

# Cryptocurrency Regulations: Institutions and Financial Openness<sup>1</sup>

Jacinta Bernadette Rico Shirakawa<sup>†1</sup> and Upalat Korwatanasakul<sup>†2</sup>

## 仮想通貨規制： 制度と金融の開放性

白川ハシナベルナデット リコ・コーワタナサクン ウッパラット

Currently, cryptocurrency is at the frontier of financial development and its role and impact on the economy is highly debated among policymakers. Research on cryptocurrency in the field of economics primarily focus on examining determinants of cryptocurrency prices, cryptocurrency exchange rates, among others. So far, there are no studies specifically investigating the how economic and institutional factors influence the policy stance on cryptocurrency. This study aims to contribute to literature by bringing together two strands of literature—one examining cryptocurrency regulation and the other investigating financial development through institutional quality and financial openness. We compose an index of de jure openness to cryptocurrency in 218 countries, using current legal and regulatory status of cryptocurrency compiled in 2018. Then, we investigate potential institutional and macroeconomic factors which can affect cryptocurrency regulation using cross-sectional ordered probit model. Our results show effective governance institution is associated with a less restrictive regulatory stance on cryptocurrency. Meanwhile, financial openness is not found to be significant. Our results are robust to alternate specifications.

**Keywords:** Cryptocurrency, institutions, financial regulations, financial development, financial openness

**JEL Classifications:** E44, F36, G18, G28

### 1. Introduction

Currently at the frontier of financial development, cryptocurrency provides both opportunities and risks in financial markets. Cryptocurrency has driven a large interest in its early years. Accordingly, the market players involved in the cryptocurrency business has risen over the years (Farell, 2015). The new business model provided by cryptocurrency along with the exponential increases in the prices of cryptocurrency may have enticed investors to cryptocurrency, with many utilizing cryptocurrencies as a speculative asset to take advantage of the early gains. However, the subsequent crash in prices

<sup>†1</sup> Economist, International Monetary Fund, 1900 Pennsylvania Ave. NW, Washington DC, 20431, USA. Email: [jshirakawa@imf.org](mailto:jshirakawa@imf.org). This research was conducted while the author was with Waseda University, Japan and before she joined the International Monetary Fund (IMF).

<sup>†2</sup> Programme Manager (PhD), Research and Policy Analysis Cluster, ASEAN-Japan Centre, 6-17-19 Shimbashi, Minato-ku, Tokyo 105-0004, Japan. Email: [upalat@asean.or.jp](mailto:upalat@asean.or.jp)

<sup>1</sup> Views, findings, and conclusions expressed in this study are entirely of the authors and should not be attributed to the IMF, its Management, its Executive Directors, or the ASEAN-Japan Center.

provided a wake-up call to speculators dealing with cryptocurrency. Additionally, risks related to price manipulation in cryptocurrency markets are not unheard of (Gandal, et al., 2018).

Although many central banks issue warnings about the use of cryptocurrency and have explicitly denied its status as a currency, only few have banned its use as a financial asset. Policymakers are concerned about the low liquidity, the use of leverage, market risks from volatility, and operational risks of cryptocurrency (FSB, 2018). Many central banks emphasize that cryptocurrency is not legal tender and that users face the risk of unenforceability of cryptocurrency transactions. The Global Research Center (2018) compiled regulations on cryptocurrency and its report shows that, in countries where cryptocurrency is allowed, cryptocurrency can be legally traded as long as it follows existing rules or laws related to financial instruments. Regardless of the regulatory stance, policymakers are wary that cryptocurrency would be used for illegal activities, such as, money laundering, trade in illegal or controlled substances, or terrorism finance. Policymakers are also aware of the potential lack of consumer and investor protection. Deposit insurance for holders of cryptocurrency are limited and not supplied by domestic monetary authorities. The combination of its potential benefits as well as macroeconomic risks begs the question of what determines policy openness or aversion to cryptocurrency.

Research on cryptocurrency encompasses several fields of study from economics and finance to computer science and engineering as well as applied mathematics. The breadth of research field is not surprising given the nature of cryptocurrency as a financial innovation with roots from blockchain technology and uses cryptography intensively. Farrell (2018) provides a brief historical background of cryptocurrency and discusses the security networks used by major cryptocurrency providers and its implications to the cryptocurrency industry. DeVries (2016) presents an examination of the Bitcoin market and industry players using a SWOT (Strengths, Weakness, Opportunities and Strengths) framework, a common management analysis tool. Recent economic literature on cryptocurrency delve on issues such as determinants of cryptocurrency prices (Liu and Tsyvinski, 2018; Corbet, et al., 2018), cryptocurrency exchange rates (Li and Wang, 2017), and persistence in the cryptocurrency market (Caporale, et al., 2019; Bouri, et al., 2019), among others.

In this study, we examine whether the presence or absence of credible surveillance and regulatory authorities influence the extent policymakers would allow, regulate, or take a hands-off approach to cryptocurrency. So far, there are no studies specifically investigating the factors influencing the policy stance on cryptocurrency. This study contributes to literature by bringing together two strands of literature—one examining cryptocurrency regulation and the other investigating financial development through legal institutions and financial openness. On the one hand, the need to balance promoting innovation while mitigating economic risks has sparked interest in the appropriate legal and regulatory framework surrounding cryptocurrency. Marian (2015) proposes a regulatory system which imposes costs on anonymity to curtail potential illicit uses of cryptocurrency, such as tax evasion, money laundering or financing terrorism, without disincentivizing innovation that cryptocurrency

could bring. On the other hand, previous research has provided evidence to link quality of institutions and governance effectiveness to financial development (La Porta, Lopez-de-Silanes Shleifer, and Vishny, 1998; Beck, Demirguc-Kunt, and Levine, 2001; Lee and Opper, 2009). Furthermore, several research works have delved in the relationship between increased financial openness through capital account liberalization and financial development. A recent research by Ozkok (2015) shows that financial openness, along with other institutional variables, explains a large part of the variations in financial development across countries and over time. Meanwhile, Klein and Ovei (2015) show that the link between capital mobility and financial depth is significant in countries with high levels institutional quality, i.e. industrialized countries. While regulation of cryptocurrency, a decentralized asset, is difficult, its potential destabilizing effects on vulnerable financial markets emphasizes the need for vigilance in cryptocurrency market development.

