Finansal Araştırmalar ve Çalışmalar Dergisi • Cilt: 13 • Sayı: 24 • Ocak 2021 ISSN: 2529-0029, ss. 16-35
DOI: 10.14784/marufacd.879164

ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

INTERNATIONAL CAPITAL FLOWS AND THE CRYPTOCURRENCY EFFECT

ULUSLARARASI SERMAYE AKIŞLARI VE KRİPTO PARA BİRİMİ ETKİSİ

Murat AKBALIK[*]
Nicholas APERGIS[**]
Melis ZEREN[***]
Ömer SARIGÜL[****]

Abstract

The paper investigates the impact of Bitcoin volatility on international capital inflows through the methodology of an AR(1)-CGARCH model across a global panel of 132 countries, as well as across different regions, i.e. Asia, European Union (EU), America (including the US, Canada and Latin American countries), and Africa. The findings document that there is a strong impact of Bitcoin volatility on global international capital inflows, as well as in the cases of the American and Asian cases. However, the results document a statistically insignificant effect for the cases of the EU and African countries.

Keywords: International capital inflows, Bitcoin returns, AR(1)-CGARCH modelling

JEL Classification: F31, F32, F65

Öz

Bu makale, 132 ülkeden oluşan küresel bir panelde ve Asya, Avrupa Birliği (AB), Amerika gibi farklı bölgelerdeki AR (1) – CGARCH modelinin metodolojisi aracılığıyla Bitcoin dalgalanmasının uluslararası sermaye girişleri üzerindeki etkisini araştırmaktadır. Bulgular, Bitcoin dalgalanmasının küresel uluslararası sermaye girişlerinin yanı sıra Amerika ve Asya vakalarında güçlü bir etkisi olduğunu belgeliyor. Ancak sonuçlar, AB ve Afrika ülkelerinin durumları için istatistiksel olarak önemsiz bir etkiyi gösteriyor.

Anahtar Kelimeler: Uluslararası sermaye akışları, Bitcoin getirisi, AR(1)-CGARCH modellemsi.

JEL Kodları: F31, F32, F65

* Prof. Marmara University, makbalik@marmara.edu.tr, ORCID: 0000-0002-7955-3630
** Prof. University of Derby, n.apergis@derby.ac.uk ORCID: 0000-0002-0375-2457
*** Marmara University, Turkey, meliszeren7@hotmail.com, ORCID: 0000-0003-1376-415X
**** Marmara University, Turkey, sarigulomer92@gmail.com, ORCID: 0000-0002-5493-9211

Başvuru Tarihi 23.09.2020 **Kabul Tarihi** 04.01.2021

Introduction

The emerging concept of cryptocurrencies markets has become a cross-cutting issue on the international agenda recently and posed a big challenge to the stability of currency markets, capital markets, and international capital flows. In this context, research has shown high volatility, uncertainty and complexity within the international cryptocurrency markets. For example, Antonakakis, Chatziantoniou and Gabauer (2019) investigate 45 cryptocurrency markets and their co-movements. They illustrate that the substantial price volatility is associated with an uncertain and complex cryptocurrency market structure. Fry and Cheah (2016) analyze potential negative bubbles and crashes related to digital currency markets and utilize probabilistic and statistical formulation derived from econophysics models, while Makarov and Schoar (2019) suggest that '*price deviations across countries co-move*'. In association with the latter issues, any potential negative effect on international capital flows could be the disruption of available liquidity, the limitation of domestic resources available, the decrease of needed tax revenues, especially in emerging economies, where these resources are critical in poverty-reducing programmes and infrastructure. As a result, economies could face investments reduction, excessive inflationary pressures, and higher interest rates, leading to unstable economies, higher income inequality and reduced levels of security. Therefore, it is highly important to explore the influence of such cryptocurrency markets on international capital flows, especially in a case where the literature has not paid sufficient attention. In this context, it is essential to discuss the comparison of US Dollar volume and cryptocurrency market cap. To address the importance of cryptocurrency flows in international capital markets, it is worth mentioning that the market cap of total cryptocurrencies in January 2018 amounted to 813,871,000,000 USD (https://coinmarketcap.com/), whereas the 24 hrs total market capitalization of US dollar at the same date was 44,060,500,000 USD (https://coinmarketcap.com/), which shows that the cryptocurrency market has an influential amount of volume in the international capital markets. This was the peak of the cryptocurrency market cap volume, while in September 2019, it dropped to 259,789,570,586 USD. On the same date, the daily total market capitalization of the market was 53,568,480,190 USD. Although the market cap has declined substantially, the cryptocurrency market still displays significant volumes of transactions. The goal of this paper is to provide for the first time some formal quantitative analysis with respect to the nexus between the volatility of cryptocurrency markets and international capital flows.

International capital flows can be expressed as the financial fragment of the international trade and international cryptocurrency flows are anticipated to increase with the rising digitalization on a global basis (Gray and Rumpe, 2015). Jacobs (2018) summarizes the impact of cryptocurrencies on global markets as follows:

> '*…the rapid deployment of cryptocurrencies could have profound impact on the capacity of governments to tax transactions, income and wealth, one of the main pillars of the modern nation state. The development of autonomous global cryptocurrencies could dramatically reduce the control and effectiveness of existing regulatory mechanisms at the national level and generate considerable pressure for the evolution of more effective institutions for global governance. They could provide compelling incentives for national governments to enhance international cooperation and strengthen the functioning of international*

> *institutions to fill the regulatory void. International organizations will play an important role in harnessing the potentials and minimizing the risks arising from the growing usage of cryptocurrencies. Most of the research conducted by central banks on cryptocurrencies over the past four years has focused on risks and benefits as viewed from the perspective of national economies and national monetary systems.'*

In the relevant literature, there are certain studies concerning the association between international capital inflows and macroeconomic variables; however, there is not any study, to the best of our knowledge, which explores the effect of recently popularized cryptocurrencies on international capital inflows. This study emphasizes the role of the cryptocurrencies' volatility and examines the relationship between the Bitcoin price volatility and international capital inflows, along with a number of macroeconomic drivers recommended by the literature. Digital (cryptocurrency) markets embody a fast-growing area of internet commerce, driven by demand for low-friction fund flows (Tucker, 2009; Meiklejohn et al., 2016). These markets represent value-exchange systems that operate electronically and make transactions with currencies that operate only online, are not issued by financial institutions and, thus, are exempted from regulation. Such currencies are exchanged between account holders or changed into traditional money. They are accessible from any part of the globe, while they allow money transfers instantly, at low cost and with anonymity (Samani, 2013; Bryans, 2014). An additional concern is that the presence of such cryptocurrency markets could destabilize not only international capital flows, but they could be also used for payments in the online underground markets, given that such currencies are decentralized and, thus, hard to control (Brito and Castillo, 2013).

