RIVER

June 2023

Research Report

Bitcoin vs the $156 Trillion Global Payments Industry

Executive Summary

Founded in 2019, River is a Bitcoin technology and financial services company. River offers the full suite of Bitcoin brokerage, custody, and mining services in one easy-to-use mobile app and on River.com.

River is also a leader in Lightning infrastructure with River Lightning, an enterprise API that allows companies to easily integrate with the Lightning Network. River Lightning powers Lightning transactions for exchanges and wallets in the crypto ecosystem, including El Salvador's Chivo wallet.

Purpose of the Report

Bitcoin's use case for payments has grown with the introduction of new technologies built on top of the Bitcoin Network. But why have business and consumer adoption of payments been relatively slow thus far? What has been built and what is missing?

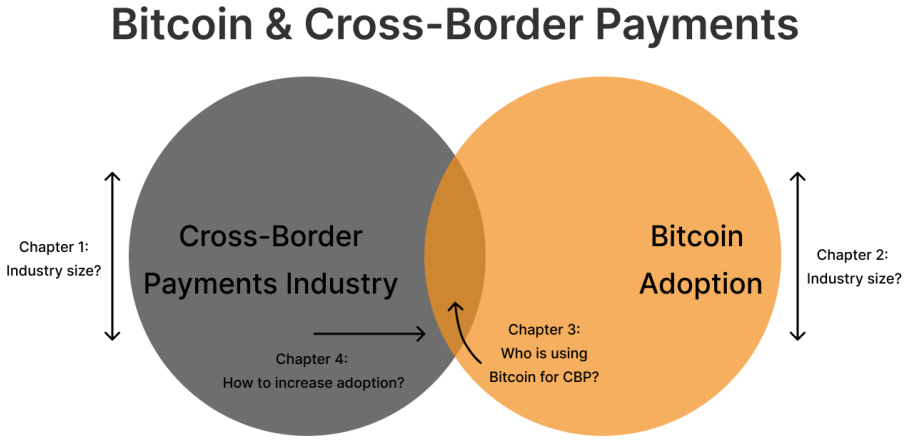
In addition, the European Central Bank claimed in an August 2022 report, "Towards the holy grail of cross-border payments", that Bitcoin is the least likely candidate because of:

1. An incorrect understanding of Bitcoin's underlying proof-of-work mechanism.
2. The claim that Bitcoin's advantages depend on regulatory gaps which will be closed.
3. Bitcoin not being stable in purchasing power today.

In this report, we challenge their conclusion and answer the questions above.

Report Structure

We first examine the cross-border payments industry and then general Bitcoin adoption in the second chapter. In the third chapter, we overlap these two domains and analyze how Bitcoin is used for cross-border payments today. Finally, we look into growing adoption.



Key Findings on the Cross-Border Payments Industry (Chapter 1)

- The cross-border payments industry is growing quickly and consistently, but there is a lack of incentives for incumbents in all segments to significantly improve the underlying payments infrastructure. Their focus is competing over vast amounts of profit, which makes data sharing unappealing and shrinking revenue a low priority. Accountability from clients is too easily hand-waved away as no consumer- or business-facing financial institution owns the underlying infrastructure.

- The Financial Stability Board, assigned by the G20 countries to measure progress towards lower payment costs, stated in its report that many underlying data sources it needs have major gaps, require a significant overhaul, or simply do not exist.

- 96.7% of cross-border payments are B2B according to EY, at $150.7 trillion in 2022. Other research institutions provide conflicting data on this opaque industry.

- 38.29% of the global population aged 15+ made a digital consumer-to-business transaction in 2021, according to The World Bank's Global Findex Database 2021. There is a strong correlation between income and engaging in C2B transactions.

- 78.8% of remittances, or $626 billion in 2022, went to low- and middle-income regions. We slice the data for 2021 in the following ways in the first chapter:
    - Highest receiving countries (India $89 billion, Mexico, China)
    - Most reliant on remittances by % of GDP (Tonga 44%, Lebanon, Tajikistan)
    - Highest sending countries (US $200 billion, Saudi Arabia, UAE)
    - Top 20 corridors (US → Mexico $52.6 billion, UAE → India, US → India)

- 85% of the world population can instantly send and receive data through their smartphones, but money transfers are measured in days and cost 6.24% on average for remittances. Theoretically, this could drop to 3.31% if all consumers were fully aware of their options.

- Worldwide adult ownership of financial accounts has risen from 51% in 2011 to 76% in 2021 according to The Global Findex Database 2021, and an estimated 10% of the global population does not have a government-issued ID to open an account.

- Innovation in cross-border payments is currently focused on two main initiatives:
    - The international linking of national instant payment systems.
    - The introduction of Central Bank Digital Currencies (CBDCs).

- For CBDCs, there is little consideration within the industry for the immense danger they represent in the hands of oppressive regimes to target, punish, tax, and

financially control specific parts of the population. 70% of the global population lives in such authoritarian regimes according to Our World in Data. There is no legislation and there are no features that would prevent CBDCs from being used to enforce government policies. We, therefore, recommend against their rollout. Instead, a decentralized network, similar to the Internet, would allow humanity to flourish.

Key Findings on Global Bitcoin Adoption (Chapter 2)

- There are roughly 800k active Bitcoin addresses per day, but this is not an accurate representation of the number of daily users due to how Bitcoin works technically.

- There are an estimated 32.9 million active entities in Bitcoin, and roughly 44.4 million addresses with usable balances according to Glassnode.
    - The average active entity excluding exchanges and miners owns around 0.46 BTC ($12,420). The median entity holds an estimated 0.0067 BTC ($180.9).

- There is roughly 2.34 million bitcoin stored on 20 major exchanges as of June 2023.
    - 500k is held on Coinbase, the largest US exchange, which has an estimated 6.1 million monthly active users, of which 73% hold bitcoin in their account, likely holding between 0.041 - 0.082 BTC on average, or $1,107 - $2,213.
    - 630k BTC is held on Binance, the largest exchange, which has an estimated 20 million monthly active users, of which 65% hold bitcoin in their account, likely holding between 0.024 - 0.048 BTC on average, or $648 - $1,296.

- Extrapolated from Binance's numbers, we estimate a range of 48.8 - 97.5 million bitcoin holders on all exchanges globally.

- An estimated 70% of users hold bitcoin on exchanges and 80% in mobile or desktop wallets, so there is a significant overlap between the 32.9 million active entities and exchange users. We believe it is likely that the total number of unique entities/actors holding bitcoin is well under 100 million, and potentially down to half that number.

- 11% of all cryptocurrency owners use it for payments, per a 2021 Binance survey.

- Relative Google search traffic for Bitcoin from 2013-2023 was highest in Nigeria and El Salvador, in which the average search query is almost twice as likely to be about Bitcoin than in the next countries of Austria, The Netherlands, and Switzerland.

- The number of people sending remittances globally (200 million) is potentially at least 100-400% higher than the number of Bitcoin holders.

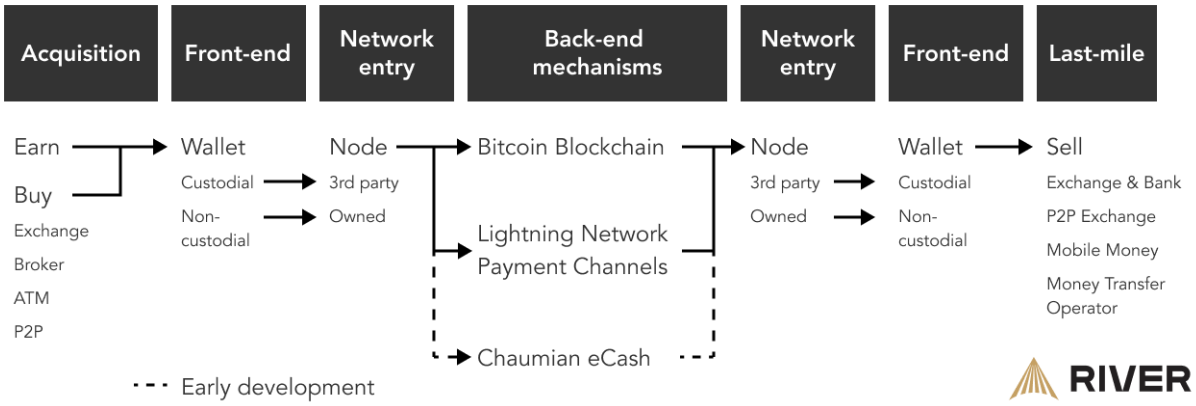
Key Findings on Cross-Border Payments with Bitcoin (Chapter 3)

- By design, Bitcoin does not care about crossing borders. There is no differentiation in time or cost based on how many countries a transaction travels across. The term “cross-border” is only used in this report to signal transaction intent.

- When on- and off-ramps to Bitcoin are involved in the cross-border payments flow, they negate the speed and cost benefits of using it for cross-border payments. The sender and receiver must wait, or be exposed to volatility, or counterparty risk. Without these on- and off-ramps, Bitcoin is a highly reliable solution, unparalleled in the final settlement of transactions, even up to billions of dollars in value.

- A sizable share of the global population does not have access to on- and off-ramps for a variety of reasons, such as a lack of government identification, government bans on Bitcoin, and difficulty for exchanges to integrate with local banks. These people instead use Peer-to-Peer exchanges or chat groups to exchange currency.

Bitcoin’s Cross-Border Payments Flow



- By design, the Bitcoin blockchain is less suited for payments and should not be compared to other payment networks. Technologies are emerging that turn the blockchain into a settlement layer while handling payments on additional layers.

- A new payment flow has emerged where services use the Lightning Network for instant settlement among each other, while clients send and receive their local currencies, without any understanding of Bitcoin, or knowledge of it being used.

    1. This model transfers volatility risk from users to financial services, but these are better equipped to offset this risk by charging small fees for payments.
    2. The model is vulnerable to regulatory changes aimed at undermining Bitcoin, as the services involved need the traditional financial system to operate.

- Stablecoins are the strongest competitor for cross-border payments to the model above. They are a popular option in emerging markets that want dollars as a store of value. If, and on which blockchain, they will ultimately operate remains to be seen.

- Bitcoin B2B cross-border payments adoption remains limited today. B2B is typically the last to adopt new technologies. The effort to not only integrate the technology but also educate many stakeholders is perceived as a hurdle.

- B2C service providers in international payroll have solved the major pain points in this segment. Workers can be paid in their desired mix of Bitcoin, stablecoins, and local currency. There are integrations with most payroll solutions and they work without employer action. We expect growth in this segment to mirror Bitcoin's, as a stable ~20% share of volume comes from Bitcoin payroll over the past three years.

- In C2B, e-commerce has proven a challenging segment for adoption.
    1. Bitcoin's design makes chargebacks and fraud impossible, which makes receiving Bitcoin payments ideal for businesses. An estimated 32,000 physical stores accept Bitcoin as payment as of June 2023.
    2. However, ~89% of consumers do not engage in payments and hold their bitcoin to make a profit. U.S. consumers are discouraged from spending bitcoin through taxation rules that turn transactions into taxable events.

- Subscription services have not seen much Bitcoin adoption, due to their reliance on "pull" systems like credit cards that allow them to take money. This mechanism is not possible in Bitcoin, which is a push system. Additional solutions are required to see adoption here, which do not require users to give up custody of their funds.

- Bitcoin is a valuable tool to pay non-profit organizations, as it opens them up to an international market without being restricted by what their payment processor supports, and without a government being able to freeze their funds.

- Remittances are considered the most important segment for Bitcoin adoption. El Salvador's central bank reported that from January to May 2022, Chivo Wallet processed $52 million in remittances or 1.6% of its total estimated volume of $3.175 billion. This number is relatively high, given how new Bitcoin is to many people.

- Since late 2022, six businesses across five continents have started building out payment networks using Lightning as back-end infrastructure as described on the previous page. We expect more institutions to join them in the coming years.

- Using Bitcoin for payments transcends all concerns and hurdles for four use cases:
    1. When there are **no alternatives** due to restrictions, costs, or business hours.
    2. **Dissidents** in authoritarian regimes who need money to operate.
    3. **Capital controls** make it difficult for businesses and consumers to maintain their purchasing power or do international business.
    4. **Fixed exchange rates** that make international business unfeasible.

Key Findings on Growing Bitcoin CBP Adoption (Chapter 4)

- The most effective way to grow adoption in B2B is likely by first building out the consumer infrastructure and battle-testing it at scale. Businesses will then follow.

- Given that the problems in B2C payroll with Bitcoin have been solved, consumer education is the biggest driver of adoption for this segment.

- In C2B payments, three initiatives can help grow E-commerce adoption:
    - Spend-and-replace feature in wallets that enables consumers to automatically rebuy any bitcoin they spend on goods and services.
    - Payment processors to work with a Lightning Service Provider to boost payments adoption, without having to build and maintain their own infrastructure. An API-based solution like River Lightning makes it easy.
    - Education initiatives should focus more on consumers than on merchants. The former may be business owners and can make their own informed decisions. The latter may have inflated expectations on transaction volumes.

- An automated recurring payment feature needs to be built for subscription services.

- To grow the adoption of remittances, education and international accessibility are key. We outline practical improvements to Bitcoin applications for this in section 4.2.

- Bitcoin advocates have a lot of work and introspection to do if they want to educate people who are thus far not interested in Bitcoin.
    - Explain Bitcoin in ways that resonate with the specific listener rather than a generalized or personal perspective.
    - Develop additional learning experiences to articles, books, and podcasts.
    - Focus on people who already understand that fiat currency is broken:
        - 2.5 billion people in 54 countries live with double-digit inflation.
        - Countries that heavily rely on remittances.
        - Countries with capital controls and black markets for currency.

Introduction

Over the past years, River has been focused on helping people and businesses accumulate bitcoin through brokerage, zero-fee recurring orders, custody, and hosted mining services.

These products are great for people with disposable income, but a growing share of the global population has less disposable income. Government deficit spending and subsequent inflation are eroding the middle- and working-class in every country. For more people to experience the benefits of Bitcoin, it must become more than a store of value.

Since 2022, River's mission has been evolving; we have expanded our focus on Bitcoin as a medium of exchange (MoE) through our Lightning efforts. So far, people in the U.S. and other developed countries have not felt the need to use bitcoin for payments. We don't want to downplay the work done by many initiatives that want to make bitcoin an MoE in developed countries, but most consumers choose the convenience of existing fiat payment methods and pay a price for it: a higher cost, as the transaction fee is often passed on to them by the merchant, and their data in the hands of far more companies.

In countries where people would benefit significantly from using Bitcoin, particularly for cross-border payments, there is often a lack of tools and education. Many initiatives have been undertaken over the years, but Bitcoin's share of global cross-border payments is still very small. Why is that? What has been built? And what is missing? These are the questions we set out to answer.

In an August 2022 report titled "Towards the holy grail of cross-border payments", the European Central Bank claimed to have the answers. Bitcoin was considered the least likely "holy grail" of cross-border payments out of all options considered, for three reasons:

1. An incorrect understanding of Bitcoin's underlying proof-of-work mechanism.
2. The claim that Bitcoin's advantages depend on regulatory gaps which will be closed.
3. The fact that Bitcoin is not stable in purchasing power today.

In this report, we challenge this conclusion, since the first two stated reasons are based on a lack of understanding, and the third assumes there are no intermediary solutions. We believe Bitcoin already plays a unique role in payments today and has tremendous potential for further adoption in the future, as we highlight from various angles in the report.

In the first chapter, we examine the size and state of the cross-border payments industry. Next, we look at general global Bitcoin adoption. Then we overlap these two domains and dive into the intersection: who uses Bitcoin for cross-border payments today? What can we learn from that? In the final chapter, we look at increasing Bitcoin's payment adoption.

The total reading time is roughly 130 minutes.

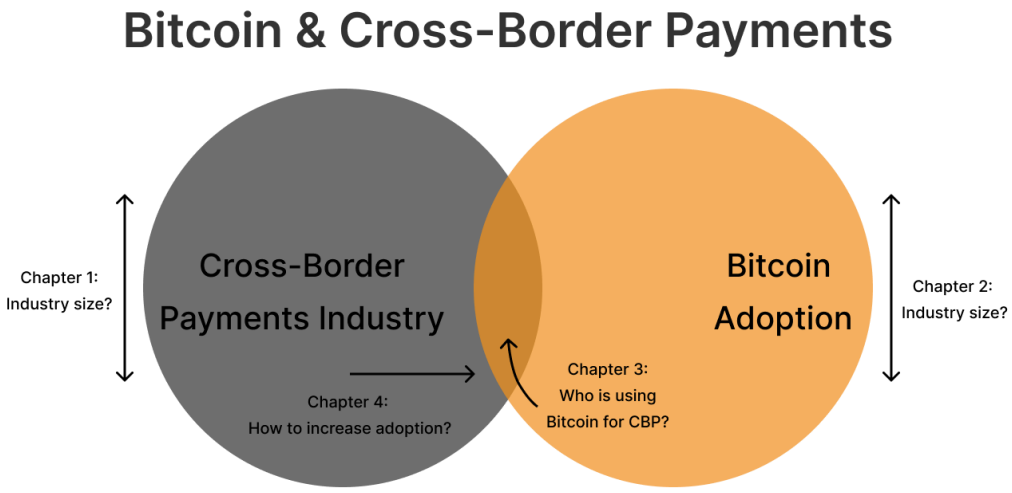


Table of contents

1. Global Cross-Border Payments Industry **8**
- 1.1 The Size of the Global CBP Industry 9
- 1.2 Cross-Border Payment Types 12
- 1.3 Cross-Border Payment Flows 13
- 1.4 Cross-Border Payment Costs 18
- 1.5 Cross-Border Payment Speeds 21
- 1.6 Innovation in Cross-Border Payments 21

2. Global Bitcoin Adoption **28**
- 2.1 How Many Bitcoin Users Are There? 28
- 2.2 The Speed of Bitcoin Adoption 32
- 2.3 The Bitcoin Adoption Funnel 33
- 2.4 The Motivation for Bitcoin Adoption 35
- 2.5 The Distribution of Bitcoin Adoption 36

3. Cross-Border Payments with Bitcoin **41**
- 3.1 Bitcoin Cross-Border Payment Process 41
- 3.2 Bitcoin Compared to Cross-Border Payment Methods 45
- 3.3 Bitcoin in Different Cross-Border Payment Types 47
- 3.4 Who Really Needs Bitcoin Payments? 56

4. Growing Bitcoin Cross-Border Payments Adoption **60**
- 4.1 Why Accelerate Bitcoin Adoption 60
- 4.2 Building Better Solutions 61
- 4.3 Growing Bitcoin Cross-Border Payments 61
- 4.4 Improving Bitcoin Education 63

Conclusion **68**

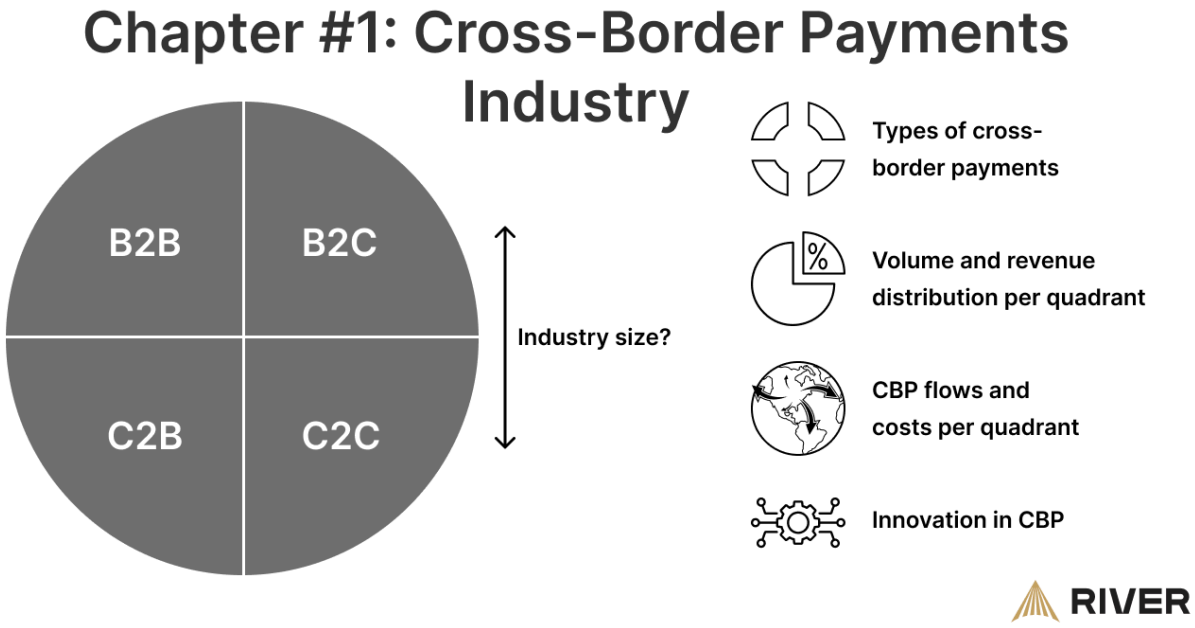
1. The Cross-Border Payments Industry

In 2023, it is possible to send information to 86% of the global population nearly instantly: smartphones. Yet, sending money to anyone still takes days and costs 6.24% on average for remittances. Why? And how do we explain to the younger generations who can access any information within seconds that money moves slowly and more expensively?

In this chapter, we examine the state of the global cross-border payments (CBP) industry. That makes it a bit of a report within a report, but this is important context if you believe Bitcoin could play a role to improve or completely overhaul this industry. To do so, we must first understand how this industry operates and where it is going.

We look into:

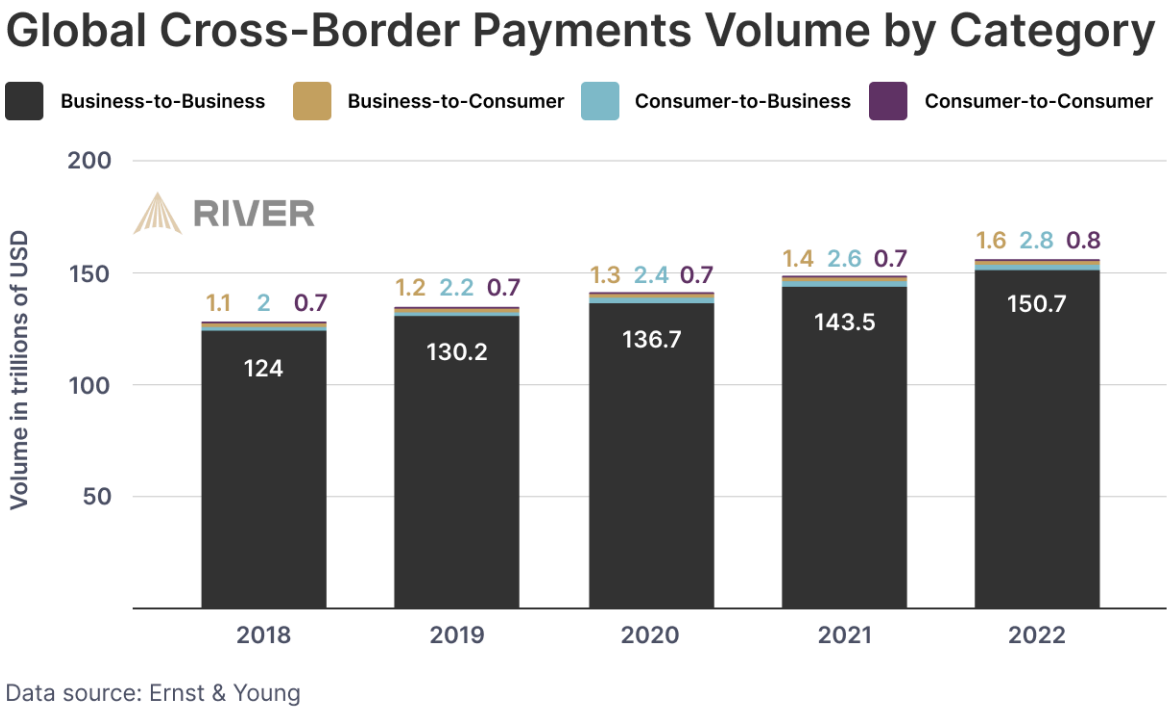
1. The size of the global CBP industry
2. Different types of CBP
3. CBP flows
4. CBP costs
5. CBP speeds
6. Innovation in CBP



It is worth noting that finding accurate data for this chapter was difficult. We found a dozen examples of large organizations contradicting their own data points by hundreds of percentages across various publications. For this report, the findings suffice as the exact numbers do not critically impact our findings, but they may not suffice for other use cases.