To provide an empirical examination of the policy stance toward cryptocurrency, we begin by composing an index of de jure openness to cryptocurrency using the current legal and regulatory status of cryptocurrency compiled in 2018 by Global Legal Research Center, Bitcoin Market Journal, and CoinStaker. We identify three broad types of regulation system in 218 countries—fully liberalized, regulated, and banned. The policy choice of allowing the use, regulating, or prohibiting the use of cryptocurrency can represent on the one hand, how open policymakers are to new avenues in financial development or how prudent they are in adopting new financial technology. Then, we refer to Chinn and Ito (2006) as our baseline model to investigate empirically to whether institutional quality as well as higher level of financial openness are associated with a less restrictive policy stance toward cryptocurrency. We use a cross-sectional ordered probit model and regressed the de jure index of cryptocurrency on the one hand, and well-developed policy environment and de jure capital openness on the other hand. Then, we control variables representing institutional and macroeconomic factors which can affect cryptocurrency regulation. The analysis is based on data covering 124 countries.

Our results show that a well-functioning policy environment is associated with a less restrictive regulatory stance on cryptocurrency. Meanwhile, financial openness is not found to be significant. Our results are robust to alternate specifications, testing the sensitivity of the results to alternate measures of policy environment and also the choice of year in the data used for the econometric estimation.

The paper is structured as follows. Section 2 provides a brief overview of what cryptocurrency is and its current legal and policy environment. Section 3 discusses the links between financial development on the one hand, and financial openness and legal systems on the other hand, as well as their implications on the policy stance on cryptocurrency. Section 4 presents our econometric model, describes the data, and provides descriptive statistics of the variables. In addition, we also explain our index of de jure openness to cryptocurrency (*cc*) in detail on the data source and the method of compilation and classification. Section 5 gives empirical results, discussion, and policy implications. Robustness checks are also provided in this section. Section 6 concludes.

## 2. Cryptocurrency and Its Policy Environment

Cryptocurrency is an electronic token, which has its origins from the need for direct peer to peer online payments (Peters, et al., 2015). The most widely used and known cryptocurrency is Bitcoin, introduced by an unknown developer or a group of developers with a pseudonym Satoshi Nakamura. It uses a decentralized public ledger to record ownership and transfers of value. The innovation behind cryptocurrency is that transactions are verified by several “miners,” who solve a complicated cryptographic problem to verify the ownership of the cryptocurrency and the subsequent transfer. The miner who solves the cryptographic problem first and validate the transaction receive cryptocurrency as remuneration. The mining process is an open source program which can be accessed by the public. The peer to peer verification system bypasses typical trusted third party such as a bank or a credit card company. Various innovations to cryptocurrency have emerged since Bitcoin rose to popularity, thus broadening the definition of cryptocurrency. While some central banks are mulling establishing their own cryptocurrency, the industry is mainly a market driven phenomenon.

Cryptocurrency at its current state is not considered money substitute. One of the largest points of contention of its value comes from the fact that it is not issued by any sovereign authority, thus, its intrinsic value is questionable. Money has three basic features—a unit of account, a generally accepted medium of exchange, and a stable store of value. Cryptocurrency cannot take the role of unit of account and a store of value because the market valuation of cryptocurrency is characterized by large volatility in prices. Bitcoin, the largest cryptocurrency in terms of market capitalization (Coinmarketcap.com, 2017), saw its value rise in December 2017, then subsequently losing 30 percent of its value in December 2018 (Kollewe, 2018). The unenforceable nature of cryptocurrency transactions in many countries also prevents it from becoming a common means of payment.

In its beginnings, cryptocurrency is used as a payment instrument (Farell, 2015). Since cryptocurrencies use distributed ledger systems that bypass intermediaries, it can potentially reduce the cost of international transfers, including remittances. Lower transaction costs can ultimately contribute to financial development and increased financial access. Thus, while the large uncertainty with the value of cryptocurrency inhibits it from recognized as a currency which functions as a unit of account or a store of value presently, it is largely used for payment which promises anonymity and elimination of intermediation costs.

As cryptocurrency gained more recognition in the financial sector, market players began to use cryptocurrency as a speculative investment asset. Similar to other financial instruments, cryptocurrency began to be traded in cryptocurrency exchanges. Bauer (2018) found that Bitcoin, holding the largest share of the cryptocurrency market, is mainly used as a speculative instrument rather than an alternative currency. Speculative trading is conducted in exchanges where consumers can buy, sell, and exchange cryptocurrencies using dollars, euros, or yen, or other cryptocurrencies. Currently, over 200 exchanges support cryptocurrency trading all over the world (Hansen, 2018). The major exchanges are located in countries such as, USA, South Korea, and Samoa, among others (Hansen, 2018).

Despite the recognition of policymakers on the risks of cryptocurrency, the policy stance on cryptocurrency among countries remain heterogeneous, with some countries being open to its use, silent in terms of regulation, or explicit in its prohibition. The Global Legal Research Center (2018) provides a comprehensive report of legal and policy landscape surrounding cryptocurrency. While some countries outright ban cryptocurrency (Nepal, Pakistan, Vietnam, etc.), most countries neither regulate nor promote cryptocurrency. Italy, Australia, Japan, among other countries require the registration and licensing of cryptocurrency operations. Meanwhile, the report shows that Isle of Man and Mexico allows the use of cryptocurrency as a means of payment.

