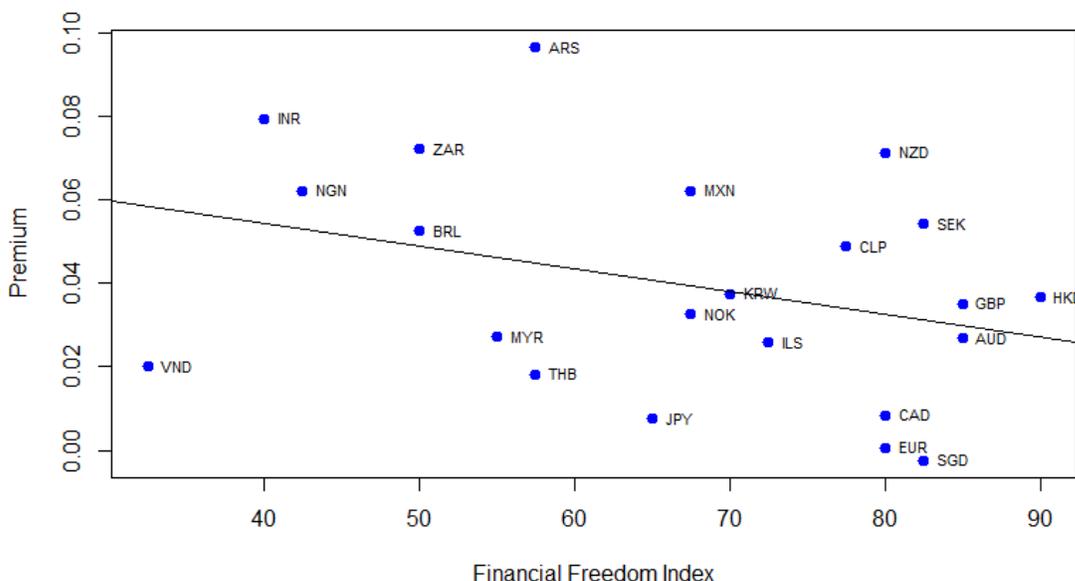


Figure 2. Bitcoin Premia and Financial Freedom: The bitcoin premium is measured as the median percentage price difference to the USD price from March 2017 to the end of February 2018. Bitcoin transaction prices are from bitcoincharts.com, foreign exchange data from the Federal Reserve Bank of St. Louis (where available) and OANDA otherwise. To measure financial freedom we average the to index components 'Investment freedom' and 'Financial Freedom' as published on a country level by the Heritage Foundation.



(i) risk (or the price volatility in our case), (ii) the international trading frictions, (iii) short-sale constraints, and (iv) opportunity cost (holding costs). For the first and the second factors, we find that the Kimchi premium has a significant positive relation to bitcoin price volatility and the capital control index, as mentioned before.⁵

For the third factor, there has been a large literature investigating the joint effect of short-sale restrictions and heterogeneous beliefs in the stock market (e.g. Miller (1997), Harrison and Kreps (1978), Chen, Hong, and Stein (2002), Scheinkman and Xiong (2003), and Hong, Scheinkman, and Xiong (2006)). Under a short-sale constraint, the optimists are more likely to be marginal buyers and the stock price tend to reflect optimists' valuation more than that of

on equity capital and so on.

⁵See, e.g. Edwards (1999) on the effectiveness of capital controls

if the ethereum premium (defined by the same way of the Kimchi premium) in South Korea would be lower than the Kimchi premium, one can undertake arbitrage by buying bitcoin in a U.S. exchange, sending it to a Korean exchange, selling the bitcoin to buy ethereum in the Korean exchange, sending those ethereum to the U.S. exchange, and selling those ethereum for a profit. Such a transaction would only involve crypto-currencies and hence not be subject to government fiat capital controls. We can apply similar arguments to any cases when the ethereum price difference is not equal to the bitcoin price difference in both countries.

We use the hourly closing price data in USD and KRW for Bitcoin (BTC), Ethereum (ETH), Litecoin(LTC), and Ripple (XRP) from CryptoDataDownload.com. For the KRW exchange Bithumb was used, and Kraken for the USD exchange. Exchanges were selected for ability to trade the desired cryptocurrencies, as well as volume, and the length of sample. Daily price for each cryptocurrency was calculated as the arithmetic mean of the hourly closing prices for each hour that day. The Kimchi premium for each cryptocurrency was then calculated as above for the main regressions. It should be noted that the trading days of January 11-13, 2018 are excluded from the sample as Kraken had a trading halt of approximately 48 hours due to a system upgrade and associated bugs which included those days. Results are robust to using a sample which utilizes Bitstamp data to replace those 3 days.