1.1 The Size of the CBP Industry

Over the past few years, we have seen a tremendous increase in global cross-border payments. According to EY, in 2022 an estimated $155.9 trillion was sent internationally, compared to $127.8 trillion in 2018.



Data source: Ernst & Young

This growth is to be expected. The world is more physically and digitally interconnected. Money has become more digital, working in or for other countries is more accessible, shopping online keeps getting easier, global supply chains have expanded, more companies can make digital payments internationally, and inflation has made a huge impact. Over the next decade, many reports and forecasts expect the CBP growth trend to continue for these same reasons.

In addition, the share of global CBP taken up by B2B payments draws attention, at 96.7% in 2022, adding up to $150.7 trillion.

More reports focus on revenue numbers rather than on volume, but the wide range of methodologies used to estimate these data points leads to a lack of consensus on the results.

As an example, below we compare two reports on revenue from McKinsey that are four years apart. Their data sources are McKinsey's proprietary payments map, The World Bank,

and the World Trade Organization. This provides context into the difficulty even the largest organizations have in accurately reporting on global money flows.

CBP revenue	2017 - Exhibit 1	2021 - Derived from Exhibit 2
B2B	$127 billion (57%)	$177 billion (83.9%)
B2C	$16 billion (7.2%)	
C2B	$54 billion (24.2%)	$34 billion (16.1%)
C2C	$26 billion (11.6%)	
Total	$223 billion	$211 billion

It is unlikely that C2B and C2C cross-border payment revenue would drop by more than half in four years, given that the average global remittance (C2C) fee decreased from around 7.6% to 6.2%, or an 18.4% decrease, but overall volume increased by at least 20%.

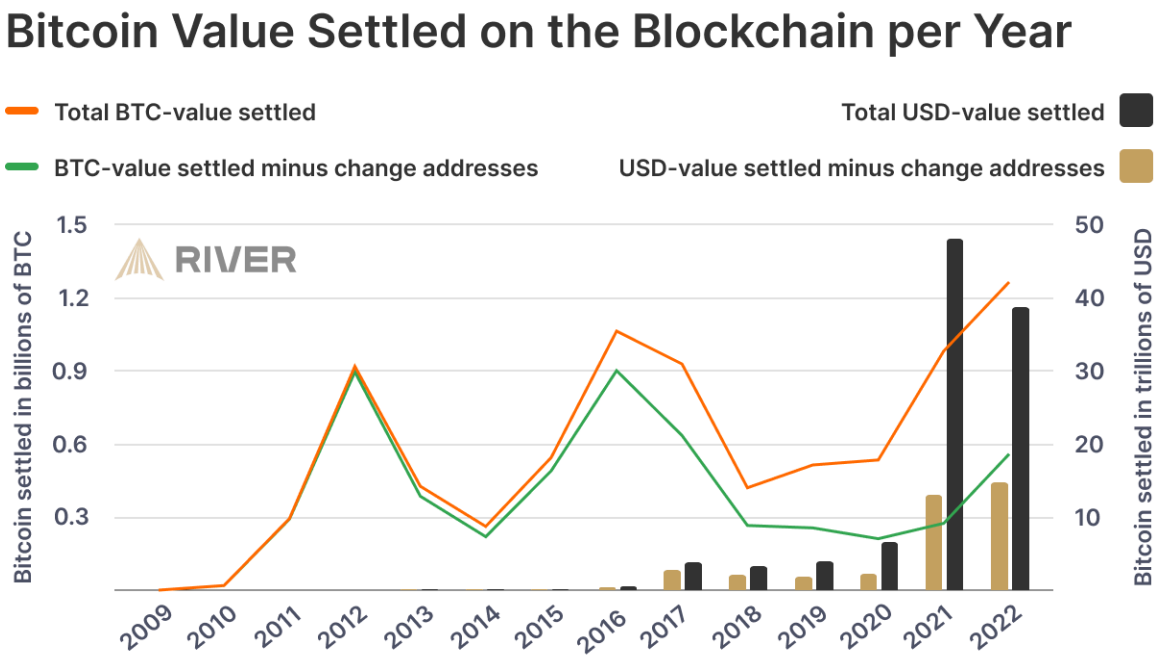
Regardless of the exact numbers, B2B certainly accounts for a majority of the volume and revenue in the CBP industry, which is not a widely considered distribution.

To make the enormous volume and revenue numbers more tangible, we provide some estimations on how many remittances are happening on a yearly and monthly basis.

Metric	Data point in 2022	Data source
Revenue from remittances	$49.86 billion	Grand View Research
Global remittance volume	$794 billion	The World Bank
Global average fee	$794 / $49.86 = 6.3%	
Average remittance size	$200-300 per 1-2 months	United Nations
Yearly remittance count	$794 billion / $200 = 3.97 billion	
Monthly remittance count	3.97 billion / 12 = 330 million	
International migrants sending remittances	200 million (out of 250 million total)	IFAD
Revenue earned by industry	$19.6 billion	Grand View Research

Cross-Border Payment Data Doesn't Include Cryptocurrency

The estimates for each cross-border payments category exclude cryptocurrency payments, as there is no reporting by centralized institutions that we could find on how much of this volume is business- or consumer-related. Some blockchain analysis firms may attempt to map this out.



Data source: Glassnode

In 2022, an estimated $14.9 trillion was settled on the Bitcoin blockchain when adjusting for what are called *change addresses*. If, for example, half of this volume was between businesses and/or consumers internationally, it would be the equivalent of ~5% of global CBP volume.

What are change addresses?

A change address is part of Bitcoin's accounting system. When a transaction is sent, no bitcoin remains on the sending address. Part of it goes to the recipient(s), part of it is paid to Bitcoin miners in fees, and the remainder is sent to a new address controlled by the sender's wallet.

Analyzing the data to filter out this volume from the total settlement on the blockchain leaves a margin of error, but creates a more accurate view of Bitcoin settlement activity. Without such adjustments, the Bitcoin blockchain settled a total of $38.8 trillion in 2022. The large delta with the $14.9 trillion shows why attempting these adjustments is important for more accurate reporting on what users intended to settle.

1.2 Cross-Border Payment Types

The terms “cross-border payments” and “remittances” are sometimes used interchangeably, but remittances are just one type of cross-border payment. Below we explain the different types of CBP, which becomes relevant later in the report when we evaluate them within Bitcoin’s context.

There is a distinction between “wholesale” and “retail” cross-border payments:

- Wholesale transactions are between financial institutions to support their activities.
- Retail transactions happen between businesses and consumers.

We do not expect Bitcoin to play a role in wholesale any time soon, and thus we only focus on retail in the report. For context, wholesale payments make up 25% of all payments revenue, while retail payments account for 75%, per a report by BCG.

We examine each of the retail cross-border payment categories below.

Cross-Border Payment Type	% of Global volume in 2022 (est.)	% of Global revenue in 2022 (est)	Payments in this category
Business-to-Business (B2B)	96.7%	79%	- International trade - Corporate investments - Treasury flows
Business-to-Consumer (B2C)	1%	4.7%	- International wages - Marketplace payouts - Social benefits - Refunds
Consumer-to-Business (C2B)	1.8%	4.7%	- e-Commerce purchases - International services (healthcare, education, entertainment) - Donations
Consumer-to-Consumer (C2C)	0.5%	11.6%	- Remittances

Remittances account for a disproportionately high revenue share. In the next sections, we look at payment flows, costs, and speed across these quadrants.

1.3 Cross-Border Payment Flows

To improve how money is flowing around the world, we first need to understand how and where it is moving. Unfortunately, data availability is a major challenge in this industry, especially in business banking. For both B2B and B2C CBP, there is no public data available that indicates volume or distribution across various payment methods or countries. The most comprehensive paid reports cover roughly 60 countries and 350 companies, but even when purchased, we would not be allowed to use their contents in this report. Replicating this research ourselves would become a project far beyond the scope of this report.

The lack of data is also a problem for governments that are trying to lower costs and speed up transactions. The Financial Stability Board assigned by the G20 countries to propose standards on improving cross-border payments noted in its report, titled "Developing the Implementation Approach for the Cross-Border Payments Targets", that many of the underlying data sources needed to measure improvements in cross-border payments either have major gaps, require a significant overhaul that is unlikely to happen soon, or simply do not exist. Even if financial businesses would succeed at the goals outlined by this board, they would largely be unable to measure this.

Businesses are not overly happy with B2B service providers. This overview by RFI Global shows how small and medium-sized enterprises in the U.S. feel about B2B payments.

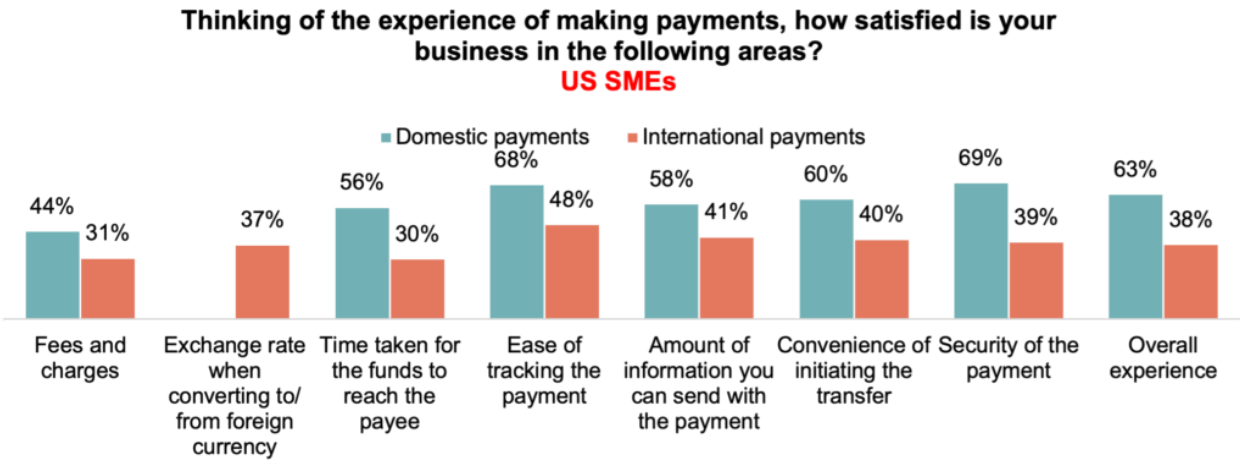
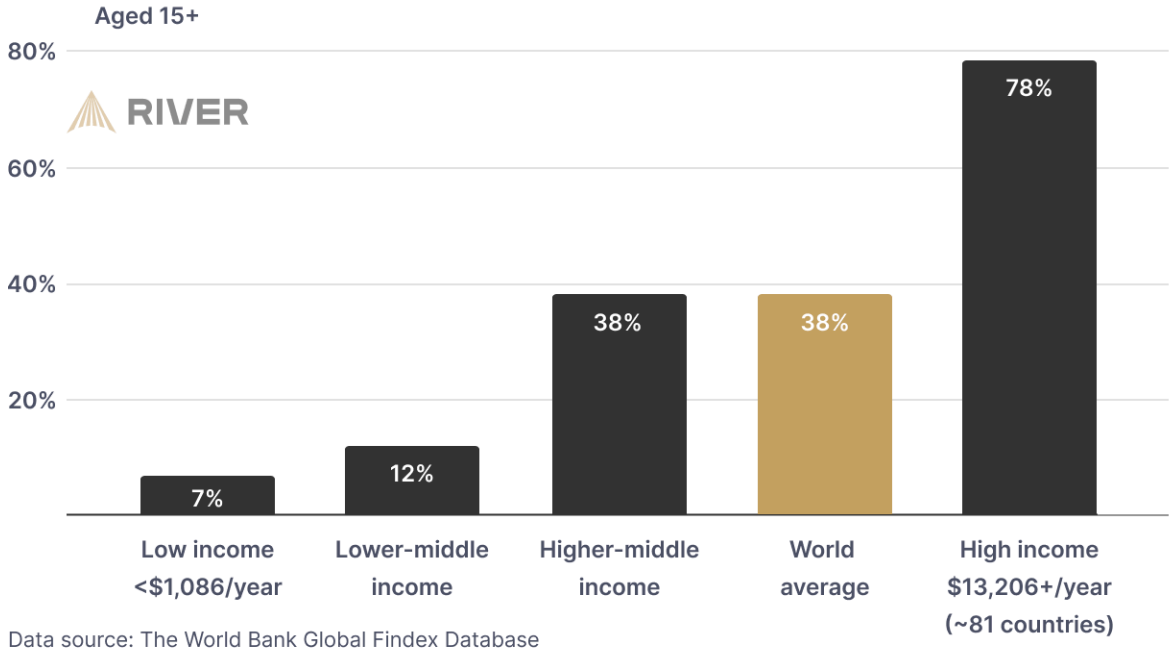


Image source: RFI Global

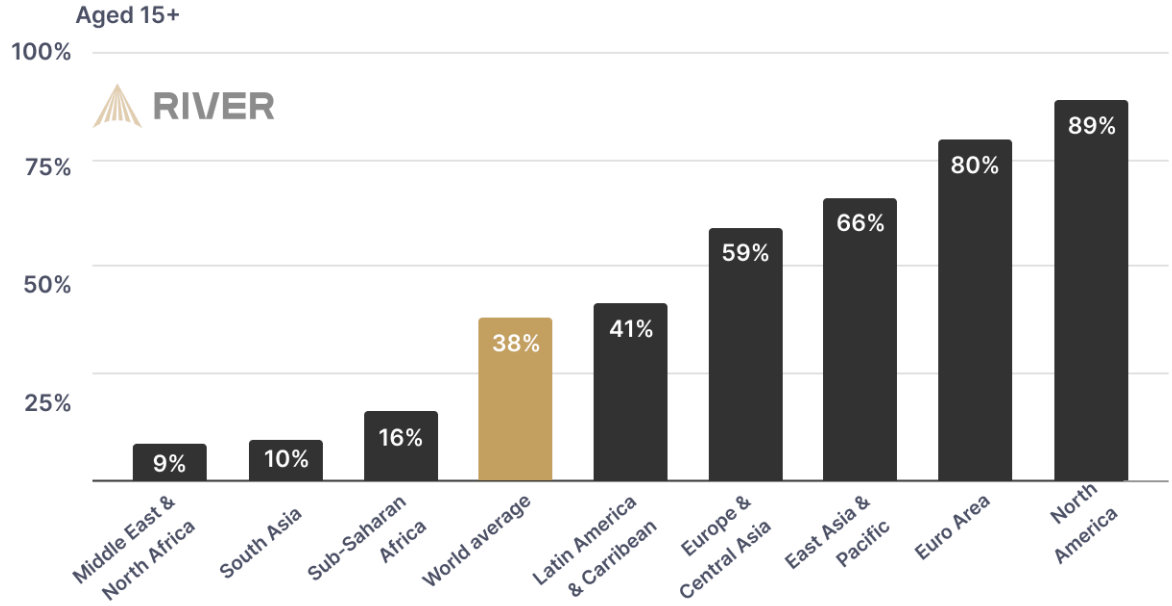
For C2B payments, we used The World Bank's Global Findex Database 2021. It shows that an estimated 38.29% of the global population over the age of 15 had made a payment to a digital merchant in 2021. This puts e-commerce into perspective; the majority of the global population has never engaged with it so far, while some have been fully relying on it for a decade. Major technological changes can take decades to reach a global scale.

Consumer to Digital Merchant Payments by Income in 2021



Data source: The World Bank Global Findex Database

Consumer to Digital Merchant Payments by Geography in 2021



Data source: The World Bank Global Findex Database

Data source: The World Bank

The bracket ranges can be found on WorldPopulationReview and are updated yearly.

Unsurprisingly, there is a strong correlation between income and the likelihood to engage in C2B transactions. Trying to enter a low-income region or segment with a Bitcoin-based solution is harder due to a lack of familiarity with digital payments in general.

Most of these digital merchant payments are domestic. By the estimation of Statista, 22% of all e-commerce happens across borders.

For C2C payments, we can look at the World Bank-KNOMAD data from their November 2022 report. Their Bilateral Remittance Matrix is widely considered to be one of the most comprehensive datasets for country-to-country remittance estimates.

Table 1.1 Estimates and Projections of Remittance Flows to Low- and Middle-Income Regions

Region	2015	2016	2017	2018	2019	2020	2021	2022e	2023f
					$ billion				
Low- and middle-income countries*	**447**	**440**	**477**	**524**	**546**	**542**	**597**	**626**	**639**
East Asia and Pacific	128	128	134	143	148	137	133	134	133
excluding China	64	67	70	76	79	77	80	83	84
Europe and Central Asia	42	43	52	59	62	56	65	72	75
Latin America and Caribbean	68	73	81	89	96	103	130	142	149
Middle East and North Africa	48	48	50	51	54	56	62	63	65
South Asia	118	111	117	132	140	147	157	163	164
Sub-Saharan Africa	42	39	42	49	47	43	50	53	55
World	602	596	638	694	722	711	781	794	815
					Growth rate (percent)				
Low- and middle-income countries*	**0.5**	**-1.4**	**8.3**	**9.8**	**4.3**	**-0.8**	**10.2**	**4.9**	**2.0**
East Asia and Pacific	3.7	-0.5	5.1	6.8	3.2	-7.5	-2.6	0.7	-1.0
excluding China	4.8	3.5	5.4	8.0	4.7	-2.8	3.7	3.7	0.8
Europe and Central Asia	-15.3	2.1	21.0	12.9	4.7	-8.9	15.7	10.3	4.2
Latin America and Caribbean	6.9	7.2	11.0	9.9	8.3	7.1	26.2	9.3	4.7
Middle East and North Africa	-6.6	-1.2	5.5	2.3	4.5	4.0	10.5	2.5	2.0
South Asia	1.6	-5.9	6.0	12.3	6.1	5.2	6.7	3.5	0.7
Sub-Saharan Africa	6.4	-8.6	9.6	16.9	-5.1	-8.5	16.4	5.2	3.9
World	-1.4	-0.9	7.0	8.8	3.9	-1.5	9.9	1.7	2.7
Memo item: Remittances to LMICs according to the 2021 country classification used in MD Brief 36									
($ billion)	453	447	484	531	555	550	607	638	651
(% growth)	0.5	-1.2	8.3	9.7	4.5	-0.9	10.3	5.2	2.1

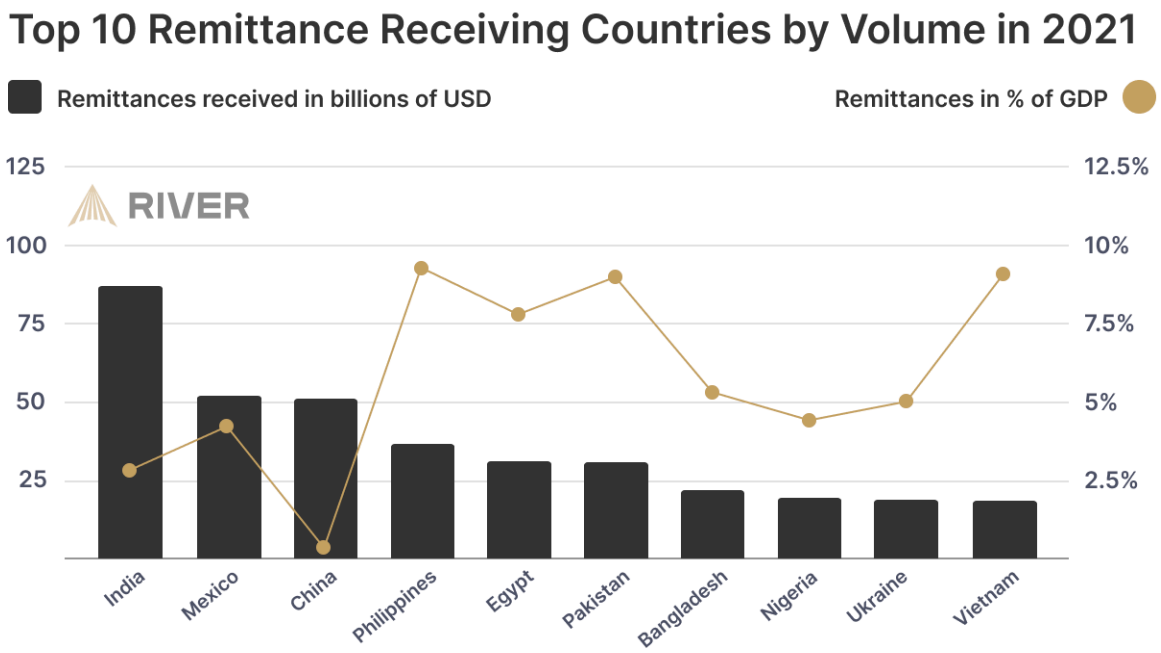
Sources: KNOMAD/World Bank staff; IMF Balance of Payments Statistics. See appendix in *Migration and Development Brief 32* for forecasting methods (World Bank/KNOMAD 2020).
Note: e = estimate; f = forecast.

The most outstanding data point in this overview is that 78.8% of remittances ($626 billion out of a total of $794 billion in 2022) went to low- and middle-income regions. Reading this number is not particularly surprising, but understanding its implications is the key insight.

Much of this volume is from expat workers around the globe, often leaving their loved ones out of necessity to provide an income. High remittance costs disproportionately affect the lowest income people. They siphon away funds that can make a difference to feed a family, cure or prevent disease, pay for education, heat a home, or leave when a country descends into chaos.

Latin America and the Caribbean stand out with 17.8% of all remittance volume in 2022, but only 8.4% of the global population. High remittance adoption has led to a higher adoption of Bitcoin and stablecoins according to an October 2022 report by Chainalysis.

Remittance activity at a country scale can be eye-opening. The countries with the largest remittance-receiving volumes tend to have large populations, with an average of 389 million people in 2021, or 138 million excluding India and China.