Uncertainty with the security, legality of its transactions, and extent of consumer and investor protection have kept policymakers wary about its operations. Because of this, many central banks around the world try to inform the public the difference between legal tender, which is backed by their central bank, and cryptocurrency, which is neither backed by the domestic nor other foreign monetary authorities. Furthermore, the combination of the speculative nature of cryptocurrency and its lack of supervision poses threat to investors and consumers. Although the cryptocurrency market itself is not large enough to pose a global risk at this time (FSB, 2018), it may still pose risks to consumers and investors in smaller countries where cryptocurrencies are being used.

For countries where cryptocurrency transactions take place, policymakers also need to consider other policy or legal issues. In particular, the anonymous nature of cryptocurrency poses concerns about using it to finance illegal activities such as trade in illegal substances, tax evasion, and financing of terrorism. Thus, particular regulations are put in place on top of existing laws on commercial activities. The Global Legal Research Center (2018) reports that South Korea, for instance, prohibits using anonymous bank accounts in cryptocurrency trading. The South Korean government also requires banks to report activities deemed suspicious under the regulations, in its thrust to prevent anti-money laundering. In addition, the report shows another example of cryptocurrency regulation with the licensing requirement of Israel's Supervision on Financial Services for financial assets service providers which includes virtual currency. While cryptocurrency operations have started to face registration and licensing requirements, they have remained outside most supervisory reach, thus, they maintain that users of cryptocurrency do so at their own risk.

With opportunities and threats in cryptocurrencies become clearer as news about cryptocurrency operations unfold, policymakers adopt their attitudes and policy stance toward cryptocurrency. For instance, the Global Legal Research Center (2018) reports that Japan revised its regulations on cryptocurrency to respond to the increasing speculation in the market. In April 2017, Japan revised the Payment Services Act to explicitly define cryptocurrency and to require the registration of dealers who exchange cryptocurrency with legal tender such as yen (Jiji, 2018). In March 2018, the Japanese regulators issued business improvement orders to cryptocurrency exchanges as a response to the incident when Coincheck, one of the biggest cryptocurrency exchanges in Japan, lost about \$400 million in cryptocurrency. From this episode, we observe that regulators can be quick to respond to the threats

that unfold from new financial technology.

In contrast, some policymakers decide not to regulate cryptocurrency specifically and let existing laws on commodities or financial instruments govern the use of cryptocurrency. The regulations of compiled by the Global Legal Research Center (2018) show several examples. Austria considers cryptocurrency as a business asset, classified under other intangible commodities. Czech Republic similarly considers cryptocurrency as a commodity, which explains their “liberal approach” in cryptocurrency, essentially neither promoting nor hindering its development as they would do in other commodity trading. Australia considers cryptocurrency as assets for the purpose of capital gains tax. Anguilla treats cryptocurrency that functions as securities to be regulated under existing securities framework. Meanwhile, some other countries, such as Bermuda or Bahamas, that currently do not have specific regulations on cryptocurrency are in the process of exploring their regulatory or legislative options.

The risks of cryptocurrency are undisputed but the policy toward it vary widely. With its increasing presence in financial markets, cryptocurrency cannot be ignored, particularly by policymakers. Policymakers have been vocal about giving warnings but not all have been active in banning or regulating it. Even the policy choice of no regulation is a policy decision in itself in that policymakers are not prohibiting, essentially allowing, people or firms to engage in cryptocurrency transactions at their own risk. In the next section, we discuss how some policy choices or legal framework affect the attitudes of policymakers in permitting or regulating cryptocurrency.

### **3. Financial Development, Legal Systems, and Policies toward Cryptocurrency**

In this study, we examine whether the quality of the governance as well as the degree of financial openness contribute to the attitude of policymakers in pursuing further financial development by allowing the use of cryptocurrency.

We posit that the characteristics of government institutions can influence the policy stance taken toward cryptocurrency. In particular, we test whether effective governance, is more likely to be supportive of financial development as characterized in this paper by a less restrictive stance to a burgeoning cryptocurrency industry. Lee and Opper (2009) show that the quality of the state bureaucracy can contribute to financial market development. They argue that financial markets develop when the institutions provide a stable environment where risks can be calculated. Enforcing contracts and protecting property rights can foster the confidence of economic actors. In particular, they emphasize the importance of credible predictable, and reliable support by the public administration in facilitating the development of the securities market where control and ownership are separated.

Further, studies examining the link between legal institutions, an important component of governance, and financial development is not scarce. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) show that differences in the legal system influence the development of financial markets. In particular, financial markets develop when legal institutions protect property rights, contracts, and the rights of owners. Beck and Levine (2003) explain that in contrast to supportive legal institutions, uncertainty in

the legal environment where a central political power can usurp private capital can impede the development of financial markets by discouraging investment. In the same way, centralization of political power can stifle the progress of financial markets (Beck, Demirguc-Kunt, and Levine, 2001). Legal institutions may also vary in the degree which they are flexible to adapt to changing times. More flexible institutions can support financial innovations that serve market gaps as shown by Beck, Demirguc-Kunt, and Levine (2001) when they investigated the link between legal origin and financial development. Thus, in this study we conjecture that policy support or non-interference for a burgeoning cryptocurrency industry is more likely with higher levels of governance institutions underpinning financial development.

In addition, we investigate whether *de jure* financial openness is related to the policy decision on cryptocurrency. On the one hand, countries with a more liberal capital flow policy may also be open to developments in new financial instruments to keep up with competition in international markets. Klein and Olivei (2008) discusses how capital account liberalization contribute to the financial development by introducing international standards, servicing niche markets, and broadening financial services through financial innovation, among others. With financial innovation offering new opportunities, many countries face the incentive to keep up with new financial instruments to compete internationally. In the same vein, we posit that countries which are more financially open tend to be more open to the adoption of cryptocurrency otherwise they risk lagging behind their peers by ignoring the current financial market developments.

