

Umit Hacıoğlu
Editor

Blockchain Economics and Financial Market Innovation

Financial Innovations in the Digital Age



Springer

Editor

Umit Hacıoğlu

School of Business

Ibn Haldun University

Basaksehir, Istanbul, Turkey

ISSN 1431-1933

Contributions to Economics

ISBN 978-3-030-25274-8

<https://doi.org/10.1007/978-3-030-25275-5>

ISSN 2197-7178 (electronic)

ISBN 978-3-030-25275-5 (eBook)

© Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

In the last decade, scholars assessed the ramifications of the global financial crisis on economic growth, stability, and prosperity. Major studies analyzing the roots of the financial crisis demonstrated the fact that financial stress in advanced economies had been transferring to emerging economies via an integrated financial system. In these studies, it was also highlighted that the transmission of financial stress caused a meltdown in global economic activity. To which extent the massive collapse of financial institutions, regulated monetary, and fiscal policies were linked to this global economic meltdown? Was it possible to prevent this collapse while integrating a more secured digital system without any intervention of the governmental institutions? Could blockchain economics be part of the more stabilized global financial system? Answering these questions is not so easy without knowing more about the components of blockchain technologies and its ability to transform the traditional financial systems. Many scholars today desire to have a deeper focus on this issue with a distinguished interdisciplinary perspective to understand the role of blockchain technologies in this transformational change in financial markets. Undoubtedly, the newest technology in the blockchain ecosystem has been shaping our understanding of traditional business and financial activities. Blockchain technologies are referred to as the decentralized integration of computers and distributed networks. These computers and networks are linked together safely based on the new growing list of records, so-called blocks, connecting the world to the future of business without regulation of any central authority.

As we know that the largest intermediaries in financial systems are the banking institutions with the largest funds and assets. This intermediary role is based on a fundamental record-keeping function and transactions are made among fundraisers and demanders. Could it be efficiently managed by advanced technology like a distributed ledger technology? Could it be possible to decrease the cost of transactions, improve data security, and improve correctness by a modern transaction than a traditional centralized intermediary function? Through a macro-perspective, similar questions could be directed to the economy itself. If traditional money for an economic system is defined as the medium of exchange, a unit of account, or a store of value, then it is time to redefine money in a digital economic system. Classical

functions of money with existing record-keeping or general ledger system cannot increase the efficiency of the monetary system or banking without the integration of new digital money with a modern distributed ledger system based on blockchain technology. Blockchain economies are referred to as a potential future environment by which cryptocurrencies replace the traditional monetary system based on blockchain technology without the intervention of any intermediary institution.

This novel book emphasizes on the blockchain economics and new investment strategies in crypto-markets. Recently, technological developments associated with the financial services industry have been introducing new investment models and techniques. With the integration of blockchain technologies in the financial services industry, a new crypto asset—Bitcoin—sparked the attention of many investors in crypto-markets apart from traditional investment strategies. Blockchain economies in this digital innovation path will continue to design a new financial model for many actors. Crypto-asset investment models, Crypto-Lending, Bitcoin Transfer, Cloud Mining, Lightning Networks, Hard-wallets, ICOs, and crowd sales are just some of the hot topics which we have recently occupied within our daily lives. Is blockchain economy a threat or opportunity for the integrated financial system? What about the economic and political agenda of FIAT money countries for new crypto-markets? How will the financial system be evolved in the next decade? Coping with this new issue of blockchain economies, scholars and researchers from different disciplines are gathered together in this novel book and tried to answer these challenging questions.

In this novel book, distinguished authors of different disciplines from economics to finance gave satisfactory answers to these challenging questions. The authors of the chapters in this publication have contributed to the success of this book by the inclusion of their respective studies. Contributors in this study formulated the new insights for the blockchain economics and questioned its future for a globalized and transforming financial system.

This book is composed of five contributory parts with 27 chapters. The first part outlines the components of *blockchain economics and financial market innovation*. Chapters in this part made assessments on a new blockchain-based financial market innovation from an economic perspective. This book continues with part two outlining *Cryptocurrency Investment Strategies and Crypto-Market Components*. The present and future of cryptocurrency investment strategies have been assessed. The third part develops a deeper understanding of the *Economic and Financial Role of Crypto-Currencies*. In this part, the authors assessed the correlations between financial conditions and cryptocurrency price changes within the international arbitraging mechanism. In the fourth part, *Cryptocurrency Taxation System in Emerging Markets* has been introduced. In this part, contributors analyzed the correlation of the effective taxation system and accounting practices via blockchain technology. In the final part, *Related Subjects and Political Agenda* for this hot topic have been assessed from a multidisciplinary perspective.