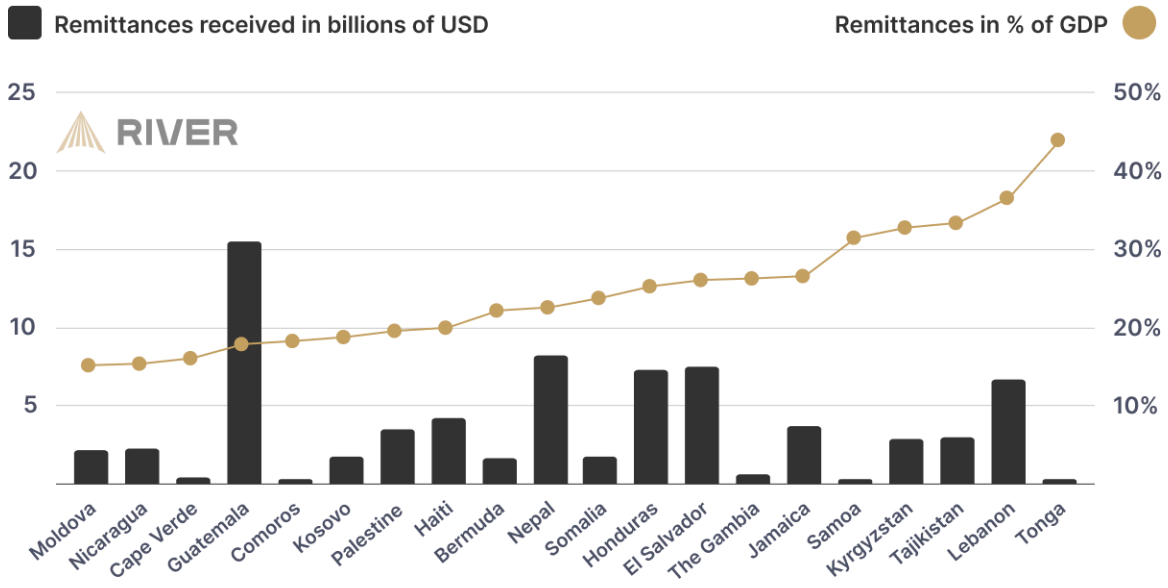


Data source: Migration Policy Institute & The World Bank Bilateral Remittance Matrix

The most noteworthy data point is how little of China's GDP comes from remittances. Due to the capital controls China has in place, it is not surprising to see a lower desire to transfer money into the country, given how hard it is to get out. The sheer size of China's GDP, $17.73 trillion in 2021, ensures the remittance share of GDP remains low.

In the countries above, less than 10% of total GDP comes from remittances. This is still a significant amount, but some countries rely on remittances to a much higher degree, especially when they have a smaller population size. The average population of the countries below was just 6.9 million people in 2021.

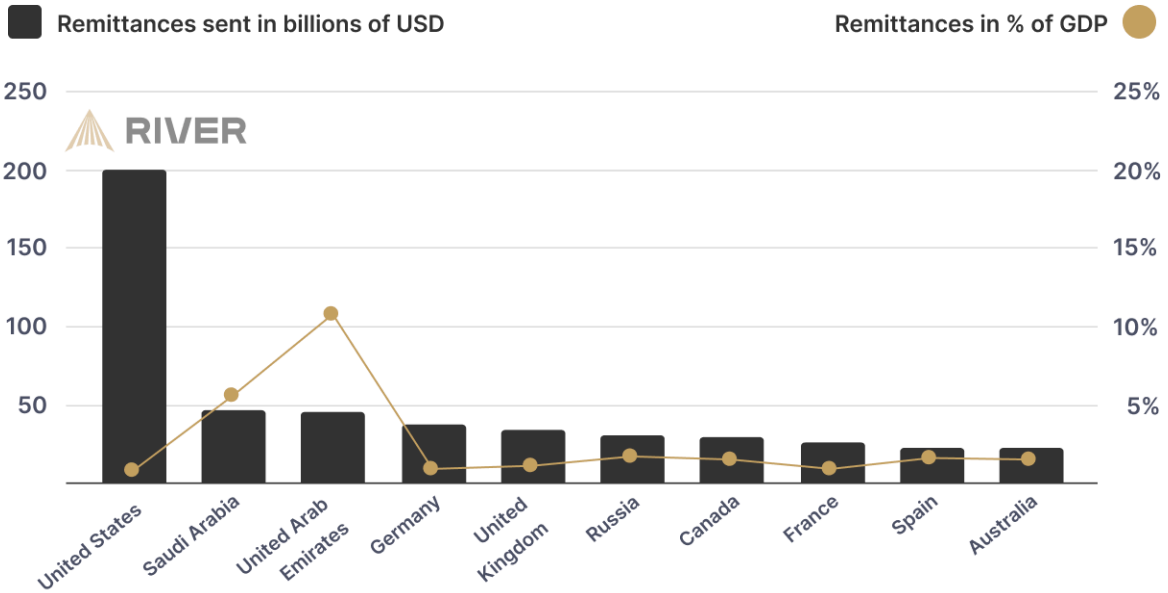
Top 20 Remittance Receiving Countries by Share of GDP in 2021



Data source: Migration Policy Institute & The World Bank Bilateral Remittance Matrix

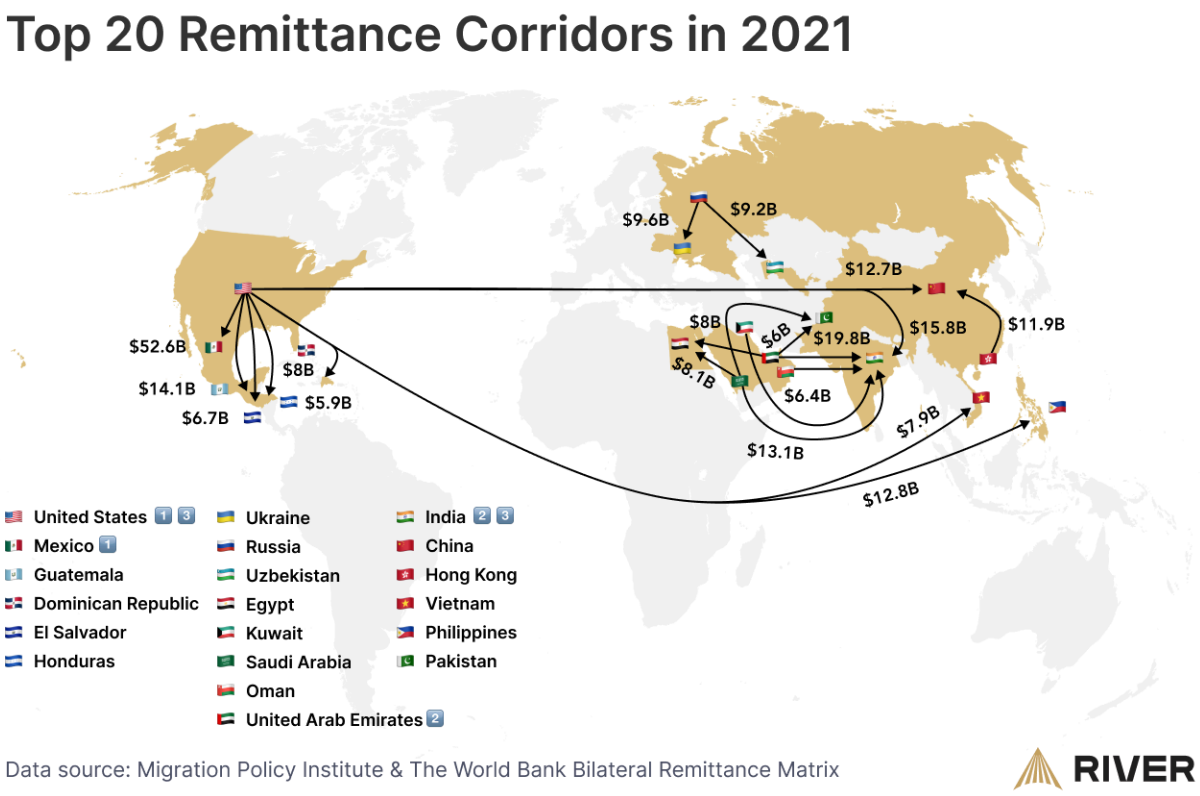
Regardless of population size, the impact of another 5-20% tax on 15-45% of a country's GDP is hard to overstate. In chapter four, we dive into where these remittances come from.

Top 10 Remittance Sending Countries by Volume in 2021



Data source: Migration Policy Institute & The World Bank Bilateral Remittance Matrix

There is a strong correlation between a high GDP and high remittance outflow, which explains the relatively low percentages of GDP that remittances account for. The United Arab Emirates and Saudi Arabia are clear outliers in this trend, as they are investing oil profits into raising their GDP and will fall in line with other countries if this succeeds. The remittances in their cases are sent by foreign workers who are building the infrastructure, primarily to their families in India, Pakistan, Egypt, Bangladesh, and the Philippines.
We mapped out the top 20 corridors, accounting for 29.6% of global remittance volume.



Data source: Migration Policy Institute & The World Bank Bilateral Remittance Matrix

RIVER

1.4 Cross-Border Payment Costs

While B2B payments account for an estimated 96.7% of all volume, they account for a disproportionately lower amount of revenue for financial institutions and payment processors. The estimation is somewhere in the 57-75% range, based on the conflicting McKinsey numbers we shared in section 1.2. This discrepancy is logical given that at a certain price point, corporate banks cap their fees to attract and retain clients. Lower-value consumer payments are disproportionately more expensive due to minimum fees.

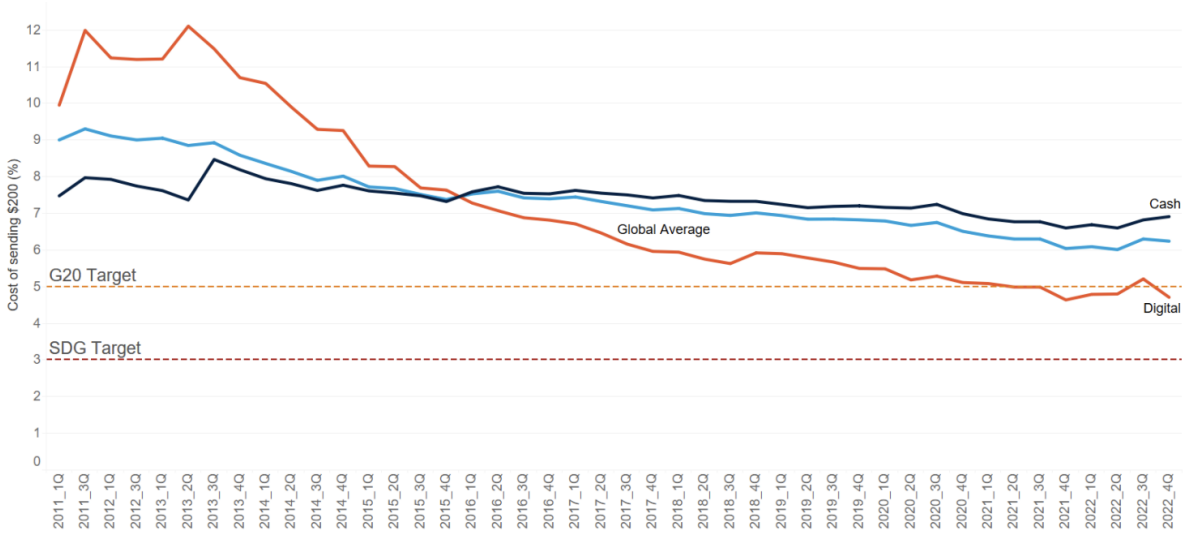
On average, international B2B transactions through SWIFT cost $43. More granular data is difficult to find, as participants are unwilling to share data with competitors on receiving costs, which leads to an incomplete view of the overall costs.

For B2C transactions, international wages are typically paid through the banking system at a fee rate of around 3-4%. Some banks cap these payments to avoid fees getting too high, and admin fees and other hidden fees can be included.

For C2B transactions, we look at data from FIS, which shows that in both 2021 and 2022, 49% of eCommerce transactions were made with digital wallets, and 20% with credit cards, which range from 1.5-3.5% in fees. The term digital wallet is confusing from a fee perspective here, as these wallets typically act as a modern interface for the same old payment rails in the background. There is, however, a wide range of payment methods that can be used through a digital wallet, which makes it impossible to determine the average fees paid—various sources estimate around 3% in foreign exchange fees.

Remittances (C2C) are trending down over time and are around 2.5% cheaper than a decade ago. We will dive into what is causing this decline in the next section on innovation.

Figure 1 Trends in the global cost of sending $200 in remittances[3]

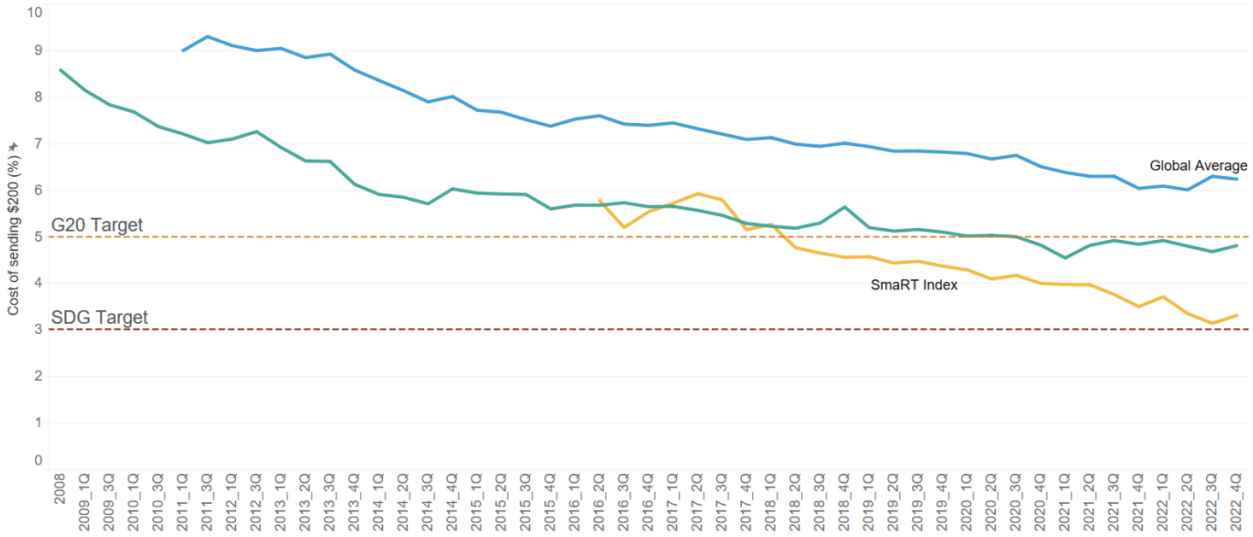


Source: The World Bank

According to The World Bank, the average remittance fee was 6.24% in Q4 2022. Banks significantly increase this number. They are the most expensive option at an average of 10.94%, due to using the correspondent banking network that involves more middlemen.

The World Bank uses two additional metrics for more accurate representations of real costs. The weighted average is based on volume per corridor; the SmaRT index assumes consumers are tech-savvy and able to fully inform themselves of their remittance options.

Figure 3 Trends in Global weighted average & SmaRT average



Source: [The World Bank]

In Q4 2022 the weighted average was at 4.81%, and the SmaRT indicator was at 3.31%.

The latter shows that sending cross-border payments through the traditional financial system can be cheaper in many places if people know how to evaluate their options. This puts the traditional remittance market in an interestingly similar position to Bitcoin, where one of the main roadblocks to further adoption is a lack of education.

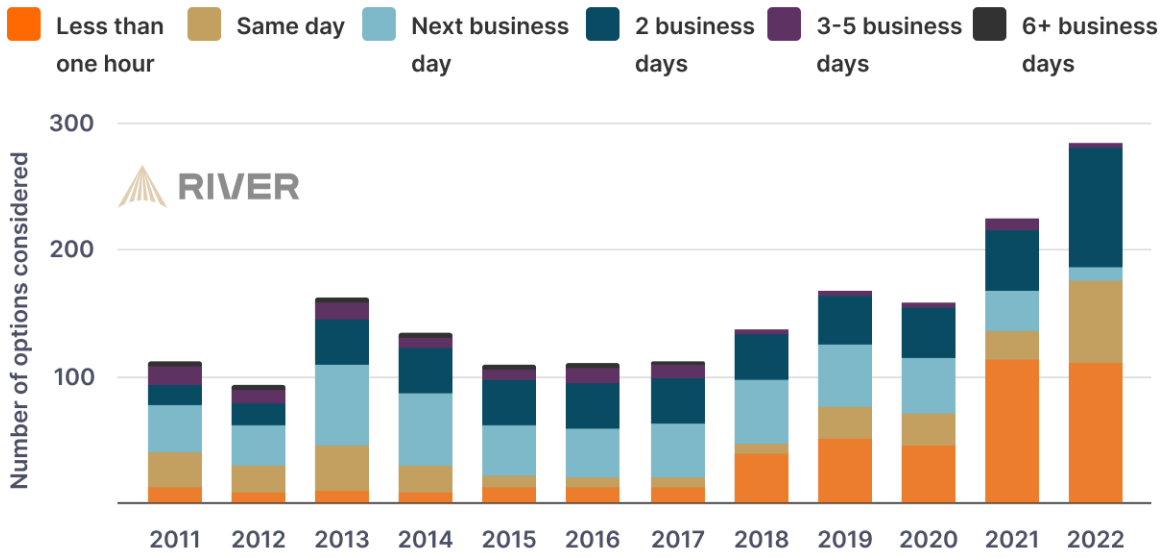
Not every country and corridor is as fortunate to have cheaper remittance options. An estimated 8-13% of payment corridors still have fees over 10%, and some of these exceed 20%. For some countries, Bitcoin and other solutions will remain more appealing financially for a longer time. Corridor-specific data can be found at remittanceprices.worldbank.org. It is worth noting that on average, roughly half of the fees are foreign exchange fees and the other half are transaction fees by the provider.

There are many other ways to slice these datasets, such as fees per country, and per payment method. This is covered extensively in The World Bank's remittance prices report.

1.5 Cross-Border Payment Speeds

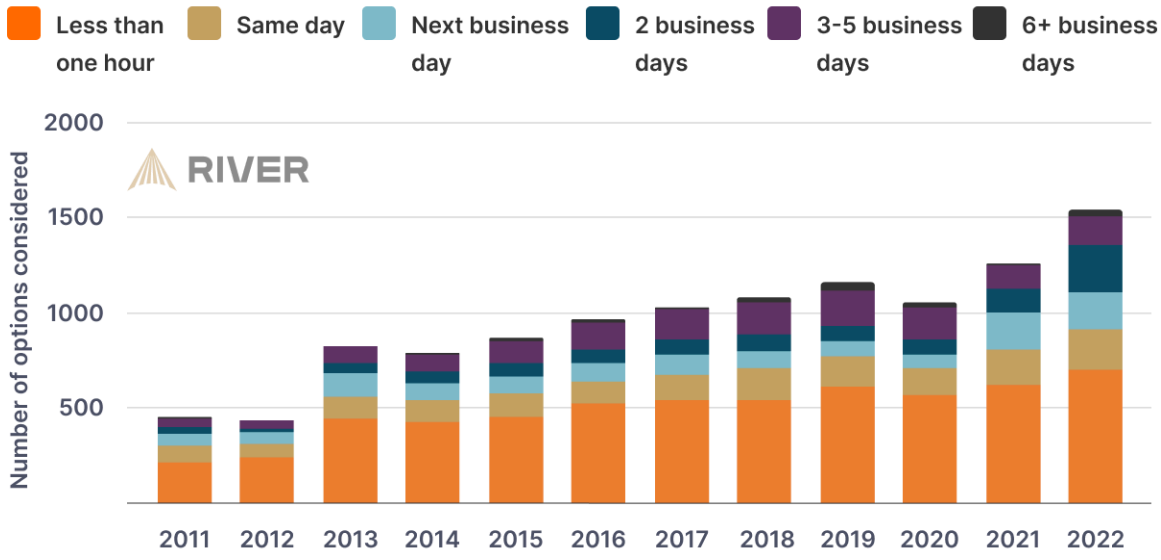
The area that needs the most improvement is payment speed. Much of the cross-border payment industry still operates on business days, an archaic practice in a largely digital world, but commonplace due to many manual processes across different time zones.

Bank Transfer Speeds For the Top 20 Remittance Corridors



Data source: The World Bank Note: Hong Kong to China data is missing and thus excluded.

Money Transfer Operator Speeds For the Top 20 Remittance Corridors



Data source: The World Bank Note: Hong Kong to China data is missing and thus excluded.

Data scientist Austin Krauss volunteered to analyze remittance speeds by banks and money transfer operators for us, for the top 20 payment corridors we listed in section 1.3, based on data from The World Bank. It shows that the number of service providers has increased in

increased in all but the highest bracket, but there is no transition towards faster payments as a share of total volume. The average fee paid across these 1,823 options is 4.4%.

The key insight is not visible in the graphs: If even the corridors with the most revenue have limited progress, it paints a grim picture for the rest of the world.

1.6 Innovation in Cross-Border Payments

To evaluate if Bitcoin can be a great tool for cross-border payments, it is important to understand how traditional cross-border payments have improved over the past decade, how these improvements are perceived by consumers, and what changes may be coming.

There are a few ways in which innovation can happen in CBP:

1. Faster payments.
2. Lower costs.
3. Increased convenience.
4. Better accessibility to solutions.

Within the payments industry, criteria such as less risk, better compliance, standardization, more accurate reporting, and faster settlement may also be seen as innovation. Yet these do not matter to consumers who primarily care about access, speed, and cost, as can be seen in a report by Visa. Below we will still review faster settlement as it is relevant to businesses and a key benefit of Bitcoin from an infrastructure perspective.

Faster Payments & Lower Costs: Enter CBDCs

As of March 2020, 55 countries had nationwide instant payment services according to a report by the ECB. These are collaborative structures between major banks and sometimes phone providers in a country. Many institutions envision these systems getting linked up internationally to speed up small international transactions. For example, in 2021 Thailand's PromptPay and Singapore's PayNow were linked for payments up to $1,000 per day.

A more frequently discussed next step is the introduction of Central Bank Digital Currencies (CBDCs). Roughly 100 countries have either launched, or are researching, developing, or piloting a CBDC. According to a 2022 report by OMFIF, 66% of Central Banks expect to issue a CBDC within 10 years, and 24% within 2 years.

In the European Central Bank's report "Towards the holy grail of cross-border payments," CBDCs are described as the best candidate to deliver on this promise, along with the previously mentioned international linking of instant payment systems. However, the potential societal implications of this technology are not at all considered in the analysis.

CBDCs fundamentally change the relationship between a government and its people. They may seem appealing at first due to faster payments, lower costs, and more automation. However, the risks of CBDCs vastly outweigh the benefits they could bring to society.

A CDBC in the hands of an oppressive government is a superpower to control its population. There are countless examples of how a CBDC may be used against people:

- Did you say something the government doesn't like? Your account may be locked.
- Are you associated with anyone the government doesn't like? Your taxes increase.
- Is your hobby unproductive in the eyes of your government? Transaction declined.
- Does the government disapprove of your religion? Your funds may be frozen.
- Did you consume your limit of meat or gas for your car? You can't buy more.