On the other hand, countries with a higher degree of financial openness may be more prudent in exposing itself to risk through new financial instruments. Higher financial openness can exacerbate the risks that cryptocurrency can bring through large and volatile flows, which can destabilize the financial sector (Kaminsky and Reinhart, 1999). Cubillas and Gonzales (2014) show that financial liberalization encourages bank risk taking in both advanced and developing countries. In particular, competition in banks encourages risk taking in advanced countries, whereas the presence of opportunities to take risk increases bank risk in developing countries. Thus, an alternative hypothesis could be that the potential risk that cryptocurrency brings with it could influence policymakers in financially open economies to be more prudent and impose regulations to repress the use of cryptocurrency, especially because it is primarily used as a speculative instrument.

#### **4. Econometric Framework**

##### **Model Specification**

To estimate the link between *de jure* openness to cryptocurrency on the one hand, and *de jure* capital openness and institutional strength on the other hand, we use a model that estimates the determinants of financial development. Since the cryptocurrency represents new financial technology, permission for the operations of cryptocurrency can be likened to further development of the financial sector. For this purpose, we base our empirical model on Chinn and Ito's (2006) empirical specifica-

tion examining the link between financial development and other policy, legal, institutional, and macroeconomic factors.

Chinn and Ito (2006) regression equation is the following:

$$FD_t^i - FD_{t-5}^i = \gamma_0 + \rho FD_{t-5}^i + \gamma_1 KAOPEN_{t-5}^i + \gamma_2 L^i + \gamma_3 (L^i \times KAOPEN_{t-5}^i) + X_{t-5}^i \tau + u_t^i \quad (1)$$

where FD refers to a measure of financial development; KAOPEN is a measure of financial openness;  $L^i$  represents a measure of legal and institutional development; and X is a vector of macroeconomic control variables.

As the main purpose of their research is to examine the determinants of the development of equity markets, FD represents any indicators that measure equity market development, e.g. size of the market, the market activeness, among others. Stock market capitalization (SMKC), total value of stocks traded (SMTV), and stock market turnover ratio (SMTO) were used as a different proxy for FD.

In contrast, instead of equity markets, our study investigates the degree of cryptocurrency markets development. Thus, we adopt a jure openness to cryptocurrency (*cc*) variable as our dependent variable. The *cc* variable is described in greater detail in the data section. Our model is specified as:

$$cc^i = \delta_0 + \delta_1 KAOPEN_{t-3}^i + \delta_2 L_{t-3}^i + X_{t-3}^i \tau + v^i \quad (2)$$

We use the Chinn–Ito index for the financial openness variable (*ka\_open*) and Worldwide Governance Indicators (WGI)’s government effectiveness (*bureau\_quality*) for a measure of legal and institutional development. The indexes are also discussed in more details in the following section. To control for macroeconomic factors, log per capita income (*log\_gdp\_pc*), inflation rate (*inflation*), and trade openness (*trade\_open*) are incorporated in the vector X. Provided in Chinn and Ito’s (2006) work, the rationale behind the inclusion of each control variable also applies in the case of cryptocurrency market development. For example, the inclusion of log per capita income is to capture the effect of rising income that may contribute to more sophisticated economic and financial structures which can support the development of cryptocurrency market. The inflation rate is included in the model as high inflation may encourage the use of cryptocurrency, rather than paper money or other assets.

Due to the unavailability of multiple-year *cc* data, our main estimation method is a cross-sectional ordered probit model using the cross-sectional data in 2018. Three-year lag independent variables are used in the main regression since new legislation takes time to adjust. We also use four-year and five-year lag independent variables to check whether our results are robust to the choice of lag period. Moreover, we estimate alternate model specifications using different definitions of legal and institutional factors to check whether our results are robust to different measures of our key variables.

Except for the dependent variable and the time dimension, we strictly follow Chinn and Ito’s (2006) model specification since 1) the model offers clean and clear interpretations of its results and each variable in relation to financial development; and 2) it is also interesting to compare our results (the cryptocurrency market development) to those of different financial markets e.g. equity market.



## Data

The data are originally recorded at an annual frequency, over the 2010–2018 period, covering 180 countries and drawn from several sources, primarily the Chinn–Ito Index, the World Bank’s Worldwide Governance Indicators (WGI), and the World Bank’s World Development Indicators, among others.

### *Index of Cryptocurrency Regulation*

The index of cryptocurrency regulation (*cc*) is an index measuring a country’s degree of de jure openness to cryptocurrency. “*cc*” is based on the ordinal variables that codify the current legal and regulatory status of cryptocurrency in 218 countries,<sup>2</sup> using current legal and regulatory status of cryptocurrency compiled in 2018 from Global Legal Research Center, Bitcoin Market Journal, and CoinS-taker. We classified countries based on their policy stance toward cryptocurrency as follows: first, assign the value 0 when the country is “banned”; 1 when “regulated”; 2 when “fully liberalized” or “no explicit prohibitions/regulations.” The higher the figure, the more liberal the country to cryptocurrency. We found that 135 countries allow the free use of cryptocurrency, 61 countries regulate its use, and 22 countries ban it.

### *Measures of De Jure Capital Openness*

We adopted the 2016 capital account openness index developed by Chinn and Ito as a proxy of financial liberalization since the Chinn–Ito index (*ka\_open*) is the most widely used in the financial literature. The Chinn–Ito index was firstly introduced in 2006 and has been continuously updated. The index covers the time period of 1970–2016 for 182 countries. It is the first standardized principal component of the four binary dummy variables reported in the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). The variables include variables indicating the presence of multiple exchange rates; restrictions on current account transactions; restrictions on capital account transactions; and the requirement of the surrender of export proceeds. The higher the value, the more liberal the country is to cross-border capital transactions.

### *Measures of Legal and Institutional Factors*

In our main regression, we use WGI’s government effectiveness (*bureau\_quality*) to control for the legal and institutional factors. Government effectiveness is one of the WGI’s six aggregate indicators of governance. With an unobserved components model, it is computed from various data sources and reported in percentile rank where higher percentile corresponds to higher quality.<sup>3</sup> The indicator of government effectiveness reflects the overall quality and credibility of the government in terms of public and civil services, legislation, and policy formation.

