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The Bitcoin Market Potential Index

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Abstract: The Bitcoin Market Potential Index ranks the potential utility of bitcoin across 177 countries to show which countries have the greatest potential to see bitcoin adoption. The index utilizes a data set with 39 variables related to bitcoin's current core functions: store of value, medium of exchange, and technology platform. The variables are grouped into the index's seven equally weighted sub-indices: technology penetration, international remittances, inflation, informal economy size, financial repression, historical financial crises, and bitcoin penetration. Index rankings with standardized and normalized country level data both indicate that Argentina and Latin America are the country and region, respectively, where bitcoin has the greatest potential for adoption. It is argued that while bitcoin regulation can play an important, perhaps even decisive, role in bitcoin adoption it should be excluded as an index variable for now due to insufficient data and uncertainty over its ultimate impact.

1 Introduction

With over \$384 million of venture capital invested in bitcoin startups to date it would be helpful for entrepreneurs and investors who are planning where to locate or expand operations to better understand which markets may prove most fertile for bitcoin.¹ At the same time policymakers are seeking to gain a better understanding of the likelihood that the use of bitcoin will gather momentum in their respective jurisdictions.

The Bitcoin Market Potential Index (BMPI), which ranks bitcoin's potential utility (usefulness) across 177 countries, is the first attempt at providing a rigorous answer to the question of where bitcoin has both the most and least potential for *adoption*.² The BMPI can be useful for anyone who seeks a better understanding of the factors that may drive further bitcoin adoption, as well as where bitcoin adoption is more likely to take place in the months and years to come.

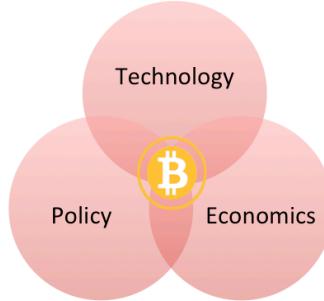
¹ CoinDesk's bitcoin venture capital database <http://www.coindesk.com/bitcoin-venture-capital/>

² In this paper the term adoption is used synonymously with utilization of bitcoin and block chain technology for a variety of monetary and non-monetary functions. At present bitcoin adoption measured through a number of metrics, such as number of transactions, number of bitcoin accepting businesses, exchange volume, number of wallets, and other metrics. The term market potential in this paper refers to in which countries will bitcoin have the greatest potential utility. In short, bitcoin's market potential in any given country is a function of its potential utility in that location.

Measuring bitcoin's potential utility

Situated at the rapidly evolving intersection of technology, policy and economics, any study of bitcoin's potential usefulness and prospects for adoption must be interdisciplinary (Figure 1).

Figure 1: Interdisciplinary Framework for Understanding Bitcoin's Potential Utility



In contemplating any measurement of bitcoin's potential for adoption one of the first questions that arises is precisely what kind of adoption should be measured? For example, should analysis focus on where bitcoin has the most potential to be used as a *store of value*? Or should bitcoin's value as a substitute *medium of exchange* take priority? Further, which of these two is more likely to influence bitcoin's adoption prospects? Answers to such questions influences the choice of index variables, data sources, and weightings.

The BMPI is designed to measure bitcoin's total potential utility and therefore includes variables and weightings that relate to bitcoin's function as both a new store of value and medium of exchange, as well as the block chain's emerging use as a non-monetary technology platform.

2 Index data and methodology

While more data does not always equate to 'better', or more accurate, index rankings, the introduction of as many relevant variables into the BMPI as can be obtained can help to provide a more nuanced view of the many forces that influence why bitcoin might prove more useful in one location over another. An effort was therefore made to include as many significant variables related to bitcoin's potential utility as were available.

An effort was also made to include in the BMPI data from a wide variety of reliable sources, including governments, multinational agencies, private companies and schol-

arly research. The most recent data available as of July 2014 was collected.³ In total nine principal sources of data were used to construct the BMPI (Table 1).

