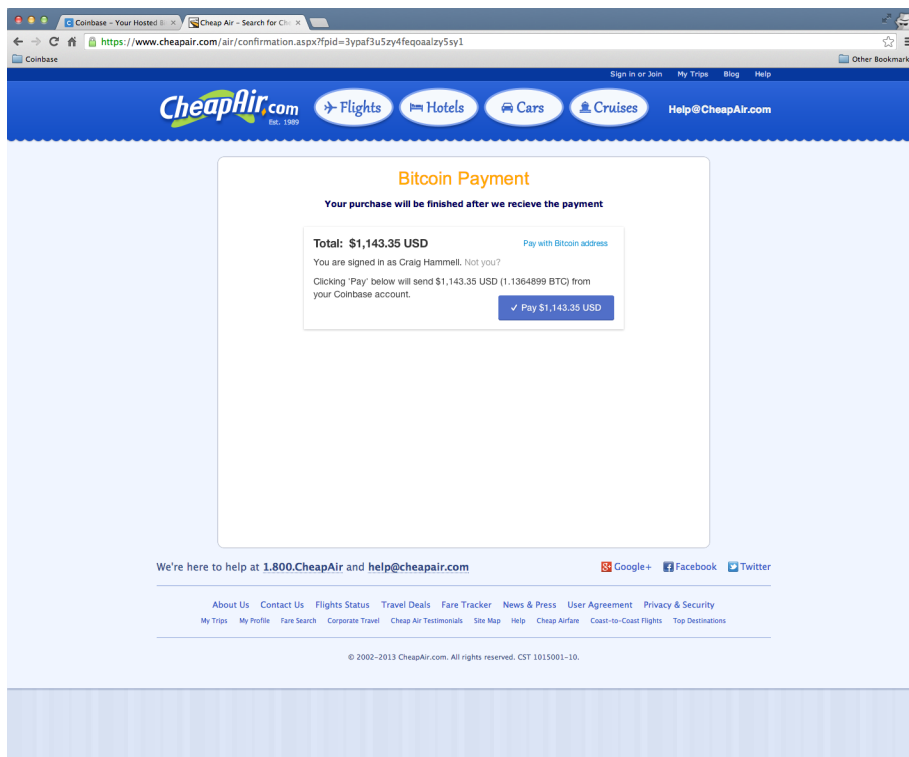
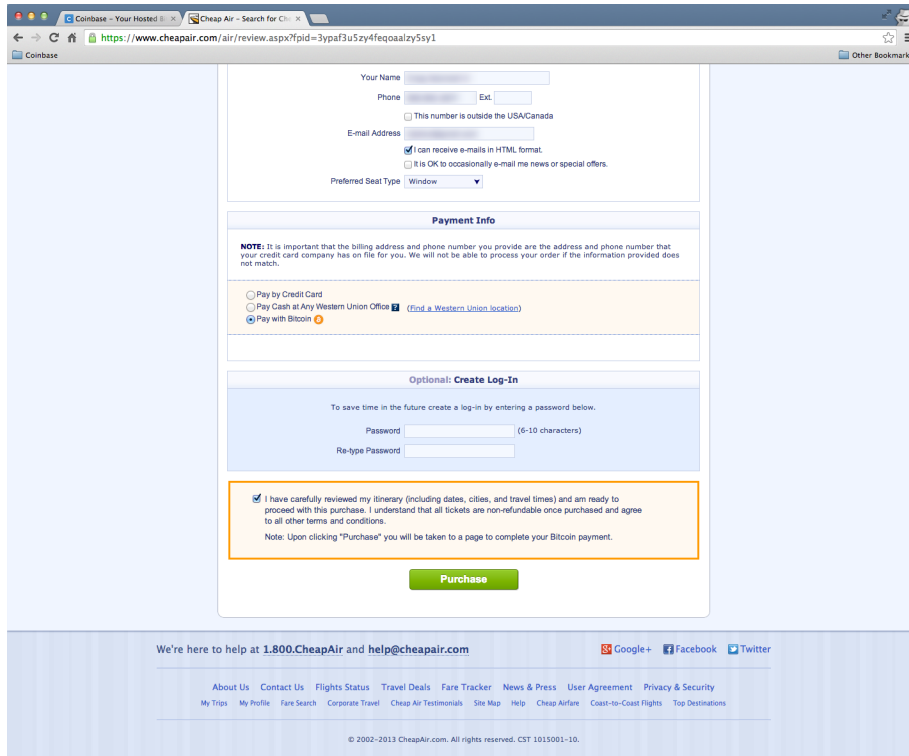
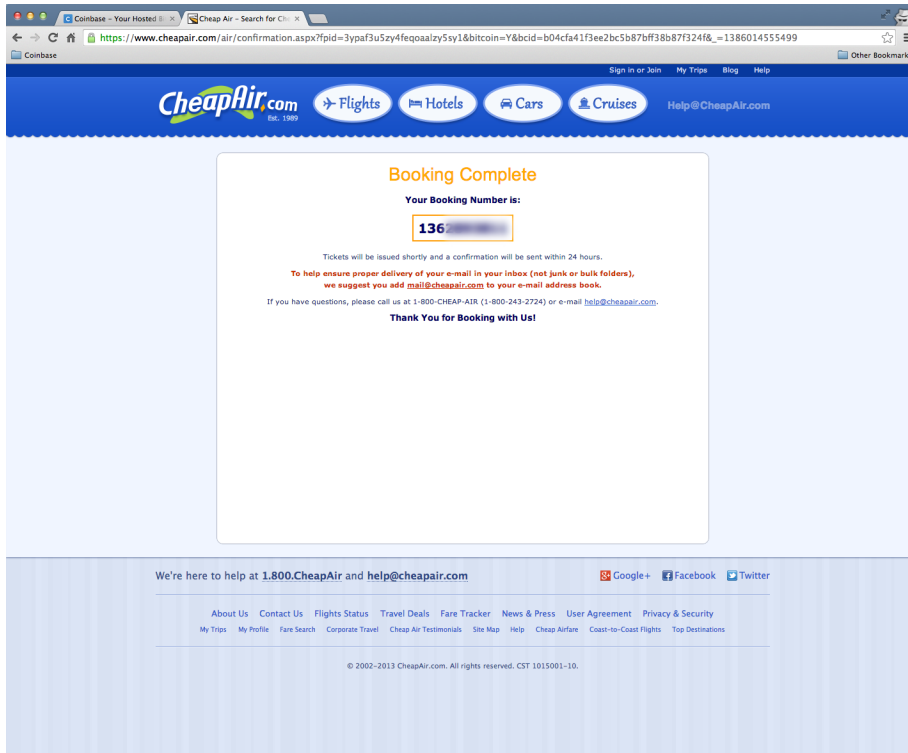