Recently, investors and other stakeholders have paid substantial attention on the behaviour of the Bitcoin market. This can be attributed to certain innovative characteristics of blockchain (the basis of the entire digital currency system), namely, the decentralized structure, the absence of any intermediaries, the anonymity feature, its speed and security. Being a fluctuating investment tool, the cryptocurrency system exhibits unpredictable ups and downs, which make it a substantially speculative asset. Other significant factors driving investing in Bitcoins are its simplicity and the transparency of transactions.

It is expected that our study could novel for both individual and institutional investors, as well as government and international regulatory authorities and academicians who study the effects of Bitcoin, since it may be accepted as a new indicator explaining international capital inflows. Since Bitcoin has certain properties, such as simplicity of use, anonymity, transparency in transactions and efficiency in transaction timing (Katsiampa, 2017), local private and institutional investors prefer to exchange their local currency and transfer via the Bitcoin system very easily and quickly without tackling any strict government regulations. The main hypothesis of this research is that the price volatility of Bitcoin impacts on international capital flows. It is expected that this study could specifically help governments and international regulatory authorities to make and manage economic policies concerning international capital inflows considering bitcoins.

1. Literature Review

Nakamoto (2008) defines Bitcoin as '*A Peer-to-Peer Electronic Cash System*' (Nakamoto, 2008), while Androulaki et. al. (2013), Underwood (2016), and Eyal et. al. (2016) express Bitcoin as an open-source, highly innovative and decentralized cryptocurrency, which has recently gained popularity, following an unprecedented and unpredicted price jump in 2018 throughout the global investment markets. The invention of cryptocurrencies in pursuit of the 2008 financial crisis commenced an inevitable process of digitalization in the international monetary system, which pervaded throughout the global markets. The tremendous increase in Bitcoin prices has triggered debates on the fundamental value, the trustworthiness, and the volatility of cryptocurrencies.

Cheah and Fry (2015) assert that the fundamental (long-term) price of Bitcoin is not statistically different from zero, while Yermack (2013) and Hanley (2013) suggest that Bitcoin does not have a real value intrinsically, but it is a highly speculative investment tool displaying high volatility. According to them, this high volatility is the primary reason why Bitcoin cannot be considered as a real currency. By contrast, Garcia et al. (2014) and Hayes (2016) assert that the cost of mining Bitcoins actually contributes to its intrinsic value, which makes it a valuable investment intermediary. Additionally, Yermack (2017) investigates the impact of blockchain technology on investors, managers, stakeholders, and others who participate in the process of corporate governance and finds that cost advantages, liquidity power, correctness in record-keeping, and distributed ownership features of blockchain can cause substantial changes among the balances of these parties. Moreover, Huberman et al. (2017) provide solid evidence on how the dynamics of the Bitcoin economy work, what kind of potential this type of cryptocurrencies carry for the future and develop models to assess the revenues of this economy, its delay costs and the infrastructure of Bitcoin measured in terms of number of miners.

Hayes (2017; 2016) documents the value determination process of cryptocurrencies and employs a cross-sectional analysis across 66 different cryptocurrencies and considers three main variables, namely, competition among the miners, the production rate of the currencies, and the difficulty of algorithm used for currency mining. By contrast, Bouri et. al. (2017) use a correlation model and assert that the Bitcoin is generally not considered a safe harbor; instead, it is only used to increase portfolio diversification; it is only considered to be a safe harbor in the Asian markets in cases where these stock markets experience high volatilities. Burniske and Whıte (2017) illustrate that Bitcoin is very much different from other assets in terms its economic profile, price independence and a risk-revenue relationship.

The observed high volatility of Bitcoin prices is a very important issue for those who invest in Bitcoins. Katsiampa (2017) examines several GARCH type models (i.e., TGARCH, EGARCH, GARCH, CMT-GARCH, ARCH, APARCH and ACGARCH) in order to determine the best fit that predicts Bitcoin price volatility. She provides solid evidence that the AR-CGARCH model is the best fit to predict Bitcoin price volatility. Consistent with this approach, the analysis in this study employs the AR(1)-CGARCH model to estimate the volatility of Bitcoin prices. The volatility of cryptocurrencies also has impact on the trade of these digital currencies, across and within the countries.

Coming to the effect of both FDI and trade openness on capital inflows, Ito et al. (2009); Wei (2011) and Liargovas (2012) argue that trade openness has a positive effect on FDI inflows in developing countries (Liargovas, 2012). Moreover, Aghion et al. (2004) and Broto et al. (2008) find an 'inverted-U-shaped' relation between FDI volatility and GDP per capita, indicating that average-income countries have less FDI volatility. The Global Financial Stability Report prepared by the IMF (2007) indicates that there is a negative relationship between FDI volatility and global liquidity, whereas Broto et al. (2008) point out the presence of a positive correlation between these two variables. GDP per capita and capital inflows are found to be correlated, where richer countries are subject to a higher volatility in capital flows and lower-income countries are exposed to less volatility. Additionally, the stock market capitalization to GDP ratio is also found to have an impact on capital inflows (IMF, 2007). If the stock market is below 50% of the GDP, it is considered as 'too low', if the ratio is between 75%-90%, it is considered as 'normal' and if it is above 115%, it is considered to be as overvalued. This ratio is also known as the Buffett Indicator referring to Warren Buffet (Mislinski, 2018) and is utilized to determine whether the market is over-capitalized or under-capitalized.

IMF's report documents that a strong domestic financial market reduces the volatility of capital inflows in developing countries. The same report asserts that both equity market liquidity and financial openness are associated with capital flows, and, hence, with the direction of investment flows. An increase in financial openness seems to be related to the reduction in capital volatility and higher capital inflows. In addition, financial market liquidity is positively associated with capital inflows. Along with that, both a measurement of institutional quality and better corporate governance levels are positively related to capital inflows (IMF Report, 2007). In addition to these findings, Broto et al. (2008) indicate that there is a strong relationship between global factors and the volatility of portfolio in-and-out flows, while a strong economic performance, measured by the interest rate and the S&P500 index, seems to be related to lower portfolio volatility. In terms of the exchange rate systems, Magud et al. (2014) find that bank credit grows faster in less flexible exchange rate systems, while capital flows are attracted to more rigid regimes, because more rigid systems benefit from regulatory policies, such as reserve, liquidity and capital requirements that are determined by the central bodies.