Consistent with the absence of arbitrage opportunities we find that premium differences across coins are very small. Table 5 shows that the average premiums across cryptocurrencies are very close to each other. The standard deviation tends to be higher if the premium is higher, which further mitigates the premium difference (when one wants to try arbitrage trading for such a small premium difference). Given that most exchanges in the world charge minimum 0.5% and up to 1-2% transaction costs, the premium differences are not enough to cover the the total transaction costs to execute the arbitrage. In addition, Table 6 shows that the correlation between the Kimchi premium and each cryptocurrency is very high. Similarly the pairwise correlation between all those premia are very high as shown by Table 7.

The results are consistent with our assumption of capital controls driving the Kimchi pre-

Table 4: Regression results The dependent variable is the premium for bitcoins with local currency (LC) versus US Dollars (USD) and is calculated: $(LCBTC_{\text{price in USD}} / (USDBTC_{\text{price}}) - 1)$, where the bitcoin price in USD is the mean price of all USD transactions on the Bitstamp exchange for that day. The bitcoin price in local currency is the median price of exchanges on bitcoincharts.com. Conversion from LC to USD is done using FX data from the St. Louis fed and using the OANDA daily average rate. The independent variables are defined as in Table 8.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bitcoin short-term volatility	0.013*** (0.001)	0.017*** (0.001)	0.018*** (0.001)	0.013*** (0.001)	0.017*** (0.001)	0.018*** (0.001)	0.013*** (0.001)
Blockchain median confirmation time	0.0004** (0.0002)		0.0004* (0.0002)	0.0004** (0.0002)		0.0004* (0.0002)	0.0004** (0.0002)
Mean blockchain transaction fee	0.001*** (0.0001)			0.001*** (0.0001)			0.001*** (0.0001)
Index of Economic Freedom		-0.001*** (0.0004)	-0.001*** (0.0004)	-0.001*** (0.0004)			
Economic Freedom Ranking					-0.022*** (0.005)	-0.022*** (0.005)	-0.022*** (0.005)
Constant	0.034*** (0.006)	0.110*** (0.026)	0.106*** (0.026)	0.108*** (0.027)	0.194*** (0.039)	0.190*** (0.038)	0.191*** (0.039)
Observations	11,628	11,628	11,628	11,628	11,628	11,628	11,628
Adjusted R ²	0.029	0.023	0.023	0.030	0.023	0.024	0.031

Note: *p<0.1; **p<0.05; ***p<0.01

pessimists. Based on this theoretical insight, Mei, Scheinkman, and Xiong (2009) investigate the price difference between the local A- and foreign B-share market in China. They show that A-share turnover had a significant and positive correlation with the A- and B-share price difference in the China market.⁶ Consistent with this stream of research we also find a positive relationship between the Kimchi premium and the bitcoin trading volume in Korean exchanges.

Finally, the literature on the cross-listed stock price difference shows that the price deviations are positively related to holding costs that impede arbitrage (Pontiff (2006), Gagnon and Karolyi (2010), and Strambaugh, Yu, and Yuan (2015)). There are several proxies for holding costs such as idiosyncratic risk, stock's dividend yield, and the interest rate. We will explore this angle in future versions of the paper.

2 Institutional background

2.1 Bitcoin microstructure

The microstructure of bitcoin markets stands out in many ways from traditional markets. Transactions, i.e. the transfer from one wallet to another wallet, get posted within the Bitcoin peer-to-peer network in the mem-pool, from where miners pick transactions to be mined into a block, which gets then added to the blockchain. Many exchanges require a certain number of confirmations to credit the Bitcoin to an account. A transaction with n confirmations means that this transaction has been included in a mined block and that there have been $n - 1$ subsequent blocks mined in the blockchain. Time delay arises from the time it takes for a transaction to be included in a mined block and from the time it takes to mine the required number of subsequent blocks. The time to be included in a block can vary substantially. The average confirmation

⁶There are other papers to study the price difference between the Chinese A- and B- share prices (e.g. Chakravarty, Sarkar, and Wu (1998) and Chan, Menkveld, and Yang (2008)). For example, Chan, Menkveld, and Yang (2008) investigate how information asymmetry affects on equity prices. The information asymmetry in the Bitcoin market matters in the world wide level, but it is unlikely to have specific impact on the Bitcoin premium in the Korean market.

