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Who buys Bitcoin? The cultural determinants of Bitcoin activity

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ABSTRACT

We examine the relationship between national culture and a country's Bitcoin activity. Given that Bitcoin is a high-risk currency/investment that is frequently used for illegal purposes and whose market is relatively opaque, we focus on the cultural dimension of individualism, which has been related to financial market participation, risk-taking behavior, and overconfidence. Using unique data that includes the originating country for Bitcoin transactions, we examine the relationship between individualism and a country's Bitcoin activity for a sample of 80 countries between 2009 and 2020. We find a significant and positive relationship between a country's individualism and its use of Bitcoin consistent with cultural values affecting the demand for such high-risk currency/investments.

1. Introduction

Bitcoin is a decentralized digital cryptocurrency whose transactions are based on a peer-to-peer network without the need for third-party intermediaries. Using blockchain technology, the publicly distributed ledger makes all transactions visible. What started as an experiment in 2009 has spawned an entire ecosystem of competing cryptocurrencies, capital raisings through initial coin offerings (de Andrés, Arroyo, Correia, & Rezola, 2021), and even decentralized financial infrastructures that allow cryptocurrency borrowing and lending (Aspris, Foley, Svec, & Wang, 2021). The usage of Bitcoin has increased considerably in the last decade, as reflected by Bitcoin's market value, reaching a peak market capitalization of over $320 billion at the end of 2017, amidst an entire cryptocurrency ecosystem worth over $390 billion in 2020.

Bitcoin's role as a currency has been questioned frequently (see, e.g., Yermack, 2015; Luis, de la Fuente, & Perote, 2019; Hui, Lo, Chau, & Wong, 2020; among others), where a currency is typically defined as having three functions: it functions as a medium of exchange; a unit of account; and a store of value. While Bitcoin found its first dominant use case in the purchase of illicit goods and services (Foley, Karlsen, & Putniņš, 2019), it is increasingly accepted as a traditional form of payment. This has been fuelled by the increased prevalence of bitcoin ATMs,[1] adoption as national currency (as in El Salvador) or in countries where fiat alternatives lack credibility (i.e., Venezuela, Argentina, etc). Despite this growing adoption, Bitcoin's worldwide commercial use remains minuscule, with most who hold it citing speculation/investment as their primary motivator (e.g., Henry, Huynh, and Nicholls (2019), Bolt and Van Oordt (2020)). Moreover, with a maximum throughput of about seven transactions per second, many argue that Bitcoin is a poor medium of exchange.[2] Bitcoin performs poorly as a unit of account, is prone to bubbles (Enoksen, Landsnes, Lučivjanská, & Molnár, 2020), and bears similarities to attention-grabbing assets (Smales, 2022). It also often trades for different prices on different exchanges with limited possibility for arbitrage. Furthermore, its use has primarily been driven by those buying illicit goods or avoiding national capital controls (Foley et al., 2019; Makarov & Schoar, 2020). Bitcoin also performs poorly as a

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[1] For example, Statista counts over 15,000 bitcoin ATMs as at the end of 2021.

[2] For instance, Easley, O'Hara, and Basu (2019) highlight increasing fees required to confirm transactions, while Foley, Hinzen, John, and Saleh (2020) show that increased congestion in the Bitcoin network results in large transactions crowding out smaller ones.

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store of value because of rampant hacking attacks, thefts, and other security-related issues (Sokolov, 2021). Numerous studies further highlight Bitcoin's speculative nature (e.g., Gronwald, 2019; Yermack, 2015), while others suggest it has a fundamental value of zero.[3] These attributes make Bitcoin a risky currency/investment asset.

Given the risky and obscure nature of Bitcoin, this paper seeks to understand whether national culture, and specifically whether a culturally-induced appetite for risk-taking and overconfidence, affects the usage of Bitcoin within a country. Since risk attitudes (Autio, Pathak, & Wennberg, 2013; Hofstede, 2001; Kwok & Tadesse, 2006; Lim, Leung, Sia, & Lee, 2004; Rieger, Wang, & Hens, 2015, among others), as well as the predisposition to overconfidence (An, Chen, Li, & Xing, 2018; Camerer & Lovallo, 1999; Daniel, Hirshleifer, & Subrahmanyam, 1998; Van den Steen, 2004) are to some extent influenced by culture, this paper examines the relationship between Bitcoin activity and national culture. We specifically focus on the cultural dimension of *individualism*. Individualism-collectivism is an important cultural dimension that is shown to affect financial decision making and outcomes in a variety of ways (Boubakri, Guedhami, Kwok, & Saffar, 2016; Griffin, Guedhami, Kwok, Li, & Shao, 2017; Hoang, Nguyen, & Nguyen, 2021; Li, Griffin, Yue, & Zhao, 2013; Shao, Kwok, & Zhang, 2013), as well as the financial system and individuals' interaction with that system (Breuer, Riesener, & Salzmann, 2014; Lu, Niu, & Zhou, 2021). Hence, we expect that individualism also affects Bitcoin activity in a society. Moreover, individualism has been shown to result in a predisposition to overconfidence and a proclivity for investment in high-risk assets (Cheon & Lee, 2018; Chui, Titman, & Wei, 2010). Given the risky and obscure nature of Bitcoin, we expect the trading activity of Bitcoin, ceteris paribus, to be higher in countries with high individualism scores.

The link between individualism and Bitcoin activity is motivated by two broad arguments. First, since individual achievement is rewarded more in individualistic cultures, individualism can lead to more risk-taking behavior than in collectivistic cultures. This has been widely demonstrated (Boubakri, Mirzaei, & Samet, 2017; Kreiser, Marino, Dickson, & Weaver, 2010; Li et al., 2013; Mihet, 2013; Mogha & Williams, 2021; among others). Second, literature shows that individualism relates to overconfidence (An et al., 2018; Cheon & Lee, 2018; Chui et al., 2010; Dou, Truong, & Veeraraghavan, 2016). This overconfidence can lead to self-enhancing beliefs where individuals think themselves to be better skilled, which could result in an underassessment of the risk involved in Bitcoin.

To investigate the relationship between Bitcoin activity and individualism empirically, we obtain a novel measure of a country's Bitcoin activity based on actual Bitcoin transactions. Since Bitcoin transactions are publicly reported to a decentralized ledger, it is possible to 'listen' to incoming transactions and record the IP address (and so location) of a transaction's sender. We do this by sourcing data from blockchain.info, which contains every Bitcoin transaction as well as IP address, including the most likely relaying IP address (similar data are used by Parino, Beiró, and Gauvin (2018)). Following the user identification methods of Foley et al. (2019), we identify the location of and activity behind each transaction. We annualize these Bitcoin data (number of trades and volume) into measures of Bitcoin trades and volume per capita. We compute these measures annually for 80 countries over the period 2009–2018.

To examine the relationship between individualism and Bitcoin activity, we conduct a multivariate regression analysis controlling for other potential determinants of a country's Bitcoin activity. These include economic development, the origin of the legal system, differences in access to the technology needed to trade Bitcoin, Bitcoin's legal status, and the extent to which a country prevents money-laundering and restricts capital flows. Our results indicate a significant and positive relationship between individualism and Bitcoin activity.

We conduct several tests to ensure that our results are robust. First, we employ alternative model specifications, such as regressions that exclude observations with zero Bitcoin activity, and Tobit specifications, where observations with zero Bitcoin activity are left-censored. We do this to ensure that our results are not driven by limited Bitcoin activity in some country-years in our sample. Second, we consider alternative individualism scores based on GLOBE (House, Hanges, & Javidan, 2004) and Schwartz (1994). Third, given that our summary statistics and global exchange volumes show that Bitcoin activity is exceptionally high in a few countries,[4] we rerun our analyses excluding them. Removing these countries has no impact on the positive relationship between Bitcoin activity and individualism. Fourth, we employ instrumental variables regressions to alleviate potential endogeneity concerns regarding the effect of culture on Bitcoin activity. As in An et al. (2018), we alternately use language and genetic distance relative to the U.S. as addtional instruments for individualism. Our finding of a positive relationship between Bitcoin activity and individualism is evident across all these robustness tests.

Our paper contributes to the literature in several ways. First, it adds to the literature on the influence of cultural values on financial product use and decision-making. A range of studies shows that culture affects investment decisions, stock market participation, and international diversification (e.g., Cheon & Lee, 2018; Chui et al., 2010; Grinblatt & Keloharju, 2001; Guiso, Sapienza, & Zingales, 2008; Karolyi, 2016; Lu et al., 2021; Shao et al., 2013). However, studies on the impact of culture on cryptocurrency usage are, to the best of our knowledge, non-existent. Our paper aims to fill this gap by showing a positive relationship between Bitcoin activity and individualism. Second, our paper contributes to an emerging literature on the pricing of cryptocurrencies and related predictive models (e.g., Balcilar, Bouri, Gupta, & Roubaud, 2017; Cheah & Fry, 2015; Cheung, Roca, & Su, 2015; Ciaian, Rajcaniova, & Kancs, 2016). In line with the novelty, riskiness, and opaque fundamental value of Bitcoin, we show that the usage of Bitcoin varies across countries depending on the cultural disposition of individuals towards both risk and overconfidence.

The remainder of this article is structured as follows. In Section 2, we discuss some of Bitcoin's transactional properties and provide an overview of the Bitcoin market. We also include justification for the positive relationship between Bitcoin activity and individualism. In Section 3, we present our data and their properties, discuss our control variables, and describe the estimation approach. Section 4 presents our main results as well as our robustness tests. Finally, Section 5 provides the conclusions of our study.