Chapter 1 evaluates the transformation of corporate finance in the new business ecosystem in the digital age. Prof. Gurunlu aims to explore the impacts of blockchain

technology—a foundationally innovative technology—reshaping and even revolutionizing corporate finance. From her explanation, this underlying technology in the heart of all financial innovations has the great disruptive potential for the financial sector. In this context, her study focuses on how corporate finance is being transformed by blockchain technology and its extensions (distributed ledgers and smart contracts) and underlines what the reflections will be on corporate governance, capital markets, corporate voting, and accounting matters in corporate finance.

Chapter 2 features an economic approach to new digital money as the global financial system's new tool. Dr. Dayi, in this chapter, underlines that the developments in information and Internet technology have led to profound changes in the global financial system. Dr. Dayi advocates that cryptocurrency technology aims to make transactions reliable and provide money control with the encryption technique. Due to the high-security encryption technique of the network structure, it is not possible to infiltrate into the system. In addition to being reliable, the new currency recently has been more effective as an investment tool rather than being a medium of exchange in daily life anywhere in the world.

Chapter 3 proposes a model with redesigning current banknotes with blockchain infrastructure. In the proposed model, Dr. Erdem and Dr. Altun aimed to propose a new hybrid system that can be applied with fewer efforts and requiring little modifications in existing structures by combining the advantages of both digital currency system and paper-based banknote system. They offered a model that uses QR Coded banknotes, digital wallets, and blockchain technology for ensuring and confirming the ownership of the banknotes. This model is considered as applicable at the macro level by governmental policies.

Chapter 4 introduces the tokens as innovative financial assets in crypto-markets and evaluates ICOs. Dr. Adhmi and Professor Giudici describe the new phenomenon of initial coin offerings (ICOs), i.e., unregulated offerings of digital tokens, built on the innovative blockchain technology, as to provide a means to collect finance for a project on the Internet, disintermediating any external platform, payment agent, or professional investor. ICO tokens allow access to platform services, may serve as cryptocurrencies, or grant profit rights; they are traded on electronic exchanges and represent a new financial asset. They highlighted the issues raised with respect to information asymmetries and moral hazard, and we review the nascent empirical literature exploring the ICO token market.

Chapter 5 develops a futuristic view on the blockchain question: Can this new technology enhance social, environmental, and economic sustainability? In this chapter, Dr. Semen Son Turan explores the nature of blockchain and discusses how it may contribute to or obstruct sustainability. To this end, first, blockchain technology is introduced. Next, a short discussion on sustainability is presented, including how it is defined, measured, reported, and understood in theoretical frameworks. After that, the 2015 United Nations Sustainable Development Goals are briefly explained. This is followed by a systematic literature review, which highlights the scarcity of literature linking blockchain to sustainability. Finally, the author offers her own reflections on the potential of blockchain to revolutionize the

financial services industry and weighs up the pros and cons of vis-a-vis sustainable development.

Chapter 6 develops a practical approach to herding behavior in cryptocurrency market by using CSSD and CSAD analysis. Dr. Gumus and her colleagues focus on the cryptocurrency index and cryptocurrencies, which have existed since the arbitrarily set starting date of the index. In addition to the CCI 30 Index, as a proxy for the market, Bitcoin, Litecoin, Stellar, Monero, Dogecoin, and Dash are used for empirical analysis. To the best of the author's knowledge, the CCI 30 Index is used for the first time as a proxy for market return. Despite the growing literature on cryptocurrencies, there is still a gap in herding behavior in the cryptocurrency market. Results indicate no evidence of herding behavior in the cryptocurrency market in both CSSD and CSAD approaches. The findings of both approaches are in line with the findings of the previous literature regarding the herding behavior in cryptocurrencies.