Similarly, *legal2* captures a broader effectiveness and quality of the government. *legal2* is the first principal component of all WGI’s six aggregate dimensions of governance, namely voice and accountability (*VA*), political stability and absence of violence (*PV*), government effectiveness (*GE*), regulatory quality (*RQ*), rule of law (*RL*), and control of corruption (*Corrupt*). The first eigenvector for *legal2* was

<sup>2</sup> For a complete list of the countries, see Appendix A.

<sup>3</sup> For more details on the methodology, refer to Kaufmann, Kraay, and Mastruzzi (2010).

found to be  $(VA, PV, GE, RQ, RL, Corrupt) = (0.415, 0.337, 0.428, 0.408, 0.401, 0.452)$ , showing that the variability of *legal2* is not driven by any particular dimensions of governance. We extend *legal2* from Chinn and Ito (2006)'s *legal1* which covers only three dimensions, including the level of corruption, law and order, and the quality of the bureaucratic system. As *legal1* has a relatively limited definition and there is no compelling reason to omit other WGI's indicators, we opt to use *legal2* in the robustness check of our main results. We normalized *legal2* in order to simplify our interpretation of the regression results.

Used for another robustness check, Polity IV's *polity2* controls for the legal and institutional factors. It captures a state's level of democracy which ranges from  $-10$  (strongly autocratic) to  $+10$  (strongly democratic). The *polity2* score is derived from a difference between the scores of democracy and autocracy. Both scores are evaluated from state's elections for competitiveness and openness, the nature of political participation, and the extent of checks on executive authority. Even though *polity2* does not directly capture the quality of legal but institutional framework, a higher level of democracy may imply more refined and sophisticated legislation (Habermas, 1995; Raban, 2015), which may also contribute to financial development.

We also use the Heritage Foundation's index of financial freedom (*fn\_freedom*) as a proxy of the legal and institutional factors. The index assesses the extent of government regulation and intervention in the financial sector, including openness to foreign competition, on a scale of 0 to 100. Higher values of the index indicate less government interference and, thus, greater financial freedom. The underlying assumption is that well-established legal and institutional frameworks such as enforcement of contractual obligations, fraud prevention, among others, would lead to higher financial freedom without further government intervention or with a very minimum level of government interference. We also normalized *fn\_freedom*.

## 5. Empirical Results and Discussion

### Empirical Results

Table 1 presents the ordered probit regression result with marginal effects of the main model specification (equation (2)). It shows the effects of legal and institutional development and financial development on the degree of cryptocurrency markets development. In addition, the results of different robustness check are presented in Table 2. We test our results against alternative specifications using alternate measures of government quality and effectiveness and also the choice of year in the data used for the econometric estimation. It is worth noting that our research does not delve deeper into the actual cryptocurrency mining or exchanges, but highlights the linkage between the policy environment and financial market development from the institutional perspective.

As shown in table 1 and column 1–3 of Table 2, the coefficients on the bureaucratic quality are statistically significant and robust across different specifications with three-year, four-year, and five-year lag independent variables. Our result shows that one unit increase in the index of bureaucratic

## Cryptocurrency Regulations

**Table 1.** Ordered Probit Regression Results and Marginal Effects

Dependent variable: de jure openness to cryptocurrency (cc) in 2018				
Independent Variable	Coefficient	Marginal Effects		
		Banned	Regulated	Fully Liberalized
Bureaucratic quality (bureau_quality)	1.509** (0.647)	-0.264** (0.118)	-0.329** (0.155)	0.592** (0.253)
De jure capital openness (ka_open)	0.262 (0.382)	-0.046 (0.067)	-0.057 (0.084)	0.103 (0.150)
GDP per capita (log_gdp_pc)	-0.673*** (0.170)	0.118*** (0.033)	0.147*** (0.047)	-0.264*** (0.066)
Inflation (inflation)	0.053* (0.032)	-0.009* (0.006)	-0.011 (0.007)	0.021* (0.012)
Trade openness (trade_open)	0.006*** (0.003)	-0.001** (0.000)	-0.001** (0.001)	0.003*** (0.001)
Constant cut1	-5.877*** (1.347)			
Constant cut2	-4.773*** (1.325)			
Observations	124	124	124	124

Source: Authors' compilation and calculation.

Note: a) Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 2.** The Ordered Probit Regression Results and Robustness Check

Dependent variable: de jure openness to cryptocurrency (cc) in 2018						
Independent Variable	(1)	(2)	(3)*	(4)	(5)	(6)
	Five-year lag	Four-year lag	Three-year lag			
Bureaucratic quality (bureau_quality)	1.098* (0.592)	1.194* (0.614)	1.509** (0.647)			
Level of governance (legal2_n)				1.567* (0.920)		
Level of democracy (polity2)					0.063*** (0.020)	
Financial freedom (fn_free_n)						1.378* (0.710)
De jure capital openness (ka_open)	0.241 (0.342)	0.320 (0.370)	0.262 (0.382)	0.174 (0.391)	-0.091 (0.380)	-0.142 (0.358)
GDP per capita (log_gdp_pc)	-0.637*** (0.158)	-0.651*** (0.165)	-0.673*** (0.170)	-0.612*** (0.169)	-0.388*** (0.118)	-0.476*** (0.124)
Inflation (inflation)	0.005 (0.019)	0.040* (0.023)	0.053* (0.032)	0.049 (0.032)	0.035 (0.027)	0.017 (0.022)
Trade openness (trade_open)	0.004* (0.002)	0.006** (0.002)	0.006*** (0.003)	0.006** (0.002)	0.007*** (0.003)	0.006** (0.002)
Constant cut1	-6.031*** (1.258)	-5.880*** (1.306)	-5.877*** (1.347)	-5.349*** (1.292)	-3.876*** (1.037)	-4.451*** (1.009)
Constant cut2	-4.966*** (1.236)	-4.798*** (1.284)	-4.773*** (1.325)	-4.254*** (1.268)	-2.800*** (1.019)	-3.430*** (0.991)
Observations	128	126	124	124	139	151

Source: Authors' compilation and calculation.