Exhibit 4 (continued)



Source: "Bitcoin Payment Examples," Coinbase, https://coinbase.com/docs/merchant_tools/examples, accessed May 3, 2014.

Exhibit 5 Fee Structure of BIPS, BitPay, and Coinbase

“Transaction Fee” refers to the fee charged to the merchant to transfer bitcoin from the consumer’s wallet to the merchant’s wallet, and “Withdrawal Fee” refers to the fee charged to the merchant to convert bitcoin into fiat currency.

BIPS

Withdrawal Method	Withdrawal Fee
Domestic	\$0
International	\$9.00
IBAN (International Bank Account Number)	\$3.00
PayPal	11%
SEPA*	\$0

*SEPA (Single Euro Payments Area) is a payment integration initiative of the European Union for simplification of bank transfers denominated in euros.

BitPay

Plan Name	Volume	Monthly Fee	Transaction Fee	Withdrawal Fee
Starter	Any	None	1%	None
Professional	Up to \$10,000 daily	\$30	None	None
Business	Up to \$100,000 daily	\$300	None	None
Enterprise	Any	Contact BitPay	None	None

Coinbase

Monthly Volume	Monthly Fee	Transaction Fee	Withdrawal Fee
Any	None	None	1% (the first \$1 million over the lifetime of the merchant is free)

Sources: Casewriters, based on information from <https://bitpay.com/pricing> and <https://bips.me/pricing>, accessed May 1, 2014.

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