2. Background and motivation

2.1. Bitcoin

Bitcoin, as a cryptocurrency, started its life in early 2009. Since its inception, numerous studies have questioned Bitcoin's role as a currency, highlighting that Bitcoin is a speculative investment vehicle with a (potentially) non-existent fundamental value. As an example of the speculative nature of Bitcoin, numerous crashes have occurred. For instance, in the first three weeks of September 2017, Bitcoin's value in $USD dropped by over 27%.

On top of the high volatility that Bitcoin is prone to, there are other risks associated with owning Bitcoin. Bitcoin transactions are verified on

[3] Cheah and Fry (2015) find that Bitcoin prices contain a considerable speculative component and that its fundamental price should be close to zero. Baek and Elbeck (2015) report that Bitcoin returns are internally driven by buyers and sellers and are not influenced by fundamental economic factors. Baur, Hong, and Lee (2018) show that Bitcoin is mainly used as a speculative asset rather than an alternative currency or medium of exchange.

[4] Dhyrberg, Foley, and Svec (2018) show a periodicity in Bitcoin transactions consistent with trading being concentrated in U.S. and U.K. time zones.

a hyper-secure, public ledger known as the blockchain. One key safety feature of the blockchain is that transactions cannot be reversed. While this guarantees the integrity of the transaction, it also exposes Bitcoin owners to considerable risk. Each Bitcoin account holder has a private key, which authorizes her to transfer Bitcoin to other accounts. Having access to this private key provides full control of the Bitcoin account. If someone manages to steal a private key, she can irreversibly transfer Bitcoins to other accounts. Hacking attacks on major Bitcoin mining and trading platforms, such as Mt. Gox ($473 million stolen), Coincheck ($533 million stolen), or NiceHash ($77 million stolen), have consistently taken place since Bitcoin's creation.

In addition to this safety risk, there is also latency risk. A Bitcoin transaction must be confirmed by the network before it is completed. That is, Bitcoin miners must solve complex computational puzzles that update the full set of Bitcoin transaction history. The Bitcoin community has set a standard of six confirmations from miners for a transfer to be irrevocably complete and to make it immune to so-called 'double spend' attacks. The average time it takes to mine a block (one confirmation) is ten minutes, so that a transaction takes about an hour to be irrevocably validated. However, Bitcoin's recent popularity has caused congestion on the network, and the average time for one confirmation has skyrocketed to more than 16 h in extreme cases.[5] This latency increases the risk of being trapped in a downward market movement and exiting the market in a timely fashion. On top of this, while individuals have been lured to the Bitcoin market by impressive historical returns, the consensus emerging from the Bitcoin literature is that its fundamental value is close to zero (e.g., Biais, Bisiere, Bouvard, Casamatta, & Menkveld, 2020; Cheah & Fry, 2015; Cheung et al., 2015; Ciaian et al., 2016).

Finally, the Bitcoin market has been subject to price manipulation. For instance, Gandal, Hamrick, Moore, and Oberman (2018) argue that suspicious trading activity on the Mt. Gox Bitcoin exchange likely caused the unprecedented spike in the USD-BTC exchange rate in late 2013, when the price jumped from around $150 to more than $1000 in two months. Further, Griffin and Shams (2020) show that the fraudulent creation of USD Tether (a cryptographically secured stablecoin pegged to the USD) was used by the Bitfinex exchange to 'pump' Bitcoin prices to sustain momentum-driven rallies.

The features of Bitcoin listed above show that Bitcoin as a currency/asset carries many inherent risks. The complexity and opacity of Bitcoin, along with its high-risk nature, would make it a risky investment for most investors.

2.2. Individualism and Bitcoin activity

Hofstede, 2001: 9) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from another." Culture is reflected in the values and beliefs that people within a particular society hold about how things are, or should, be done. As such, culture shapes and influences both societal structures and behaviors. In addition, culture changes slowly (Guiso, Sapienza, & Zingales, 2015), making its impact persistent and pervasive. Culture has been shown to affect economic outcomes, such as national savings or fiscal redistribution (Guiso, Sapienza, & Zingales, 2006). Cultural biases also affect economic exchange. Guiso, Sapienza, and Zingales (2009), for instance, show that cultural biases result in lower bilateral trust which in turn results in less bilateral trade, portfolio investment and direct investment. Culture also affects financial outcomes and financial decision-making, as evidenced by the growing literature documenting culture's financial consequences (see Karolyi (2016) for an overview).

An important cultural dimension of Hofstede (2001) framework that has been related to economic activity and financial decision-making is *individualism*. This dimension describes an individual's position within the collective – whether the individual is an integral part of the collective or whether the individual is an independent 'self' within the collective. Individualistic societies focus on individual achievement and self-attribution in decision making and attribute and reward success to the individual rather than to the collective. In individualistic countries, members value themselves as independent entities separate from the group they belong to. As Lu et al. (2021) argue, this encourages intergroup interaction, leading to greater trust, which leads to a greater willingness to participate in financial markets. In addition, in individualistic cultures, members see it as their responsibility to look after themselves and their close family, relying less on society. This aspect of individualism is, for instance, highlighted by Chui and Kwok (2008), who link individualism to life insurance consumption.

Several studies have linked individualism to risk-taking. At a managerial level, Kreiser et al. (2010) argue that individualistic managers place a higher value on individual accomplishments and consequently engage in more risk-taking in the hopes of larger payoffs. In the context of corporate risk-taking, Li et al. (2013) argue that individualistic managers are motivated to stand out, leading to decision rules that overweigh risky payoffs. In addition, they argue that individualistic managers believe that they are more skilled and have a higher level of outcome control than other managers and, as such, underestimate the level of uncertainty in risky decisions. Li et al. (2013) confirm that individualism is positively related to firm-level risk-taking for a U.S. sample, while Mihet (2013) confirms this in an international context. Kanagaretnam, Lim, and Lobo (2014), Ashraf, Zheng, and Arshad (2016), Boubakri et al. (2017), and Mourouzidou-Damtsa, Milidonis, and Stathopoulos (2019) use similar arguments to motivate a positive relation between individualism and bank risk-taking. From an investment perspective, Beckmann, Menkhoff, and Suto (2008) document that asset managers from individualistic cultures display less herding behavior.

Another aspect of individualism is that it is related to a self-attribution bias, making individuals overconfident about their abilities, resulting in higher risk-taking. Markus and Kitayama (1991) argue that people in individualistic cultures think positively about themselves and focus on their internal attributes, such as their abilities. Heine, Lehman, Markus, and Kitayama (1999) argue that children in individualistic cultures "are encouraged to think about themselves positively as stars, as winners, as above average and as the repositories of special qualities." These aspects of individualism can result in a self-attribution bias, which can encourage people from these cultures to overestimate their abilities, which, according to Odean (1998), is a manifestation of overconfidence.

Based on the nexus between individualism and overconfidence, several studies document an impact of individualism on financial decision-making and outcomes. Chui et al. (2010) use individualism to explain cross-country differences in price momentum. They argue that in individualistic societies, people rely more on their private information and less on public information when determining a company's value. Thus, when public information about a stock is released, investors in individualistic societies rely less on this news and give more weight to their private beliefs about the company's value. This overweighting of private information leads to a more gradual incorporation of public information into prices, causing price momentum in more individualistic countries. Chui et al. (2010) document stronger price momentum in more individualistic countries, while Dou et al. (2016) document higher post-earnings announcement drifts (also known as earnings momentum) in more individualistic countries. Breuer et al. (2014) connect individualism to risk-taking behavior in financial markets in the form of stock market participation. Based on the argument that individualism leads to overconfidence and overoptimism, which can result in a greater risk tolerance (see Pan & Statman, 2010), they find that there is more financial risk-taking (in the form of more individual stock investments) in countries that score high on individualism. Cheon and Lee (2018) use individualism as a proxy for overconfidence when assessing the pricing

[5] Source: https://coincentral.com/how-long-do-bitcoin-transfers-take

of lottery-like stocks. They find that individualistic countries observe higher prices for lottery-like stocks. This, they argue, is evidence that overconfidence leads to overpayment for lottery stocks, as individualistic investors overestimate the probability of extreme (positive) payoffs. Consistent with the self-attribution/overconfidence channel, Dang, Faff, Luong, and Nguyen (2019) and An et al. (2018) link individualism to stock price crash risk. One of their arguments is that managers in individualistic societies are more overconfident and underestimate the possibility of adverse outcomes (crashes). This overconfidence can lead to an overassessment of the value of the firm and an underassessment of the potential crash risk of the firm, increasing the likelihood of actual crashes, which they document empirically.

Based on the arguments presented above, which show that individualism has been connected with risk-taking and overconfidence, we expect a positive relationship between individualism and the adoption of Bitcoin within a specific country.

3. Data and empirical model

3.1. Bitcoin properties

To investigate the relationship between cultural values and the demand for cryptocurrencies, we focus on Bitcoin, being the first and most dominant of the many cryptocurrencies. Over the period 2009–2018, this cryptocurrency dominated all others in terms of value. As shown in Fig. 1, the USD price of Bitcoin has fluctuated considerably over time, reaching a high of nearly $20,000 towards the end of 2017, closing at a value of $10,000 towards the end of our sample.

Fig. 2 shows the monthly average volume of Bitcoin transactions during the sample period. We observe that Bitcoin traded volume also increased substantially over time. Not surprisingly, trading activity peaked at the time when the price of Bitcoin peaked as well.