To people in highly developed countries, such scenarios may seem unthinkable, but the unfortunate reality is that at least 70% of the global population lives in autocratic countries, in some of which governments will happily abuse CBDCs or equivalent tools.

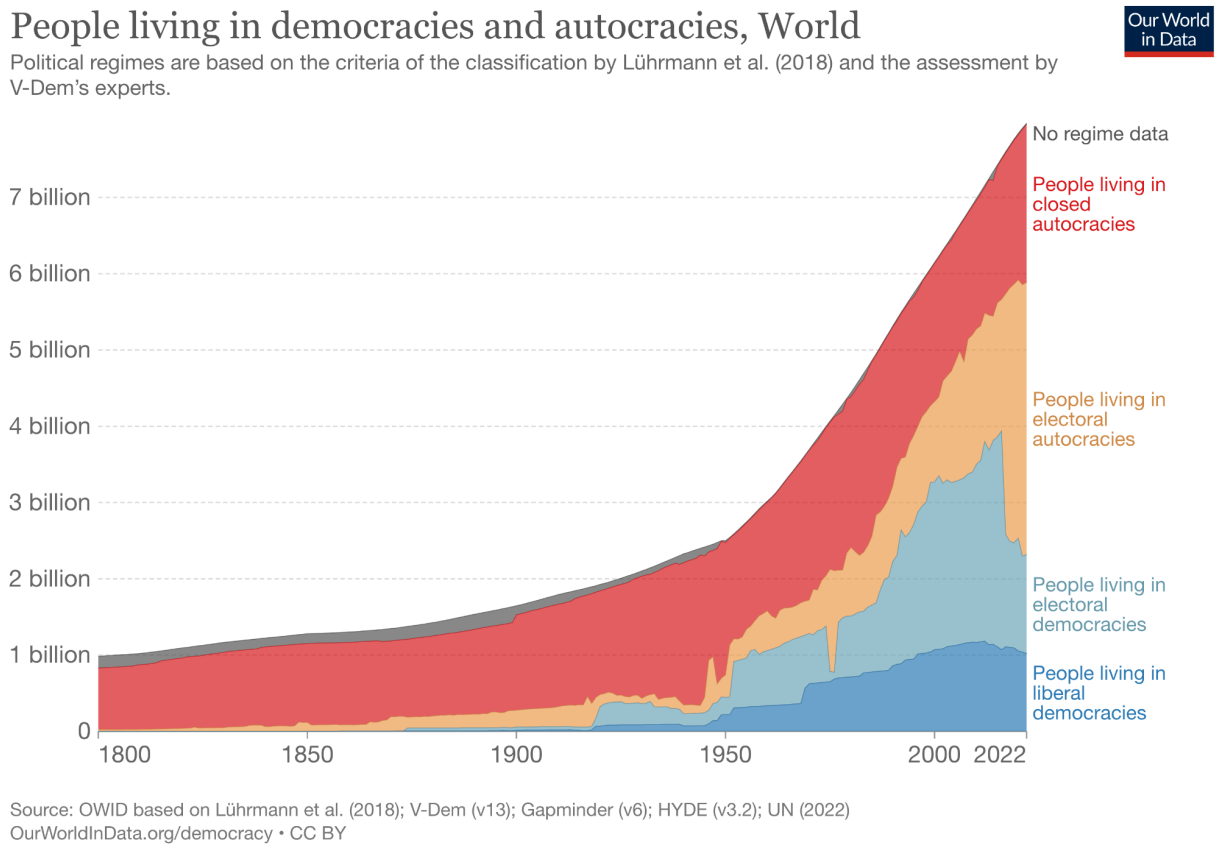


Image source: Our World in Data

Even democratic governments will increasingly look towards CBDCs to "stimulate" results. Initially, this would be done with the best intentions, likely against fringe groups in easily

justifiable cases. The risk is that this is such an effective tool that it would be increasingly used to enforce any policy.

In many countries, promises and proposals will be made to implement rules or systems that would prevent such abuse. However, in practice, most if not all countries would see a decrease in liberty over time after adopting a CBDC. The temptation to abuse this tool will be far too great, as has been proven many times in the history of money manipulation.

The only way a CBDC would not ultimately become a tool to control a population is by not being a centrally controlled system, but a decentralized system in which no individual or group can alter the rules. The incentives and technology of this system need to be set up in such a way that the system does not centralize over time. Unsurprisingly, we have not yet seen an attempt from CBDC working groups to replicate these characteristics.

It is worth noting that CBDCs could also negatively affect businesses. They could be used as a weapon in political disputes, blocking transaction flows between countries and hurting international trade. On a national level, CBDCs could be used to force business compliance with certain rules. In a management role at a company, you may no longer be able to advocate for certain personal beliefs in public, as they could negatively impact your company and employees.

Increased Convenience

As Bitcoiners are well aware, sending a payment to the wrong address is problematic. Even in the banking system, erroneous transactions were a major issue until recently, leading to a significant increase in the duration of the payment process, or a loss of funds. In 2022, SWIFT introduced a payment pre-check to see if the recipient of an address had previously received funds. This reduced errors, though no data has been shared on how much.

SWIFT has made strides in general with its gpi initiative to improve transaction speeds and traceability for major corporations and financial institutions, but significant costs and lengthy settlement times remain, and they too are looking towards integrating CBDCs.

Better Accessibility to Solutions

The accessibility of cross-border payment solutions has improved significantly. Worldwide adult financial account ownership rose from 51% to 76% between 2011 and 2021 according to the World Bank. Smartphones and software solutions have gradually made it easier to open financial accounts remotely. However, these solutions require a government-issued identity, which an estimated 10% of the world population does not have. Like with most new technologies, people in less developed countries tend to reap their benefits significantly later, with adult account ownership often as low as 20-50%.

Finality of Payment

Change in the traditional financial system is slow, and it typically does not occur at its decades-old base infrastructure. Instead of innovating at the base layer, the financial sector has largely focused on building solutions on top of the outdated infrastructure. Their solutions make it appear as if settlement is happening much faster than it is in reality, while they earn fees for taking the risks associated with what are essentially accounting tricks.

Traditional financial rails have higher systemic risk and slower settlement, but to many consumers and businesses, these solutions appear good enough. As a result, they typically do not care that Bitcoin offers orders of magnitude improvements in final settlement speeds. It is thus not an area of innovation that is likely to win over the masses.

For major businesses and institutional account holders, on the other hand, final settlement is very important to improve capital efficiency and de-risk the business. If funds are not settled yet, they can't be accessed for operations, and are fully at risk of loss in the event of a bank failure. This period can last several business days, up to weeks, or even months in some cases, as that is how long the final settlement typically takes.

Some large companies have been in contact with us to explore internal international settlement solutions. This is likely where the first Bitcoin adoption would happen with faster final settlement as the main driver, rather than between different companies.

Conclusion on the Cross-Border Payments Industry:

Cross-border payments are a huge and consistently growing industry. Unfortunately, the incumbent companies lack incentives to significantly improve the infrastructure that powers them. They are engaged in fierce competition over billions in profit, which makes data sharing with competitors unappealing. Entrenched incumbents are paid well, and even if they succeeded at overhauling the system, their competitors would have faster payments too, and overall industry revenues would shrink significantly, by an estimated 80%. Accountability from clients to improve the status quo is limited, as the problem is far bigger than any individual company and is too easily hand-waved away.

Central banks, various government bodies, and tech startups are among the most motivated actors in the space to improve the status quo, as their incentives are more clearly aligned. CBDCs will give central banks unprecedented levels of control and monetization options, while potentially solving many of the issues that may otherwise take decades.

It will be up to the public to push back on the invasiveness and risks associated with CBDCs, especially because their proponents see them as the holy grail in payments.

Regardless of which systems end up being used the most, goals have been set by the G20 nations on how cross-border payments should progress over the next few years.

	Challenge	Payment Sector	
	Wholesale	Retail (e.g. B2B, P2B/ B2P, other P2P[3])	Remittances
Cost	No target set[4]	Global average cost of payment to be no more than 1%, with no corridors with costs higher than 3% by end-2027	Reaffirm UN SDG: Global average cost of sending $200 remittance to be no more than 3% by 2030, with no corridors with costs higher than 5%
Speed	75% of cross-border wholesale payments to be credited within one hour of payment initiation[5] or within one hour of the pre-agreed settlement date and time for forward-dated transactions[6] and for the remainder of the market to be within one business day[7] of payment initiation, by end-2027. Payments to be reconciled by end of the day on which they are credited, by end-2027.	75% of cross-border retail payments to provide availability of funds for the recipient within one hour from the time the payment is initiated[8] and for the remainder of the market to be within one business day[7] of payment initiation, by end-2027	75% of cross-border remittance payments in every corridor to provide availability of funds for the recipient within one hour of payment initiation[8] and for the remainder of the market to be within one business day[7], by end-2027
Access	All financial institutions (including financial sector remittance service providers) operating in all payment corridors to have at least one option and, where appropriate, multiple options (i.e. multiple infrastructures or providers available) for sending and receiving cross-border wholesale payments by end-2027	All end-users (individuals, businesses (including MSMEs) or banks) to have at least one option (i.e. at least one infrastructure or provider available) for sending or receiving cross-border electronic payments by end-2027	More than 90% of individuals (including those without bank accounts) who wish to send or receive a remittance payment to have access to a means of cross-border electronic remittance payment by end-2027
Transparency	All payment service providers to provide at a minimum the following list of information concerning cross-border payments to payers and payees by end-2027: total transaction cost (showing all relevant charges, including sending and receiving fees including those of any intermediaries, FX rate and currency conversion charges); the expected time to deliver funds; tracking of payment status; and terms of service.)		

Image source: Financial Stability Board

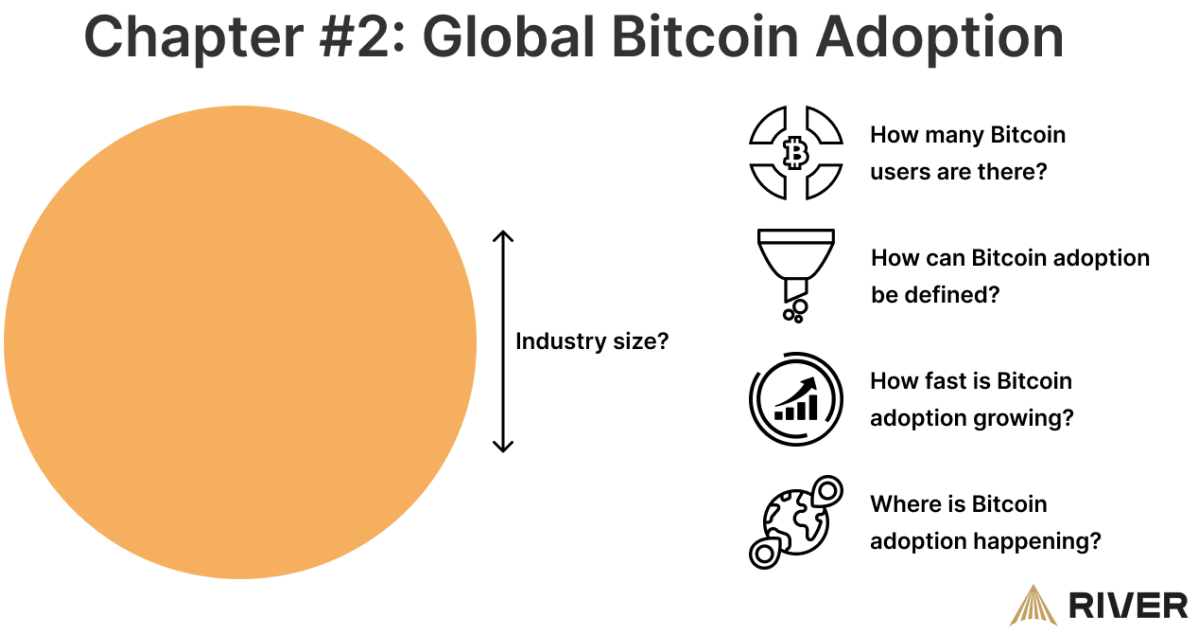
Given the starting points we listed in sections 1.4 and 1.5 on costs and speed and the time it would take to get CBDC adoption off the ground, we are unconvinced to see global averages even close to these targets by 2027-2030.

2. Global Bitcoin Adoption

To explore if Bitcoin is a great tool for cross-border payments and if adoption could be increased, it is useful to first understand Bitcoin adoption in general.

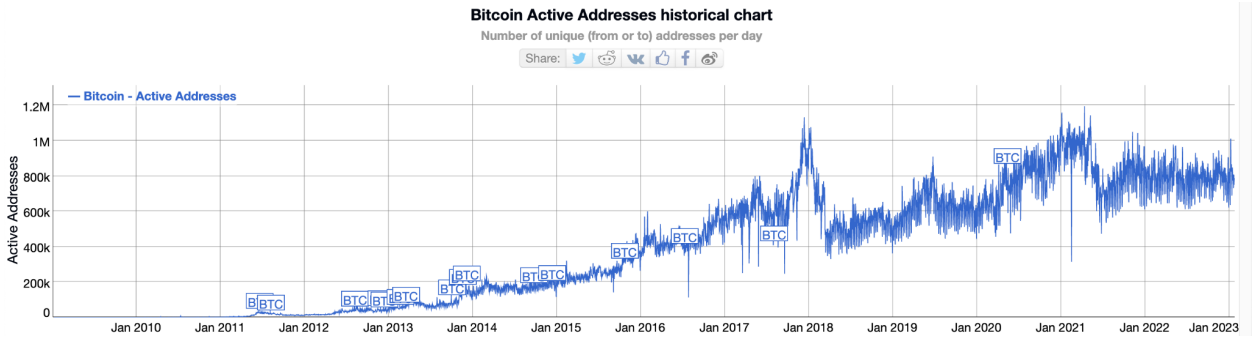
In this chapter, we look into:

- How many Bitcoin users there are
- The speed of Bitcoin adoption
- How Bitcoin adoption can be defined
- The motivation for Bitcoin adoption
- The distribution of Bitcoin adoption



2.1 How Many Bitcoin Users Are There?

In the tech industry, adoption is typically measured in Daily/Weekly/Monthly Active Users. Despite the transparency of Bitcoin's public blockchain, it is not possible to retrieve a precise number of how many people are using Bitcoin in any timeframe. The number of active addresses can be analyzed, which hovers around 800k per day over the past year.



Source: Bitinfocharts.com

However, an address is not representative of an individual, and the number of active addresses also does not represent an upper or lower bound. One individual can use many addresses in the same or even several wallets. On the other hand, many individuals can use one address, such as one belonging to an exchange or other custodial service. There is no way to accurately distinguish how many people interact with Bitcoin at any given time using public data; at best, people can estimate.

We do not expect it to become easier to determine overall activity—on the contrary, it will be more difficult and thus better for user privacy. As the Bitcoin blockchain transitions towards a settlement layer over time to accommodate more users, the number of active addresses will become even more inaccurate as a measurement of active users. A user on Bitcoin's Lightning Network could do several transactions a day, and only close or open a payment channel on the base layer on a rare occasion. As a result, this person would not be acknowledged as a user at all.

Is there a way to get a better estimate?

Active Entities

Various analytic approaches try to approximate the number of active entities, such as the approach Glassnode first used in 2020. Based on their analysis, the number of entities holding bitcoin was approximately 23.1 million as of January 2020, which was 18.7% less than the number of Bitcoin addresses with a balance above zero (~28.4 million). Note that there is a large disparity within the UTXO set, as the majority of addresses have a balance under the "dust" limit, which is lower than the cost to spend it. In total these add up to less than a thousand BTC in value.

In March 2023, Glassnode repeated the methodology and arrived at 32.9 million entities, which was 25.9% less than the number of bitcoin addresses with a balance above zero (~44.4 million)

If Glassnode's results are accurate, it would mean that the average Bitcoin entity holds its bitcoin on 1.18-1.34 addresses at any given time. Or in other words, only one in five or six entities would have bitcoin on two addresses. At face value, this number seems unlikely, given that power users will typically have dozens of addresses with balances on them.

As stated in Glassnode's methodology, they did not dive deeper into how many users are storing their bitcoin on exchanges. They only track the total amount of bitcoin this adds up to. Exchanges only disclose their aggregate user numbers, which does not clarify how many of them have bitcoin on their account balance. It is not in their best interest to talk about the number of Bitcoin users, as their business model relies on total trading volumes across various coins, and thus a narrative of "crypto" being top of mind.

Reverse Engineering Bitcoin Holders

Without data from the exchanges themselves, at best we can use public data points and assumptions to get an approximation of Bitcoin users on major exchanges.

We know from public data how much bitcoin is held by major exchanges. Glassnode tracks 20 exchanges, which hold an aggregate of around 2.34 million bitcoin as of June 2023. This number excludes any holdings in custodial services they may offer.

Below we look at two of the largest exchanges with public user counts, and cross-reference them with Bitcoin ownership numbers to estimate how much bitcoin an average exchange user owns.

	Coinbase	Binance
Bitcoin held as of June 2023	500k btc (Coinbase Pro)	630k btc
Monthly active users	8.4 million (Q1 2023)	20 million (Q2 2023, estimate*)
Bitcoin ownership penetration	73% of all US users	65% of all global users
Estimated monthly active bitcoin users	6.1 million	13 million
Monthly website visitors	32 million	66.7 million
BTC/user if 100% was held by active users	0.082 BTC ($2,213)	0.048 BTC ($1,296)
BTC/user if 50% was held by active users	0.041 BTC ($1,107)	0.024 BTC ($648)

*The Binance estimate is based on a previously reported 29 million active user number, but website traffic has dropped roughly 31% since to 66.7 million monthly visits per SimilarWeb data, which would indicate the active user number may be closer to 20 million.

Given that Binance has a more global user base, using their numbers and extrapolating them to the 2.34 million bitcoin held by exchanges would mean there could be somewhere around 48.8 - 97.5 million bitcoin holders on exchanges.

There is a stark contrast with how much bitcoin is held by the average entity—excluding exchanges and miners. The total supply held by participants outside of these two groups is around 15.16 million bitcoin or 78.8% of all outstanding supply.

At approximately 32.9 million active entities, this would mean the average non-exchange, non-miner entity owns 0.46 BTC, or around $12,420. The median is significantly less, at 1.34 addresses per user and the median address holding roughly 0.005 BTC, the median entity would have roughly 0.0067 BTC, or around $180.90.

Adding up the active entities and estimated exchange users holding bitcoin, we would arrive at a range of 81.7 - 130.4 million entities holding bitcoin. However, it is important to keep in mind that these two groups have a significant overlap as some users will hold bitcoin both on an exchange and outside of it.

Based on public sales numbers by two of the largest hardware wallet manufacturers, Ledger and Trezor, we know that less than 10 million hardware wallets have been sold. However, we have no data on how many desktop and mobile wallets are being used.

Based on a CoinGecko survey of a relatively low 421 respondents, 33.5% of users store cryptocurrency in a cold wallet, 70.6% leave it on exchanges, and 80.1% use hot wallets which are on an internet-connected device. There are overlaps between these groups.

Given the number of hardware wallet sales highlighted above, we believe it is unlikely that most survey respondents understood the difference between a cold and a hot wallet. If their data were accurate, then there would be less than 30 million people who own bitcoin today including on exchanges. However, the huge overlap between people who hold their bitcoin on an exchange and a mobile or desktop wallet is interesting. It likely skews the unique number of entities holding bitcoin to well under 100 million today. It could even be down to 50 million if half of the users on an exchange also held Bitcoin off the exchange.

It is worth noting the possibility that some exchanges are not solvent. Some funds could be lent out or even lost, resulting in more users who think they are holding bitcoin than there are in reality. This would not be unprecedented in the industry, nor finance in general.

There are several compounded assumptions here. We do not claim these estimates are accurate, but we believe this is an interesting approach to estimate a range of the number of people holding bitcoin.

To conclude, there are an estimated 200 million people sending remittances globally, which is potentially 100-400% higher than the number of Bitcoin holders. We will revisit the implications of this gap later in the report and whether Bitcoin could scale up.

Adoption Is Subjective

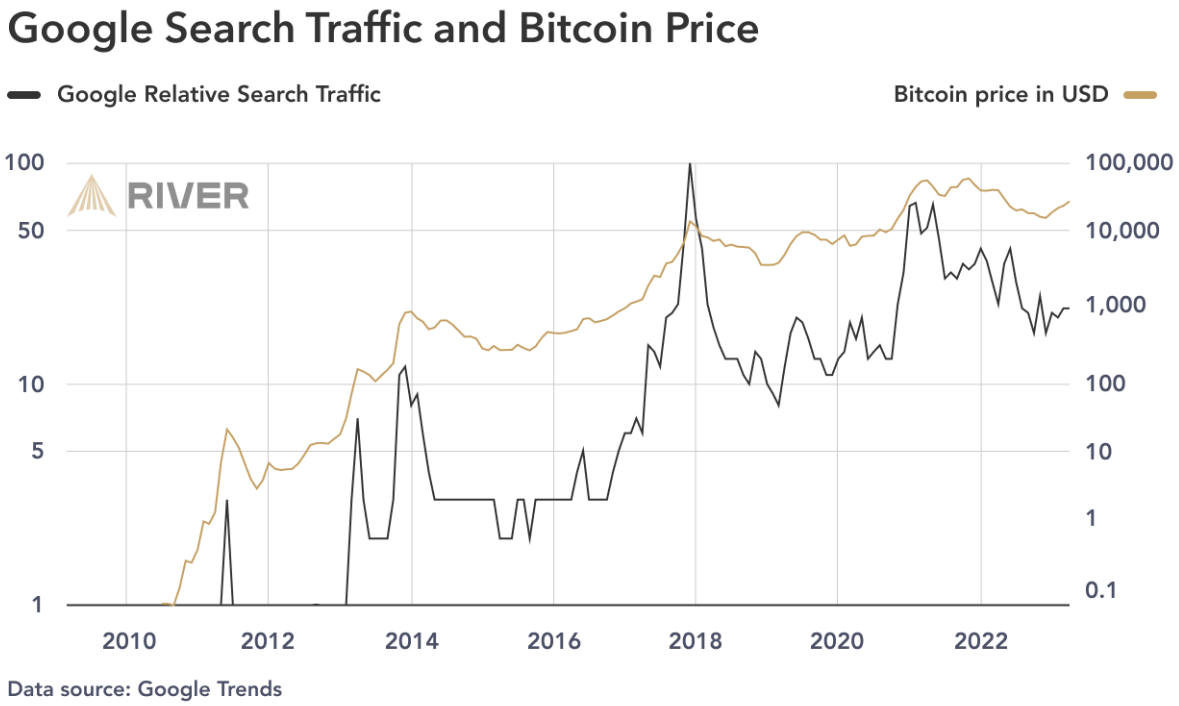
In the above section, we referred to bitcoin "holders", as adoption is difficult to define. Is someone who only buys and holds bitcoin for the long term considered an adopter? Is that also true for someone who holds $10 worth of bitcoin that was given to them, at which they look once per year? Or are you only an adopter if you are sending a certain amount of Bitcoin transactions? Just because the "active user" metric is commonly used in the tech world, does not mean it makes sense to use for Bitcoin at its current stage.