In contrast, Hilorme et al. (2019) argue that banks are under substantial competitive pressure by other financial institutions because in the former decades banks were controlling 70% of the world's financial assets, however, now they only manipulate 30% of the total due to the increasing usage of credit cards and cryptocurrencies. This means that the international capital flow structure has been going through a substantial change recently. Bartosova et. al. (2019) suggest that the introduction of the electronic money has made the purchase of goods by 2.5 – 5% cheaper and has fostered trade favoring buyers and sellers, where both national and international buyers and sellers are included. Limba, Stankevičius and Andrulevičius (2019) summarize the benefits of cryptocurrencies as system trust, simplicity and efficiency, elimination of banks, acceleration of global transactions, and low cost. They argue that the leveraging effect of cryptocurrencies will create a disrupting technological change. This disruptive change is expected to differentiate the whole financial system of the world and international capital flows.

Relying on previous literature mentioned above, this research assumes that capital inflows can be affected by a number of economic drivers, such as the income of the country, trade openness, financial openness, stock market capitalization, interest rates, global income levels, global stock prices, global liquidity, institutional quality, exchange rate volatility and, our primary target, the conditional volatility of Bitcoin prices. Broner and Rigobon (2005) find that the standard deviation of capital flows in developing countries is 80% higher than the capital flows in industrialized countries and asserted that this can be attributed to three reasons: i) capital flows in developing countries are more apt to experience crises, ii) crises are due to contagion effects, and iii) crises in developing countries are more long-lasting than those in industrialized countries. They argue that the high volatility of capital flows is correlated with the underdevelopment of financial markets, institutional weaknesses, and low per capita GDP (Broner and Rigobon, 2005).

2. Methodology

The hypothesis of this paper is that international capital flows are affected by the volatility displayed by cryptocurrency markets. We specifically choose the Bitcoin market to measure this impact, because Bitcoin is the most common and widely-used cryptocurrency and it experienced an attention-taking jump in the period 2016-2018. In order to examine the analysis yields the following model:

$$CF_{it} = a_i + b_1 \, GDP_{it} + b_2 \, P_{it} + b_3 \, TRADE_{it} + b_4 \, STOCK_{it} + b_5 \, FOPEN_{it} +$$
$$b_6 \, INTEREST_{it} + b_7 \, GGDP_t + b_8 \, GSP_t + b_9 \, GBM_t + b_{10} \, INST_{it} +$$
$$b_{11} \, VRER_{it} + b_{12} \, VBIT_t + u_{it}$$

where: CF_{it} denotes the size of capital inflows as a percentage of GDP for country i at year t, GDP_{it} is per capita income of country i at year t, P_{it} is domestic prices of country i at year t, $TRADE_{it}$ is trade openness of country i at year t, $STOCK_{it}$ denotes stock market capitalization over GDP of country i at year t, $FOPEN_{it}$ is the financial openness of country i at year t, $INTEREST_{it}$ is the interest rate differential between domestic and US interest rates of country i at year t, $GGDP_t$ is the global GDP at year t, GSP_t is global stock prices at year t, GBM_t is global liquidity at year t, $INST_{it}$ is the institutional quality index for country i at year t, $VRER_{it}$ is the volatility of the real exchange rate for country i at year t, and, finally, VBIT expresses the conditional volatility of the Bitcoin cryptocurrency. a_i denotes country fixed effects and u_{it} is the error term.

Per capita income is expected to increase the size of capital inflows (Broner and Rigobon, 2005), in contrary to expectations, we find a negative relationship, however the connection is insignificant. On the other hand, trade openness increases the size of FDI inflows (Ito et al., 2009; Wei, 2011) and there is also the reverse effect of FDI and openness. Countries that rely heavily on international trade tend to be more vulnerable to changes in global investment conditions, especially for economies where foreign investments are mainly directed to the export sectors. Stock market capitalization is expected to increase the size of investment inflows (IMF, 2007). It implies that investors take the growing equity market capitalization as a signal of market liquidity, which helps investors to buy or sell more stocks in a given period. Financial openness increases the size of capital flows, particularly in the form of FDI inflows (IMF, 2007). Higher global GDP should be also increasing the size of FDI inflows. Global broad money (liquidity) tends to encourage capital inflows. Better institutional quality should be leading to greater capital inflows (Broner and Rigobon, 2005; Wei, 2011), while higher exchange rate volatility reduces the size of capital inflows. Other factors, such as domestic prices, higher interest rate differentials, and global stock prices are also expected to impact capital inflows. Broto et al., (2008) argue that investors view domestic prices and inflation as a signal that the economies might be undertaking distortionary policies, hence, negatively impacting capital inflows. Moreover, it is also often suggested that higher interest rate differentials may attract capital flows (IMF, 2007). An increase in the global stock price index is expected to increase the size of capital flows, since a strong global stock market performance tends to encourage the incentive to invest the generated wealth globally.

The analysis, to avoid potential endogeneity problems, makes use of the panel system GMM methodology, which provides coefficient estimates that are corrected for endogeneity, heteroskedasticity and autocorrelation. Lagged values of the endogenous variables are used as instruments, while this methodological approach provides a straightforward way to test the specification of the proposed model through the Hansen J-test, which assesses the validity of over identifying restrictions, under the null hypothesis that the over identifying restrictions are satisfied and are valid.

3. Data and Empirical Analysis

A panel dataset has been constructed for the empirical analysis. In particular, the dependent variable is the size of capital inflows. Quarterly data on capital inflows, spanning the period 2012 to 2016, obtained from the IMF international financial statistics database for 132 economies (see Appendix A for the detailed country sample and sub-samples).

The size of capital inflows is measured as the ratio of capital inflows to nominal GDP. The set of independent variables include domestic and global macroeconomic and financial indicators, institutional quality indexes, the volatility of the real exchange rate, and regional dummy variables. Domestic macroeconomic factors include per capita income, prices, and trade openness. Domestic financial indicators are the change in stock market capitalization, financial openness, and nominal interest rate differentials. Global economic indicators are global growth expectations, measured as the lagged value of the global GDP growth rate, global broad money growth, and growth of the world stock price index (see Appendix B for a detailed description of the data variables, along with their sources). Data on the Bitcoin cryprocurrency are obtained from the Bloomberg database. Bitcoin prices were 0.0001$ in 2009, 0.07$ in 2010 and 15$ in 2011, while the price increased to 220$ in 2015 (Bitcoin College, 2015). In 2016 the price was raised to almost 800$ (Bovaird, 2016), while on 28 August 2017, it was 4,343.8$ (Investing.com, 2017) and on January 10, 2018 the price reached $12,931 (Investing.com, 2018). The inevitable and unprecedented jump of the price in 2017 and 2018 attracted the attention of the public to the cryptocurrency markets, primarily in relevance to their most famous market component, the Bitcoin.