3.2. Sample

Our starting point is the data available to construct our measure of national Bitcoin activity, which covers the period January 2009 to April 2018. As a public technology, all Bitcoin transactions are available for any user to access. This is the 'distributed' component of the distributed ledger. Much like a Visa transaction, users of the Bitcoin network submit a new transaction to the network for confirmation. Unlike Visa, which acts as a central clearing authority, each transaction is sent around the world to all users via a *gossip protocol*, including the miners who eventually confirm the transaction. As shown by Koshy, Koshy, and McDaniel (2014), a flaw in the Bitcoin protocol allowed any motivated user to create connections to all other network users, both miners and otherwise.[6] Unlike Visa, a proposed transaction from a user is sent to that user's connections (between 8 and 150 other users) and is then propagated out to the entire network. Forcing a connection with every other user allowed this 'motivated' participant to listen to all transactions and, critically, to observe the IP address from which a message is sent. When connected to all (or most) users, the first participant from which a given transaction is received is recorded as the 'likely origin' of the transaction.[7] Similar to Parino et al. (2018), our Bitcoin data is obtained from blockchain.info, one of the oldest blockchain explorers, who operated such a node between 6 January 2012 and 4 April 2018. Blockchain.info stores a dynamically updated record of every transaction on the blockchain and made IP addresses during this time available to us. We link IP addresses to geographical locations (city, state, and country) using ip2location.com. We then combine the geo-location of the most likely relaying IP address with the clustering method employed in Foley et al. (2019) to define the full set of IP addresses observed for any particular user (across any number of unique controlled bitcoin wallet addresses). Following the methodology of Cole, Dyhrberg, Foley, and Svec (2022), we exclude transactions that are sent and received by the same user (even if they are sent between different controlled wallets). We also exclude 'change' transactions as defined by these authors, as they are unlikely to represent true transactional volume. We then (conservatively) assign each user to a country if (and only if) that user sends more than 50% of their transactions from that country.[8]

Having determined the location of Bitcoin users, we construct our country-level measure of Bitcoin activity by aggregating transactions on the Bitcoin network (the number of transactions sent and received as well as the volume sent and received per country).[9] We obtain data on the number and volume of trades per day and aggregate these data to an annual frequency. Overall, this yields a sample of 770 observations (80 countries over the period January 2009–April 2018).[10] To assess the impact of culture on Bitcoin activity, we scale our Bitcoin metric on a per capita basis and use logarithms of this metric as our dependent variable.[11] Given the difficulty of attributing pan-national exchanges to a particular country (i.e., Binance offers services to over 140 countries globally) as well as the issues regarding wash-trading (i.e., see Cong, Li, Tang, and Yang (2021)), we constrain our country-level measure to on-chain activity. As such, we do not consider off-trade transaction volumes in centralized exchanges.

Our main variable of interest is Hofstede (2001) *individualism* score. Hofstede constructed various culture dimensions on which 50 countries were scored based on surveys conducted among IBM employees from 1967 to 1973 and later extended these by including data on other countries. While these scores are arguably dated, culture is shown to be persistent over time (e.g., Beugelsdijk, Maseland, and Van Hoorn (2015) document that the relative ranking of countries on Hofstede's cultural dimensions remained stable over the last thirty years). In addition, we test the robustness of our results using alternative culture frameworks that provide more recent indicators of individualism.

In our empirical analysis, we control for the influence of other factors on a country's Bitcoin activity. First, we control for a country's development by including *GDP Growth* in our regressions, using annual GDP growth data from the International Monetary Fund (IMF). We also include a dummy variable, *Emerging Market*, to identify emerging markets as classified by the IMF.

We further control for cross-country differences in technology access needed to trade Bitcoin. We expect individuals in countries with a lower percentage of people connected to the internet to make less use of Bitcoin. Specifically, we control for *Internet Coverage*, defined as the percentage of people in a country using the internet. These data are available annually and are obtained from the United Nations' International Telecommunications Union.

[6] To preserve the privacy elements of Bitcoin, this flaw in the gossip protocol was fixed in 2018.

[7] It is the 'likely origin' as it is possible for Bitcoin users to obfuscate their IP addresses by using virtual private networks or The Onion Router (TOR). Our analysis is not able to avoid such errors, but it is unlikely that many users employ such techniques. Indeed, Parino et al. (2018) show that less than 0.001% of all transactions were relayed by known TOR exit nodes. For further discussion, see Meiklejohn et al. (2013).

[8] Some users remain unassigned, for example those using TOR exit nodes. Given users' identities are revealed via the blockchain and geography is attributed to users, it is possible to ascribe transactions to users who have been geographically located - even outside of the time period for which we observe IP addresses.

[9] Note that a transaction from a UK IP address to a UK IP address will still count as a sending and receiving transaction for the UK.

[10] Since we control for year fixed effects, we include the part year of 2018 in our sample, where we scale the 2018 aggregate to reflect a full year. Our results are robust to the exclusion of 2018.

[11] Specifically, we use the transformation log(Bitcoin per capita +0.0001) to avoid creating missing values when Bitcoin activity for a particular country-year is zero.

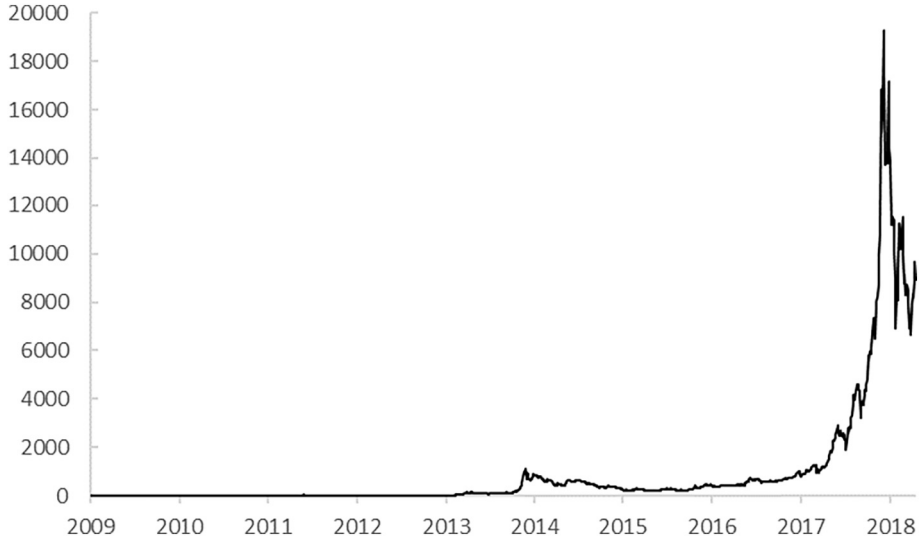

Fig. 1. USD price of Bitcoin over time.
This figure shows the price of Bitcoin over the sample period. (source: blockchain.info).

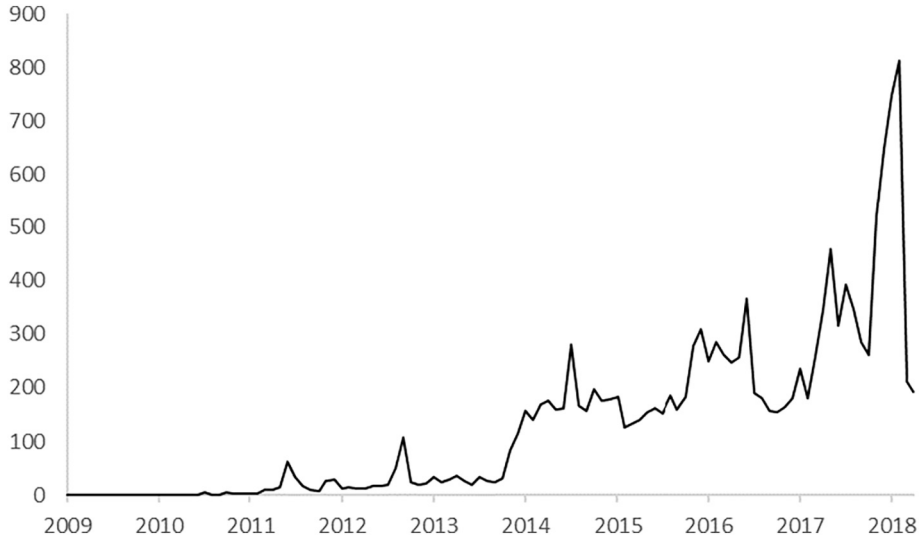

Fig. 2. Daily Bitcoin Volume over time.
This figure shows the value of monthly Bitcoins traded (in millions). (source: our data).

We next control for the legality of Bitcoin use in a country. We obtain this information from *coin.dance.com*, which lists countries where Bitcoin-related activities are illegal. Anti- or pro-Bitcoin regulations have natural repercussions on national Bitcoin activity (for instance, Bitcoin prices plummeted when South Korea's government announced it was preparing a bill to ban trading of the virtual currency on domestic exchanges).[12] We create a dummy variable, *Legality Dummy*, that takes the value of one if Bitcoin-related activities are legal and 0 otherwise.

Beyond the mere legality of Bitcoin, we also control for institutional frameworks by considering creditor rights. A range of studies shows that creditor rights shape differences in risk-attitudes across countries (e.g., Acharya, Amihud, & Litov, 2011; Djankov, McLiesh, & Shleifer, 2007; Houston, Lin, Lin, & Ma, 2010; Mihet, 2013). We use Djankov et al.'s (2007) creditor rights index as our proxy in this study.