Chapter 7 analyzes cryptocurrency volatility. Dr. Cankaya and his colleagues, in this chapter, contribute to the field of research by examining the relationship between cryptocurrency's volatile returns and the effects of different types of news on selected cryptocurrencies. This chapter categorizes the news about cryptocurrencies and determines the effect of news from each category on the return structure of each cryptocurrency. By using 1054 news sources, 22 categories are created, and a clustering analysis is used to set these categories into six groups. These groups are modeled in proper ARCH family models, which are created for different cryptocurrencies to analyze the effect on volatility. The results show that different cryptocurrencies react differently to various news categories. News about regulations from national authorities exhibits a significant effect on all selected cryptocurrencies.

Chapter 8 analyzes Bitcoin market price movements and develops an empirical comparison with main *currencies, commodities, securities, and altcoins*. Dr. Haslak and her colleagues analyze the Bitcoin (BTC) market prices and to answer the question of whether there is a relationship between BTC and other asset prices, where other assets include currencies, commodities, securities, and altcoins. In the empirical part, they evaluate the lead-lag relationships among each type of asset. Their result shows that BTC does not have a long-run relationship with any asset type, but that it has a short-run relationship with gold and especially altcoins, which are both significant and bidirectional. While BTC and altcoins are closely interrelated with each other, BTC price variation is mostly borne by its own prices in all cases.

Chapter 9 initially assesses the causal relationship between returns and trading volume in cryptocurrency markets with a recursive evolving approach. Dr. Efe Cagli examines the time-varying causal relationship between trading volume and returns in cryptocurrency markets. The chapter employs a novel Granger causality framework based on a recursive evolving window procedure. The procedures allow detecting changes in causal relationships among time series by considering potential conditional heteroskedasticity and structural shifts through recursive subsampling. The chapter analyzes the return–volume relationship for Bitcoin and seven other altcoins:

Dash, Ethereum, Litecoin, Nem, Stellar, Monero, and Ripple. The results suggest rejecting the null hypothesis of no causality, indicating bidirectional causality between trading volume and returns for Bitcoin and the altcoins except Nem and Stellar. The findings also highlight that the causal relations in cryptocurrency markets are subject to change over time. The chapter may conclude that trading volume has predictive power on returns in cryptocurrency markets, implying the potential benefits of constructing volume-based trading strategies for investors and considering trading volume information in developing pricing models to determine the fundamental value of the cryptocurrencies.

Chapter 10 underlines a piece of empirical evidence from unit root tests with different approximations on the assessment of the crypto-market efficiency. Dr. Iltas and his colleagues examine whether the weak form of the efficient market hypothesis (EMH) is valid for the Bitcoin market. To that end, they consider the recent developments in unit root analysis utilizing daily data from February 2, 2012, to November 23, 2018. More specifically, they employ unit root tests with and without sharp breaks and also a unit root test with gradual breaks in order to obtain the efficient and unbiased output. Major findings show that the EMH appears to be valid for the Bitcoin market. We discuss the theoretical and practical implications of these findings.

Chapter 11 develops a critical approach to forecasting the prices of cryptocurrencies using GM(1,1) Rolling Model. Dr. Kartal and Dr. Bayramoglu explain the functioning of the cryptocurrencies as an investment tool in the market and to share information about the types of investors who have transferred their funds to cryptocurrencies by providing statistical information. Then, it is aimed to share the theoretical knowledge about GM(1,1) Rolling Model which has been proved by the literature in which it produces successful results especially in forecasting problems in an uncertainty environment. The results may be considered that the model was successful in forecasting the prices but unsuccessful in the direction forecasting.

Chapter 12 questions the possibility to understand the dynamics of cryptocurrency markets using econophysics in crypto-econophysics. Dr. Ulusoy and Dr. Celik advocate that following the second law of thermodynamics, the Carnot cycle was written from a new point of view: whether the amount of work given to the system in the cryptocurrency reserve can explain the possible trading (exchange) prices that occur or are likely to occur with the exchange of money.

Chapter 13 initially evaluates the linkages between cryptocurrencies and macro-financial parameters: a data mining approach. Dr. Arzu Bayramoglu and Dr. Basarir address the importance of digital currencies which have increased their effectiveness in recent years and have started to see significant demand in international markets. Bitcoin stands out from the other cryptocurrencies in considering the transaction volume and the rate of return. In this study, Bitcoin is estimated by using a decision tree method which is among the data mining methodologies.