The first step of the empirical analysis examines the unit root properties in the data through advanced panel unit root tests. Panel unit root tests of the first-generation can lead to spurious results (because of size distortions), if significant degrees of positive residual cross-section dependence exist and are ignored. Consequently, the implementation of second-generation panel unit root tests is desirable only when it has been established that the panel is subject to a significant degree of residual cross-section dependence. In the cases where cross-section dependence is not sufficiently high, a loss of power might result if second-generation panel unit root tests that allow for cross-section dependence are employed. A second-generation panel unit root test is employed to determine the degree of integration in the respective variables. The Pesaran (2007) panel unit root test does not require the estimation of factor loading to eliminate cross-sectional dependence. Specifically, the usual ADF regression is augmented to include the lagged cross-sectional mean and its first difference to capture the cross-sectional dependence that arises through a single-factor model. The lag length for the corresponding regression has been selected through the Akaike criterion. The null hypothesis is a unit root for the Pesaran (2007) test. The results are reported in Table 1 and support the presence of a unit root across all variables under consideration, except in the cases of interest rate differentials, the volatility of the real exchange rate, and the conditional volatility of Bitcoin, which are all three I(0) variables by construction. If a panel or time series shows unit root, it exhibits a systematic pattern that is not predictable, a possible unit root.

Table 1: Panel Unit Root Tests

Variable	CIPS	CIPS*
Full sample		
CF	-1.10(4)	-1.26(4)
ΔCF	– 5.31(3)***	– 5.65(3)***
GDP	-1.12(4)	-1.25(4)
ΔGDP	-5.41(3)***	– 5.30(3)***
P	-1.21(4)	-1.28(4)
ΔP	-5.57(3)***	-5.61(3)***
TRADE	-1.25(2)	-1.27(2)
ΔTRADE	-5.68(1)***	-5.41(1)***
STOCK	– 1.32(3)	– 1.40(3)
ΔSTOCK	– 5.42(2)***	-5.60(2)***
FOPEN	– 1.24(3)	-1.41(3)
ΔFOPEN	– 5.42(1)***	-5.72(1)***
INTEREST	– 5.35(3)***	-5.49(3)***
INST	– 1.24(4)	-1.36(4)
ΔINST	– 5.41(2)***	-6.50(2)***
VRER	-5.18(2)***	-5.32(2)***
VBIT	-6.36(2)***	-6.52(1)***
EU		
CF	-1.15(3)	-1.28(3)
ΔCF	-5.21(2)***	– 5.46(2)***

GDP	-1.15(4)	-1.27(4)
ΔGDP	-5.54(3)***	– 5.80(3)***
TRADE	-1.26(3)	-1.33(3)
ΔTRADE	-5.51(2)***	-5.64(2)***
STOCK	-1.32(2)	-1.41(2)
ΔSTOC	-5.53(1)***	-5.72(1)***
FOPEN	-1.27(3)	-1.36(3)
ΔFOPEN	-6.11(2)***	-6.52(1)***
INTEREST	-5.83(2)***	-6.02(2)***
INSTIT	-1.28(3)	-1.39(3)
ΔINSTIT	-5.64(2)***	-5.93(2)***
VRER	-6.12(2)***	-6.39(1)***
Asian		
CF	-1.26(4)	-1.35(4)
ΔCF	-5.11(3)***	– 5.40(3)***
GDP	-1.22(3)	-1.34(3)
ΔGDP	-5.33(2)***	– 5.51(2)***
TRADE	-1.32(3)	-1.43(3)
ΔTRADE	-5.31(2)***	-5.55(2)***
STOCK	-1.24(2)	-1.36(2)
ΔSTOC	-5.51(1)***	-5.63(1)***
FOPEN	-1.28(3)	-1.25(3)
ΔFOPEN	-5.81(2)***	-5.97(2)***
INTEREST	-6.11(2)***	-6.35(2)***
INSTIT	-1.29(3)	-1.37(3)
ΔINSTIT	-5.42(2)***	-5.68(1)***
VRER	-6.21(2)***	-6.37(2)***
American		
CF	-1.34(4)	-1.46(4)
ΔCF	-5.42(3)***	– 5.57(3)***
GDP	-1.32(3)	-1.43(3)
ΔGDP	-5.53(2)***	– 5.77(2)***
TRADE	-1.35(3)	-1.42(3)
ΔTRADE	-5.51(1)***	-5.72(1)***
STOCK	-1.34(2)	-1.40(2)
ΔSTOCK	-5.59(1)***	-5.82(1)***
FOPEN	-1.34(3)	-1.42(3)
ΔOPEN	-5.63(2)***	-5.81(2)***
INTEREST	-6.02(2)***	-6.19(2)***
INSTIT	-1.28(3)	-1.39(3)
ΔINSTIT	-5.71(2)***	-5.86(1)***
VRER	-6.12(1)***	-6.28(1)***
African		
CF	-1.40(2)	-1.53(2)
ΔCF	-5.52(1)***	– 5.76(1)***

GDP	-1.34(3)	-1.43(3)
ΔGDP	-5.32(1)***	– 5.64(1)***
P	-1.28(2)	-1.38(2)
ΔP	-5.62(1)***	-5.91(1)***
TRADE	-1.42(2)	-1.48(2)
ΔTRADE	-5.81(1)***	-6.05(1)***
STOCK	-1.36(3)	-1.42(3)
ΔSTOCK	-5.73(2)***	-5.91(2)***
FOPEN	-1.29(2)	-1.41(2)
ΔFOPEN	-5.84(1)***	-5.98(1)***
INTEREST	-6.13(2)***	-6.27(2)***
INSTIT	-1.31(3)	-1.39(2)
ΔINSTIT	-5.63(1)***	-5.84(1)***
VRER	-6.14(2)***	-6.30(1)***
FDI		
CF	-1.42(2)	-1.55(2)
ΔCF	-5.23(1)***	– 5.53(1)***
GDP	-1.27(3)	-1.41(3)
ΔGDP	-5.09(2)***	– 5.34(2)***
P	-1.21(2)	-1.33(2)
ΔP	-5.24(1)***	-5.40(1)***
TRADE	-1.26(2)	-1.41(2)
ΔTRADE	-5.32(1)***	-5.61(1)***
STOCK	-1.29(3)	-1.38(3)
ΔSTOCK	-5.73(1)***	-5.90(1)***
FOPEN	-1.30(3)	-1.28(2)
ΔFOPEN	-5.73(1)***	-5.94(1)***
INTEREST	-6.11(1)***	-6.27(1)***
INSTIT	-1.28(3)	-1.43(2)
ΔINSTIT	-5.82(1)***	-6.01(1)***
VRER	-6.25(1)***	-6.43(1)***
FPI		
CF	-1.32(3)	-1.48(3)
ΔCF	-5.11(2)***	– 5.25(2)***
GDP	-1.31(3)	-1.42(3)
ΔGDP	-5.30(2)***	– 5.52(2)***
P	-1.28(2)	-1.35(2)
ΔP	-5.41(1)***	-5.62(1)***
TRADE	-1.33(2)	-1.42(2)
ΔTRADE	-5.51(1)***	-5.72(1)***
STOCK	-1.25(3)	-1.38(3)
ΔSTOC	-5.73(1)***	-5.94(1)***
FOPEN	-1.32(2)	-1.44(3)
ΔFOPEN	-5.83(1)***	-6.07(1)***
INTEREST	-6.25(1)***	-6.39(1)***