To capture other institutional determinants of Bitcoin activity, we control for the legal origin of a country. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) find that legal origins influence the development of modern legal systems. We control for a country's legal origin by including dummy variables for whether the country derives its legal origin from English common law (*English*), French civil law (*French*), or German civil law (*German*).[13]

We additionally control for the existence of capital controls, as these reduce the ability of citizens to access Bitcoin markets because they limit the flow of currency trades in and out of a country (Makarov & Schoar, 2020). At the same time, capital controls may create a greater need for

[12] Source: www.telegraph.co.uk/technology/2018/01/11/bitcoin-price-plummets-south-koreas-plan-ban-cryptocurrency/

[13] Individualism scores are known to be high for Anglo-Saxon countries, and thus it is important to control for this to make sure that we are not just capturing an Anglo-Saxon effect, but rather the cultural trait of individualism.

alternative ways to convert local currency into foreign currencies, possibly through Bitcoin transactions.[14] We capture capital flow restrictions using the overall capital flow restriction index developed by Fernandez, Klein, Rebucci, Schindler, and Uribe (2016) (*Capital Flow Restrictions*).

Finally, we control for the extent to which a country prevents money laundering. Foley et al. (2019) find that approximately one-quarter of Bitcoin users are involved in illegal activity ($76 billion, 46% of Bitcoin transactions). Cryptocurrency research group CipherTrace analyzed 45 million transactions from the top 20 cryptocurrency exchanges globally and found a prevalence of Bitcoin use for criminal purposes.[15] They show that $2.5 billion of Bitcoin had been laundered through cryptocurrency exchanges, almost all of it ending up in countries with lax Anti-Money-Laundering (AML) regulations. To control for the extent a country prevents money laundering, we use the Basel AML Index (*Anti-Money Laundering Index*). We only use the *Capital Flow Restrictions* and *AML Indexes* in subsequent tests as they are not available for the whole sample period, where the *Capital Flow Restrictions* index is only available for the early part of the sample (2009–2013), and the *AML Index* is only available for the latter part of the sample (2012–2018).

3.3. Empirical model

To assess the relationship between a country's Bitcoin activity and the national cultural trait of individualism, we estimate the following panel regression:

$$BIT_{it} = Individualism_i + X_{it} + Year\ FE + \epsilon_{it} \quad (1)$$

where BIT_{it} is Bitcoin activity, based on the log transformation of either trades or volume in a country on a per capita basis ($BIT_{it} =$ log (*Bitcoin Activity per Capita* + 0.0001)), *Bitcoin Activity* per Capita is either the average annualized Bitcoin trades or volume to and from a specific country, for country i in year t on a per capita basis. $Individualism_i$ is Hofstede (2001) individualism score for country i. Eq. (1) includes the set of control variables, X_{it}, described in the previous subsection: *GDP Growth, Emerging Market, Internet Coverage, Legality Dummy, Creditor Rights Index, Capital Flow Restrictions, Anti-Money Laundering Index,* and legal origin dummies. We include year fixed effects to ensure that our results are not driven by time variation in the usage of Bitcoin and compute t-statistics based on country-clustered standard errors.

4. Results

4.1. Descriptive statistics

Table 1 provides summary statistics for our national Bitcoin activity data, as well as Hofstede's individualism score per country. All continuous variables are winsorized at the 1 and 99 percentiles. We report the average of annual Bitcoin transactions and volume "From" and "To" a country, as well as the average of the two. We also report the average annual transactions and volume per capita. As shown in Table 1, larger economies make more use of Bitcoin. The highest average number of Bitcoin transactions is for the U.S., where we observe an average annual number of transactions exceeding 17.5 million per year. This is followed by Germany, which shows approximately 17 million transactions and the Netherlands having around 21 million transactions a year. The largest volume is also observed for the US, with an average annual volume of approximately 650 million. This is followed by Germany and then the Netherlands. The summary statistics show that about 85% (based on trades) to 90% (based on volume) of Bitcoin activity is concentrated in these three countries. When we look at per-capita activity, the picture changes slightly. Per capita, the highest Bitcoin activity is observed for Germany (both in terms of trades and volume), followed by the Netherlands and then the US. Since we examine the impact of cultural traits on Bitcoin activity, we use per capita activity in our regressions.

Table 1 also provides Hofstede individualism scores for the countries in our sample. Individualism is highest for the US (91), followed by Australia (90) and the UK (89). On the low end of the individualism scale, we find several Latin American countries; Guatemala (6), Ecuador (8), and Panama (11).

Table 2 reports the correlation coefficients for the different Bitcoin activity measures, as well as for Hofstede's individualism score. We observe that all Bitcoin activity metrics are highly correlated. For absolute transaction and volume measures, correlations are all well above 0.85, suggesting that these metrics capture similar activity. Correlations between absolute and per capita metrics are slightly lower but generally above 0.5, with transactions per capita correlating almost perfectly with volume per capita (0.897). When we consider the correlations between Bitcoin activity and Hofstede's individualism scores, we observe positive correlations of around 0.2, suggesting that countries with more individualistic cultures make more use of Bitcoin as a transaction medium.

4.2. Main regression results

Table 3 presents the estimation results for Eq. (1). We report results for both Bitcoin transactions as well as volume per capita. All regressions include year fixed effects and t-statistics are based on country-clustered standard errors. The first two columns show the results for the main specification. For both Bitcoin activity metrics, we observe a positive and significant relationship with *Individualism*. This suggests that there is more Bitcoin activity in more individualistic cultures, which is consistent with our main hypothesis that individualism-induced risk-taking and overconfidence lead to greater utilization of this risky financial product. This result is obtained after controlling for various other variables that are expected to correlate with Bitcoin activity.

For the control variables, we find that *GDP Growth* is positively and significantly related to Bitcoin activity. This is also confirmed by our control variable for whether a country is an *Emerging Market*. This emerging market dummy yields a negative and significant coefficient in both specifications (trades and volume), suggesting that there is less Bitcoin activity in emerging markets. We also find that *Internet Coverage* is positively related to Bitcoin activity, significantly so for the volume measure and just outside the 10% level for the transaction measure. This suggests that internet access indeed promotes cryptocurrency usage. We also find a positive relationship between *Legality Dummy* and Bitcoin activity. For the *Creditor Rights Index*, we find no significant relationship with Bitcoin activity. Finally, we include legal origin dummies, controlling for *English*, *French*, and *German*. We find a positive coefficient on the German civil law dummy, significant for the volume-based metric, and negative for English and French legal origin.

Columns 2 and 5 of Table 3 report the results for the regressions where we include the *Capital Flows Restrictions Index*. Data on this index are only available for the earlier part of the sample, up to and including 2013. Hence, this regression also serves as a subsample test focusing on the early years of Bitcoin's existence. While the coefficients on individualism reduce slightly in these regressions, they remain positive and significant for both the trade and volume specifications, and so our results are robust to the inclusion of the *Capital Flows Restrictions Index*, as well as over the first part of the sample. The *Capital Flows Restrictions Index* is negative and significant in both specifications suggesting that tighter capital flow restrictions reduce Bitcoin activity.

Columns 3 and 6 of Table 3 report the results, including the *Anti-Money Laundering Index*. Data on this index are only available from 2012

[14] For example, it is very difficult to get RMB out of China, but easy to use RMB to purchase Bitcoins that can be moved out and exchanged for dollars. Argentina and Venezuela are also hampered by capital movement controls and restrictions, and Bitcoins can offer a vehicle to access foreign currencies.

[15] The CipherTrace 2018 Q3 Cryptocurrency Anti-Money Laundering Report (Source: https://ciphertrace.com/crypto-aml-report-2018q3)

Table 1
Summary statistics on Bitcoin activity and culture scores.