Unlike financial apps and services, Bitcoin has no management team or shareholders that want it to acquire as many users as possible. While Bitcoin users love to see increased adoption, Bitcoin is a tool. It is not the end goal itself. This tool enables users to have financial freedom, and the more users adopt it, the more we will see a separation of money and state. Progress towards this outcome can happen even if most people don't end up using Bitcoin—although whether it would be sustainable or meaningful progress is a different question.

As a tool, Bitcoin has much broader potential than any payment network or service. It can be used in many different ways, and the adoption speed of these different use cases will vary.

2.2 The Speed of Bitcoin Adoption

Interest in Bitcoin is straightforward to measure, through search traffic and Bitcoin's price. On a logarithmic scale, it is easy to see that the correlation has been there from the start.



However, interest is not the same as adoption. When the hype dies down and the price declines, many people don't continue holding or using bitcoin. This trend is much harder to measure, as there is no singular metric and little public data.

If we fall back on Glassnode's measurement of active entities, there would be a 42.4% increase, from 23.1 million active entities in January 2020 to 32.9 million entities in March 2023. This period spans nearly a full price and halving cycle, so it decently accounts for hype. It would mean an increase of around 3.1 million entities per year.

For context, over the same period:

- Search volume increased by 69% in total or 21.8% per year.
- Bitcoin's price increases from $7,200 to $23,653, 229% in total, or 72.3% per year.

Growth likely won't happen linearly, as Bitcoin's growth has historically been cyclical and exponential. There is no guarantee adoption will continue to grow at all. It is important to note that as time progresses, the number of estimated active on-chain entities will become less representative of the real number of holders or users, due to activity increasingly moving off the blockchain and onto other layers by design.

Fast Adoption Has Drawbacks

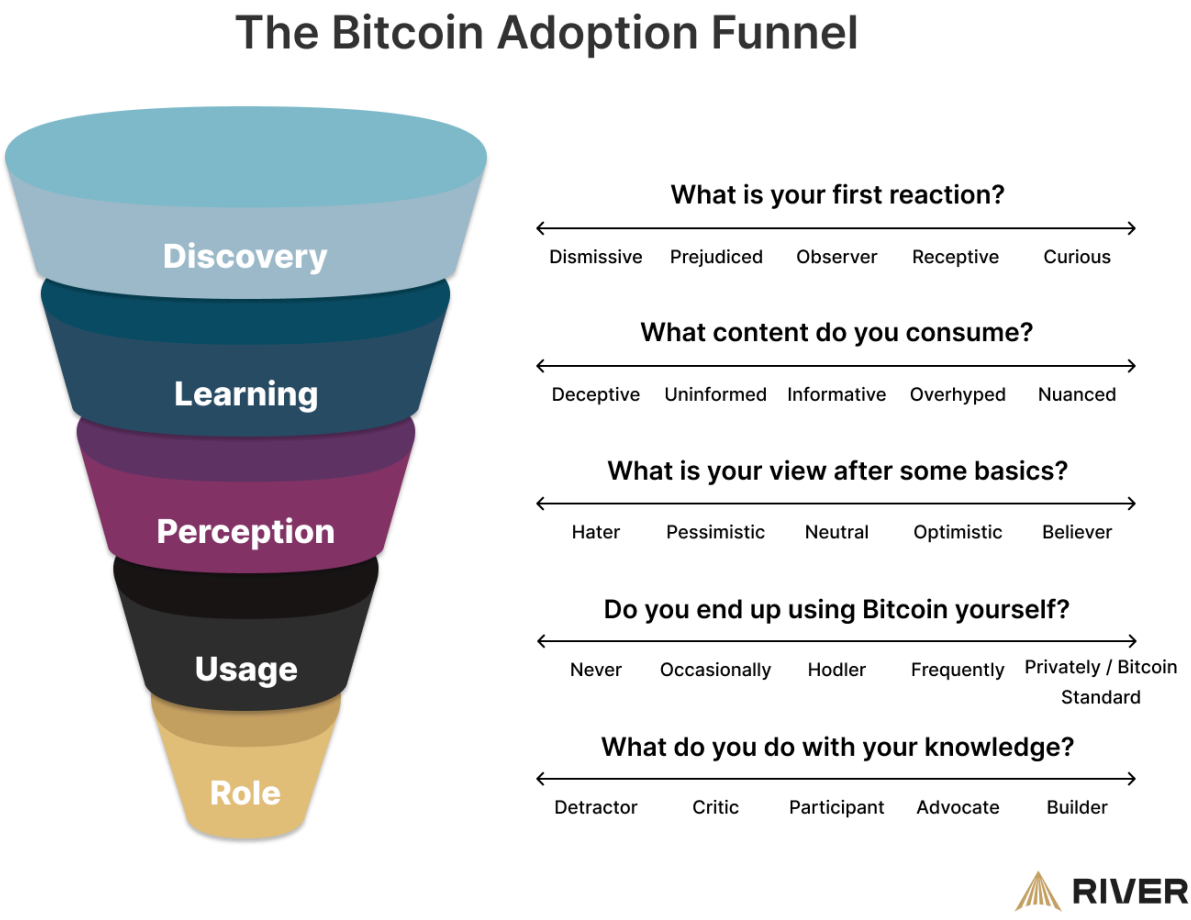
Traders love the wild price swings caused by fast adoption, as they create more profit opportunities, but not everyone benefits. Users can have a worse experience as systems

break and builders need to scramble to catch up. A bad user experience can slow down long-term adoption, as bad impressions can deter people from trying again in the future.

Instead of thinking about Bitcoin adoption as a metric or goal that must increase quickly, and that can only ever increase, we believe it makes sense to look at it differently.

2.3 The Bitcoin Adoption Funnel

From what exact point do you become a Bitcoin adopter? People agree that you must use Bitcoin in some way to be considered an adopter, but usage is a spectrum. Your position on it is influenced by various other factors such as your background, character, relations, location, and the media you consume. Below we illustrate what we believe the journey to Bitcoin adoption looks like. Each individual goes through this funnel at their own pace.



With this model, we want to highlight an important oversight in the Bitcoin space. Many people in the Bitcoin space see adoption as something that can only ever increase: The more people we get through the funnel, the more adopters we end up with.

A key part of this model is that it also shows the negative side: the people actively working against adoption. Their impact is difficult to measure, as there is no Google Trends for "people who didn't learn about Bitcoin because they read or heard too many hysterical headlines".

The mindset of the person in the **discovery** phase is critical. If they are too prejudiced and not open to learning, it can massively delay the point at which they get into Bitcoin. Their decision to proceed is heavily influenced by their background and personal situation.

If people are open to **learning** more, perhaps the first article they received is a positive one, but in their research, they may come across different information and opinions from personal relations that sway their perspective.

It is easy to blame media and misinformation for people not getting through this learning phase in a positive way, but introspection by the Bitcoin industry is also important. A Bitcoiner's passion for the problems they believe it solves can also turn people off by going too deep on certain topics or overcomplicating their explanations.

After learning a bit, whether that is one or many articles, people will gain a certain **perception** of Bitcoin. This time, all of the above factors influence whether they will proceed and go deeper.

When it comes to **usage**, sometimes the journey from discovery to usage can be just a few minutes with the right person as a guide. Quickly letting people experience Bitcoin can be an effective tool to give people a wow moment, but it only works towards adoption if they commit to a learning phase after. We classify "private" usage as the highest order here, given that maintaining your privacy on Bitcoin requires significant knowledge. This is also the case for using Bitcoin as the standard money in your life.

After having used Bitcoin, some people decide to take a certain **role** in the space, either personally or professionally. Some become users of Bitcoin. Many go a step further to actively educate others around them, and some become builders who maintain and accelerate the movement. There are also critics and detractors who try to slow down Bitcoin adoption.

Adoption Changes in the Future

It is a common misconception that people must be well-informed about Bitcoin and have a positive view of it for adoption to grow significantly. However, we will likely see an increasing number of solutions built on top of Bitcoin, where users do not [need to] understand what is happening on the back end, and they simply send and receive their local currencies.

It is also possible that more people will be driven towards Bitcoin out of necessity, even if they are uncertain it has a future or claimed for years that they never wanted anything to do with it. As governments continue their deficit spending and central banks keep printing money, an increasing number of people will be forced towards anything that manages to maintain their purchasing power. One of those options is Bitcoin.

If you believe that the traditional financial system as it exists today will eventually collapse, then rather than looking at active users, you would be more interested in how secure the network is, if it remains decentralized in the long term, and if it remains appealing enough as an alternative option to people around the world. In this line of thinking, each day that goes by while these aspects remain true is a successful day for Bitcoin.

We will revisit this model later to understand how Bitcoin could be used more for cross-border payments. Next, we look into why and where people adopt Bitcoin.

2.4 The Motivation for Bitcoin Adoption

The main motivation for people to adopt Bitcoin has always been straightforward: profit. According to a survey by Morning Consult, 63% of all cryptocurrency owners cite wanting to make money as a major reason why they own it. By looking at the other major reasons listed in the report, the actual percentage is significantly higher, but worded differently. Nonetheless, with bitcoin's price going up over time, different motivations have emerged:

Wealth preservation: Rather than buying Bitcoin with the expectation to make a profit, some people buy it to avoid loss from local currency inflation or bank failures.

Portfolio insurance: Some investors buy bitcoin as a small percentage of their portfolio for risk management purposes. If they underestimated Bitcoin's impact and it ends up outperforming all the other assets in their portfolio, they want to have a small allocation.

All kinds of payments: Some people adopted Bitcoin as their preferred solution for payments, primarily remittances, due to its speed and relatively low cost compared to some other options in certain corridors. Based on a 2021 survey by Binance, this was 11% of all cryptocurrency owners.

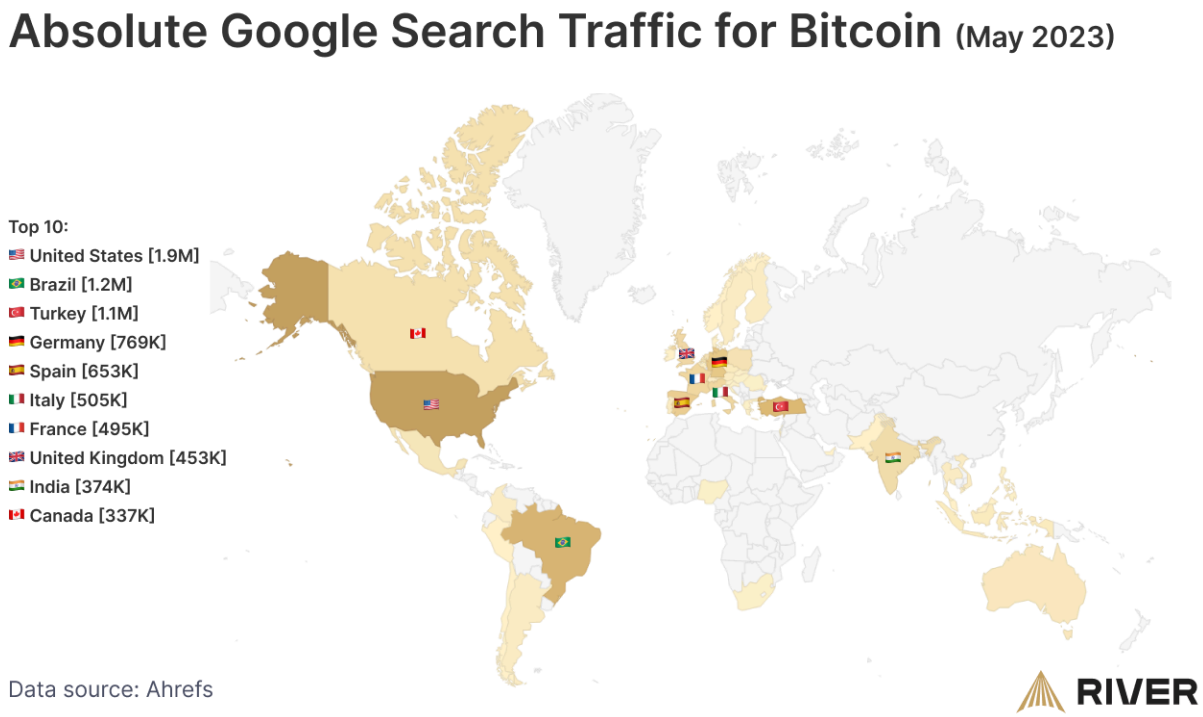
Interest: People are fascinated by the technological possibilities and are interested in Bitcoin as a hobby, or to build their career.

Necessity: As a last resort option, bitcoin is used to buy and sell goods that may be prohibited in a country such as medicinal marijuana or a VPN service. Others use it to continue operating if their financial access has been shut off, or to preserve their privacy.

These motivations represent a smaller percentage of all Bitcoin adoption and vary heavily by country, but their share may grow in the future. We could not find additional data that provides clear insights into geographical differences in motivation.

2.5 The Distribution of Bitcoin Adoption

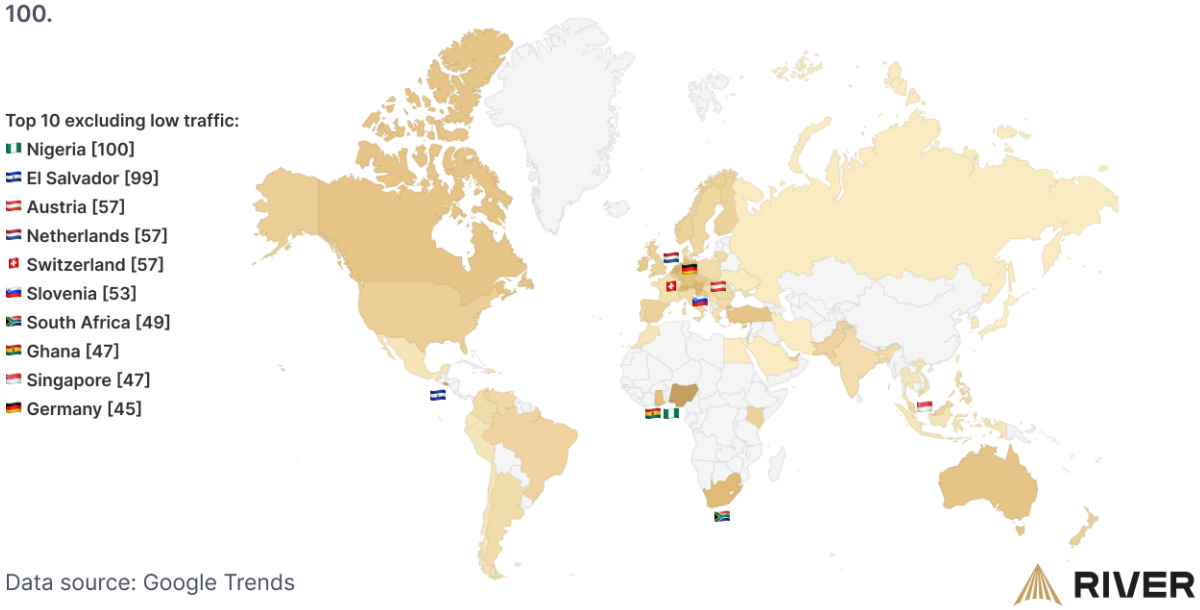
If we assume that Google search traffic is closely correlated with Bitcoin interest and adoption in a particular region, we get an overview of the areas in which Bitcoin has been most top of mind. In May 2023, a total of 12 million people globally searched for "Bitcoin" according to Ahrefs. We have visualized the top 10 countries.



Alternatively, relative interest shows the countries with the highest percentage of Bitcoin queries relative to total queries. Below we show what it looks like over the past 10 years, excluding low search volume areas or places to avoid tiny wealthy nations from dominating.

Relative Google Search Traffic for Bitcoin (2013-2023)

The country with the highest % of Bitcoin search queries relative to all its search queries gets a score of 100.



Data source: Google Trends

RIVER

Read as: In El Salvador a Google search is twice as likely about Bitcoin than in South Africa.

Google Trends divides the number of searches for a term by the total searches in that area. The area with the highest percentage gets a score of 100, and then other scores are determined relative to the leader. We highlight the fluctuations over time below.

Top 10 Countries in Relative Google Search Traffic for Bitcoin

The country with the highest % of Bitcoin search queries relative to all its search queries gets a score of 100.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 YTD
#1	Estonia 100	Estonia 100	Ghana 100	Nigeria 100	South Africa 100	South Africa 100	Nigeria 100	Nigeria 100	El Salvador 100	El Salvador 100	El Salvador 100
#2	Netherlands 93	Slovenia 100	Estonia 67	Ghana 49	Slovenia 81	Nigeria 82	South Africa 65	South Africa 44	Netherlands 50	Nigeria 57	Nigeria 71
#3	Czechia 82	Canada 80	Slovenia 68	South Africa 43	Australia 75	Slovenia 75	Austria 58	Austria 43	Turkey 50	Netherlands 35	Netherlands 45
#4	Hong Kong 82	Singapore 78	Latvia 61	Venezuela 32	Netherlands 73	Ghana 74	Ghana 52	Switzerland 37	Austria 48	Switzerland 33	Switzerland 43
#5	Finland 75	Cyprus 73	Tunisia 55	Malaysia 30	Austria 73	Netherlands 73	Netherlands 52	Ghana 37	Nigeria 47	Slovenia 32	Slovenia 42
#6	Slovenia 75	Czechia 68	Singapore 53	Slovenia 28	Singapore 72	Singapore 69	Switzerland 51	Germany 32	Switzerland 44	Austria 32	Austria 41
#7	Slovakia 72	Netherlands 68	Moldova 52	Estonia 28	Nigeria 68	Australia 69	Germany 45	Netherlands 31	Slovenia 42	Turkey 25	Brazil 32
#8	Norway 72	United States 68	Canada 49	Singapore 26	Switzerland 65	Austria 67	Brazil 42	Slovenia 28	Singapore 41	Cyprus 25	Germany 32
#9	Sweden 68	Bulgaria 63	Czechia 49	Tunisia 22	Canada 62	Canada 61	Singapore 40	Kenya 26	Germany 37	Singapore 23	Belgium 28
#10	Canada 65	Hong Kong 63	Finland 49	Latvia 22	Norway 59	Switzerland 61	Australia 39	Turkey 25	Canada 37	Germany 23	Turkey 26

Data source: Google Trends

RIVER

We can conclude that as time progresses, Bitcoin has increasingly become a global phenomenon. In addition, there are various countries where interest in Bitcoin per individual consistently remains high, such as Nigeria, the Netherlands, Switzerland, Slovenia, Austria, and recently, El Salvador as an outlier in the cause behind it.

There is no correlation between this ranking and individual factors such as GDP, GDP per capita, remittance share of GDP, standard of living, education, regulation, taxation, or inflation of the local currency. For each country, there is a mix of factors such as:

- A well-educated population, leading to a higher pace of technological adoption.
- Good Bitcoin education in the local language.
- Strong local players that help create non-hostile regulations.

As a final note on distribution, there is a clear gap between men and women, as outlined in various reports. Men are 3-4 times more likely to adopt Bitcoin than women are today. If Bitcoin were to rise significantly in value with mostly men involved, then it may not be beneficial to women's financial sovereignty globally.

Validation Against Other Data Sources

A prominent report on adoption is Chainalysis' yearly "Geography of Cryptocurrency" report. It does not focus on Bitcoin but on cryptocurrency in general. It is still relevant to evaluate the report, given that Bitcoin has always been the most popular cryptocurrency in existence, but the results are skewed by a strong focus on DeFi and NFTs.

Chainalysis' methodology heavily relies on web traffic data provided by Similarweb. From a quick comparison with 10 websites where we could see real data through analytics tools, it appears Similarweb's results are frequently off by significant amounts, at times over 50%.

Based on their data, the most traffic towards exchanges comes from the previously mentioned large population countries:

1. India
2. China
3. United States
4. Philippines
5. Vietnam
6. Vietnam
7. Brazil
8. Russia
9. Turkey
10. Pakistan

P2P Exchanges

P2P exchanges are one of the primary methods to acquire Bitcoin in developing countries. They are often less convenient than the centralized exchanges people are used to in wealthier countries. Today, there are only a handful of P2P exchanges.

The Chainalysis report we referred to in section 2.5 also ranks countries by P2P exchange trade volume. The ranking is weighted in favor of countries with a lower wealth per resident and a lower number of internet users.

Across various marketplaces, relative P2P exchange usage is highest in:

1. Seychelles
2. Vietnam
3. Bahamas
4. Jamaica
5. Kenya
6. Ecuador
7. Somalia
8. Belize
9. Tanzania
10. Colombia

In addition, reports from former P2P exchange Paxful in the same Chainalysis report confirmed that some of the highest growth in Africa came from Nigeria, Kenya, Ghana, and South Africa, which correlates closely with Google Trends' relative interest.

Conclusion on Bitcoin Adoption:

We estimated the number of Bitcoin holders today around 81.7 - 130.4 million, before accounting for overlap on- and off-exchanges. The real number is likely under 100 million.

The journey to Bitcoin adoption and long-term behavior change is complex. Great strides have been made in education, but if Bitcoiners who are less experienced in education want to accelerate adoption, they would benefit from gaining a deeper understanding of the education process to take ownership of it and become more effective. This starts by understanding the gap between their perspective and knowledge and that of the recipient.

This introspection extends to the gap that has been highlighted by other reports between male and female Bitcoin adoption of 3 or 4 to 1. Finding ways to better reach women around the world could significantly accelerate Bitcoin adoption, without turning it into a debate on gender (in)equality or whether such initiatives should be undertaken at all.

There are many angles to study the factors that drive Bitcoin adoption, but results vary dramatically. Attempting to summarize adoption in a formula for success is likely not the most effective way, but there are certainly specific factors that have a major impact.

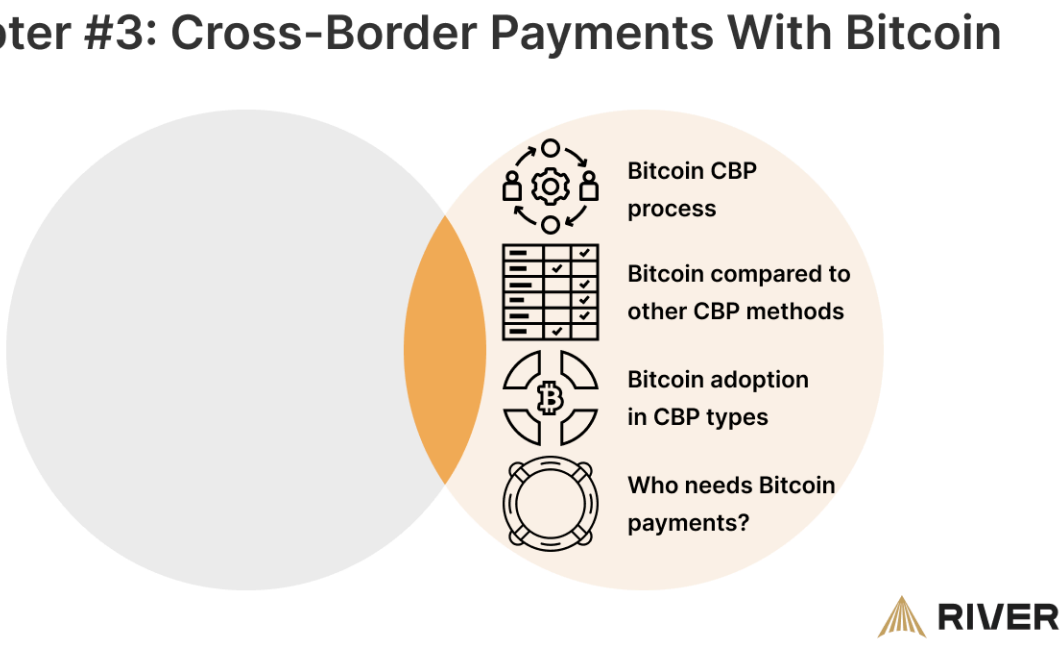
Good education in the local language and strong local Bitcoin companies and meetups play key roles in growing interest and adoption at a higher rate. Strong local companies require great talent which requires good technical education. Good technical education requires funding or a sustainable business model, and above all, motivated people to maintain it and make it more accessible to people around the world.