Note: a) Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

b) All independent variables are lag variables (please refer to the title of each column).

c) \* Model (3) is the main regression specification.

quality associates with higher chance of full cryptocurrency liberalization by 59 percentage points. In contrast, the probability of banned and regulated is lower by 26 and 33 percentage points, respectively, when the index of bureaucratic quality rises by one unit. Therefore, the results show that the quality of legal and institution strongly relates to the attitude of policymakers towards the cryptocurrency liberalization. On the other hand, it seems that de jure capital openness is not relevant in the context of cryptocurrency development as the capital openness variable is not statistically significant in all different model specifications.

We also check the robustness of our results with the alternative measures of legal and institutional framework, including *legal2*, *polity2*, and *fn\_freedom*. Even though legal and institutional framework is measured or proxied differently, our results of the robustness check (column 4–6 of Table 2) shows that our regression model is quantitatively and qualitatively robust across different specifications, except for the magnitude of *polity2*'s coefficient. As discussed in the previous section, *polity2* possibly captures only the quality of institutional framework, but not the legal one. This may explain the reason that the coefficient of *polity2* is lower than the other alternate measures.

By considering our control variables, we observed some interesting patterns. Firstly, economic development has a negative effect on the development of cryptocurrency since a percentage change in real income per capita decreases probability of full cryptocurrency liberalization by 26 percentage points (Table 1). In contrast, we found that trade openness positively affects a policymaker's attitude towards cryptocurrency liberalization. The result indicates that an additional unit of trade openness raises chance of full cryptocurrency liberalization by 0.3 percentage point. However, the magnitude of trade openness's coefficient seems negligible, compared with the effects of bureaucratic quality and real income per capita. Lastly, we did not find a relationship between inflation and the development of cryptocurrency.

### **The Case of Emerging Asia**

The implications of this study resonate with the lessons from the Asian Financial Crisis in 1997, which includes the importance of sequencing of financial reforms with the de jure capital account liberalization. In addition, the crisis also emphasized the importance of early warning systems to detect risks and vulnerabilities stemming from large and volatile capital flows brought about by speculation. The prudence exercised by Asian economies after the Asian Financial Crisis insulated these countries from exposure from toxic subprime loans and related financial instruments which triggered the 2008 Global Financial Crisis. In addition, the financial reforms implemented by these economies built up their resilience which allowed them to escape virtually unscathed at the beginning of the crisis. While Asian economies did suffer the consequences of the Global Financial Crisis albeit belatedly, Park et al. (2013) explains that Asian countries did not experience a financial crisis but a trade crisis caused by the subsequent global economic downturn.

We can observe similar prudence adopted by some Asian economies in treating cryptocurrency (Table 3). For instance, the Global Legal Research Center (2018) reports that Indonesia forbids the use

**Table 3.** Cryptocurrency regulation in East and South East Asian economies

CC	Country
"0"—Banned	China, Indonesia, Macao (China), Vietnam
"1"—Regulated	Japan, Myanmar, North Korea, Philippines, South Korea, Taiwan, Thailand
"2"—Fully liberalized	Brunei, Cambodia, Hong Kong (China), Lao PDR, Malaysia, Mongolia, Singapore, Timor-Leste

Source: Author's categorization of the regulatory stance.

of virtual currencies as payment in accordance to Bank Indonesia Regulation No. 18/40/PBI/2016 on Implementation of Payment Transaction Processing and Bank Indonesia Regulation No. 19/12/PBI/2017 on Implementation of Financial Technology. Moreover, it also reports that Vietnam similarly prohibits the use of cryptocurrency for payment and other transactions. Prudence may also take the form of imposing regulations or surveillance systems to monitor the markets actors involved in cryptocurrency as well as detect potential suspicious activities. The Global Legal Research Center (2018) also reports that the Thailand government has enacted regulations to govern cryptocurrency, meanwhile, the Philippines require businesses engaging in cryptocurrency to register with the Bangko Sentral ng Pilipinas. South Korea and Japan, two of the biggest markets of cryptocurrency to date, is actively watching market developments and revising their regulations and supervisions accordingly. While currently not explicitly regulating cryptocurrency, Malaysia is in the process of finalizing their regulations.

### Policy Implications

The results of this study on cryptocurrency regulation can contribute to policy discussions on the timing of adopting financial technology in line with developing financial markets. This study reaffirms previous findings that institutional quality contributes to financial development even after taking into consideration, i.e. controlling for factors such as de jure financial openness, economic development, inflation and trade openness which may also influence the decision of policymakers to be open to cryptocurrency. Putting it differently, the results imply that a certain level of institutional quality may be necessary before opening up to new forms of financial technology. Cryptocurrency in particular is recognized as a risky speculative financial instrument. Its current state of many unknowns can also impede policymakers from conducting a thorough surveillance to avoid system-wide vulnerabilities.

Furthermore, the findings of this study invite policymakers to consider the different pace in development of institutions and the financial market. Financial market developments appear to outrun institutional development. In 2011, other cryptocurrency emerged after three years from the inception of Bitcoin in 2008 (Farell, 2015). In this short period of time, various players joined in to take advantage of the opportunities. Since then, however, several legal and security problems also emerged. In the meantime, the pace of strengthening institutions by enhancing bureaucratic effectiveness or the credibility of legal systems may not keep up with the demands of the financial sector. Some policymakers and industry players acknowledge the gap in institutional capacity to regulate and intervene and thus advocate for a hands-off government approach to market development. Nevertheless, whether the government decides to intervene, to regulate or to let markets be, the quality of governance gives policymakers the credibility in enforcing their policy choice. Trust in the system can facilitate financial

development. Hence, improving institutions could still be a worthwhile aim moving forward even if it is outpaced by financial development.