	Number of Trades (/100)			Bitcoin Volume (/1000)			Average per capita (x1,000)		
Country	From	To	Average	From	To	Average	Trades	Volume	Individualism
Angola	0.05	0.05	0.05	0.04	0.18	0.11	0.00	0.00	18
Argentina	52.25	58.74	55.49	101.47	178.86	140.16	0.13	3.29	46
Australia	599.79	486.65	543.22	1679.06	1444.81	1561.93	2.30	67.00	90
Austria	693.91	595.60	644.76	1014.98	1106.03	1060.51	7.40	121.97	55
Bangladesh	1.02	1.59	1.31	0.57	6.46	3.52	0.00	0.02	20
Belarus	61.48	55.99	58.73	78.22	129.71	103.97	0.62	10.97	39
Belgium	428.25	357.56	392.91	839.91	944.89	892.40	3.48	79.15	75
Brazil	240.32	214.33	227.32	463.14	548.46	505.80	0.11	2.47	38
Bulgaria	1015.61	811.32	913.47	2539.48	2181.93	2360.71	12.77	328.08	30
Canada	5052.50	3913.65	4483.08	7306.85	11,185.59	9246.22	12.51	258.86	80
Chile	122.17	66.07	94.12	145.78	141.67	143.73	0.52	7.98	23
China	5501.57	2208.78	3855.17	5214.43	6393.07	5803.75	0.28	4.23	20
Colombia	49.64	40.10	44.87	43.98	127.55	85.77	0.09	1.79	13
Costa Rica	52.63	41.57	47.10	33.36	70.79	52.08	0.96	10.68	15
Croatia	60.11	42.82	51.47	64.32	60.09	62.21	1.23	14.82	33
Czech Republic	1744.96	1496.51	1620.73	2158.18	2793.49	2475.83	15.34	234.30	58
Denmark	1103.15	758.21	930.68	1552.12	1304.12	1428.12	16.25	249.45	74
Ecuador	2.50	3.59	3.04	2.78	5.76	4.27	0.02	0.27	8
Egypt	2.44	2.07	2.25	9.38	7.36	8.37	0.00	0.09	25
El Salvador	0.45	0.15	0.30	0.32	0.40	0.36	0.00	0.06	19
Finland	779.68	520.73	650.20	1451.82	1373.87	1412.85	11.87	258.19	63
France	17,287.83	12,246.27	14,767.05	28,102.58	23,888.16	25,995.37	22.13	389.84	71
Germany	149,852.20	189,162.40	169,507.30	365,116.00	525,401.50	445,258.80	205.71	5395.11	67
Greece	90.35	74.78	82.56	156.78	172.21	164.50	0.76	15.07	35
Guatemala	4.70	4.69	4.69	1.29	4.82	3.05	0.03	0.18	6
Hong Kong	364.99	177.59	271.29	1048.15	408.44	728.29	3.70	99.38	25
Hungary	617.72	487.10	552.41	630.97	926.22	778.59	5.63	79.22	80
India	74.25	80.62	77.44	112.92	657.67	385.29	0.01	0.29	48
Indonesia	6.15	4.24	5.19	13.25	17.41	15.33	0.00	0.06	14
Iran	6.31	4.22	5.27	7.72	11.10	9.41	0.01	0.12	41
Ireland	1959.33	1216.10	1587.72	2848.86	2219.39	2534.13	33.36	532.47	70
Israel	77.87	54.97	66.42	148.48	183.07	165.77	0.80	20.19	54
Italy	1547.18	922.42	1234.80	2117.43	1730.76	1924.09	2.04	31.79	76
Jamaica	1.70	0.69	1.19	1.70	1.53	1.61	0.04	0.56	39
Japan	1246.41	385.68	816.05	935.00	1048.45	991.73	0.64	7.80	46
Jordan	22.37	18.24	20.31	22.68	56.50	39.59	0.21	4.18	30
Kenya	0.25	0.35	0.30	0.38	1.50	0.94	0.00	0.02	25
Kuwait	1.61	1.11	1.36	2.61	5.69	4.15	0.04	1.16	38
Latvia	501.79	391.85	446.82	924.20	1452.64	1188.42	22.84	610.03	70
Lebanon	0.19	0.10	0.14	0.51	0.42	0.46	0.00	0.08	40
Lithuania	1347.09	853.19	1100.14	2065.88	1375.44	1720.66	38.51	601.98	60
Malaysia	41.71	47.44	44.58	64.56	121.65	93.10	0.15	3.06	26
Mexico	84.58	46.85	65.72	104.22	90.58	97.40	0.05	0.80	30
Morocco	1.00	1.09	1.04	2.25	8.64	5.45	0.00	0.16	46
Mozambique	0.09	0.05	0.07	0.04	0.05	0.05	0.00	0.00	15
Nepal	0.36	0.22	0.29	0.66	0.97	0.81	0.00	0.03	30
Netherlands	25,203.89	17,311.74	21,257.82	37,719.93	32,851.86	35,285.89	124.78	2069.99	80
New Zealand	53.13	37.59	45.36	90.78	137.33	114.05	0.99	24.96	79
Nigeria	0.94	0.76	0.85	0.48	0.77	0.63	0.00	0.00	30
Norway	820.15	427.56	623.86	1218.16	988.44	1103.30	12.01	213.69	69
Oman	0.35	0.12	0.24	0.31	0.47	0.39	0.01	0.09	38
Pakistan	1.36	1.38	1.37	1.94	4.03	2.98	0.00	0.02	14
Panama	40.77	22.94	31.85	45.57	47.62	46.60	0.79	11.64	11
Peru	3.65	2.55	3.10	4.99	5.52	5.26	0.01	0.17	16
Philippines	19.31	16.04	17.67	20.19	39.95	30.07	0.02	0.30	32
Poland	1362.09	795.57	1078.83	1885.00	1559.56	1722.28	2.84	45.32	60
Portugal	170.71	100.24	135.47	226.41	204.66	215.53	1.31	20.76	27
Puerto Rico	2.03	1.89	1.96	3.95	6.33	5.14	0.06	1.47	27
Romania	822.91	427.84	625.38	838.16	726.29	782.22	3.17	39.58	30
Russia	3023.25	1883.27	2453.26	5265.80	4698.19	4982.00	1.70	34.61	39
Saudi Arabia	14.12	11.05	12.59	10.66	31.70	21.18	0.04	0.66	25
Serbia	26.69	17.49	22.09	36.49	65.32	50.91	0.31	7.14	25
Singapore	231.04	162.05	196.54	353.15	364.95	359.05	3.54	64.60	20
Slovakia	327.24	159.06	243.15	659.66	322.57	491.11	4.48	90.46	52
Slovenia	327.14	170.89	249.01	483.27	369.77	426.52	12.06	206.78	27
South Africa	328.35	163.88	246.12	712.26	267.54	489.90	0.44	8.66	65
South Korea	355.77	260.72	308.24	611.48	540.08	575.78	0.60	11.24	18
Spain	961.47	673.98	817.73	1655.97	1296.65	1476.31	1.76	31.71	51
Sri Lanka	0.19	0.10	0.15	0.16	0.17	0.17	0.00	0.01	35
Sweden	2932.29	1722.62	2327.45	4462.30	3467.65	3964.98	23.53	402.55	71
Switzerland	4694.41	3778.82	4236.61	6315.11	7965.79	7140.45	50.87	859.23	68
Thailand	37.55	32.29	34.92	57.98	81.27	69.62	0.05	1.02	20
Turkey	206.98	115.13	161.05	208.17	288.45	248.31	0.20	3.11	37

(*continued on next page*)

Table 1 (*continued*)

	Number of Trades (/100)			Bitcoin Volume (/1000)			Average per capita (x1,000)		
Country	From	To	Average	From	To	Average	Trades	Volume	Individualism
Ukraine	1357.94	790.61	1074.28	2795.43	1771.27	2283.35	2.38	50.61	25
United Arab Emirates	12.11	12.16	12.13	13.74	48.28	31.01	0.13	3.35	38
United Kingdom	11,384.97	7139.56	9262.26	15,358.35	14,466.97	14,912.66	14.14	227.95	89
United States	165,526.30	184,174.20	174,850.20	730,920.50	578,084.70	654,502.60	54.41	2035.15	91
Uruguay	2.45	3.44	2.94	7.80	10.60	9.20	0.09	2.71	36
Venezuela	18.90	14.37	16.63	66.55	56.12	61.33	0.06	2.07	12
Vietnam	7.84	6.69	7.26	8.32	16.54	12.43	0.01	0.13	20

Note: This table reports summary statistics for all countries in our sample that have both Bitcoin data as well as a Hofstede individualism score. We report the average number of trades (/100) towards and from a specific country as well as their average, and the average volume (/1000) traded towards and from a specific country as well as their average over the sample period from 2009 to 2018. We further compute the average Bitcoin volume and number of trades on a per capita basis. All measures are computed on an annual basis. We finally report Hofstede's (1980, 2001) individualism score.

Table 2
Correlation coefficients.

	Trades from	Trades to	Av. Trades	Volume from	Volume to	Av. Volume	Trades per cap.	Vol. per cap.	Individualism
Trades from	1.000								
Trade to	0.991	1.000							
Av. Trades	0.997	0.998	1.000						
Volume from	0.895	0.867	0.882	1.000					
Volume to	0.931	0.931	0.933	0.948	1.000				
Av. Volume	0.925	0.910	0.919	0.988	0.986	1.000			
Bitcoin Trades cap.	0.725	0.724	0.726	0.515	0.633	0.580	1.000		
Bitcoin Vol. Cap.	0.794	0.799	0.799	0.707	0.823	0.774	0.897	1.000	
Individualism	0.214	0.193	0.203	0.195	0.193	0.197	0.238	0.220	1.000

Note: This table reports the correlation coefficients between the different Bitcoin metrics as well as Hofstede's (1980, 2001) individualism score. All Bitcoin activity metrics are annualized averages over the sample period 2009–2018.

Table 3
Main results: Bitcoin activity and individualism.