INSTIT	-1.30(3)	-1.43(3)
ΔINSTI	-5.73(1)***	-5.96(2)***
VRER	-6.31(1)***	-6.53(2)***

Notes: Δ denotes first differences. A constant is included in the Pesaran (2007) tests. Rejection of the null hypothesis indicates stationarity in at least one country. CIPS* = truncated CIPS test. Critical values for the Pesaran (2007) test are – 2.40 at 1%, – 2.22 at 5%, and – 2.14 at 10%, respectively. Figures in parentheses denote the number of lags in the corresponding regressions selected through the Akaike criterion. The null hypothesis is that of a unit root. *** denotes the rejection of the null hypothesis at the 1% significance level.

More specifically, the modeling approach follows the model recommended by Katsiampa (2017). In particular, she provides evidence that the best model that describes Bitcoin's volatility is that of the Autoregressive (1) Component GARCH [AR(1)-CGARCH]:

$$r_t = c + b_1 r_{t-1} + u_t,$$

with

$$h_t^2 = q_t + \alpha\,(u_{t-1}^2 - q_{t-1}) + \beta\,(h_{t-1}^2 - q_{t-1})$$

$$q_t = \omega + \rho\,(q_{t-1} - \omega) + \theta\,(u_{t-1}^2 - h_{t-1}^2)$$

where r_t is the bitcoin price return on day t, u_t is the error term, and h_t is the conditional standard deviation. This modeling approach provides more extensive information on volatility by splitting the component of volatility into permanent volatility and transitory volatility, while it offers information on the speed of adjustment. More specifically, the h_t^2 equation stands for the short-run memory component, while the q_t equation, especially the ρ term, stands for the long memory component. The Akaike criterion also selects an AR(1) model for Bitcoin returns. The estimates over the analysis time span are reported in Table 2.

The CGARCH model incorporates two main components and captures volatility of long-and-short run (Jesús Gutiérrez, 2017). The term $u_{t-1}^2 - h_{t-1}$ stands for the distinction between the conditional variance and its tendency, whereas the term $(h_{t-1} - q_{t-1})$ is the lagged difference between short-and-long run components that approaches to zero at a velocity (α + β). The term $u^2_{t-1} - q_{t-1}$ indicates the difference between the conditional variance and its long run tendency, and the term $u_{t-1}^2 - h_{t-1}$ stand for the difference between conditional variance and its short-run tendency. And ω indicates the unconditional volatility. Table 2 shows that all the coefficients are statistically significant.

Table 2: CGARCH Estimates: Bitcoin Returns

Mean equation	
Constant term:	0.0025 [0.04]
AR(1) term:	0.0673 [0.01]
Conditional volatility equations	
Constant term:	0.1636 [0.07]
$h_{t-1}^{2} - q_{t-1}$ term:	0.8120 [0.00]
$u^{2}_{t-1} - q_{t-1}$ term:	0.2138 [0.00]
$q_{t-1} - \omega$ term:	0.9879 [0.00]
$u_{t-1}^{2} - h_{t-1}^{2}$ term:	0.0781 [0.00]

Note: Figures in parentheses denote p-values.

Table 3 reports the empirical findings in relevance to the effect of the Bitcoin volatility on international capital flows, with the volatility of the Bitcoin being measured through an AR(1)-C-CARCH(1,1) model as suggested in Table 2. The various columns in Table 3 present the GMM results across a number of specifications. In particular, column (1) reports the full sample estimates, while columns (3) to (5) report the regional estimates. Finally, columns (6) and (7) repeat the estimate analysis, but this time with respect to FDI and FPI flows, respectively. If we focus on the primary variable of interest, the findings document that the Bitcoin volatility leads to lower international flows in relevance to the overall sample; the findings remaining robustly similar across all regional cases, except in the cases of the EU and African sub-samples. The findings remain robust across FDI flows, while the impact turns out to be weaker in the case of the FPI capital flows. The results remained consistently similar across regions, with the volatility of the Bitcoin cryptocurrency exerting the strongest effect on international capital flows in the case of the American region (that includes both the U.S. and Canada), followed by that in the case of the Asian regions.

Table 3: GMM Estimates: Dependent Variable is International Capital Flows and VBIT is from a CGARCH(1,1) Model

Variables	Full sample	EU	Asian	American	African	FDI	FPI
ΔGDP	0.189***	0.165***	0.175***	0.248***	0.074***	0.168***	0.131***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ΔGDP(-1)	0.093***	0.081***	0.104***	0.185***	0.038**	0.131***	0.106***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.05]	[0.00]	
ΔP	-0.126***	-0.094***	-0.073***	-0.086***	-0.126***	-0.129***	-0.137***
	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
ΔP(-1)	-0.072***	-0.066***	-0.042**	-0.044**	-0.074***	-0.092***	-0.096***
	[0.00]	[0.00]	[0.03]	[0.02]	[0.01]	[0.00]	
ΔTRADE	0.268***	0.244***	0.205***	0.303***	0.114***	0.214***	0.142***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ΔSTOCK	0.185***	0.127***	0.118***	0.225***	0.062**	0.144***	0.269***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.03]	[0.00]	[0.00]
ΔSTOCK(-1)	0.117***	0.096***	0.069***	0.164***	0.035*	0.113***	0.185***