Chapter 14 assesses the impact of digital technology and the use of blockchain technology from the consumer perspective. In this chapter, cryptocurrencies, specifically Bitcoin and the underlying technology blockchain, are discussed by

Dr. Bumin Doruk, from the consumer point of view. Awareness of cryptocurrencies, attitudes toward it, purchase intentions, user profiles, and usage motivation around the world and in Turkey are also assessed. Following this part, the adoption of blockchain technology and Bitcoin is analyzed by different technology acceptance and adoption models.

Chapter 15 demonstrates the empirical evidence of the relationships between Bitcoin and stock exchanges with a case of return and volatility spillover. Dr. Kamisli and his colleagues explain the new investment vehicle which is also used for portfolio diversification. But to provide the desired benefits, the relationships between the Bitcoin and asset or assets will be included in the portfolio. Therefore, the purpose of this study is to analyze the return and volatility relationships between Bitcoin and stock markets from different regions. For this purpose, Diebold and Yilmaz's spillover tests are applied to the return series. The empirical results indicate both return and volatility spillovers between the Bitcoin and the selected stock markets that should be considered in portfolio and risk management processes.

Chapter 16 focuses on the asymmetric relationships between Bitcoin and precious metals. Dr. Kamisli analyzes the causality relationships between the most popular cryptocurrency Bitcoin and gold, silver, platinum, palladium, ruthenium, rhodium, iridium, osmium, and rhenium by asymmetric causality in frequency domain approach.

Chapter 17 develops an economic and institutional approach to effective taxation system by blockchain technology. Dr. Dermirhan discusses the applicability of blockchain technology for use in a tax system. This chapter, therefore, attempts to explain the applicability of blockchain technology in relation to taxation, and it clarifies (1) how blockchain technology represents a new approach to taxation, (2) how blockchain technology reduces tax expenditure, (3) how blockchain technology increases both transparency and accountability, (4) how tax evasion can be reduced using blockchain technology, and (5) how blockchain technology can reduce the administrative tax burden.

Chapter 18 examines the impact of size and taxation of cryptocurrency with an assessment for emerging economies. Dr. Teyyare and Dr. Ayyildirim attempt to discuss the dimensions of cryptocurrencies in developing countries and show the debates on the taxation of these currencies. As countries' tax systems and taxable incomes may differ, under which income category cryptocurrencies and incomes to be gained through them will be treated and how they will be taxed are still being debated. In this regard, it is aimed to determine the current situation in certain developing countries and in Turkey and to put forward some policy recommendations about taxation.

Chapter 19 explains the framework of the accounting and taxation system of cryptocurrencies in emerging markets. Dr. Kablan makes recommendations on accounting and taxation of cryptocurrencies by providing examples of accounting records. Finally, the study recommends that common definitions are made for these new assets throughout the world, and globally accepted international cryptocurrency

standards for the accounting and taxation of these currencies are established and implemented.

Chapter 20 evaluates the cryptocurrency and tax regulation by assessing the global challenges for tax administration. Dr. Yalaman and Dr. Yildirim investigate whether the government should tax cryptocurrency or not by using the game theoretical framework. In this game, both government and cryptocurrency investors will determine the strategies to maximize their own benefits. This chapter also investigates various countries taxation policy on cryptocurrency. It is clear that there is no consensus among countries about legal status and taxation process of cryptocurrencies.

Chapter 21 proposes a model for using smart contracts via blockchain technology for effective cost management in health services. In this chapter, the health services where E-government applications, tele-medicine, and artificial intelligence are reviewed and the effects of the sharing of the data about patients and diseases among health sector parties with the blockchain technology through smart contracts have been investigated by Dr. Oflaz. The theoretical framework of blockchain technology has been also investigated within the existing framework, and the applications of countries such as Estonia, Sweden, and the USA, who use blockchain technology in the health sector, have been analyzed and their effects on the costs of health services were evaluated.

Chapter 22 analyzes the role of technological trust and its international effects and evaluates the future of cryptocurrencies in the digital era. Dr. Dilek has assessed the evolution of money in the era of digital transformation and the repositioning of cryptocurrencies with a focus on Bitcoin. The study analyzes the global effects of blockchain technology and cryptocurrencies and the risk, opportunities, and environmental effects of mining.