	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Vol. Cap.	Bitcoin Vol. Cap.	Bitcoin Vol. Cap.
Individualism	0.022***	0.014***	0.026***	0.021***	0.011***	0.025***
	(3.30)	(3.05)	(2.94)	(3.59)	(3.13)	(3.25)
GDP Growth	0.071***	0.005	0.054*	0.051***	0.001	0.037*
	(3.34)	(0.30)	(1.78)	(3.27)	(0.05)	(1.71)
Emerging Market	−1.03***	−0.379	−1.14***	−0.849***	−0.216	−0.939***
	(−3.33)	(−1.52)	(−2.87)	(−3.33)	(−1.00)	(−2.78)
Internet Coverage	0.003	−0.0002	0.010*	−0.002	−0.001	0.002
	(0.75)	(−0.06)	(1.70)	(−0.48)	(−0.31)	(0.39)
Legality Dummy	0.705***	0.299**	0.799***	0.375**	0.208*	0.414*
	(2.98)	(2.24)	(2.72)	(2.19)	(1.94)	(1.93)
Creditor Rights Index	−0.043	−0.0441	−0.037	−0.028	−0.036	−0.026
	(−0.47)	(−0.83)	(−0.28)	(−0.38)	(−0.82)	(−0.24)
English	−0.764***	−0.529***	−0.585	−0.640***	−0.540***	−0.554
	(−3.10)	(−2.78)	(−1.58)	(−2.66)	(−2.71)	(−1.64)
French	−0.615**	−0.590***	−0.451	−0.505*	−0.587**	−0.435
	(−2.16)	(−2.74)	(−1.21)	(−1.80)	(−2.63)	(−1.21)
German	0.265	−0.076	0.632	0.146	−0.164	0.406
	(0.79)	(−0.28)	(1.43)	(0.46)	(−0.65)	(0.95)
Capital Flow Restrictions Index		−0.474**			−0.338*	
		(−2.19)			(−1.89)	
Anti-Money Laundering Index			−0.296**			−0.188
			(−2.15)			(−1.63)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
N	770	354	520	770	354	520
R-sq	0.639	0.595	0.715	0.566	0.526	0.642

Note: This table reports regression results for the regression of Bitcoin activity (measured by either Bitcoin volume per capita or trades per capita) on Hofstede (1980, 2001) individualism, as well as a set of control variables (GDP growth over the specific year, internet coverage over the year, a legality dummy indicating whether Bitcoin trading is allowed, a creditor rights index indicating the level of creditor protection, a dummy variable indicating whether a country is classified as an emerging market; and three dummies indicating the legal origin of a country (English, French, German)). All variables are explained in Appendix A. In addition to these controls, we also include year fixed effects. Robust standard errors are clustered by country and *t*-statistics are reported in parentheses, and significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

onwards. Hence, this regression also serves as a subsample test for the second sub-period of our sample. We find that the inclusion of the *Anti-Money Laundering Index* and the focus on the second half of the sample does not alter our main findings with respect to the relationship between Bitcoin activity and individualism. The coefficient on *Individualism* remains almost unchanged and highly significant. The *Anti-Money*

Laundering Index has the expected negative coefficient and is highly significant for both volume and trade metrics. Hence, tighter controls on money laundering result in less Bitcoin activity. This finding supports Foley et al.'s (2019) findings, which show that approximately one-quarter of Bitcoin users are involved in illegal activity ($76 billion annually, or 46% of Bitcoin transactions).

4.3. Robustness tests

4.3.1. Alternative model specifications

Our main results are based on the full sample (2009–2018) for which we have Bitcoin and culture data. However, Bitcoin activity can be quite low for some country-years in our sample, particularly in the early period when Bitcoin was still relatively new. Although we have already demonstrated the robustness of our results across different sub-periods, we have not explicitly controlled for situations where there is no Bitcoin activity for a particular country-year. In this subsection, we address this issue by 1. re-estimating the OLS regressions in Eq. (1) where we exclude observations with zero Bitcoin activity for a particular country-year; and 2. by estimating a Tobit regression where we left-censor observations with zero Bitcoin activity.

Table 4 reports the results for the regression specifications where we exclude zero observations as well as where we estimate a Tobit model. As can be seen from Table 4, our results are not affected by the zero observations in the sample or when we left-censor the data. The relationship between individualism and Bitcoin activity remains positive and significant in all estimated specifications.

4.3.2. Alternative measures for individualism

The results reported in the main specification are based on Hofstede's individualism score. To assess the robustness of our results with regard to the choice of culture framework, we collect individualism scores from alternative sources. Specifically, we obtain data from the GLOBE project (House et al., 2004), where we use both their *In-Group Collectivism*, as well as their *Institutional Collectivism* scores, noting that the collectivism scale is the reverse of the individualism scale (i.e., a high score on collectivism equates to a low score on individualism). *In-Group Collectivism* captures the degree to which people express pride, loyalty, and cohesiveness in their organizations or families, while *Institutional Collectivism* captures the degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action. Although we expect a stronger connection between *Institutional Collectivism* and Bitcoin activity, we include both metrics as a robustness test. We also employ the "as-is" scores based on practices within a country, as practices will be most-related to the actions of people.

In addition to the GLOBE scores, we obtain data from Schwartz (1994). Schwartz (1994) constructs various bi-polar culture dimensions. We focus on the dimensions that most resemble individualism/collectivism. We obtain the *Embeddedness* score, which relates to collectivism, as well as the opposite end of the spectrum: *Affective* and *Intellectual Autonomy*, which both relate to individualism. *Embeddedness* captures the degree to which people view themselves as entities embedded in the collective, their commitment to the status quo, and their restraining of actions that may disrupt in-group solidarity or the traditional order. *Affective Autonomy* captures the degree to which people are free to pursue their affective desires, while *Intellectual Autonomy* captures the degree to which people pursue their own ideas and intellectual directions independently. We expect *Intellectual Autonomy* to be most closely related to Bitcoin activity.

We report separate regressions for each alternative individualism/collectivism measure in Table 5. We note that for each specification, the number of observations is less than for the specification using Hofstede's individualism score, as culture scores from these alternative sources are not available for all countries in our sample. Focusing on the first two columns of Table 5, where we use the GLOBE *In-group* and *Institutional*

Table 4
Alternative model specifications.

	Excluding Zeros			Tobit Model		
	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.
Individualism	0.024***	0.016**	0.026***	0.024***	0.016***	0.025***
	(3.16)	(2.56)	(2.96)	(3.28)	(2.81)	(2.95)
GDP Growth	0.069***	−0.012	0.054*	0.072***	−0.004	0.057*
	(2.67)	(−0.40)	(1.74)	(2.95)	(−0.15)	(1.88)
Emerging Market	−1.03***	−0.326	−1.12***	−1.01***	−0.333	−1.11***
	(−2.91)	(−0.93)	(−2.83)	(−2.90)	(−0.97)	(−2.83)
Internet Coverage	0.011**	0.010*	0.010	0.013**	0.011**	0.012**
	(2.12)	(1.93)	(1.64)	(2.55)	(2.15)	(2.02)
Legality Dummy	0.920***	0.598***	0.809***	0.963***	0.650***	0.832***
	(3.28)	(2.87)	(2.69)	(3.43)	(3.08)	(2.82)
Creditor Rights Index	−0.070	−0.085	−0.030	−0.097	−0.113	−0.044
	(−0.60)	(−0.96)	(−0.22)	(−0.82)	(−1.29)	(−0.33)
English	−0.68**	−0.452*	−0.590	−0.620**	−0.391*	−0.544
	(−2.43)	(−1.87)	(−1.56)	(−2.29)	(−1.74)	(−1.49)
French	−0.610*	−0.616**	−0.464	−0.577*	−0.573**	−0.430
	(−1.90)	(−2.24)	(−1.23)	(−1.85)	(−2.26)	(−1.17)
German	0.385	0.045	0.620	0.473	0.191	0.654
	(1.01)	(0.13)	(1.39)	(1.27)	(0.61)	(1.49)
Capital Flow Restrictions Index		−0.358			−0.299	
		(−0.90)			(−0.77)	
Anti-Money Laundering Index			−0.288**			−0.303**
			(−2.05)			(−2.23)
Country-Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
N	630	246	508	770	354	520
R-sq	0.679	0.658	0.710			

Note: This table reports regression results for the regression of Bitcoin activity (measured by either Bitcoin volume per capita or trades per capita) on Hofstede (1980, 2001) individualism, as well as a set of control variables (GDP growth over the specific year, internet coverage over the year, a legality dummy indicating whether Bitcoin trading is allowed, a creditor rights index indicating the level of creditor protection, a dummy variable indicating whether a country is classified as an emerging market; and three dummies indicating the legal origin of a country (English, French, German)). All variables are explained in Appendix A. In addition to these controls, we also include year fixed effects. Robust standard errors are clustered by country and *t*-statistics are reported in parentheses, and significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

Table 5
Alternative culture frameworks.

	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.	Bitcoin Trades Cap.
In-group Collectivism	−0.963***				
	(−3.31)				
Institutional Collectivism		−0.883**			
		(−2.11)			
Embeddedness			−1.32**		
			(−2.41)		
Affective Autonomy				1.01***	
				(3.05)	
Intellectual Autonomy					1.18**
					(2.28)
GDP Growth	0.075***	0.086***	0.051**	0.056**	0.053**
	(3.26)	(3.35)	(2.01)	(2.36)	(2.11)
Emerging Market	−0.74*	−1.25***	−0.709*	−0.850**	−0.897**
	(−1.96)	(−3.21)	(−1.80)	(−2.37)	(−2.61)
Internet Coverage	0.009	0.019**	0.007	0.008	0.007
	(1.39)	(2.64)	(1.08)	(1.04)	(1.07)
Legality Dummy	0.673***	0.755***	0.786**	0.781***	0.870***
	(3.52)	(3.39)	(2.64)	(2.84)	(3.21)
Creditor Rights Index	−0.224**	−0.113	−0.109	−0.080	−0.121
	(−2.12)	(−0.87)	(−0.81)	(−0.61)	(−0.90)
English	0.215	−1.00**	−0.330	−0.510	−0.161
	(0.56)	(−2.48)	(−1.00)	(−1.51)	(−0.45)
French	0.091	−1.55**	−0.784**	−0.647*	−0.692**
	(0.19)	(−2.33)	(−2.44)	(−1.95)	(−2.08)
German	0.751	−0.497	0.262	0.276	0.327
	(1.59)	(−0.93)	(0.70)	(0.70)	(0.84)
Year FE	Yes	Yes	Yes	Yes	Yes
Country-Clustered SE	Yes	Yes	Yes	Yes	Yes
Nobs	484	484	572	572	572
R-sq	0.676	0.652	0.657	0.662	0.657

Note: This table reports regression results to assess the robustness of our results to alternative culture frameworks. We consider two alternative culture scores from the GLOBE project (House et al. (2004): In-Group Collectivism and Institutional Collectivism (both based on practices scores); and three alternative culture scores from Schwartz (1994): Embeddedness; Affective Autonomy and Intellectual Autonomy. Further definitions of these alternative culture scores are given in Appendix A. Regressions include the same controls and year fixed effects as in Table 3 and reported *t*-statistics (in parentheses) are based on robust standard errors clustered by country. Significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

Collectivism scores, we observe a negative and highly significant relationship with Bitcoin activity. This is expected as collectivism is the opposite of individualism. This result holds after controlling for the other determinants of Bitcoin activity included in our main regression. Hence, our results are robust to using GLOBE data.