Variables	Full sample	EU	Asian	American	African	FDI	FPI
	[0.00]	[0.00]	[0.01]	[0.00]	[0.06]	[0.00]	[0.00]
ΔFOPEN	0.274***	0.178***	0.125***	0.198***	0.040*	0.098***	0.163***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.06]	[0.00]	[0.00]
ΔFOPEN(-1)	0.148***	0.119***	0.080***	0.125***	0.018	0.075***	0.105***
	[0.00]	[0.00]	[0.01]	[0.00]	[0.17]	[0.01]	[0.00]
INTEREST	0.137***	0.116***	0.124***	0.174***	0.082***	0.104***	0.173***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]
ΔINST	0.158***	0.149***	0.096***	0.184***	0.036*	0.185***	0.177***
	[0.00]	[0.00]	[0.01]	[0.00]	[0.10]	[0.00]	[0.00]
ΔINST(-1)	0.109***	0.096***	0.032	0.118***	0.010	0.142***	0.118***
	[0.00]	[0.00]	[0.18]	[0.00]	[0.27]	[0.00]	[0.00]
VRER	-0.088***	-0.049**	-0.075***	-0.126***	-0.053**	-0.102***	-0.084***
	[0.00]	[0.03]	[0.01]	[0.00]	[0.03]	[0.00]	[0.01]
VBIT	-0.069***	-0.014	-0.069***	-0.039**	-0.042**	-0.058***	-0.023*
	[0.00]	[0.38]	[0.01]	[0.04]	[0.05]	[0.01]	[0.08]
VBIT(-1)	-0.043**	-0.000	-0.044**	-0.013	-0.022	-0.027**	-0.018*
	[0.00]	[0.49]	[0.02]	[0.41]	[0.13]	[0.05]	[0.10]
Diagnostics							
R^2	0.68	0.66	0.57	0.64	0.43	0.65	0.68
AR(1)	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
AR(2)	[0.43]	[0.39]	[0.56]	[0.48]	[0.36]	[0.36]	[0.41]
Hansen test	[0.47]	[0.50]	[0.51]	[0.56]	[0.37]	[0.48]	[0.45]
Difference Hansen test	[0.55]	[0.64]	[0.67]	[0.73]	[0.44]	[0.55]	[0.63]
No. of obs.	2,800	540	820	500	740	2,800	2,800

Notes: AR(1) is the first-order test for residual autocorrelation. AR(2) is the test for autocorrelation of order 2. Hansen is the test for the overidentification check for the validity of instruments. The difference-in-Hansen test checks the exogeneity of the instruments. Figures in parentheses denote p-values. **: p≤0.05; ***: p≤0.01. All estimations were performed with time and country dummies. The number o observations for specific regions does not include countries that belong in the full sample (mostly European countries).

4. Results and Discussion

In terms of the remaining control variables, the findings illustrate that GDP growth changes in trade openness, financial openness and market capitalization exert a positive effect on international capital flows. Moreover, interest rate differentials and institutional quality also have a similar impact on those flows. By contrast, inflation and real exchange rate variability affect international capital flows in a negative manner. In terms of the FDI flows, the results are consistent with those provided by IMF (2007), Ito et al. (2009) and Wei (2011). All the relevant diagnostics are reported at the bottom of Table 3. For the validity of instruments used, the results reject second-order autocorrelation, AR(2), in the error variances. Moreover, they reject the null hypothesis of difference-in-Hansen disturbances and the difference-in-Hansen tests fail to reject the respective nulls. Hansen tests imply the exogeneity of the instruments employed. In the estimation process, 27 instruments have been used.

These instruments were generated as we used a constant, two lags for levels and three lags for difference in the regressors. As the number of instruments was by far lower than the number of observations, it did not create any identification problem, as reflected in the Hansen test. Reported Hansen test results also fail to detect any problem in the validity of the instruments used in the estimation approach. Finally, the explanatory power of models, through the R-squared metrics, is highlighted to be strong enough.

The findings seem to support the role of the exchange rate regime on international capital flows. In particular, Calvo and Reinhart (2002) argue that exchange rate manipulation could be potentially a problem that can distort trade and finance flows, while governments display a 'fear of floating' attitude, i.e. they are officially declaring they allow their exchange rates to float (a de jure floating regime), while still actively manipulating their exchange rates (a de facto managed regime). Furthermore, Alesina and Wagner (2006) document that only 157 out of 601 de jure floats were de facto floats, with countries declaring a floating regime to signal their virtuousness. Given the absence of accurate official data, researchers use indirect methods to detect the de facto exchange rate regime. For instance, Levy-Yeyati and Sturzenegger (2005) use the volatility of a policy instrument, i.e. interest rates or foreign exchange reserves, and interpret a smooth exchange rate accompanied by a volatile policy as a non-floating exchange rate regime. Klein and Shambaugh (2015) document that economies can successfully 'mix-and-match' policies to smooth exchange rates, i.e. temporary capital controls accompanied by only small adjustments to interest rates, thus, leading to the under-detection of de jure deviations. Given the fact that Bitcoin's lack of regulations and lack of transportation costs (as a virtual good), which both facilitate purchases across multiple currencies and countries, thus providing timely, high frequency, and free-of-charge price data through Bitcoin sales, can be used to construct a dataset of daily unofficial exchange rates and detect de facto regimes. Moreover, because Bitcoin has an alternative use as an investment and purchasing vehicle, its prices exist across a variety of regimes, even currencies with non-manipulated exchange rates. In that sense, Bitcoin prices can detect any transitory interventions in the currency markets (Klein and Shambaugh, 2015). Furthermore, Ilzetzki et al. (2017) note that the de facto exchange rate literature often ignores capital controls. Measures of capital controls are usually on an annual basis, while they also lag in availability. In contrast, the high-frequency Bitcoin exchange rates can be used to detect capital controls, even if the impact is transitory.

Overall, Bitcoin is a sovereign-less vehicle currency, so it can decompose exchange rate effects, as Yang and Gu (2016) demonstrate for trade, while Michalski and Stoltz (2013) find that among countries of similar economic profiles, fear-of-floating countries are more likely to misreport economic data. The above discussion seems to be in consistency with the results reported in Table 3. More specifically, the absence of any statistically significant effect of Bitcoin volatility in the case of the EU capital flows clearly indicates the absence of any capital controls or serious manipulation of the euro exchange rates. By contrast, in the other regions, there seem to be certain (potentially many) countries that explicitly intervene in their exchange rate markets to somehow control the course of their currency or/and to explicitly impose certain controls on their international capital flows.

Finally, the countries seem to exert in various types of capital controls in the case of the FPI flows, while they seem to relatively avoid them in the case of FDI flows, since the latter seem to be substantially crucial for generating positive economic spillovers to the domestic economy (i.e., technological spillovers, higher growth rates, lower unemployment).