3. Cross-Border Payments with Bitcoin

After examining Bitcoin adoption in general, we now dive into who is already using Bitcoin for cross-border payments and what we can learn from them to grow adoption.

In this chapter, we look into:

- The process of a Bitcoin cross-border payment.
- Bitcoin compared to alternative cross-border payment methods.
- Bitcoin adoption in various cross-border payment types.
- Who really needs Bitcoin payments.



3.1 Bitcoin Cross-Border Payment Process

We want to start with an important note that makes Bitcoin different from other financial networks: By design, Bitcoin does not care about crossing borders, and there is no differentiation in time or cost based on how many countries a transaction travels across. The term “cross-border” is only used here to signal the intent of a transaction.

Below, we look into the process of cross-border payments in the banking system, cross-border payments in a fintech solution, how the process differs when using Bitcoin, and how it can be further improved.

The traditional method is highly inefficient for cross-border payments. It involves many hops and manual processes across different time zones that make it unappealing from both a time and cost perspective.

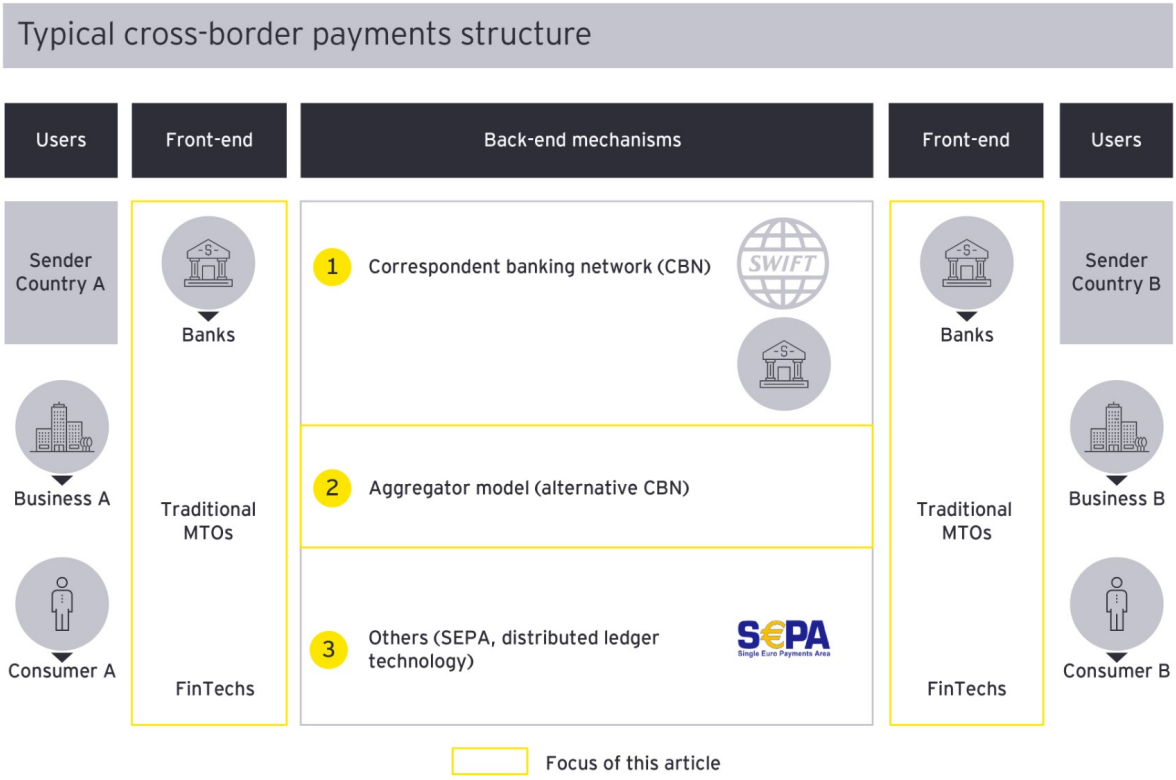


Image source: EY

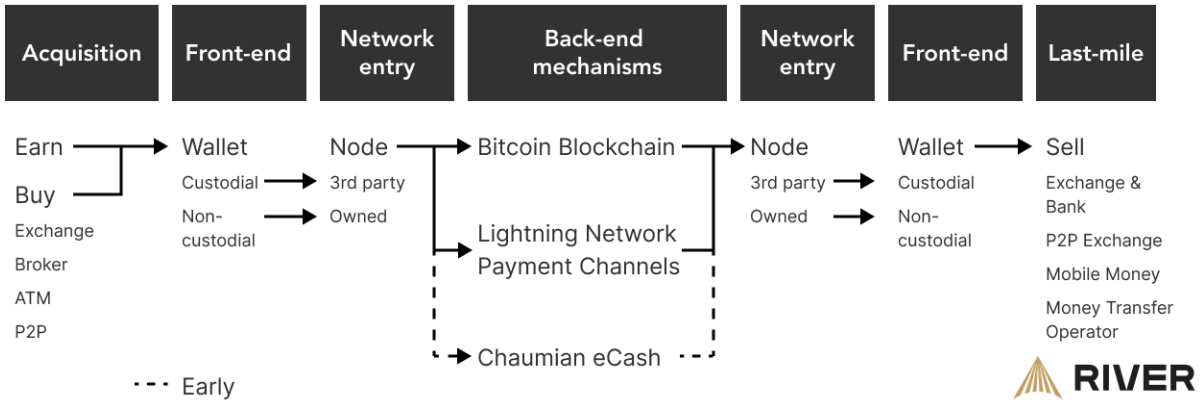
Fintech companies try to improve upon these limitations with a better user experience. This is often accomplished by having accounts at many banks across the world, so they can offer instant payments to their customers while using the slow route to settle payments among their accounts in the background. From a user perspective, this flow works well. When users transfer money to an account at the same bank, it completes quickly, and from that point forward the fintech needs to ensure it mitigates fraud risk.

The drawback for some users is that their desired payment corridors may not be covered by the fintech company, or that there may not be enough volume transferred in the opposite direction to allow fintech companies to keep their costs low, and thus the customer still pays significant fees.

While Bitcoin cross-border payments don't have these challenges, there are different obstacles. For starters, users need to understand how the technology works to avoid the common mistakes people make.

Below we show what the various flows look like. The biggest differences are in the acquisition of bitcoin, the back-end mechanism to transfer it, and the last mile to sell it.

Bitcoin's Cross-Border Payments Flow



The various back-end mechanisms to transfer Bitcoin are frequently discussed and each has its pros and cons. The Bitcoin blockchain is most battle-tested for payments and can scale up to billions of dollars for a transaction while maintaining a low fee, but it is not designed to handle small payments in the long term (described in chapter two).

To fill in this need, the Lightning Network is a viable option today, but it still has challenges to overcome. Other solutions are emerging to further help scale Bitcoin for payments, such as eCash, but these are in such an early stage of development that it is hard to weigh their pros and cons. Interestingly enough, the emergence of these solutions was predicted by early Bitcoin developer Hal Finney in a Bitcointalk post in 2010 on Bitcoin Banks.

Regardless of which back-end mechanism is used to transfer Bitcoin, on- and off-ramps play a critical role in a Bitcoin cross-border payment.

The major drawback of these flows for the sender and recipient is that they each have to decide on how to handle the bitcoin, and in many cases none of their options is ideal.

The sender must already have bitcoin, or cash readily available on a service, to benefit from Bitcoin's speed advantage.

- If they already have bitcoin, its value may fluctuate, which is not always desirable.
- If they have cash available on a platform, they have counterparty risk.
- If they have neither, they must wait for their payment to clear to the platform they are buying bitcoin on, which adds to the duration of the payment.
- If there is no platform available in their country, they may have to buy bitcoin from individuals, which can involve other costs and risks.

The recipient has a different set of challenges:

- Depending on the service used, they may need to be online to immediately convert bitcoin into their preferred currency to avoid exposure to potential price drops.
- Holding bitcoin and accepting potential price drops is an alternative option, but typically not viable for recipients with a limited budget.
- The recipient has to wait on a transfer from the exchange they are using to their account, which can negate (part of) Bitcoin's speed advantage.
- The recipient may not have an easy way to convert bitcoin to their local currency.

The last point on a lack of off-ramps can happen for various reasons:

- Individuals may not have a government-issued identity or lack a physical address.
- Entrepreneurs haven't built a local exchange yet.
- The market may be too small to operate in.
- The costs to run an exchange may be too high due to local regulations.
- Governments may make it illegal to run an exchange in the country.
- Governments or banks may prohibit banking relations with exchanges.
- Bitcoin may be outright declared illegal.

When there are no centralized exchanges available, or the only available exchanges are forced to operate using government-defined exchange rates, people have no other option than to acquire their bitcoin on a peer-to-peer (P2P) marketplace from other individuals, or even more directly: through chat groups. These marketplaces are critical for people around the world to get money into and out of bitcoin at their real currency rates.

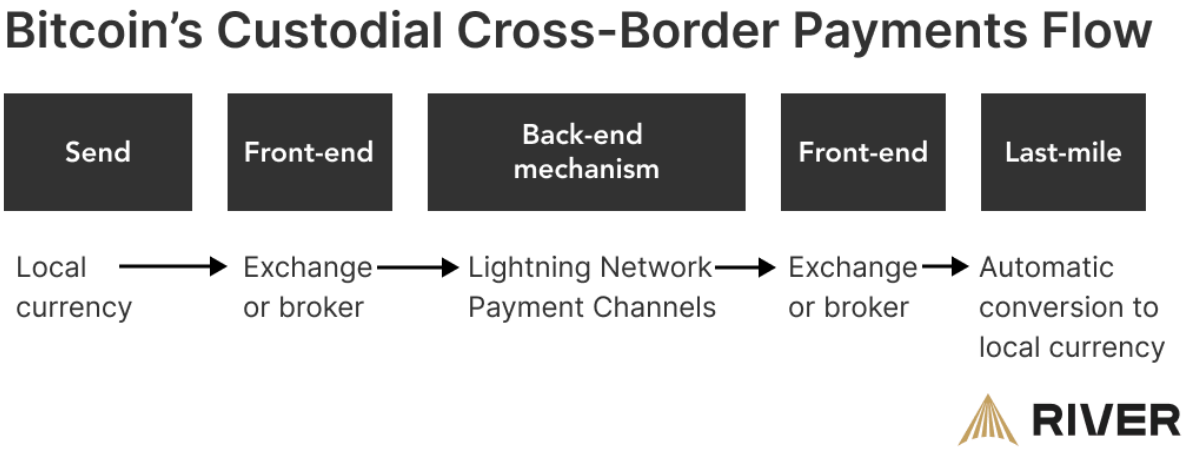
If both the sender and receiver are happy to keep their money in bitcoin, then Bitcoin is an ideal cross-border payment solution for them, but today this is not preferable for most people engaged in cross-border payments. Fortunately, there is a solution to some of the problems listed above.

Bitcoin Can Outdo Fintechs

As previously described, fintechs use clever constructions with accounts at many banks to keep their costs low, while money still settles slowly in the background. A similar model is being built on Bitcoin, but it has a different set of business challenges.

This model uses Bitcoin's biggest second-layer scaling solution, the Lightning Network, but not in the way many Bitcoiners would expect where they directly interface with it.

Exchanges and other financial services are also users of this network. They can transact among each other on behalf of their clients, which has a key advantage: clients never need to understand, own, or use bitcoin. It is simply used as a back-end settlement solution.



If we revisit the challenges we listed above:

- This approach eliminates the risk of price drops for both sender and recipient, as they are never holding any bitcoin. The services they use take on this risk.
- This approach ensures both sender and recipient don't need to understand Bitcoin.
- Counterparty risk for a recipient is reduced by automatically being paid out in their traditional financial account.

The tradeoff this model makes is that price drops now fall upon the exchanges. If they do not use a service like River Lightning, they must hold large amounts of Bitcoin in their Lightning payment channels to satisfy user demand at all times. They can offset risk by charging small fees for payments, but it is a business challenge to ensure the exchange is long-term profitable. However, exchanges are likely better equipped than individual users to protect themselves against price drops.

A major risk of the model is that it is vulnerable to regulatory changes aimed at undermining Bitcoin. The companies involved rely on the banking system to operate and could have their access cut off, as we have historically seen in some countries. In addition, the model does not eliminate costs to move money into and out of these services.

If this model scales well, it is likely that in the long run, the financial services that are part of this network would turn into major banking players, as people would increasingly want to hold their balance on these platforms for convenience and make use of additional services. There are API-based services that make it easy for financial institutions to join in today.

3.2 Bitcoin Compared to Cross-Border Payment Methods

The Bitcoin whitepaper has 12 mentions of payments, most of them reference the focus on non-reversible, electronic, online payments. There are no mentions of cross-border payments, or Bitcoin being the cheapest, fastest, or most convenient payment method.

These are nonetheless properties that businesses and consumers value the most for money to be used in exchange.

Bitcoin's blockchain will never be the universally best tool for cross-border payments, as it wasn't designed to be at this layer. It can be great for periods of time, and in specific places or situations where there are no good alternatives, but over time, there is the expectation that payments will move to additional layers and scaling solutions as fees rise. Because of this, comparing Bitcoin's base layer to other solutions does not make sense.

Only additional scaling solutions that are specifically designed for payments should be compared, such as the most prominent one; the Lightning Network. Lightning users can send bitcoin between them without having to settle each transaction on the blockchain. As such, one transaction on the blockchain can represent thousands or millions of transactions on the Lightning Network, which increases throughput and lowers cost. Lightning and other solutions will invalidate the "energy per transaction" metrics critics use.

We compare the Lightning Network to a few other cross-border payment methods below. We distinguish between remaining within the system (native) and the end-to-end process, in which conversions into and out of local currencies are needed. The latter is bottlenecked by traditional methods, which undo some of the benefits of other payment methods.

CBP method	Native speed	End-to-end speed	Native cost	End-to-end cost	Accessibility
Bitcoin's Lightning Network	Seconds	Days	Low	Medium	Global 24/7, but limited adoption
Stablecoins (USDT, USDC)	Seconds	Days	Low	Medium	Global 24/7, but limited adoption
Correspondent Banking	Days	Days	High	High	Global besides sanctions
Fintech (Wise, Revolut)	Days	Days	Medium	Medium	Unavailable in many countries
Mobile money (M-Pesa)	Seconds	Seconds	Medium	Medium	Country-specific 24/7
Money transfer operator (Remitly, Western Union)	Hours/ Days	Hours/ Days	High	High	Global, business hours only
Card (Credit/Debit)	Seconds	Seconds	Medium	High	Global 24/7

In general, stablecoins are the strongest competitor to the Lightning Network for cross-border payments due to their relative stability. They are centralized tools that aren't without risk, but when given the choice between stability and no counterparty risk, consumers typically choose stability. This is especially apparent in Latin America, where much of Bitcoin's adoption emerged from a need for stability, away from hyperinflating fiat currencies. However, when stablecoins emerged as a more stable option, much activity moved over to this new tool, as detailed in Mastercard's 2022 research and echoed by Bitrefill's data in section 3.3.

We chose not to compare other cryptocurrencies besides stablecoins, as they do not have the global liquidity and level of adoption that Bitcoin has. This lower liquidity also isn't overcome by other properties that would make them significantly more attractive for cross-border payments. There is, for example, no clear need for complex programmability of transactions for cross-border payments, and even faster settlement is so far only a factor in marketing other cryptocurrencies, rather than being driven by real user demand.

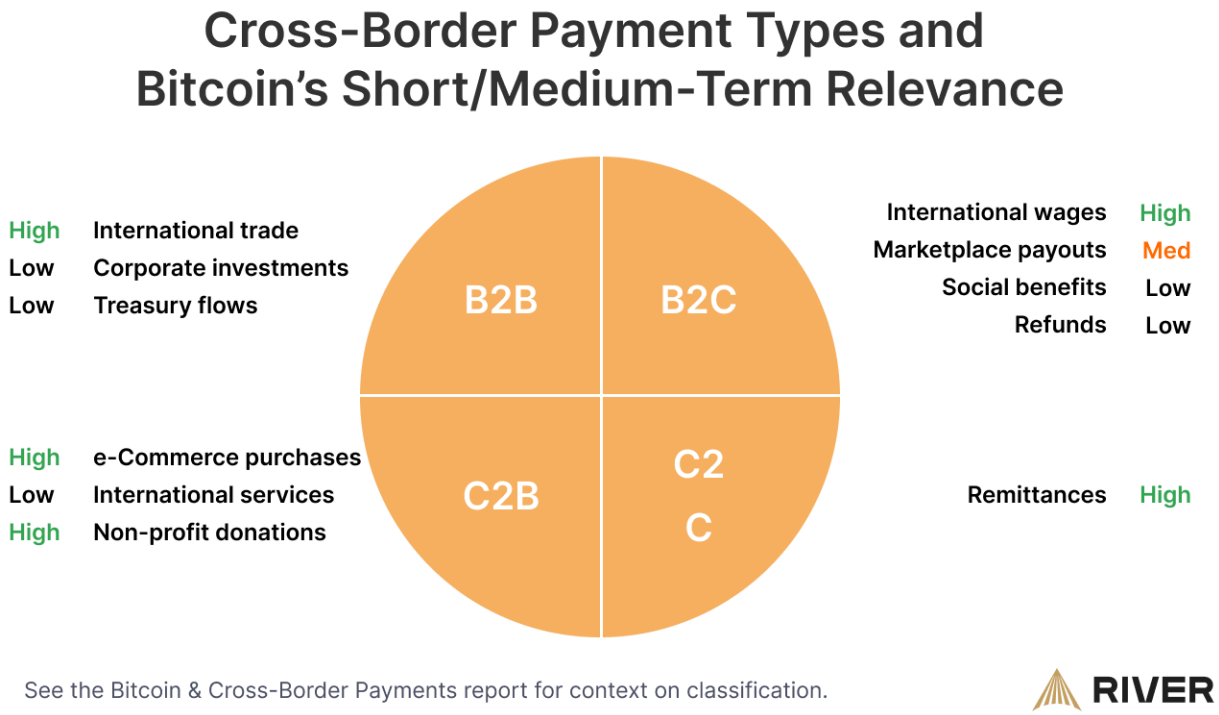
Driving costs lower is proving to be the most difficult challenge. As long as various services and/or banks remain involved for the last mile of payments, also called the on- and off-ramps, costs will remain at least a few percent at a minimum. Alongside the monetary cost, there is also a mental cost to get educated enough about Bitcoin, and a business cost to integrate Bitcoin into systems and accounting, depending on the implementation.

If the average cost of traditional remittances eventually drops to just a few percent, that can be low enough to make many people not want to bother switching to a Bitcoin-based solution purely for cost reasons. Low cost is not the main value proposition of Bitcoin, but it could remain part of its appeal depending on how the system scales.

3.3 Bitcoin in Different Cross-Border Payment Types

Although Bitcoin's payment user experience has its challenges today, it is great in various use cases. No opinions by finance, banking, or payments experts, or government officials, will change the fact that people around the world rely on Bitcoin for their payment needs.

Like in the first chapter, we looked into different types of cross-border payments and found solutions for each of the four quadrants (B2B, B2C, C2B, C2C).



Bitcoin B2B Cross-Border Payments:

The adoption of Bitcoin for B2B cross-border payments is limited and situational. No highly successful service providers have emerged in this quadrant. Nonetheless, there are examples of companies that pay their international business partners in Bitcoin, or non-profit organizations such as the Human Rights Foundation that provide their grants in bitcoin out of convenience. These B2B payments are often driven by a knowledgeable business owner or employee with a deep understanding of Bitcoin.

The primary reason for businesses to avoid cross-border payments in bitcoin is that the upside of adopting it is often perceived as limited relative to the effort to integrate solutions, deal with accounting and taxation challenges, as well as educate and convince their business partners. Many people have prejudices about Bitcoin, and company politics, as well as higher business priorities, can quickly get in the way of meaningful progress.

It will take a lot of time and effort to grow adoption for B2B payments as it did for Bitcoin in its early years. This quadrant will likely be the last of the four to see significant adoption, but this is the same pattern for any other technology, including something as simple as a website.

Bitcoin B2C Cross-Border Payments:

International payroll is a noteworthy segment to explore. There are a few components that define adoption:

1. Do employees want to be paid in Bitcoin?
2. How accessible and appealing is it for a company to pay employees in Bitcoin?
3. Is it legally allowed for both parties?

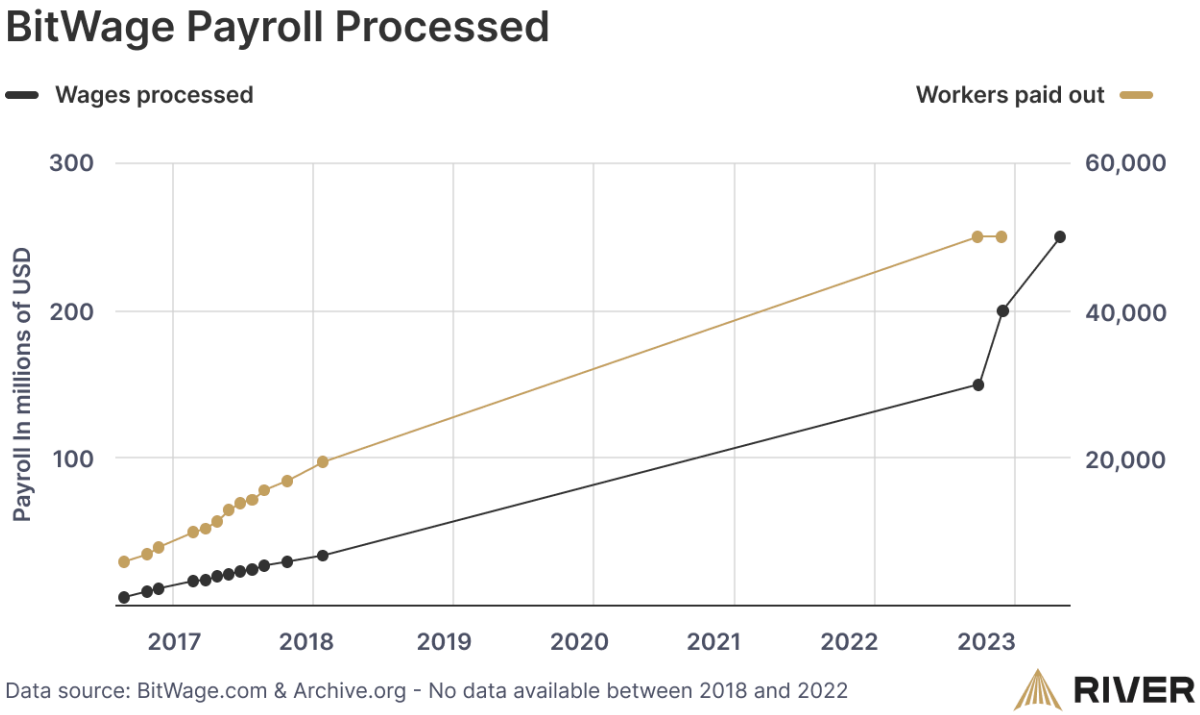
Given that people around the world hold part of their savings in bitcoin, we logically see many people happy to be paid in bitcoin. If they aren't paid in it directly, they might spend part of their paycheck on it anyways. The partial aspect is key here; the number of people who want to receive their full wages in bitcoin is smaller. Cointelegraph put together an extensive overview of the real adoption of Bitcoin salaries with various surveys that prove this point, such as NYDIG's Bitcoin Benefits 2022 survey that shows 36% of all employees under 30 would be interested in receiving a portion of their pay in bitcoin.