The relationships between most of the BMPI variables should be self-evident for those generally familiar with bitcoin. For example, bitcoin is fundamentally a technology, and the level of technology adoption in a country as reflected in measures such as internet use and mobile phone penetration will have an important influence on bitcoin adoption. In addition, the memory of recent financial crises, particularly hyperinflation or a currency crisis, will also have an influence on those seeking an alternative store of value. The greater the degree of technology penetration as well as frequency and size of financial crises for a particular country, then the higher that country will rank in the BMPI. International remittances are generally considered to be one of the market sectors that bitcoin is most likely to impact in the near-term because of the high fees and poor exchange rates, and so countries with relatively large remittance markets rank higher in the BMPI. Informal markets (black markets) were one of the first areas to see bitcoin used widely as a medium of exchange due to the anonymity offered by crypto currencies, and countries with a relatively large informal market rank higher in the BMPI. Countries with a high degree of financial repression in the form of capital controls, restrictions on ownership of gold and foreign banknotes, or other financial system restrictions will rank higher in the BMPI. Countries that have experienced a greater degree of bitcoin penetration in the form of measures such as venture capital backed startups and bitcoin client software downloads will also rank higher in the BMPI.

The BMPI is comprised of 39 variables deemed important to bitcoin's potential for adoption, and these 39 variables are grouped into seven equally-weighted sub-indices to calculate BMPI's rankings (Table 1).

³ In some instances the sources from Table 1 were supplemented or updated with other data where appropriate, including to reflect recent events. For example, Reinhart and Rogoff's 2010 financial crisis data were updated to include the July 2014 sovereign default by Argentina, as ruled by the International Swaps and Dealers Association. Due to space constraints in this paper a full list of all source supplementations and adjustments is available as a separate Appendix on the author's website: <http://www.garrickhileman.com/p/research.html>

Table 1: BMPI Index Variables and Data Sources

Sub-index	Variable	Sub Variable	Source
Inflation (1,0)	Inflation, consumer prices (annual %)		World Bank
Black market (1,0)	Informal economy as % of total economy		Elgin and Oztunali (2012)
Remittances (0,2)		Personal remittances, received (current US\$)* Personal remittances, received (as % of GDP)	World Bank World Bank
Technology Penetration (3,0)	Internet users per 100 people Mobile cellular subscriptions per 100 people Fixed broadband Internet per 100 people		World Bank World Bank World Bank
Financial Crises (1,5)	Hyperinflation (No. of years since 1980) Currency and inflation crises Other crisis episodes	Currency crises (No. of years since 1980) Inflation crises (No. of years since 1980) External default (No. of episodes since 1980) Domestic default (No. of episodes since 1980) Banking crisis (No. of years since 1980)	Reinhart & Rogoff (2010) Reinhart & Rogoff (2010) Reinhart & Rogoff (2010) Reinhart & Rogoff (2010) Reinhart & Rogoff (2010)
Financial repression (13,7)	Controls on the use of domestic currency Control on the use of foreign exchange among residents Controls on trade in gold (coins No. and/or bullion) Resident Accounts in domestic currency convertible into foreign currency Controls on exports and imports of banknotes Exports and Export Proceeds - Surrender requirements		IMF IMF IMF IMF IMF IMF

Sub-index	Variable	Sub Variable	Source
	Capital Transactions - Controls on capital transactions		IMF
	Capital Transactions - Repatriation requirements		IMF
	Capital Transactions - Surrender requirements		IMF
	Controls on real estate transactions - Purchase abroad by residents		IMF
	Controls on personal capital No. transactions		IMF
	Transfer of assets abroad by emigrants		IMF
	Transfer of assets into the country by immigrants		IMF
	Financial sector repression (provisions specific to the financial sector)	Borrowing abroad	IMF
		Maintenance of accounts abroad	IMF
		Lending locally in foreign exchange	IMF
		Purchase of locally issued securities denominated in foreign exchange	IMF
		Insurance companies - Limits (max.) on investment portfolio held abroad	IMF
		Pension funds - Limits (max.) on investment portfolio held abroad	IMF
		Investment firms and collective investment funds - Limits (max.) on investment portfolio held abroad	IMF
Bitcoin penetration (2,4)	Global Bitcoin nodes	a) Total nodes b) Nodes per capita	Bitnodes.io Bitnodes.io /World Bank
	Bitcoin software client downloads	a) Total client downloads b) Client downloads per capita	Sourceforge.net Sourceforge.net /World Bank
	Google 'bitcoin' search ranking		Google Trends
	Bitcoin VC investment (\$s per country)		CoinDesk