The next three columns report the results for the alternative culture scores of Schwartz (1994). We use embeddedness, which resembles collectivism, and affective and intellectual autonomy, which resemble individualism. We observe that all three metrics yield significant results. For embeddedness, we find a significant and negative coefficient, i.e., in more collectivistic societies, Bitcoin activity is lower than in more individualistic societies. For both autonomy metrics, we find positive relationships, in line with more individualistic societies engaging in more Bitcoin transactions. Again, these results hold while controlling for other determinants of Bitcoin activity and demonstrate that our main results are robust to utilizing Schwartz's alternative measures.

4.3.3. Excluding major players

Our summary statistics reveal that Bitcoin activity is concentrated in a few countries. To assess whether these countries drive our results, we conduct a robustness test by excluding these countries from the regressions. Specifically, we identify the top five countries by transactions (U.S., Germany, the Netherlands, France, and the U.K.) as well as the five most active countries per capita (Germany, the Netherlands, U.S., Switzerland, and Lithuania) and exclude each of these countries individually to see if our results are driven by the existence of these large bitcoin transacting countries.

Table 6 reports the results for the regressions, where we exclude each country individually. The exclusion of these countries does not alter the main findings on the role of individualism. Individualism remains positive and highly significant in each regression specification, suggesting that our results are driven by the broader cross-section of country-level individualism.

4.3.4. Endogeneity

The associations we document are arguably causal because the cultural traits of individuals cannot be influenced by recent Bitcoin activity. Nevertheless, our results could still suffer from an omitted variable bias. To mitigate potential endogeneity concerns, we employ an instrumental variables (IV) approach.

Our choice of relevant instruments for individualism is guided by prior literature. We follow An et al. (2018) and use a country's grammatical rules on pronoun drops. Language evolves slowly over time and is closely related to culture but not directly related to economic variables (Licht, Goldschmidt, & Schwartz, 2007). Kashima and Kashima (1998) show that there is an association between the use of first- and second-person singular pronouns and individualism. Davis and Abdurazokzoda (2016) extend the work of Kashima and Kashima (1998) and construct six pronoun-drop categories, which capture different aspects of pronoun drop within a specific country. They show that it strongly correlates with Hofstede's individualism score and, as such, can serve as a valid instrument for individualism. We label this metric *PD* and use it as one of our instruments.

In addition to pronoun drop, we employ a second instrument based on genetic distance (see Spolaore & Wacziarg, 2018). Given that genes, like culture, are passed from generation to generation, there is a strong correlation between genetic markers and culture. In line with Davis and Abdurazokzoda (2016), we use genetic distance (the difference in genetic markers between two countries), relative to the country with the highest individualism score (the U.S.) as an instrument for individualism. We label this metric *GD*.

Table 7 reports the IV regression results. Panel A reports the results using *PD* as our instrument. The first-stage regression results show that *PD* is negatively and significantly related to *Individualism*. The country-clustered *F*-statistic for the test of weak instruments of 17.01 is significantly above the Stock and Yogo (2002) threshold of 10. In the second-stage regression, instrumented individualism is significantly and positively related to Bitcoin activity. In Panel B, we perform a similar analysis with *GD* as our instrument. Again, the first-stage regression reveals a significant negative relationship between GD and *Individualism*, with an *F*-statistic (test for weak instruments) of 34.83. In the second-stage regression, instrumented individualism is significantly and positively related to Bitcoin activity. Both instrumental approaches confirm our previous finding that national Bitcoin activity is influenced by individualism across countries. These results alleviate any endogeneity concerns and support a causal interpretation of our results.

Our main sample stops in 2018 and relies on a direct measure of Bitcoin trades. We now exploit the volume of Google search for Bitcoin per country over time to be able to extend our analysis up to 2020 (starting in 2011) and to capture the local demand for Bitcoin that is not directly reflected in the volume of trades. Da, Engelberg, and Gao (2011), among others (e.g., Ap Gwilym, Kita, & Wang, 2014), use GSVI to capture retail investors' attention. They show that GSVI is positively related to speculative demand and trading frequency.

More specifically, we compute Bitcoin GSVI as the natural logarithm of Google Search Volume Index (GSVI) for the word "Bitcoin". The Google Search Volume Index (GSVI) is calculated on a scale from 0 to 100, where 100 is the country with the highest fraction of searches about Bitcoin to total searches. A value of 50 indicates a country which experiences half the level of bitcoin searches. A higher value means a

Table 6
Excluding major countries.

	Ex U.S.	Ex Germany	Ex Netherlands	Ex France	Ex U.K.	Ex Switzerland	Ex Lithuania	Ex All Major Countries
Individualism	0.020***	0.021***	0.019***	0.022***	0.022***	0.022***	0.011**	0.020***
	(3.01)	(3.28)	(3.05)	(3.10)	(3.30)	(3.19)	(1.99)	(3.01)
GDP Growth	0.072***	0.071***	0.068***	0.071***	0.071***	0.067***	0.062***	0.072***
	(3.32)	(3.34)	(3.20)	(3.29)	(3.34)	(3.11)	(2.79)	(3.32)
Emerging Market	−1.02***	−0.940***	−0.998***	−1.03***	−1.00***	−0.962***	−0.656**	−1.02***
	(−3.27)	(−3.17)	(−3.26)	(−3.33)	(−3.18)	(−3.15)	(−2.36)	(−3.27)
Internet Coverage	0.004	0.005	0.003	0.004	0.004	0.004	0.007	0.004
	(0.91)	(1.08)	(0.67)	(0.76)	(0.84)	(0.91)	(1.66)	(0.91)
Legality Dummy	0.684***	0.747***	0.750***	0.703***	0.712***	0.699***	0.804***	0.684***
	(2.95)	(3.16)	(3.19)	(2.96)	(3.00)	(2.97)	(3.58)	(2.95)
Creditor Rights Index	−0.014	−0.064	−0.083	−0.049	−0.033	−0.049	−0.058	−0.014
	(−0.15)	(−0.68)	(−0.93)	(−0.51)	(−0.35)	(−0.52)	(−0.63)	(−0.15)
English	−0.899***	−0.763***	−0.807***	−0.779***	−0.777***	−0.784***	−1.18***	−0.899***
	(−3.67)	(−3.15)	(−3.37)	(−3.00)	(−3.06)	(−3.15)	(−4.40)	(−3.67)
French	−0.676**	−0.665**	−0.804***	−0.628**	−0.628**	−0.701**	−1.29***	−0.676**
	(−2.32)	(−2.32)	(−3.29)	(−2.10)	(−2.17)	(−2.42)	(−5.58)	(−2.32)
German	0.211	0.096	0.203	0.260	0.206	0.232	−0.318	0.211
	(0.62)	(0.31)	(0.61)	(0.77)	(0.57)	(0.69)	(−1.01)	(0.62)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nobs	761	760	760	760	760	761	760	702
R-sq	0.636	0.638	0.640	0.636	0.635	0.632	0.637	0.627

Note: This table reports regression results to assess the robustness of our results to major players in the sample. We run separate regressions, excluding the specific country from the sample. Regressions include the same controls and year fixed effects as in Table 3 and reported *t*-statistics (in parentheses) are based on robust standard errors clustered by country. Significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

higher proportion of all queries, not a higher absolute query count. Note that the cross-country search volume index is available only at the yearly frequency. In some countries, people may refer to "Bitcoin" using their own alphabet more frequently than using the Latin alphabet such as for South Korea, Japan, and Taiwan. Hence, for these countries, we aggregate the search volume index for "Bitcoin" with those for the local translation.

Appendix B reports the mean Google SVI for Bitcoin per country as

Table 7
IV regressions.

	Instrumented by Pronoun Drop		Instrumented by Genetic Distance	
	First-Stage	Second-Stage	First-Stage	Second-Stage
	Individualism	Bitcoin Trades Cap.	Individualism	Bitcoin Trades Cap.
PD	−15.63***			
	(−3.26)			
GD			−695.89***	
			(−3.80)	
Individualism		0.055***		0.056***
		(2.75)		(3.33)
GDP Growth	−0.026	0.073***	0.046	0.073***
	(−0.08)	(2.93)	(0.15)	(3.04)
Emerging Market	−8.76	−0.717	−13.81**	−0.614
	(−1.42)	(−1.61)	(−2.51)	(−1.28)
Internet Coverage	0.364***	−0.008	0.156	−0.007
	(2.99)	(−0.80)	(1.58)	(−0.91)
Legality Dummy	4.36	0.322	4.34	0.434***
	(0.96)	(0.93)	(1.00)	(1.33)
Creditor Rights Index	−1.43	0.014	−0.505	0.008
	(−0.87)	(0.12)	(−0.37)	(0.08)
English	6.00***	−0.864**	1.87	−0.799**
	(1.07)	(−2.32)	(0.38)	(−2.28)
French	−0.218	−0.322	−9.60**	−0.246
	(−0.05)	(−0.92)	(−2.09)	(−0.76)
German	1.36	0.489	−5.97***	0.498
	(0.28)	(1.52)	(−1.34)	(1.48)
Year FE	Yes	Yes	Yes	Yes
Country-Clustered SE	Yes	Yes	Yes	Yes
R-sq	0.587	0.591	0.634	0.578
F-Stat (weak instrument)	17.01		34.83	
Nobs	704	704	704	704

Note: Panel A reports the first- and second-stage results for IV regressions of Bitcoin activity on Hofstede's (1980, 2001) individualism when instrumented by pronoun drop (*PD*) as computed by Davis and Abdurazokzoda (2016). Panel B reports the first- and second-stage results for IV regressions of Bitcoin activity on Hofstede's (1980, 2001) individualism when instrumented by Genetic distance (GD), computed as the genetic distance score of the particular country relative to the US (Spolaore & Wacziarg, 2018). We run regressions for both Bitcoin volume per capita as well as Bitcoin trades per capita. All regressions include year fixed effects and *t*-statistics (based on robust standard errors clustered by country) are reported in parentheses. The (robust) *F*-statistic for the test of weak instrument tests is also reported. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

Table 8
Google Search Volume Index.