Accessibility is critical. Payroll is enough of a challenge for companies as it is. Adopting yet another solution for just a handful of employees may not always make sense for a company. The economics also need to support such a decision.

Legal limitations to be paid in bitcoin are somewhat rare, as Bitcoin is illegal in less than ten countries as of 2023. Some jurisdictions require employers to pay at least minimum wage in fiat currency, so employees in such jurisdictions could only be partially paid in bitcoin.

Providers like Bitwage and Deel have focused on the main pain points and challenges for both consumers and businesses that we listed above. They enable people to receive their wages in their preferred mix of Bitcoin, stablecoins, and their local currency. They provide tax and accounting solutions, and integrations with all of the most popular HR systems. Even if the employer is not open to paying employees in other currencies, the employee can use a generated bank account offered by the provider to get paid the way they want.

Below we share public data from their websites and reports to give more insight.



This data was gathered from Bitwage's website using archive.org. Between February 2018 and October 2022, no data was shared. We could not get more insight from the company. Another noteworthy data point between February 2018 and October 2022 is that the average payout per worker increased by 70%, which could mean a mix of things:

- Bitwage managed to appeal to workers with higher salaries.
- Part of the increase could be attributed to inflation.

At Bitcoin 2023 in Miami, Bitwage shared that 20% of their business is from people receiving their salary in bitcoin, which has not changed in three years.

We do not have further insight into how much of this value is international, what their top payment corridors are, and what the distribution across different currencies is.

Deel reported that ~2.5% of all payments withdrawn from its platform since January 2022 were in Bitcoin, and 1.5% in USDC, a stablecoin. From July to December 2021, this was 1% and 0.6% respectively. The company also reported on distribution, with Latin America as the highest adopter at 67% withdrawing in cryptocurrency, followed by Europe, the Middle East, and Africa at 24% and North America at 7%. Asia-Pacific was the lowest at 2%.

It is no surprise to see these services growing, and we expect it to continue in the future.

Bitcoin C2B Cross-Border Payments:

C2B payments are made up of E-commerce, international services, and donations.

From a business perspective, Bitcoin is great for e-commerce.

- It significantly reduces fraud risk and time spent to dispute chargebacks. However, consumers are not as protected from untrustworthy merchants with faulty products.
- Rather than paying a high fee to credit card companies, Bitcoin payments can be automatically processed by a service provider for a 1% fee or less, while the merchant is paid out in their desired currency. The lower fee gives the merchant the option to increase their profit margins or lower their pricing to attract customers.

Historically, businesses have been eager to accept bitcoin as a payment method, including major publicly traded companies such as Microsoft, Overstock, and Dell back in 2014. These companies quickly found that transaction volumes were more limited than they thought, as bitcoin holders had high conviction in their investment and were not looking to spend. The “hodl” meme has been incredibly powerful for years, and in hindsight, it is hard to disagree with this approach. It was too early for the payment use case to flourish.

E-commerce activity began to pick up when the Lightning Network emerged years later and major improvements were made to the user experience for merchants and consumers.

An estimated 32,000 physical stores are accepting Bitcoin as of June 2023 on Coinmap.org. How many of these merchants still do so today is not possible to say.

The most popular solution to accept Bitcoin appears to be BTCPayServer. While the project does not track its user base, there are a few metrics to measure adoption:

- As of June 2023, their software has been downloaded a total of 22,900 times by developers building on top of it, of which 1,800 downloaded the latest version, and 900 of those were over the past 6 weeks.
- There are over 1,000 active installations on WordPress, with a historical total of 16,500 downloads as of June 2023.

The second most popular solution is Coinbase Commerce. According to data by BuiltWith, it is integrated into 4,478 live websites, and BitPay's solution is integrated into 215 live websites. It is likely the real numbers are higher, especially given that BitPay has been in business since 2011.

In addition, BitPay publicly shares extensive data on the usage of its solutions. Over the past 2 years, BitPay has processed roughly 30,000-45,000 Bitcoin transactions per month with an average value of ~$700, and around 1,500-4,000 USDC transactions per month. Over the past year, it has also processed 13,000 Lightning transactions with an average value of $71. How much of their volume is cross-border is unknown, but we can see that around 25-45% of these payments are to purchase prepaid and gift cards, around 10-25% goes towards gaming, 15-20% to Internet, and 10-20% to VPN services. Bitcoin's share of total payments hovers around its market capitalization dominance of 46%.

Bitcoin's payments share is echoed by Bitrefill, one of the largest e-commerce companies in the industry, which in May 2023 shared data on the various payment methods used on its platform.

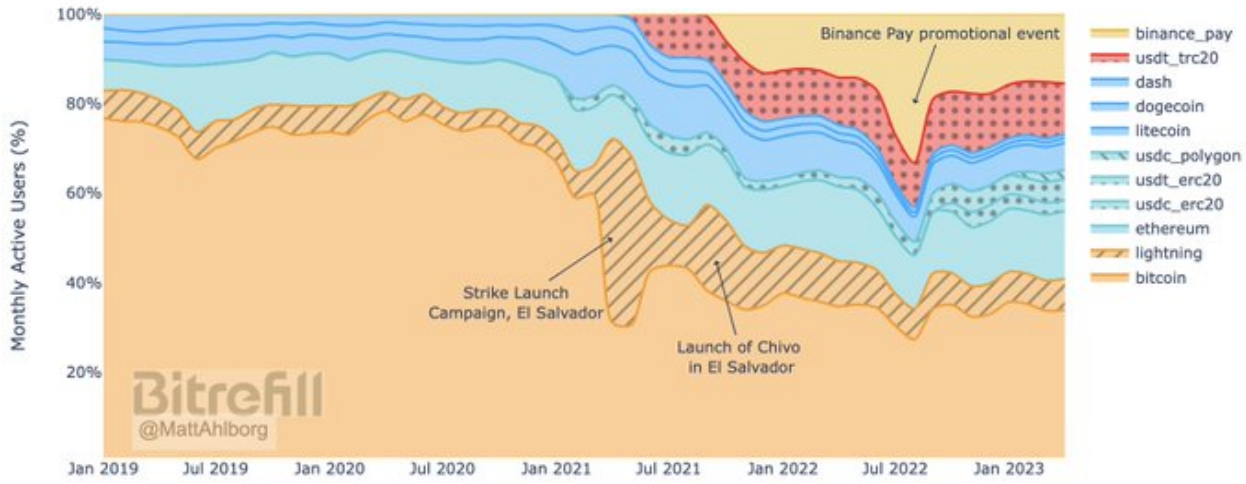


Image source: @MattAhlborg

Bitcoin has given ground in market share to other options, while still growing in absolute numbers itself. There are a few reasons for this:

- Some people want to avoid volatility and use stablecoins.
- Some people prefer to hold Bitcoin and spend other coins.
- Some people want to avoid fees and use other coins with less fee pressure.

According to Bitrefill's data, this shift especially happened during periods of high fees on Bitcoin. Some of the activity has shifted to the Lightning Network, but adoption here is still lagging due to not enough exchanges and wallets integrating Lightning yet.

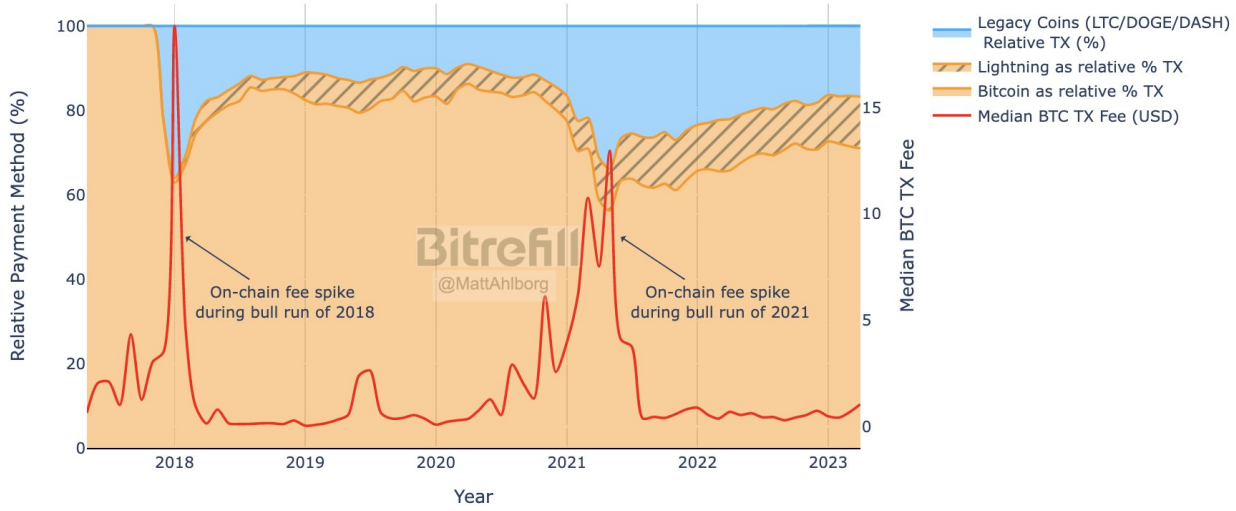


Image source: @MattAhlborg

In addition to the distribution of payment methods, Bitrefill also shared geographical differences.

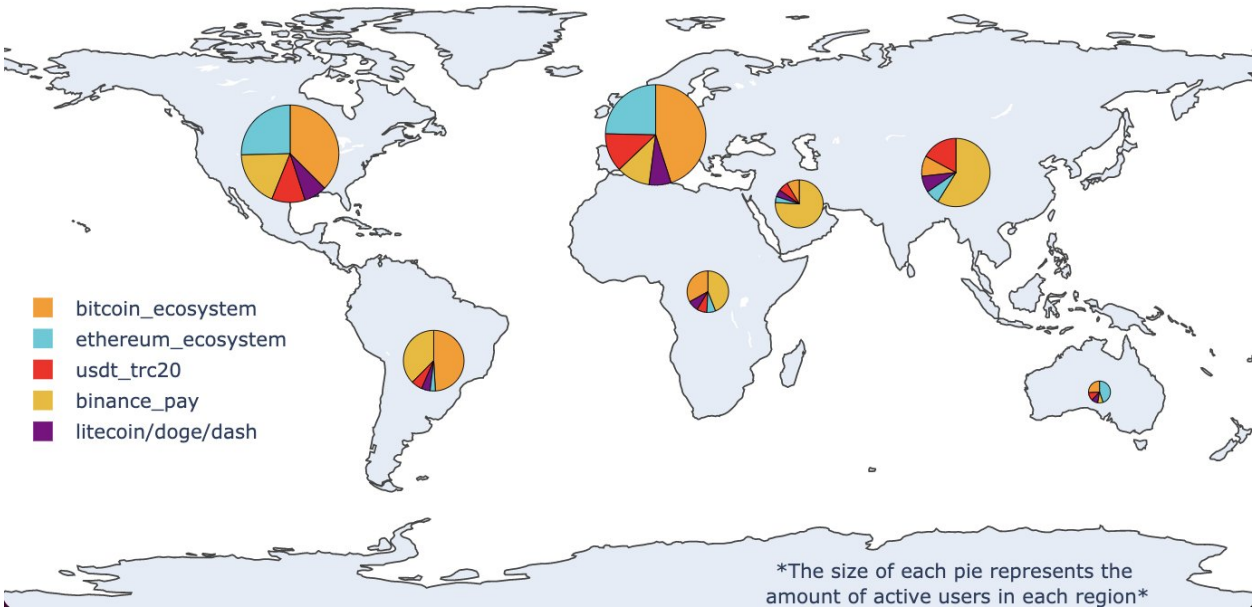


Image source: @MattAhlborg

There is a clear west-east divide in Bitcoin's popularity as a payment method, and altcoins are barely used outside of high-income countries.

Bitrefill shared an interesting exception: In El Salvador, where bitcoin is legal tender, 73% of all payments volume to Bitrefill happened over the Lightning Network, 18% over the Bitcoin base layer, 7% used Binance Pay and 2% used other methods in Q1 2023.

Overall bitcoin activity across other services in El Salvador was reported to be around 40% of what it was at the peak when bitcoin became legal tender in Q3 2021. This is remarkably high given that there is no pressure or additional incentives to keep using Bitcoin and shows sustained impact.

One significant adoption hurdle worth pointing out is that in the United States, each bitcoin sale or exchange is a taxable event, while the US is the biggest Bitcoin market in the world.

International Services

New services that are trying to grow in market share may find it appealing to accept bitcoin as payment as a way to differentiate themselves from the competition and reach global customers.

However, many services are subscription-based, and Bitcoin is by design a system in which payments can only be pushed, rather than a pull system like credit cards. This means that on the blockchain itself, no service can take money from you every month.

Additional solutions are required to see adoption here—ideally ones that don't require users to give up custody of their funds.

Non-Profit Organizations

Bitcoin is a valuable tool for non-profit organizations to accept donations from consumers around the world without being restricted to particular payment methods dictated by a payment service provider.

Organizations that accept Bitcoin donations cannot have their funds frozen by their service provider, such as WikiLeaks getting its access cut off from the traditional financial system, and the Canadian trucker protest getting its fundraiser blocked. Governments can block their access to regulated on- and off-ramps, but can not directly control funds or prevent peer-to-peer exchange.

Thus far, these are marginal examples with limited volume, but to the recipients, they can make all the difference in the world. Significant growth in adoption from non-profits may be a signal that the world is becoming more authoritarian.

Bitcoin C2C Cross-Border Payments:

Remittances are widely recognized as the most important payment category for Bitcoin adoption, and yet adoption is not easy to quantify.

The blockchain itself does not store physical location data, but nodes in the network have IP addresses, and other devices with IP addresses communicate with them about transactions. Blockchain analysis companies and individuals have tried to link IP addresses to Bitcoin addresses at scale, such as in a case shared by developer 0xB10C.

Large-scale analysis would provide insight into cross-border transaction activity, and how much of it is between consumers, but also harm consumer privacy and put dissidents at risk. All known instances of activity from, to, and between exchanges, services, mining pools, and institutions would have to be excluded to gain insight into consumer activity.

Even then, it would not give an accurate representation of remittance activity, as some services would bundle remittance transactions with non-remittance activity. In addition, this approach would not capture activity on additional scaling solutions.

Without such an overview, approximations offer the best insight into remittance activity and adoption. We reached out to a wide range of businesses in the industry, but data sharing is often tricky for competitive reasons.

We highlight the three largest remittance examples below.

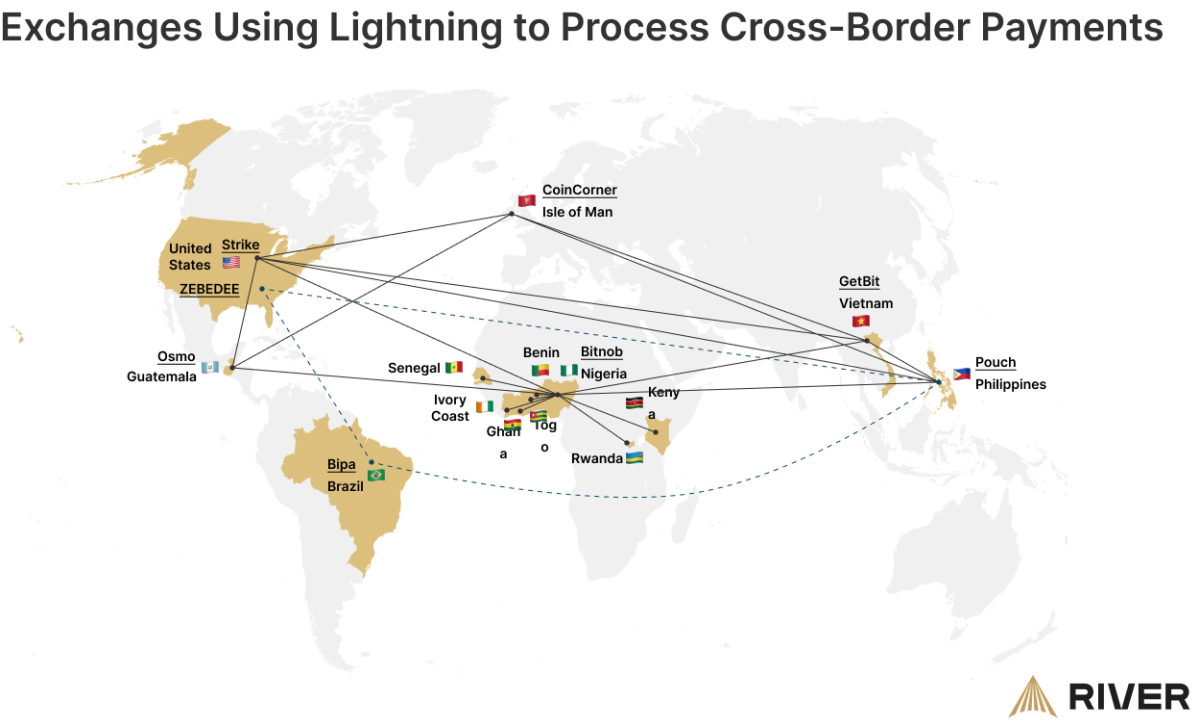
1. In 2015, Rebit's Product Lead Luis Buenaventura wrote how at the time, Bitcoin did not make remittances cheaper for the Philippines. The dominant network of last-mile brokers charged a 6-7% fee regardless of the method used to transfer the money internationally. Rebit ceased operating since, but today this reality is still reflected in the product offering of another local exchange, Coins.ph, which is integrated with Western Union due to difficulties to get a physical foothold in the country. In his article, Luis described how the ideal solution would be mobile-based. Ever since, smartphone ownership in the Philippines has risen from 42.1% to 76.1%, but this does not imply the adoption of digital transactions. According to data from the World Bank, 38.53% of people aged 15+ in the Philippines made a digital payment in 2021. It is no surprise that adoption is slower in areas where technological savviness is still developing.

2. Between January and May 2022, El Salvador's Chivo wallet processed $52 million in remittances, as reported by the president of the El Salvador central bank. This represents 1.6% of El Salvador's estimated remittance volume of $3.175 billion in that period, a relatively high number. It is very difficult to convince even one in a hundred

people to use a new payment method they have heard little to nothing about—especially with their family depending on its success.

3. In December 2022, U.S.-based Bitcoin company Strike partnered with Nigeria-based Bitnob to launch its "Send Globally" initiative. U.S. customers can instantly send money to Nigeria, Kenya, and Ghana. Recipients receive payments in their bank account, mobile money account, or on the exchange, in their preferred currency.

   This initiative has grown since, with Isle of Man-based CoinCorner joining and reporting 53% of all outgoing transactions using Lightning in March 2023. In addition, Philippines-based Pouch, Vietnam-based GetBit, and Guatemala-based Osmo joined as well, while Bitnob expanded to Senegal, Benin, Rwanda, Ivory Coast, and Togo.



Strike expanded access to its wallet to more countries than we have listed above, but without on- and off-ramp integration in these countries, this does not provide the entire payments flow to users.

ZEBEDEE launched a similar initiative in March 2023, partnering with Bipa in Brazil and Pouch in the Philippines. We expect more companies to join and/or launch initiatives.

It is important to note that users may still incur costs and/or waiting times related to traditional financial services at the on- and off-ramps, but the settlement between the Bitcoin services is as cheap as a Lightning Network transaction: a fraction of a cent.

These solutions are live versions of the model we described earlier in section 3.1, as they use the Lightning Network as the back-end settlement layer. The businesses involved need to manage their capital-intensive Bitcoin and local currency balances in markets that sometimes have mostly uni-directional cash flows. These providers also have to manage reliable infrastructure. Meanwhile, consumers can use these solutions without ever needing to understand or know about Bitcoin being used in the backend; they simply send and receive their desired currencies. This significantly lowers the barrier to entry, which is one of the biggest challenges in growing Bitcoin adoption.

If these new payment networks are successful, we will likely see all kinds of financial institutions attempt to join in. However, they won't have in-house Lightning Network expertise and will likely outsource this part of the operation to accelerate their go-to-market and manage costs, as talent will be scarce. River has built River Lightning to make it easy for companies to participate in the Lightning Network through an API service. The previously mentioned Chivo wallet in El Salvador is one of our clients.

3.4 Who Really Needs Bitcoin Payments?

There are four use cases where using Bitcoin for payments transcends all concerns we have previously listed. All but the first tend to emerge under authoritarian regimes:

1. **People with no alternatives** because existing options are geographically restricted, too expensive, or closed due to weekends, holidays, or business hours.

2. **Dissidents** often find their financial access cut off to stop them from operating. Bitcoin payments are a lifeline for them to receive (international) support and continue their operations. WikiLeaks got cut off by traditional financial institutions and started accepting bitcoin donations in June 2011. Since then, many other examples have arisen, including in Belarus in 2020 to support protestors against the incumbent president.

3. **Capital controls** are government-imposed limitations on the purchase and sale of currencies used to prevent capital flight and stabilize an economy, so the government can keep inflating its currency to support deficit spending. Individuals and businesses will often resort to workarounds to preserve their purchasing power, and Bitcoin is one option to do so. When capital controls are imposed, regulated on- and off-ramps are similarly restricted, and many users move to peer-to-peer marketplaces.

4. A **fixed exchange rate** is applied by a government or central bank to tie a country's official exchange rate to another currency. This can lead to the emergence of a black market for currency exchange, which represents the real conversion rate according to the people. The real rate can significantly diverge from the fixed rate. Today, most currencies are pegged to other currencies in some way.

Mapping out real rates in black markets globally goes beyond the scope of this report. There are many historic examples listed by Winton, and recent examples such as a 100% gap in Argentina in March 2023, or a 63% difference in Nigeria in June 2023.

Comparing gross national income per capita based on the official exchange rate to the real exchange rate on the black market shows how on paper, an economy may seem stable, but at an international scale, it is crumbling.