Index variable weighting

Some of the 39 BMPI variables will have a greater influence over bitcoin adoption than others and these variables therefore hold additional weight in the index. The different variable weights are detailed in Table 1 as follows: two numbers in parentheses follow each sub index (e.g., (1,5)). The first number inside the parentheses indicates the number of variables for each respective sub index whose score is not further comprised of any sub variables. This first-tier of stand-alone variables carry greater weight in the index than the sub variables. The second number in the parentheses indicates the number sub variables in each sub index that factor into the scores for their corresponding first-tier variables.

While the Inflation sub index (1,0) is based on a single first-tier variable (consumer price inflation) most of the sub-indices in Table 1 contain multiple variables. For example, the Financial Crises sub-index (1,5) has one stand-alone variable (Hyperinflation) and five sub variables (Currency crises, Inflation crises, External default, Domestic default, and Banking crisis). The first two sub variables (Currency crises, Inflation crises) comprise 50% each of the score for their corresponding first-tier variable, ‘Currency and inflation crises’. The other three sub variables (External default, Domestic default, and Banking crisis) comprise 33% each of the score for corresponding first-tier variable, ‘Other crisis episodes’.

A variety of factors went into weighting determinations. For example, the Bitcoin Penetration sub-index contains four first-tier variables. One of these first-tier variables, ‘Global bitcoin nodes’, is comprised of two equally weighted sub variables: total bitcoin nodes per country and bitcoin nodes per capita. Adding a per capita sub variable in this case helps ensure that the index is less skewed by large countries. Additional subjective weighting determinations were made, such as the decision to weigh individual (personal) measures of financial repression more strongly than institutional (bank and insurance) measures due to the reluctance at this stage of many financial institutions to explore the use of bitcoin.

Index ranking methodology

Data across the different variables was standardized using the following equation:

$$z = \frac{x - \bar{x}}{s}$$

Where x = each data point, \bar{x} = the average of the sample data points, s = the sample standard deviation, and z = the standardized data point. Data were also normalized to fit a scale of 0 to 1 using the following equation:

$$x_{0 \text{ to } 1} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Where x = each data point, x_{min} = the minimum value of the sample data points, x_{max} = the maximum value of the sample data points, $x_{0 \text{ to } 1}$ = the normalized data point, scaled from 0 to 1.

3 Results

The 10 countries with the highest relative potential for bitcoin adoption according to the Bitcoin Market Potential Index can be found in Table 4.

Table 2: BMPI Top 10 Countries (Standardized Data)

Ranking	Country Name
1	Argentina
2	Venezuela, RB
3	Zimbabwe
4	India
5	Nigeria
6	Brazil
7	United States
8	Nicaragua
9	Russian Federation
10	Iceland

Index rankings with normalized data was were broadly similar to standardized results. For example, the top three countries (Argentina, Venezuela, Zimbabwe) were the same under either method. Other countries that did change position saw a modest shift. For example, India ranked 4th and 7th when data were standardized and normalized, respectively. The largest change between the two methods was for the United States, which fell from a ranking of 7th to 58th when data were normalized. This change was largely due to the United States' high Bitcoin Penetration ranking and the fact that, put simply, normalization can reduce the effect of outliers on index rankings more than standardization.