Conclusion

This paper documented that the volatility of Bitcoin prices led to reduced international capital inflows; although these findings for the cases of the EU and African regions were not robust, the analysis provided a clear evidence that there was a strong significant influence of cryptocurrencies on international capital flows in the US, Canada, and Asia. In addition, the findings highlighted that the exchange rate regime had an important impact on international capital flows. The overall results documented that data manipulation by governments can be approximately detected through FPI (Foreign Portfolio Investments); however, in the case of foreign direct investment (FDI) flows, where government manipulations cannot be clearly detected, Bitcoin's price volatility can be a clear indicator of detecting this manipulation.

References

Aghion, P, Bacchetta, P.,and Banerjee, A (2004). Financial development and the instability of open economies. Journal of Monetary Economics, 51, 1077-1106.

Alesina, A, and Wagner, A (2006). Choosing (and reneging on) exchange rate regimes. Journal of the European Economic Association, 4, 770-799.

Androulaki, E., Karame, G. O., Roeschlin, M., Scherer, T., & Capkun, S. (2013, April). Evaluating user privacy in bitcoin. In International Conference on Financial Cryptography and Data Security (pp. 34-51). Springer, Berlin, Heidelberg.

Antonakakis, N., Chatziantoniou, I., & Gabauer, D. (2019). Cryptocurrency market contagion: Market uncertainty, market complexity, and dynamic portfolios. Journal of International Financial Markets, Institutions and Money, 61, 37-51.

Bartosova, V, and Petrova, L (2019). Accounting of transactions in electronic money: international trends. Bitcoin.com: https://www.bitcoin.com/you-need-to-know, 01.26.2018.

Bloomberg (2018). https://www.cnbc.com/2018/01/15/china-is-reportedly-raising-thebar-on-its-cryptocurrency-crackdown.html, 01.26.2018

Bouri, E, Molnár, P, Azzi, G, Roubaud, D, and Hagfors, LI (2017). On the hedge and safe haven properties of Bitcoin: Is it really more than a diversifier? Finance Research Letters, 20, 192-198.

Brito, J, and Castillo, A (2013). Bitcoin: a primer for policymakers. Working Paper, Mercatus Center, George Mason University.

Broner, F, and Rigobon, R (2005). Why are capital flows so much more volatile in emerging than in developed countries? Working Paper, No. 382, Central Bank of Chile.

Broto, C, Diaz-Cassou, J, and Erce-Dominguez, A (2008). The sources of capital flows volatility: empirical evidence for emerging countries. Money Affairs, 21, 1-22.

Bryans, D (2014). Bitcoin and money laundering: mining for an effective solution. Indiana Law Journal, 89, 441-472.

Burniske, C., & White, A. (2017). Bitcoin: Ringing the bell for a new asset class. Ark Invest (January 2017) https://research. ark-invest. com/hubfs/1_Download_Files_ARK-Invest/White_Papers/Bitcoin-RinginggThe-Bell-For-A-New-Asset-Class. pdf.

Calvo, GA, and Reinhart, CM (2002). Fear of floating. Quarterly Journal of Economics, 107, 379-408.

Cheah, ET, and Fry, J (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. Economics Letters, 130, 3236.

Chinn, M, and Ito, H (2008). A new measure of financial openness. Journal of Comparative Policy Analysis, 10, 309-322.

CoinMarketCap (2019). https://coinmarketcap.com/ , 09.12.2019

de Jesús Gutiérrez, R., Calisto, E. O., & Salgado, O. G. (2017). Long-term effects of the asymmetry and persistence of the prediction of volatility: Evidence for the equity markets of Latin America. Contaduría y administración, 62(4), 1081-1099.

Eyal, I., Gencer, A. E., Sirer, E. G., & Van Renesse, R. (2016). Bitcoin-ng: A scalable blockchain protocol. In 13th {USENIX} symposium on networked systems design and implementation ({NSDI} 16) (pp. 45-59).

Fry, J., & Cheah, E. T. (2016). Negative bubbles and shocks in cryptocurrency markets. International Review of Financial Analysis, 47, 343-352.

Garcia, D, Tessone, CJ, Mavrodiev, P, and Perony, N (2014). The digital traces of bubbles: feedback cycles between socio-economic signals in the Bitcoin economy. Journal of the Royal Society Interface, 11, 2014-2023.

Gray, J., Rumpe, B. Models for digitalization. Softw Syst Model 14, 1319–1320 (2015). https://doi.org/10.1007/s10270.015.0494-9

Hanley, BP (2013). The false premises and promises of Bitcoin. arXiv preprint arXiv:1312.2048.

Hayes, AS (2016). Cryptocurrency value formation: an empirical study leading to a cost of production model for valuing bitcoin. Telematics and Informatics, 41, 256-291.

Hayes, AS (2017). Cryptocurrency value formation: an empirical study leading to a cost of production model for valuing bitcoin. Telematics and Informatics, 34, 1308-1321.

Hilorme, T., Shurpenkova, R., Kundrya-Vysotska, O., Sarakhman, O., Lyzunova, O. (2019). Model of energy saving forecasting in entrepreneurship. Journal of Entrepreneurship Education. 22(Special Issue), 1-6.

Huberman, G, Leshno, JD, and Moallemi, CC (2017). Monopoly without a monopolist: An economic analysis of the bitcoin payment system. Columbia Business School Research Paper, No. 17-92, Columbia University.

Ilzetzki, E, Reinhart, CM, and Rogoff, KS (2017). Exchange arrangements entering the 21st century: which anchor will hold? Working Paper, No. 23134, National Bureau of Economic Research.

International Monetary Fund (IMF) (2007). Global financial stability report: October 2007. Washington, DC., http://www.imf.org/External/Pubs/FT/GFSR/2007/02/index.htm, 01.26.2018

Ito, H., Jongwanich, J, and Terada-Hagiwara, A (2009). What makes developing Asia resilient in a financially globalized world? ADB Economics Working Paper Series, No. 181, Manila: Asian Development Bank.

Jacobs, G (2018). Cryptocurrencies and the challenge of global governance. Cadmus, 3, 109-123.

Katsiampa, P (2017). Volatility estimation for Bitcoin: a comparison of GARCH models. Economics Letters, 158, 3-6.

Klein, MW, and Shambaugh, JC (2015). Rounding the corners of the policy trilemma: sources of monetary policy autonomy. American Economic Journal: Macroeconomics, 7, 33-66.