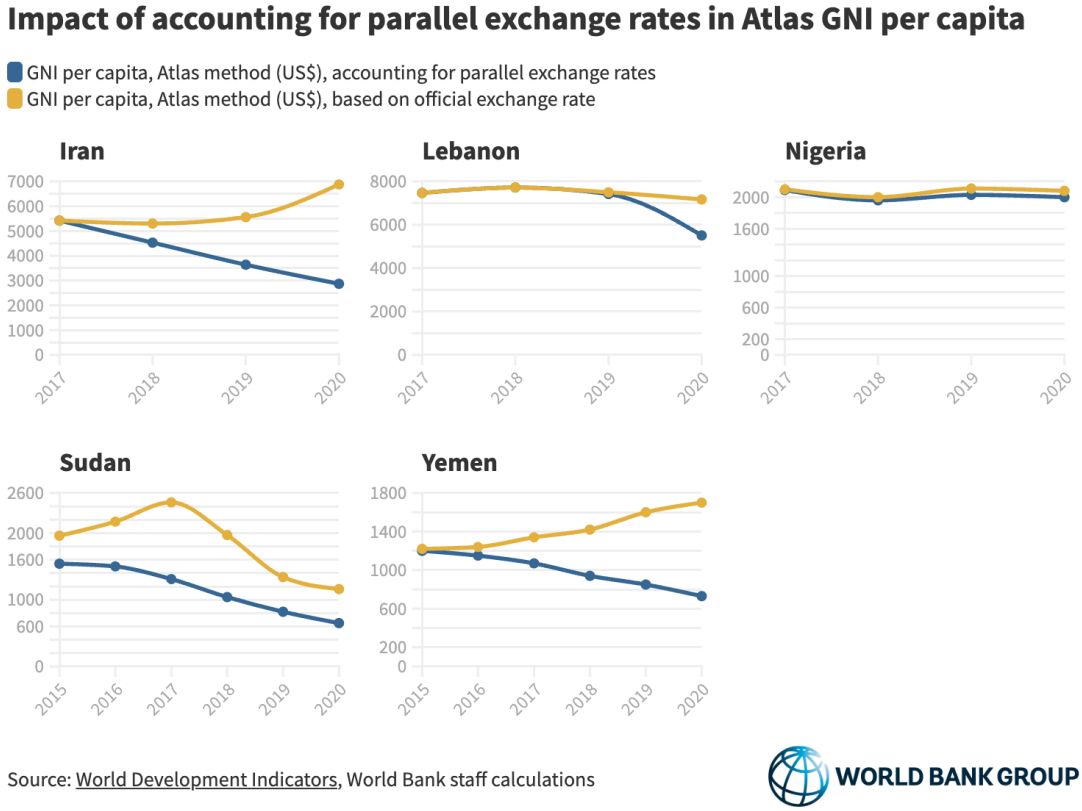


Image source: The World Bank

The use case for Bitcoin payments becomes clear when money is sent to a country with a fixed exchange rate. Using a traditional payment method, the recipient receives up to double digits less value than intended. For this reason, organizations like the Human Rights Foundation send grants in Bitcoin, so that, for example, recipients in Senegal or Kenya receive closer to the real rates.

However, no story or personal experience compares to hearing directly from people on the ground how Bitcoin is useful to them.

This is where the European Central Bank fundamentally misunderstands Bitcoin's comparative advantages. In their report, the authors describe that Bitcoin only has advantages due to regulatory gaps which will all be closed, but they did not identify any of the advantages above.

Closing the gaps they are actually referring to will play out in a straightforward way: Most countries will introduce regulations to enforce identification under the guise of stopping what Timothy May calls the "Four horsemen of the infocalypse": terrorists, pedophiles, drug dealers, and money launderers. According to a January 2023 report by Chainalysis, this represents 0.24% of all activity.

Conclusion on Cross-Border Payments with Bitcoin:

Bitcoin is used in most cross-border payment segments today with various adoption rates:

- The B2B segment remains the least developed, as more stakeholders are involved and the cost-benefit ratio is not always in Bitcoin's favor. Technological adoption in B2B is generally also slower than in segments involving consumers.
- In B2C there are sophisticated solutions that solve the main pain points for both businesses and consumers. Increased adoption here is only a matter of education.
- The C2B e-commerce segment has professionalized over the years. The emergence of payment solutions and the Lightning Network have significantly improved the user experience. However, there are not yet subscription solutions for B2C services. Bitcoin is a valuable option for international donations but adoption is limited.
- The C2C remittance segment is situational. If there are no alternatives for consumers it is fantastic, otherwise, adoption remains challenging due to the learning curve, as well as costs associated with the last mile of payments.

Despite growth in adoption in most of these segments, Bitcoin's main function is not as a medium of exchange today. Most users prefer to hold their bitcoin, as the world continues to discover how big its role as a store of value can be. Until this becomes increasingly clear, cross-border payment adoption will likely increase gradually, as Bitcoiners learn to spend and replace their holdings and occasionally want to do things with their profits.

Despite some challenges with the current user experience, Bitcoin is still being used for payments. Mere opinions from financial experts and government officials do not stop people around the world from relying on Bitcoin for their payment needs.

This is especially true for four use cases:

- People who have **no alternative options** for cross-border payments.
- **Dissidents** in authoritarian regimes whose lives depend on receiving funds. 70% of the world population lives in such regimes, so the importance of this tool can't be overstated.

- People who live in countries with **capital controls** that prevent them from securing their purchasing power abroad.
- People who are forced to exchange their **currency at fixed rates**, which differ vastly from real exchange rates and distort markets.

Many countries are struggling with no favorable options to improve their currencies. Bitcoin will likely be one of the options people and businesses turn to for safety.

The Lightning Network continues to become a robust payments network native to the Internet, supplemented by other systems that are still under development, some of which can support stablecoins themselves. With the rise of these solutions and more education over time, Bitcoin cross-border payments adoption will likely grow too.

4. Growing Bitcoin Cross-Border Payments Adoption

In the third chapter, we established that payment adoption varies per segment. In this chapter, we will summarize why it is important to grow adoption and what initiatives could further accelerate it.

4.1 Why Accelerate Bitcoin Adoption

In section 2.3 we presented the Bitcoin adoption funnel. When looking at this funnel, the logical conclusion to draw would be to increase the number of people who go through it and end up having a positive view. This is what many Bitcoin users have been focused on since Bitcoin's inception, through educational efforts, as well as building great user experiences. As a result, there are now over a hundred million people around the world who view Bitcoin positively, even if they do not own any.

If this approach continues, Bitcoin could eventually be positively perceived by billions of people. The question is when, and what will the world look like then?

Bitcoin Does not Exist in a Vacuum

Every day, more people are educated about Bitcoin and the values its users hold dearly. At the same time, governments and banks introduce more financial controls, reduce privacy, and ultimately get closer to the introduction of Central Bank Digital Currencies (CBDCs).

CBDCs not only have advantages from a government perspective, but they would also make cross-border payments easier and cheaper for individuals and businesses. The downside is that they will also introduce a level of population control and destruction of privacy that will harm the 70% of the global population who are living in oppressive regimes (see section 1.6).

If Bitcoin does not succeed at becoming more appealing to use than CBDCs, there is a chance that it could remain niche enough for governments to work against it to protect their interests. So even if you are only buying and holding Bitcoin in the hopes to preserve or increase your purchasing power, it is still in your best interest to actively grow Bitcoin adoption.

With this in mind, how can the adoption of Bitcoin be accelerated? Is the only way for Bitcoin adoption to grow for everyone to understand self-custody, and how mining helps secure their money? Will continuing with the same approach be enough?

4.2 Building Better Solutions

In an ideal world, using Bitcoin can become so simple that people barely need to overcome any technical hurdles and it just works for them in the background. Builders around the world are working tirelessly to improve Bitcoin and move in this direction.

Upgrades can be made to the payments experience, many of which are being experimented with in new protocols and applications. We touched on some of these in section 3.1 about the Lightning Network and e-Cash systems, and in section 3.3 when evaluating a user experience that does not require the user to understand Bitcoin at all.

Beyond infrastructure work, basic user experience improvements can be made in existing Bitcoin apps. Journalist Joe “Nakamoto” Hall shared app improvements to improve global accessibility, which he learned throughout his travels and onboarding new users to Bitcoin:

- English should remain simple, and ideally, more languages are supported. The Bitcoin community can help with free translations.
- In-app links towards basic explainers.
- Simple app names to make them more memorable and shareable.
- No KYC where possible.
- Introduce security measures once there is money in the wallet.
- The app size should be small as many people don’t have space on their phones.
- Dark mode in apps is impractical in sunny countries.
- Ensure the app still works on a broken screen.

4.3 Growing Bitcoin Cross-Border Payments

Below we highlight initiatives that can boost specific (cross-border) payment segments.

B2B

Despite B2B making up 96.7% of the traditional cross-border payments volume, there is low activity within the Bitcoin space to encourage businesses to adopt Bitcoin for B2B payments. As previously mentioned, no highly successful service providers have emerged.

One way to change this is first building the consumer payments network that we previously described, using the Lightning Network as a settlement solution between Bitcoin banks. Once tested at scale, businesses may be more willing to adopt such a solution.

B2C

As mentioned in the third chapter, the problems in this segment have largely been solved. Consumers can be paid out in the currencies of their choosing in their desired distribution,

and their employer is not even required to adopt a solution. What remains is a further global rollout to enable people in more countries to use these solutions.

As a result, the most practical way to grow adoption in this segment is by focusing on consumer education. The more individuals that have a positive perception of Bitcoin, the more likely they are to want to be (partially) paid in bitcoin.

C2B

E-commerce is a complex segment to grow adoption in. Consumers are reluctant to spend their bitcoin, businesses prefer to work with one payment service provider, and payment service providers have been slow to integrate Bitcoin and Lightning payments.

Certain initiatives could help to grow adoption, but whether they would have a significant impact can only be discovered by trying them out.

- **Spend-and-replace feature in wallets**: This feature would enable consumers to automatically rebuy bitcoin that was spent on goods and services. A manual version would require the consumer to tag such transactions, while an automated version would make the point-of-sale software signal to the wallet that it is a purchase.

- **Payment processors to work with a Lightning Service Provider**: Instead of committing to building and maintaining Lightning infrastructure themselves, payment processors can work with an API-based solution such as River Lightning to rapidly enable Lightning payments without taking on too many overhead costs.

- **Education initiatives for consumers**: Rather than educating businesses to accept bitcoin, we believe it makes more sense to educate consumers on Bitcoin's general benefits. Some of them will be business owners, and once they are educated, they can make a conscious decision to accept bitcoin, rather than doing so in an attempt to gain customers or market share and finding that the time invested resulted in disappointing transaction volumes.

C2C

To grow adoption in remittances, education is the most critical component. This is not just the case for Bitcoin remittances. In Section 1.4 we shared the SmaRT indicator, which showed that in remittance in general, most consumers could pay a few percent less in transaction fees if they were better educated about their options.

Without a strong foundation of education, Bitcoiners keep pouring water into a leaky bucket, or in other words, pushing people through a chaotic adoption funnel as we outlined in section 2.3. First, we need to understand what is not working well today.

4.4 Improving Bitcoin Education

The main challenge in education is a major mismatch between people who need the education the most, and the best teachers and solutions. Those who need education often don't have money to spend on it, and there are language and location barriers as well.

These factors make it difficult to build successful, scalable educational resources that provide an outstanding and effective learning experience. The business model is hard. As a result, learning about Bitcoin is a scattered process across many articles, podcasts, videos, and books, many of which claim to be the best introduction to Bitcoin. Navigating this chaotic space requires a level of self-learning that many people won't achieve, and along the way, it becomes easy to get distracted by projects that are promising to be technologically better or highly profitable.

Meanwhile, some people inside the Bitcoin space are not aware enough of how difficult it is for the average person to go through this journey. They managed to progress through their learning journey and assume others can and will do the same. They eagerly forward resources to friends, family, and other relations, and don't understand why these people aren't interested.

Improvements in Bitcoin Education

While builders are creating and improving Bitcoin solutions, Bitcoiners can get much better at education to get through to people who are thus far not interested in it. These improvements can happen in three main categories:

1. **Approach**: Not everyone will agree with your view of the world and why Bitcoin is important. Rather than explaining Bitcoin in a way that resonates with you, explain it in a way that will resonate with them.

2. **Format**: Many Bitcoiners love books and podcasts and there are many excellent resources in these formats. With that said many people prefer to learn in different ways. They need visualizations, exercises, Q&A, clear sequences, etc. If you always recommend the same learning format to everyone, it likely won't be effective. Ask people how they like to learn, and provide educational resources that are not just informative, but well crafted and engaging.

3. **Target audience**: Focus on people who already understand that fiat currency is broken. If you first have to convince people they have a problem and then explain that there is a solution to the problem they didn't know they have, you will struggle.

In the next section, we provide a potential approach to help you find these people.

Who Understands Fiat Currency Is Broken

Fourteen years after Bitcoin's inception, most people around the world have heard of it, and much of the low-hanging fruit has been captured: People who were inclined to be interested in Bitcoin, no matter how difficult it is to learn about it, have largely done so.

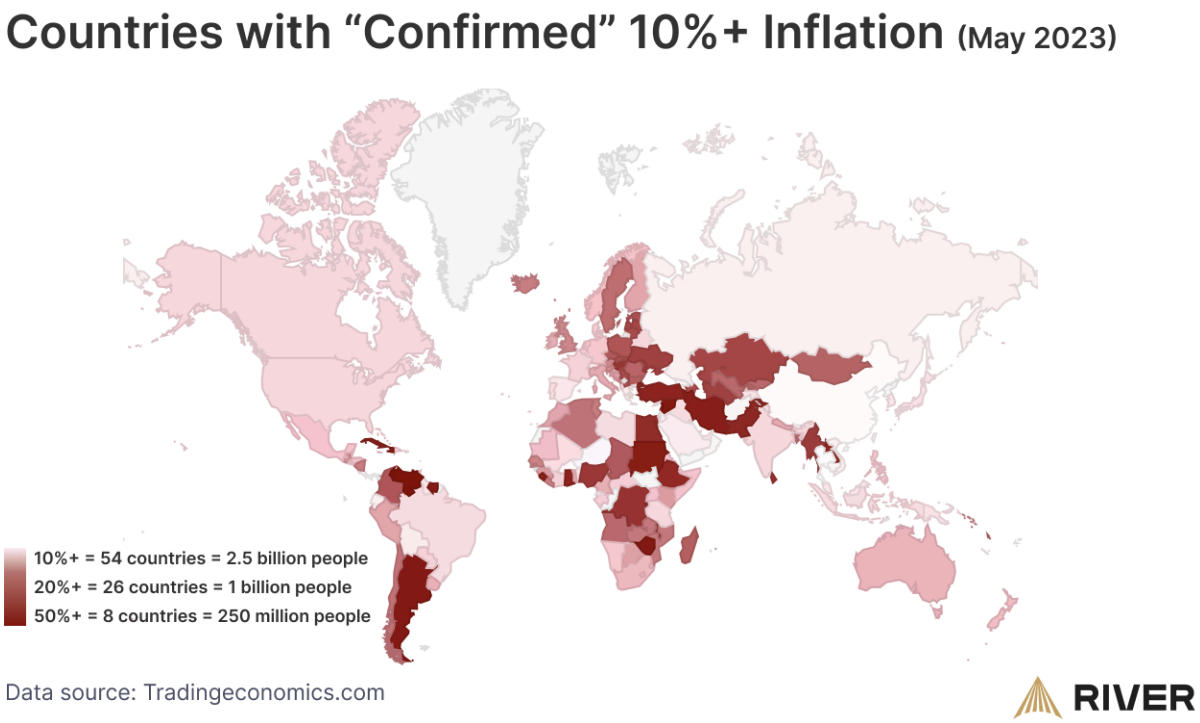
Out of convenience, passion, and because they care, many Bitcoiners try to explain Bitcoin to their family and friends. These are often not the people who would experience the most tangible and direct benefits from adopting it, nor those who understand that fiat currency is broken. Finding people who do understand this may lead to more success, such as:

- People who live or used to live in countries with double-digit inflation
- People whose countries of origin heavily rely on remittances
- People who live in countries with capital controls and black markets for currency

There is an overlap between the first two factors. People in countries with struggling currencies may migrate to earn an income for their families, but a lack of economic opportunity can be another cause. Ultimately, these people still migrate because of money.

As of May 2023, per government-defined inflation numbers around the world:

- 54 countries with a total of ~2.5 billion living in them have over 10% inflation.
- 26 countries with a total of ~1 billion people living in them have over 20% inflation.
- 8 countries with a total of ~250 million people living in them have over 50% inflation.



Below we look at the top 20 countries by remittance share of GDP from section 1.3. It gives an impression of where people move to provide for their families back home, which can be an interesting entry point for Bitcoin adoption.

Receiving country	Total received in 2021 (in millions of USD) & share of GDP	Top sending countries	Share received (in millions of USD)
Tonga	213 (44%)	United States New Zealand Australia	85 (40%) 75 (35%) 43 (20%)
Lebanon	6,394 (37%)	Saudi Arabia United States Australia Canada Germany	1,114 (17%) 1,001 (16%) 719 (11%) 702 (11%) 669 (11%)
Tajikistan	2,922 (33%)	Russia	2,307 (79%)
Kyrgyzstan	2,793 (33%)	Russia	2,018 (72%)
Samoa	248 (32%)	New Zealand Australia United States	105 (42%) 64 (26%) 56 (23%)
Jamaica	3,707 (27%)	United States Canada	2,710 (73%) 474 (13%)
The Gambia	547 (26%)	United States Italy Germany Spain	160 (29%) 86 (16%) 76 (14%) 69 (13%)
El Salvador	7,488 (26%)	United States	6,710 (90%)
Honduras	7,203 (25%)	United States	5,933 (82%)
Somalia	1,735 (24%)	Kenya United Kingdom United States Ethiopia	235 (14%) 214 (12%) 210 (12%) 195 (11%)
Nepal	8,203 (23%)	Saudi Arabia Malaysia India Qatar	1,692 (20%) 1,685 (20%) 1,583 (19%) 1,099 (13%)
Bermuda	1,574 (22%)	United States United Kingdom	981 (62%) 355 (23%)

Haiti	4,196 (20%)	United States Dominican Republic Chile	2065 (49%) 912 (22%) 481 (11%)
Palestine	3,393 (20%)	Jordan Syria Lebanon	1,868 (55%) 462 (14%) 389 (11%)
Kosovo	1,689 (19%)	Germany Switzerland	923 (55%) 420 (25%)
Comoros	243 (18%)	France	225 (93%)
Guatemala	15,400 (18%)	United States	15,395 (91%)
Cape Verde	312 (16%)	Portugal United States France	101 (32%) 73 (23%) 51 (16%)
Nicaragua	2,150 (15%)	Costa Rica United States	922 (43%) 909 (42%)
Moldova	2,100 (15%)	Russia Romania Ukraine	554 (27%) 527 (25%) 263 (13%)

Data source: KNOMAD / The World Bank - Bilateral Remittance Matrix

Locate the Right People and Communities

After identifying relevant audiences, the next challenge is to find the people. This could be a community or an individual who will help you to connect with a community.

Approaching them is a delicate matter. It is unusual that someone seeks out a specific community they have nothing in common with without commercial intentions. It has to be a genuine intent to help these people, or you may give them a bad impression of Bitcoin. Take time to get to know them, understand their values and the situation in their country of origin. Bitcoin does not fix all problems and is not directly applicable to everyone today. Perhaps you just make a friend and become more cultured.

If the person you have found is interested and eventually convinced, consider helping them put together a presentation for their community. They will be more credible than you, or may even need to do all of the storytelling due to language constraints.

This approach of trial and error helps the educator to step outside of their bubble, understand how complex and nuanced the world is, and that growing Bitcoin adoption requires effort.

Conclusion

Many initiatives have been undertaken over the years to boost Bitcoin adoption in cross-border payments. In absolute terms, adoption is small today, as Bitcoin's main function is currently not as a medium of exchange. Most users still prefer to hold their bitcoin, as the world continues to discover how big its role as a store of value can be. Nonetheless, adoption has been growing continuously across B2C, C2B, and C2C cross-border payments, and there are several legitimate use cases where people around the world depend on Bitcoin for their payments.

There are still unexplored features that could boost adoption, and the payments infrastructure built on top of the Bitcoin blockchain is still young and not yet widely supported across the industry. There continue to be promising new developments that boost scalability, privacy, and user experience.

User onboarding and the experience are major factors to grow Bitcoin adoption. Cost and speed alone may not be enough to convince all consumers to move over, and Bitcoin's core value proposition to be peer-to-peer money rather than being centrally controlled does not appeal to everyone. Understanding this will require introspection for some Bitcoin advocates, so they can improve how they onboard others into Bitcoin.

Finally, we want to revisit the European Central Bank's report and their verdict on Bitcoin's potential to be the holy grail of cross-border payments. They considered Bitcoin to be least likely to fulfill this role based on three cited reasons:

1. "The underlying technology (and in particular its "proof-of-work" layer) is inherently expensive and wasteful."

In their report, the authors state that "the holy grail of cross-border payments is a solution allowing cross-border payments to be immediate, cheap, universal, and settled in a secure settlement medium". At no point does this refer to how much energy such a system is allowed to use. Energy is not being wasted in Bitcoin, it is spent to secure the network from attacks so it can remain decentralized and useful to anyone. An individual can decide this is not useful to them personally, but it does not mean the energy was wasted as one might consider food waste.

2. "Bitcoin's comparative advantages depend on regulatory gaps which will be closed."

The authors identified the comparative advantages to be a lack of global regulation and compliance but did not acknowledge Bitcoin's advantages for people with no alternative payment methods, dissidents, or people struggling to maintain their purchasing power due

to capital controls and fixed exchange rates. They also completely ignored use cases of instant and native payments on the internet through the Lightning Network.

3. “Its price volatility makes it unsuitable as a unit of account.”

The transition to any alternative system will always come with volatility. The authors did not consider the possibility that eventually, volatility may decrease, nor that in the meantime, solutions are being built and can be used to reduce exposure to price volatility. Businesses around the world are building out payment networks in which they use Bitcoin to settle transfers among them, and users simply transact in their preferred currencies without any understanding of Bitcoin.

We believe that a pessimistic view of Bitcoin, the world’s first and most successful programmable money, is a pessimistic view of the ability of developers to create fundamentally better solutions than exist in the traditional sense. Betting against its success, rather than exploring its possibilities and improving them, will likely be viewed in the future as a complete recurrence of how the Internet was first received by incumbents of information control.

We are optimistic that humanity can do better than creating enormous government-controlled financial databases that empower them to systematically “encourage” behaviors that suit their interests, and punish those against their agendas.

Instead, we will have global, internet-native money that can be sent anywhere in seconds at a low cost. Building the required infrastructure and getting widespread adoption may take decades, but Bitcoin is not a centralized company with a CEO, a marketing engine, investor relations, lobbyists, and lawmakers. It is up to us Bitcoiners. We have to take ownership of how we educate people and help them access the network. And we have to improve Bitcoin in long-term sustainable ways so it can be the best form of money, with the best payment experience in the world.

River Lightning

If you are interested in taking action and getting your business involved, check out River Lightning at rls.dev for seamless integration of Lightning payments into your business.

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A special thank you to Austin Krauss for his help gathering research material and data for the first chapter of the report.

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NMLS ID#1906809