Given the BMPI's criteria it is not surprising to see Argentina ranked number one. The country suffers from persistently high inflation, has a large informal economy and a history of recent financial crises. In addition, Argentina has a relatively high degree of technology penetration and controls on the movement of capital. Argentina also just defaulted on its sovereign debt for the second time in 13 years. While external sovereign defaults have a relatively minor weighting in the BMPI this recent development is reflected in the BMPI rankings.

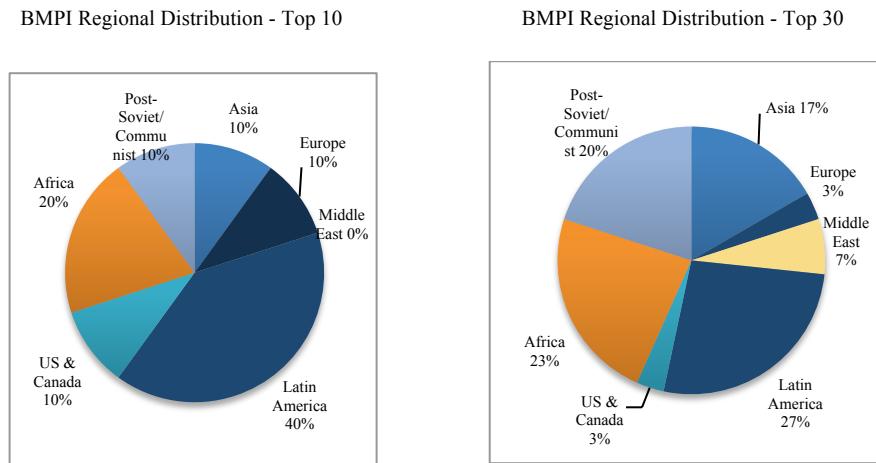
Like Argentina, number two ranked Venezuela also suffers from relatively high inflation and frequent financial crises, while number three ranked Zimbabwe has the largest informal economy (black market) of any country in the dataset at 63% of GDP. A country which often features in discussion of bitcoin adoption but which is just out-

side of the top-10 is China, which is ranked number 13. China's ranking is brought down by its relatively small black market.⁴

In contrast, near the bottom of the overall BMPI rankings at number 167 is Ireland, which recently hosted a high-profile bitcoin conference. While Ireland scores well in some categories, such as technology and bitcoin penetration, the country has wrestled with deflationary pressures in recent years and also has a relatively limited set of restrictions on the flow of capital. Dublin is a global tech hub, however, and the fact that the BMPI does not include a separate tech hub variable brings down Ireland's ranking.

Latin America is the most fertile region for bitcoin adoption, followed by Africa and Post-Soviet/Communist countries (Figure 2).