Ln (SVI)	(1)	(2)	(3)
Individualism	0.008**	0.008**	0.008**
	(2.07)	(1.99)	(2.01)
GDP Growth	−0.026**	−0.029**	−0.031**
	(−2.03)	(−2.06)	(−2.22)
Emerging Market	−0.148	−0.129	−0.067
	(−0.71)	(−0.59)	(−0.32)
Internet Coverage	0.003	0.004	0.002
	(0.99)	(0.99)	(0.55)
Legality Dummy	0.256	0.214	0.262
	(1.49)	(1.20)	(1.55)
Creditor Rights Index	0.077	0.062	0.087
	(1.57)	(1.20)	(1.60)
English	−0.068	−0.069	0.039
	(−0.36)	(−0.36)	(0.21)
French	−0.459**	−0.490***	−0.350**
	(−2.55)	(−2.65)	(−2.01)
German	−0.174	−0.149	−0.058
	(−0.60)	(−0.48)	(−0.22)
Capital Flow Restrictions Index		−0.022	
		(−0.10)	
Anti-Money Laundering Index			−0.116
			(−1.60)
Year FE	Yes	Yes	Yes
N	781	360	530
R-sq	0.592	0.600	0.612

Note: This table reports regression results for the regression of Bitcoin activity measured by the logarithm of google search volume index on Hofstede (1980, 2001) individualism, as well as a set of control variables (GDP growth over the specific year, internet coverage over the year, a legality dummy indicating whether Bitcoin trading is allowed, a creditor rights index indicating the level of creditor protection, a dummy variable indicating whether a country is classified as an emerging market; and three dummies indicating the legal origin of a country (English, French, German)). All variables are explained in Appendix A. The sample period is from year 2011 to year 2020 by including recent sample. In addition to these controls, we also include year fixed effects. Robust standard errors are clustered by country and *t*-statistics are reported in parentheses, and significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

well as the Hofstede individualism score. This proxy is broader but also noisier because a Google search does not imply a trade. As reported in Table 8, we still document a positive and significant association between association and local search intensity for Bitcoin, consistent with the demand for Bitcoin being higher in countries with a more individualistic culture.

5. Conclusion

In this study, we focus on a relatively new financial asset that exposes investors to a significant amount of risk, namely Bitcoin. In line with previous literature that documents the cultural determinants of financial decision-making, we link the cultural dimension of individualism, which has been shown to capture risk-taking behavior and a proclivity for overconfidence, to Bitcoin activity. Using a unique measure for Bitcoin activity based on actual Bitcoin trades and location, we empirically document that individualism is a robust determinant of the country-level usage of Bitcoin.

Our results highlight the importance of culture in financial decision-making and specifically that culture plays a role in investment decisions in high-risk assets, in our case, Bitcoin. Our results can provide indications of whether specific financial products will be successful in a particular country. This information can be useful for financial institutions and markets when considering the design of financial products.

Author statement

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Appendix A. Variable definition

Variable	Definition	Source
Panel A: Bitcoin Activity		
Bitcoin Trades Cap.	Annual average of Bitcoins traded from and towards a specific country per capita	Blockchain.info
Bitcoin Vol. Cap.	Annual average of Bitcoin volume trade traded from and towards a specific country per capita	
Panel B: Culture Scores for Individualism		
Individualism	Hofstede's culture score that measures the degree to which people in a society are integrated into groups.	Hofstede (2001)
In-Group Collectivism	The degree to which individuals express pride, loyalty, and cohesiveness in their organizations or families (practices score).	GLOBE project - House et al. (2004)
Institutional Collectivism	The degree to which organizational and societal institutional practices encourage and reward the collective distribution of resources and collective action (practices score).	GLOBE project - House et al. (2004)

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Variable	Definition	Source
Embeddedness	The degree to which people view themselves as entities embedded in the collectivity. Embedded cultures emphasize maintaining the status quo and restraining actions that might disrupt in-group solidarity or the traditional order.	Schwartz (1994)
Affective Autonomy	The degree to which people are free to independently pursue their affective desires.	Schwartz (1994)
Intellectual Autonomy	The degree to which individuals pursue their own ideas and intellectual directions independently.	Schwartz (1994)
Panel C: Control Variables		
GDP Growth	GDP Growth	International Monetary Fund
Emerging Market	A dummy variable equal to one if a country is labeled an "Emerging Market" according to the IMF and zero otherwise	International Monetary Fund
Internet Coverage	The percentage of the population that is covered by at least an LTE/WiMAX mobile network.	International Telecommunications Union ICT indicators (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx)
Legality Dummy	Dummy that is equal to one if Bitcoin is unrestricted and legal and zero otherwise	https://coin.dance/poli
Creditor Rights Index	An index aggregating creditor rights. A score of one is assigned when each of the following rights of secured lenders is defined in laws and regulations: First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved, i.e., there is no automatic stay or asset freeze. Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, if management does not retain administration of its property pending the resolution of the reorganization. The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights)	Djankov et al. (2007)
AML Index	Basel Anti Money-Laundering Index	Basel Institute on Governance
Capital Flow Restriction	Overall capital flow restrictions index	Fernandez et al. (2016)
English	A dummy variable equal to one if legal origin of a country is English Law and zero otherwise	La Porta et al. (1998).
French	A dummy variable equal to one if legal origin of a country is French Law and zero otherwise	La Porta et al. (1998).
German	A dummy variable equal to one if legal origin of a country is Germany Law and zero otherwise	La Porta et al. (1998).
Panel D: Instruments		
Pronoun Drop	the country grammatical rule based on six pronoun-drop categories	Davis and Abdurazokzoda (2016)
Genetic Distance	the country's genetic distance to the US	Spolaore and Wacziarg (2018)

Appendix B. Google SVI and individualism score by country

Country	Ln (Google Search Volume)	Individualism
Angola	1.95	18
Argentina	2.14	46
Australia	3.18	90
Austria	3.18	55
Bangladesh	2.25	20
Belarus	1.72	39
Belgium	2.78	75
Brazil	1.96	38
Bulgaria	3.04	30
Canada	3.24	80
Chile	1.55	23
China	2.60	20
Colombia	1.84	13
Costa Rica	2.14	15
Croatia	2.64	33
Czech Republic	2.99	58
Denmark	2.71	74
Ecuador	1.38	8
Egypt	1.13	25
El Salvador	1.95	19
Finland	3.16	63
France	1.98	71
Germany	2.96	67
Greece	2.32	35
Guatemala	1.48	6
Hong Kong	3.04	25
Hungary	2.42	80
India	1.99	48
Indonesia	1.79	14
Iran	2.44	41

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(*continued*)

Country	Ln (Google Search Volume)	Individualism
Ireland	3.02	70
Israel	2.66	54
Italy	2.28	76
Jamaica	2.49	39
Japan	2.14	46
Jordan	1.49	30
Kenya	2.76	25
Kuwait	1.99	38
Latvia	2.86	70
Lebanon	2.45	40
Lithuania	2.81	60
Malaysia	2.46	26
Mexico	1.54	30
Morocco	1.75	46
Mozambique	1.72	15
Nepal	2.38	30
Netherlands	3.33	80
New Zealand	3.00	79
Nigeria	2.32	30
Norway	3.03	69
Oman	1.47	38
Pakistan	2.29	14
Panama	2.30	11
Peru	1.42	16
Philippines	2.43	32
Poland	2.53	60
Portugal	2.53	27
Puerto Rico	1.99	27
Romania	2.64	30
Russia	1.88	39
Saudi Arabia	1.27	25
Serbia	2.47	25
Singapore	3.14	20
Slovakia	2.68	52
Slovenia	3.43	27
South Africa	3.25	65
South Korea	2.91	18
Spain	2.33	51
Sri Lanka	1.83	35
Sweden	3.04	71
Switzerland	3.16	68
Thailand	1.57	20
Turkey	1.93	37
Ukraine	2.03	25
United Arab Emirates	2.33	38
United Kingdom	2.88	89
United States	3.04	91
Uruguay	1.94	36
Venezuela	2.48	12
Vietnam	1.88	20

Note: This table reports summary statistics for all countries in our sample that have both Google search volume index (SVI) data as well as a Hofstede individualism score. We report the average number of the logarithm of google SVI over the sample period from 2011 to 2020, for each country. All measures are computed on an annual basis. We finally report Hofstede (2001) individualism score.

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