Chapter 23 takes a contrary view and discusses the existence of speculative bubbles for us at times of two major financial crises in the recent past with an econometric check of Bitcoin prices. In this study, Dr. Mukherjee uses a speculative bubble tracker, based on Wiener stochastic process, at times of two major financial crises, i.e., during the 2008–2009 US subprime mortgage market crisis and the global recession that started from 2010 onward.

Chapter 24 examines the relationship between international interest rates and cryptocurrency prices with a case for Bitcoin and LIBOR. In this study, the change in weekly USD LIBOR Rate and USD Bitcoin Price for 2013–2018 was analyzed by Dr. Erdogan and Dr. Dayan. According to the results of their study, the variables are stationary at the $I(0)$ level. The VAR model was stationary and significant. According to the ARDL model, short-term deviations have stabilized in the long run. The Granger causality test was one-way significant.

Chapter 25 evaluates cryptocurrency derivatives in blockchain economics with a case of Bitcoin. Dr. Soylemez states that “cryptocurrencies are recognized by individuals, institutions, and governments as an economic asset. However, the high price volatility of cryptocurrencies shows that they have significant risks. Cryptocurrency derivatives are used to hedge against and benefit from price

movements.” This study provides a basic framework for cryptocurrency derivatives. In this study, the most traded cryptocurrency type, Bitcoin derivatives, are used.

Chapter 26 questions that how a machine learning algorithm is *now-casting* stock returns. Dr. Sorhun’s study focuses on measuring the performance of algorithmic trading in the now-casting of stock returns using machine learning techniques. The main findings are: (1) the decision tree algorithm performs better than K-nearest neighbors, logistic regression, Bernoulli naïve Bayes alternatives; (2) the now-casting model allowed us to realize an 18% of yield over the test period; and (3) the model’s performance metrics (accuracy, precision, recall, f1 scores, and the ROC-AUC curve) that are commonly used for classification models in machine learning takes values just in the acceptance boundary.

Chapter 27 draws a comprehensive framework for accounting 4.0 with the implications of Industry 4.0 in the digital era. Prof. Aslanterlik and Dr. Yardimci underline that accounting systems, which have a very important function for businesses, need to adapt to Industry 4.0 by redefining the whole accounting system, as well as redesigned strategies. Industry 4.0 offers new potential for the transformation of the accounting process through digitalization and application of new tools of Industry 4.0 such as big data analytics, networking, and system integration. The main objective of this chapter is to offer a conceptual framework for a newly designed accounting process in terms of procedures, technology, and accounting professionals.

This book gathers colleagues and professionals across the globe from multicultural communities to design and implement innovative practices for the entire global society of business, economics, and finance. The authors of the chapters in this premier reference book developed a new approach to economic and financial issues in the digital era with an elaborate understanding of financial innovation on the basis of blockchain economics and crypto-markets.

Finally, distinguished authors and professionals with respect to their studies in the field contributed to the success of existing literature with their theoretical and empirical studies from multidisciplinary perspectives in this novel book.

Istanbul, Turkey

Umit Hacioglu

Acknowledgment

In this novel book, I have many colleagues and partners to thank for their impressive contribution to this publication. First of all, I would like to praise the people at Springer International Publishing AG: Editors Mr. Prashanth Mahagaonkar and Mr. Philipp Baun, who have the attitude and substance of a genius—they continually and convincingly conveyed a spirit of adventure in regard to this research at each stage of our book development process; our Project coordinator and all Springer team, without their persistent help this publication would not have been possible; and others who assisted us to make critical decisions about the structure of the book and provided useful feedback on stylistic issues.

I would like to express our appreciation to the Editorial Advisory Board Members. The members who helped with the book included Dursun Delen, Ekrem Tatoglu, Ekrem Tatoglu, Hasan Eken, Idil Kaya, Ihsan Isik, Martie Gillen, Michael S. Gutter, Nicholas Apergis, Ozlem Olgu, Ulas Akkucuk, and Zeynep Copur. The excellent advice from these members helped us to enrich the book.

I would also like to thank all of the authors of the individual chapters for their excellent contributions.

I would particularly like to thank the Bussecon International Academy Members for their highest level of contribution in the editorial process.

The final words of thanks belong to my family and parents separately. I would like to thank my wife Burcu, my son Fatih Efe, my girl Zeynep Ela, as well as my parents, my father Ziya and my mother Fatma. Their pride in this challenging accomplishment makes it even more rewarding to me.

Umit Hacıoğlu