Figure 2: BMPI Regional Concentration

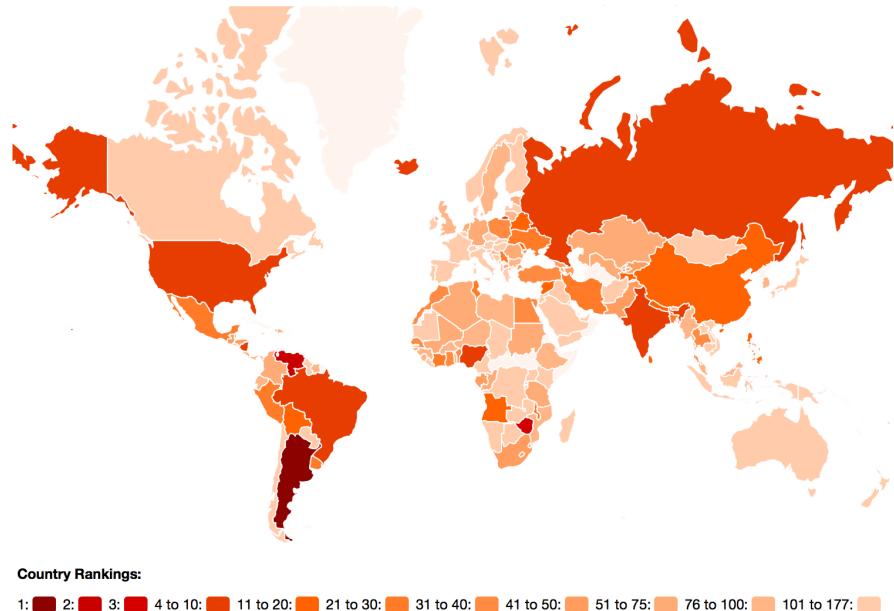


An interactive online BMPI 'heat map' is depicted below (Figure 3).⁵ A full list of the BMPI rankings is in Appendix A.

⁴ According to Elgin and Oztunali (2012) and other shadow economy researchers (Buehn and Schenider (2012), Schneider, Buehn and Montenegro (2010)) it is estimated that roughly 10% of the economic activity is conducted informally in China.

⁵ Interactive map is located at www.bitcoiniq.info

Figure 3: BMPI Online Interactive Heat Map*



*Note: interactive map is located at www.bitcoiniq.info

4 Research agenda

While the BMPI provides a useful reference for better understanding the factors that may influence bitcoin adoption it is important to acknowledge some of the index's current limitations and how those limitations can be addressed in future research. Specifically, a number of variables that will impact bitcoin adoption are not currently included in the index due to data availability. Variables with data available for a large number of countries were prioritized in the interest of allowing for maximum global coverage, while a number of relevant variables simply did not possess sufficient cross-country data.⁶ With bitcoin it could also have been useful (and more

⁶ For example, smartphone penetration data set is unfortunately only available for 48 countries (Our Mobile Planet <http://think.withgoogle.com/mobileplanet/en/>). If this variable were to be included in the index then the BMPI would then need exclude countries which do not have smartphone penetration data. This would result in a less global BMPI as the index would lose nearly 130 countries. In the specific case of smartphone penetration data, while not a perfect proxy other variables that are included in the index, such as broadband and mobile phone penetration, do also serve as an approximate proxy for smartphones. Another data point which could potentially be helpful for understanding bitcoin adoption is how quickly social norms spread across different countries. After all, using bitcoin requires at

precise) to examine which cities or regions may see the fastest bitcoin adoption. However, much of the relevant data is only available at country level and, as a result, the BMPI analysis is a country-level index.

Just as the choice of variables included in the BMPI must be defended some justification should be provided for why some variables were omitted from the BMPI. For example, one area that was excluded from the BMPI but which could have a significant influence on bitcoin adoption is bitcoin regulation. There are three primary reasons why bitcoin regulation was excluded from the BMPI for now: first, bitcoin regulation is a recent development and still evolving; second, it is unclear what bitcoin regulation actually signals; third, the efficacy of bitcoin regulation is uncertain. For example, more aggressive bitcoin regulation in countries such as Ecuador and Bolivia may ultimately serve as a significant barrier to bitcoin's prospects in those countries. However, aggressive bitcoin regulation could also provide a signal from regulators about bitcoin's positive adoption prospects in that country, as perhaps has been the case in China where bitcoin exchange trading volumes have continued to remain strong in spite of stricter bitcoin regulations. In sum, it is too early to tell how to score bitcoin regulation and this category has therefore not been included in the overall BMPI rankings.

The data set is structured in such a way that it can also be used to construct alternative versions of the index around different assumptions or use cases. For example, one may believe that bitcoin does not have as much immediate potential in the international remittances market as compared to its use as a store of value, or that another crypto currency such as Darkcoin will supplant bitcoin as the preferred crypto currency in the black market.⁷ Such scenarios can be incorporated into alternative calculations of the BMPI by removing the corresponding variables and or adjusting weights.

Finally, measuring actual bitcoin adoption against the BMPI forecast presents a number of challenges, including the lack of individual country data for many adoption metrics. Obtaining country level adoption data would help test the BMPI's accuracy.

least some change in existing behavior. However, the relevant study on smoking adoption and cessation only covered 25 countries (Lang et al 2014).