Levy-Yeyati, E, and Sturzenegger, F (2005). Classifying exchange rate regimes: deeds vs. words. European Economic Review, 49, 1603-1635.

Liargovas, P. (2012). Economics, Political and Social Issues.

Limba, T, Stankevičius, A, and Andrulevičius, A (2019). Cryptocurrency as disruptive technology: theoretical insights. Entrepreneurship and Sustainability Issues, 6, 2068-2080.

Magud, NE, Reinhart, CM, and Vesperoni, ER (2014). Capital inflows, exchange rate flexibility and credit booms. Review of Development Economics, 18, 415-430.

Makarov, I., & Schoar, A. (2019, May). Price discovery in cryptocurrency markets. In AEA Papers and Proceedings (Vol. 109, pp. 97-99).

Mehmet Balcılar, EB (2017). Can volume predict Bitcoin returns and volatility? A quantiles-based approach. Economic Modelling, 64, 74-81.

Meiklejohn, S, Pomarole, M, Jordan, G, Levchenko, K, McCoy, D, Voelker, GM, and Savage, S (2016). A fistful of Bitcoins: characterizing payments among men with no names. Communications of the ACM, 59, 86-93.

Michalski, T, and Stoltz, G (2013). Do countries falsify economic data strategically? Some evidence that they might. The Review of Economics and Statistics, 95, 591616.

Mislinski, J (2018). Market cap to GDP: an updated look at the Buffett valuation indicator'. https://www.advisorperspectives.com/dshort/updates/2018/01/03/market-capto-gdp-an-updated-look-at-the-buffett-valuation-indicator.

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system.(2008). https:// http://www.bitcoin.org/bitcoin.pdf, 01.01.2019

Panagiotis G, and Liargovas, KS (2012). Foreign direct investment and trade openness: the case of developing economies. Social Indicators Research, 106, 323-331.

Pesaran, MH (2007). A simple panel unit root test in the presence of cross-section dependence. Journal of Applied Econometrics, 22, 265-312.

IMF Report, I (2007). The quality of domestic financial markets and capital inflows. IMF Staff Papers, 77-108.

Samani R (2013). Digital laundry: an analysis of online currencies and their use in cybercrime. White Paper, McAfee Labs.

Tucker, PC (2009). The digital currency doppelganger: regulatory challenge or harbinger of the new economy? Cardozo Journal of International and Comparative Law, 17, 589-626.

Underwood, S. (2016). Blockchain beyond bitcoin.

Wei, SJ (2011). Not all financial integration is created equal: the composition matters. In Devereux, M., Lane, P., Park, C.Y., Wei, S.J. (Eds.), The Dynamics of Asian Financial Integration: Facts and Analytics. Oxon and New York: Asian Development Bank/Routledge.

Yang, G, and Gu, Q (2016). Effects of exchange rate variations on bilateral trade with a vehicle currency: evidence from China and Singapore. Journal of International Money and Finance, 68, 50-73.

Yermack, D (2013). Is Bitcoin a real currency? An economic appraisal. Working Paper, No. 19747, National Bureau of Economic Research.

Yermack, D (2017). Corporate governance and blockchains. Review of Finance, 21, 731.

Appendix A. Country list

Global sample

Algeria, Angola, Argentina, Armenia, Austria, Australia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Bolivia, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Laos, Latvia, Lebanon, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Tajikistan, Tanzania, Thailand, Togo, Trinidad & Tobago, Tunisia, Turkey, Turkmenistan, Uganda, United Arab Emirates, U.K., U.S., Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe.

American sample

Argentina, Barbados, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad & Tobago, U.S., Uruguay, Venezuela.

EU sample

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, U.K.

Asian sample

Armenia, Australia, Azerbaijan, Bahrain, Bangladesh, Brunei, Cambodia, China, Fiji, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Laos, Lebanon, Malaysia, Mongolia, Nepal, New Zealand, Oman, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, South Korea, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates, Vietnam.

African sample

Algeria, Angola, Burkina Faso, Cameroon, Central African Republic, Chad, Cote d'Ivoire, Egypt, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Libya, Madagascar, Maldives, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.

Appendix B. Variables and sources

For Bitcoin prices, the analysis used the four-biggest over-the-counter markets with respect to their volume, namely, BITSTAMP, COINBASE, ITBIT, KRAKEN. The final price was determined as weight average, with weights being the volume of respected transactions (Bloomberg).

International capital inflows = Capital inflows include Foreign Direct Investment inflows (FDI) and Foreign Portfolio Investment inflows (FPI)

Foreign Direct Investments inflows = FDI over GDP (Datastream)

Foreign portfolio investments inflows = FPI over GDP – Such flows represent real portfolio investment liabilities that include transactions with non-residents in financial securities of any maturity, such as corporate securities, bonds, notes, money market negotiable debt instruments, stocks, exceptional financing, and reserve assets (Datastream)

Per capita income = nominal per capita income (Datastream)

Prices = consumer price indexes (Datastream)

Trade openness = the sum of exports and imports of goods and services over GDP (in percent) (Datastream)

Stock market capitalization = stock market capitalization over GDP (in percent) (Datastream)

Financial openness = the capital account openness index obtained from Chinn and Ito (2008). The index measures a country's degree of capital account openness. It is based on dummy variables that codify the tabulation of restrictions on cross-border financial transactions (including the presence of multiple exchange rates, restrictions on current and capital account transactions, and regulatory requirements). They are reported by the IMF Annual Report on Exchange Arrangements and Exchange Restrictions. A higher index illustrates stronger financial openness

Interest rate differentials = Data refer to the difference between the nominal domestic and US interest rates (for the case of the US only the domestic interest rate is used), in percent per annum. Data are associated with 10-year government bond yields or T-bill rates or deposit rates, depending on data availability (Datastream)

Global stock prices = Data refer to the MSCI Barra All Country World Index (MSCI Barra website)

Global broad money = Data refer to GDP weighted broad money (M2) of the 20 largest economies (International Financial Statistics)

Institution quality index = Data are associated to the average of the World-wide Governance Indicators and are taken from the Worldwide Governance Indicators by Kaufmann, Kraay, and Mastruzzi, available at http://info.worldbank.org/governance/wgi/index.asp, which includes measures for voice and accountability, political stability, rule of law, and control of corruption

Volatility of the real exchange rate = Computed as the quarterly standard deviation of monthly real exchange rates. The real exchange rate was derived as the product of the nominal exchange rate (units of the local currency per US dollar) and the ratio of price level indexes for both the US and the domestic economies. For the case of the US, the effective exchange rate has been used (Datastream).