Finally, the decentralized and international nature of the cryptocurrency industry underlies a need for international cooperation. Standing issues include avoiding potential circumvention of regulation and supervision in the international trade of cryptocurrency, particularly for preventing money laundering or terrorism finance. Policymakers also need to be vigilant of potential spillover effects of volatility in the cryptocurrency market. Increasing macro financial linkages could make the real sector vulnerable from amplified adverse effects coming from new financial technology, especially if the presence of cryptocurrency continues to rise in coming years.

## 6. Conclusion

In this study, we investigate how effective governance institutions and de jure financial openness influence attitude of policymakers in pursuing further financial development by allowing the use of cryptocurrency. Although several sources have compiled regulatory stance on cryptocurrency (Global Legal Research Center, 2018; Bitcoin Market Journal, 2018; and CoinStaker, 2018), a systematic investigation of the policy, economic, and institutional factors influencing the policy choice has not been conducted. As a first step, we compose an index of de jure openness to cryptocurrency in 218 countries, using current legal and regulatory status of cryptocurrency compiled in 2018. We categorize policy stance into “banned,” “regulated,” and “permitted” and investigate its determinants using a cross-sectional ordered probit model.

The regression analysis shows that effective governance institutions is associated with a less restrictive regulatory stance on cryptocurrency. The results are robust when we use different measures of effective governance, namely, bureaucratic quality, a calculated governance indicator index, democratic institutions, and financial freedom. This provides evidence that policymakers in an environment with institutions conducive to financial development are more likely to be open to cryptocurrency. Meanwhile, financial openness is not found to be significant. Thus, the results do not support the hypothesis that higher degree of financial openness would translate to higher openness to new financial technology presented by cryptocurrency. The empirical results imply that policy and institutions associated with financial development, rather than financial openness itself, determines de jure openness to cryptocurrency.

The limitations of this paper can pave the way for future research. For one, the index of de jure openness to cryptocurrency is constructed based on the current policy stance of countries toward cryptocurrency by 2018. Our index does not capture changes in regulatory stance of government. It would be interesting to investigate the drivers of policy change over the years. Examining the policy stance vis-a-vis the size of the cryptocurrency market can also provide a more nuanced interpretation of the policy choice based on how large the cryptocurrency industry is relative to the size of the country's financial market or economy.

## References

- Baur, D. G., Hong, K., & Lee, A. D. (2018). Bitcoin: Medium of exchange or speculative assets? *Journal of International Financial Markets, Institutions and Money*, 54, 177–189.
- Beck, T., Demirgüç-Kunt, A., & Levine, R. (2001). Law, politics, and finance. Policy Research Working Paper No. 2585. World Bank, Washington, DC.
- Beck, T. & Levine, R. (2003). Legal institutions and financial development. World Bank Policy Research Working Paper 3136.
- Bouri, E., Gil-Alana, L. A., Gupta, R., & Roubaud, D. (2019). Modelling long memory volatility in the Bitcoin market: Evidence of persistence and structural breaks. *International Journal of Finance & Economics*, 24: 1, 412–426.
- Caporale, G. M., Gil-Alana, L., & Plastun, A. (2018). Persistence in the cryptocurrency market. *Research in International Business and Finance*, 46: 141–148.
- Chinn, M. D. & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, 81: 1, 163–192.
- Corbet, S., Lucey, B., & Yarovaya, L. (2018). Datestamping the bitcoin and ethereum bubbles. *Finance Research Letters*, 26, 81–88.
- CryptoCurrency Market Capitalizations. [online] Available at: <https://coinmarketcap.com/all/views/all/> [Accessed 15 May 2017]
- Cubillas, E. & González, F. (2014). Financial liberalization and bank risk-taking: International evidence. *Journal of Financial Stability*, 11, 32–48.
- DeVries, P. D. (2016). An Analysis of Cryptocurrency, Bitcoin, and the Future. *International Journal of Business Management and Commerce*, 1: 2, 1–9.
- Farell, R. (2015). An analysis of the cryptocurrency industry. Wharton Research Scholars, 130.
- Financial Stability Board. 2018. Crypto-asset markets: Potential channels for future financial stability implications. Retrieved from: <http://www.fsb.org/2018/10/crypto-asset-markets-potential-channels-for-future-financial-stability-implications/>
- Gandal, N., Hamrick, J., Moore, T., & Oberman, T. (2018). Price manipulation in the bitcoin ecosystem. *Journal of Monetary Economics*, 95, 86–96.
- Global Legal Research Center (2018). Regulation of cryptocurrency around the world. *Library Law of Congress*. Retrieved from: <https://www.loc.gov/law/help/cryptocurrency/cryptocurrency-world-survey.pdf>
- Habermas, J. (1995). On the internal relation between the rule of law and democracy. *European Journal of Philosophy*, 3: 1, 12–20.
- Hansen, S. (2018, June 20). Guide to top cryptocurrency exchanges. *Forbes*. Retrieved from: <https://www.forbes.com/sites/sarah-hansen/2018/06/20/forbes-guide-to-cryptocurrency-exchanges/#2c3711502572>
- Jiji (2018, August 8). Japan's Financial Services Agency set to update cryptocurrency regulations in speculation countermeasure. *The Japan Times*. Retrieved from: <https://www.cnn.com/japan-targets-speculative-cryptocurrency-investments-in-regulatory-revamp>
- Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: The causes of banking and balance-of-Payments problems. *American Economic Review*, 89(3), 473–500.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). The worldwide governance indicators: Methodology and analytical issues. World Bank Policy Research Working Paper No. 5430.
- Klein, M. W., & Olivei, G. P. (2008). Capital account liberalization, financial depth, and economic growth. *Journal of International Money and Finance*, 27(6), 861–875.
- Kollewe, J. (2018, November 20). Bitcoin price plunges below \$4,500 mark in new 2018 low. *The Guardian*. Retrieved from: <https://www.theguardian.com/technology/2018/nov/20/bitcoin-price-plunges-2018-low-cryptocurrency-value>
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny R. (1998). Law and finance. *Journal of Political Economy*, 106: 6, 1113–1155.
- Li, X., & Wang, C. A. (2017). The technology and economic determinants of cryptocurrency exchange rates: The case of Bitcoin. *Decision Support Systems*, 95, 49–60.
- Liu, Y., & Tsyvinski, A. (2018). Risks and returns of cryptocurrency (No. w24877). National Bureau of Economic Research.
- Marian, O. (2015). A conceptual framework for the regulation of cryptocurrencies. *U. Chi. L. Rev. Dialogue*, 82, 53.
- Nee, V., & Oppen, S. (2009). Bureaucracy and financial markets. *Kyklos International Review for Social Sciences*, 62: 2, 293–315.
- Ozkok, Z. (2015). Financial openness and financial development: An analysis using indices. *International Review of Applied Economics*, 29: 5, 620–649.
- Raban, O. (2015). The rationalization of policy: On the relation between democracy and the rule of law. *New York University Journal of Legislation and Public Policy*, 18: 1, 45–66.