Like our event? Scan the QR code below to join our community and receive the news news about events. Please make sure you scan the WeChat QR code or Whatsapp QR code to join our Webinar's Q and group chat. The wallet system has completed the function to scan the QR code and analyze the data of the QR code.

Step 2 - Enter the POA20 address or scan the user QR code to send funds from your wallet.

Step - Copy your POA network address or allow users to scan your QR code to receive a POA network token for your wallet.

Coindesk News, Apple's new smartwatch app, Lightning Web Wallet Bluewallet, allows users to receive Bitcoin via Lightning Payment Technology. Traders can use the smartwatch app to generate QR square barcodes, and the other party can use a smartphone scan to make payments. As of May 5.

Step 2 - Enter the POA network address or scan the QR code of the wallet you want to transfer funds.

Scan the QR code below and sign up for this event.

Scan QR Code for Number.

STEP 1: Please Scan the QR code to pay the deposit.

Scan QR Code to watch livestreaming.

Scan the QR code below to register for the CES Asia 2019 conference

One of lightning Technologies' enhancements is the ability to quickly scan QR codes and transfer funds directly from services to your wallet without the hassle of creating and ar

chiving invoices.

When Coinbase users scan TheWalletLink QR code using the Wallet app, they can use DApp anywhere, and their cryptocurrencies will be saved in their mobile wallets.

Apple SmartWatch's new app Lightning Web Wallet Bluewallet allows users to receive bitcoins via Lightning Payment technology. Traders can use the smartwatch app to generate QR square barcodes, and each other can use a smartphone scan to make payments. As of May 5, it can be officially downloaded from the iTunes Store.

At that time, customers will be able to scan the QR code printed on the store's product packaging to obtain detailed product origin information.

Scan the QR code below to sign up for the TC Hardware Battlefield.

Scan the chip using the VeChain Pro App or the Swell App.

Scan the QR code in the flyer / Click "Read More"

Scan the QR Code or click "Read More" at the bottom of the page.

Be displayed after users scan a QR code and before you can get a code to.

The QR code contains a simple case number. You can scan and connect to phone numbers using the apps available on Google Play and Apple App Stores. It scans nearby Wi-Fi signals and uses their relative strength to determine whether an individual has left home. The Stay Home Safe app has been criticized for not working properly and may not function properly.



subject to considerable delay. For example in Canada processing times for deposits and withdrawals can take several months. In part the delay is caused by banks' refusal to deal with crypto-currency companies. Quadriga, one of the two established exchanges in Canada has to rely on a Portuguese bank to process many of its fiat currency transfers.⁹

2.2 Capital Controls

On June 13, 2010, in the aftermath of the global financial crisis and the European sovereign debt crisis, Korea introduced capital controls that were revised several times since. The Korean foreign exchange transaction law has been very restrictive. According to the most recent law revision (valid since July 18th, 2017)¹⁰, an individual can send money up to 3,000 USD per transfer and up to 20,000 USD in total between January 1st and December 31st through a particular financial institution. The total maximum is limited to 50,000 USD a year through different institutions.¹¹ There are several alternative ways to send cash abroad. First, one can use a Korean credit card when buying Bitcoin at an exchange in the U.S.. However, the maximum amount of purchases outside of Korea is limited to 10,000 USD per year. In addition, this transaction is considered as commodity purchase, which means the buyer should pay customs on buying Bitcoin. One can send US dollars to someone (e.g. relatives or friends in the U.S.) who can help arbitrage trading through Paypal. In this case, however, Paypal automatically reports this transaction to the US Internal Revenue Service (IRS) and the IRS normally considers this money inflow to the receiver as taxable income if the transfer amount is sufficiently large or the transfers occur on a regular basis. In addition, many Korean lawyers¹² say that in the current South Korean law it is not very clear if transferring Bitcoins between a Korean exchange

⁹See article *'I just want my money back. Couple had \$100K wire stuck for months after trying to buy Bitcoin'*, GlobalNews, March 27, 2018.

¹⁰See the government website on small foreign remittance: http://www.mosf.go.kr/nw/nw/detailNesDtaView.do?searchBbsId1=&searchNttId1=MOSF_000000000009556&menuNo=4010100.

¹¹There are some exceptions. For example, the maximum per year is up to 100,000 USD for educational reasons such as tuition with proper evidence.

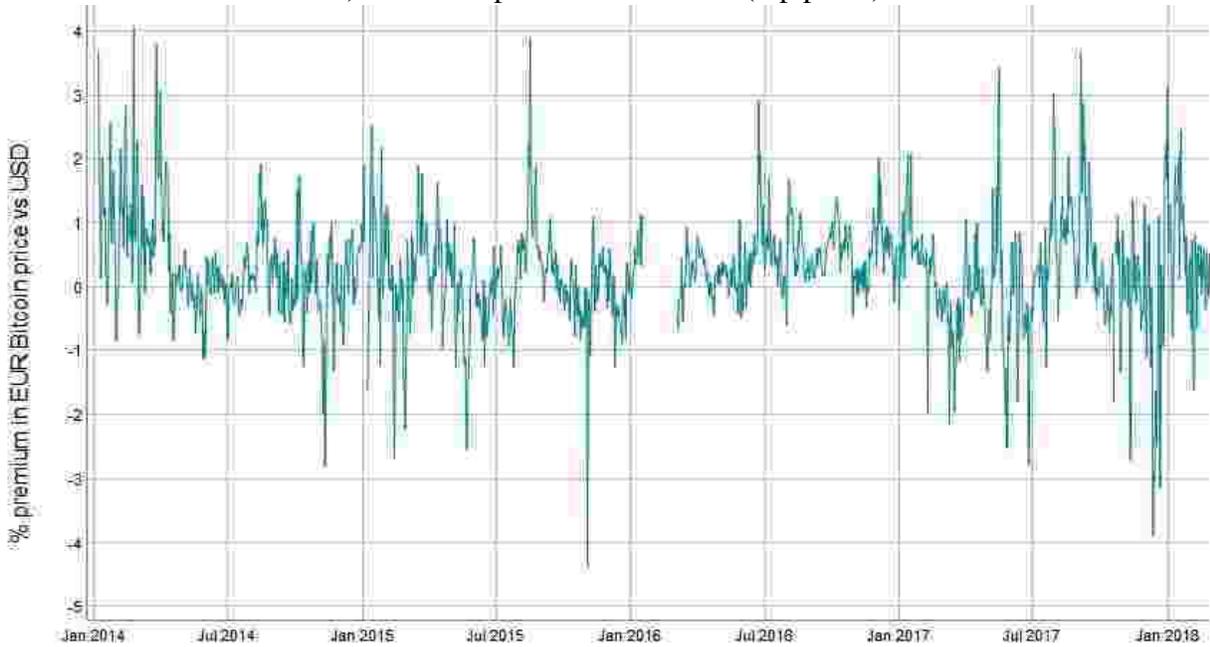
¹²See, e.g. <http://hongbyun.tistory.com/22>.

mium. If one of the other crypto currencies had no premium or a lower premium than Bitcoin arbitrageurs could use that currency to move funds out of Korea and complete the arbitrage. Since crypto-currencies are not subject to capital controls no arbitrage opportunities between crypto-currencies should be possible. This implies that all crypto currencies should have very similar premia. Similar to the logic with Bitcoin other crypto currencies can trade at a premium since the arbitrage is restricted because of the capital controls. The analysis shows that the Kimchi premium is therefore not something unique to Bitcoin but rather a result of Korea's capital controls that prevent arbitrageurs from aligning Korean prices with those of the world market.

Anecdotal evidence shows that traders in Korea are closely following the premia in different crypto-currencies. Figure 5 shows a typical cryptocurrency trading discussion website in South Korea. As seen in the screen shot and its description, Korean investors keep track of not only the Kimchi premium on the bitcoin but also other coin premiums. If they find one premium is significantly lower (or higher) than another premium, they would sense it as the signal that the corresponding coin is under- or over-valuated within the Korean market, which leads to push up or down the coin premium. Consequently, the coin premiums are more and less the same in each time, as seen in the green number inside each parenthesis in Columns 3 to 7 in the table in the figure. Traders also watch out the premiums across major Korean exchanges. This mechanism would be a main reason why the Korea premiums stays more and less the same across coins over time.

Figure 3. The Bitcoin EUR Premium: Bitcoins sometimes trade at a higher price even between relatively frictionless markets (here EUR vs. USD) The premium for purchasing bitcoins with Euros (EUR) versus US Dollars (USD) is calculated: $(\text{KRWBTC}_{\text{price in USD}})/(\text{USDBTC}_{\text{price}}) - 1$, where the bitcoin price in USD is the mean price of all USD transactions on the Bitstamp exchange for that day. The bitcoin price in EUR is similarly defined from the Kraken exchange. Conversion from EUR to USD is done using the OANDA daily average rate.

a) The EUR premium over time (top panel)



b) Distribution of the EUR premium (bottom panel)