## Appendix

Table A-1. Index of Cryptocurrency Regulation (as of 2018)

<b>East Asia and Pacific</b>		Bahamas	2	Guinea	2	Peru	2
Australia	1	Bahrain	0	Guinea-Bissau	2	Poland	2
Brunei	2	Barbados	2	Guyana	2	Portugal	2
Cambodia	2	Belarus	2	Haiti	2	Puerto Rico	1
China	0	Belgium	2	Honduras	2	Qatar	0
Fiji	2	Belize	2	Hungary	2	Romania	1
Hong Kong, China	2	Benin	1	Iceland	1	Russian Federation	2
Indonesia	0	Bermuda	2	Iran, Islamic Rep.	0	Rwanda	2
Japan	1	Bolivia	0	Iraq	0	Sahrawi Republic	2
Kiribati	2	Bosnia and Herzegovina	2	Ireland	2	San Marino	2
Korea, Dem.	1	Botswana	1	Isle of Man	1	Sao Tome and Principe	2
Korea, Rep.	1	Brazil	2	Israel	1	Saudi Arabia	0
Lao PDR	2	British Virgin Islands	2	Italy	1	Senegal	2
Macao, China	0	Bulgaria	1	Ivory Coast	2	Serbia	2
Malaysia	2	Burkina Faso	2	Jamaica	2	Seychelles	2
Marshall Islands	2	Burundi	2	Jersey	1	Sierra Leone	1
Micronesia	1	Cameroon	2	Jordan	1	Slovak Republic	2
Mongolia	2	Canada	1	Kazakhstan	2	Slovenia	1
Myanmar	1	Cape Verde	1	Kenya	2	Somalia	2
Nauru	2	Cayman Islands	1	Kosovo	2	Somaliland	2
New Zealand	2	Central African Republic	2	Kuwait	0	South Africa	2
Palau	2	Chad	2	Kyrgyz Republic	1	South Ossetia	2
Papua New Guinea	1	Chile	2	Latvia	1	South Sudan	2
Philippines	1	Colombia	2	Lebanon	1	Spain	1
Samoa	2	Comoros	2	Lesotho	0	St. Kitts and Nevis	2
Singapore	2	Congo, Dem.	2	Liberia	2	St. Lucia	2
Solomon Islands	2	Congo, Rep.	1	Libya	0	St. Vincent and the Grenadines	2
Taiwan	1	Cook Islands	2	Liechtenstein	1	Sudan	2
Thailand	1	Costa Rica	1	Lithuania	1	Suriname	2
Timor-Leste	2	Croatia	1	Luxembourg	1	Swaziland	2
Tonga	2	Cuba	2	Macedonia, FYR	2	Sweden	1
Tuvalu	2	Cyprus	2	Madagascar	2	Switzerland	1
Vanuatu	2	Czech Republic	2	Malawi	2	Syrian Arab Republic	2
Vietnam	0	Denmark	2	Mali	2	Tajikistan	2
<b>South Asia</b>		Djibouti	2	Malta	2	Tanzania	1
Afghanistan	1	Dominica	2	Mauritania	2	Togo	2
Bangladesh	0	Dominican Republic	0	Mauritius	1	Transnistria	1
Bhutan	1	Ecuador	0	Mexico	2	Trinidad and Tobago	2
India	2	Egypt	0	Moldova	2	Tunisia	2
Maldives	2	El Salvador	2	Monaco	2	Turkey	2
Nepal	0	Equatorial Guinea	2	Montenegro	2	Turkmenistan	2
Pakistan	2	Eritrea	2	Montserrat	2	Uganda	2
Sri Lanka	1	Estonia	2	Morocco	0	Ukraine	2
<b>Other Countries</b>		Ethiopia	2	Mozambique	2	United Arab Emirates	0
Abkhazia	1	Finland	1	Namibia	2	United Kingdom	1
Albania	2	France	1	Netherlands	2	United States	1
Algeria	0	Gabon	2	Nicaragua	1	Uruguay	1
Andorra	1	Gambia	2	Niger	2	Uzbekistan	2
Angola	1	Georgia	2	Nigeria	2	Vatican City	2
Anguilla	2	Germany	1	Niue	2	Venezuela, RB	2
Antigua and Barbuda	2	Ghana	2	Northern Cyprus	2	Yemen, Rep.	2
Argentina	1	Gibraltar	1	Norway	1	Zambia	2
Armenia	2	Greece	2	Oman	0	Zimbabwe	1
Artsakh	1	Grenada	2	Palestine	2		
Austria	1	Guatemala	2	Panama	1		
Azerbaijan	2	Guernsey	2	Paraguay	2		

Source: Authors' compilation and calculation.

Note: a) Country grouping is based on the World Bank Country and Lending Groups. b) 0="banned"; 1="regulated"; and 2="fully liberalized."