⁷ For more on Darkcoin see <http://www.wired.com/2014/05/darkcoin-is-booming/>

Sources

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Appendix A – BMPI Rankings (Standardized)

Ranking	Country	Ranking	Country	Ranking	Country	Ranking	Country Name	Ranking	Country Name
1	Argentina	36	Ghana	71	Netherlands	106	Italy	141	Sao Tome and Principe
2	Venezuela, RB	37	Senegal	72	St. Vincent and the Grenadines	107	Burundi	142	Laos
3	Zimbabwe	38	Turkey	73	Dominican Republic	108	Hungary	143	Greece
4	India	39	Panama	74	Swaziland	109	St. Lucia	144	Cambodia
5	Nigeria	40	Benin	75	Germany	110	Trinidad and Tobago	145	San Marino
6	Brazil	41	Guatemala	76	Suriname	111	Chad	146	Australia
7	United States	42	Gabon	77	Jamaica	112	Congo, Dem. Rep.	147	Cameroon
8	Nicaragua	43	Lesotho	78	Korea, Rep.	113	Cyprus	148	Botswana
9	Russian Federation	44	Honduras	79	Togo	114	Vietnam	149	Singapore
10	Iceland	45	Kyrgyz Republic	80	Grenada	115	Portugal	150	Chile
11	Angola	46	South Africa	81	Sweden	116	Albania	151	Kenya
12	Belarus	47	Pakistan	82	Guinea	117	Latvia	152	Austria
13	China	48	Dominica	83	Bulgaria	118	Finland	153	Israel
14	Bolivia	49	Georgia	84	Samoa	119	Curacao	154	Uganda
15	Tajikistan	50	Azerbaijan	85	Ecuador	120	Antigua and Barbuda	155	Maldives
16	Moldova	51	Armenia	86	Lithuania	121	Belgium	156	Czech Republic
17	Syria	52	Uzbekistan	87	Burkina Faso	122	Zambia	157	Yemen, Rep.
18	Nepal	53	St. Kitts and Nevis	88	Bhutan	123	Madagascar	158	Qatar
19	Philippines	54	Mali	89	Niger	124	Seychelles	159	Mauritius
20	Sri Lanka	55	Estonia	90	Malaysia	125	Comoros	160	Iraq
21	Serbia	56	El Salvador	91	Fiji	126	Denmark	161	Japan
22	Uruguay	57	Guinea-Bissau	92	Croatia	127	Bahamas, The	162	Afghanistan
23	Ukraine	58	Romania	93	Hong Kong SAR, China	128	Liberia	163	New Zealand
24	Iran, Islamic Rep.	59	Haiti	94	Solomon Islands	129	Indonesia	164	Slovak Republic
25	Malawi	60	Algeria	95	United Kingdom	130	Tonga	165	Jordan
26	Peru	61	Belize	96	Sierra Leone	131	Malta	166	United Arab Emirates
27	Tunisia	62	Costa Rica	97	Ethiopia	132	Slovenia	167	Ireland
28	Bangladesh	63	Aruba	98	Myanmar	133	Canada	168	Rwanda
29	Mexico	64	Colombia	99	Mozambique	134	Guyana	169	Papua New Guinea
30	Cote d'Ivoire	65	Lebanon	100	Libya	135	Paraguay	170	Timor-Leste
31	Barbados	66	Macedonia, FYR	101	Norway	136	Gambia, The	171	Mongolia
32	Egypt, Arab Rep.	67	Tanzania	102	France	137	Spain	172	Brunei Darussalam
33	Morocco	68	Congo, Rep.	103	Namibia	138	Mauritania	173	Saudi Arabia
34	Poland	69	Kazakhstan	104	Montenegro	139	Switzerland	174	Kuwait
35	Thailand	70	Sudan	105	Bosnia and Herzegovina	140	Luxembourg	175	Bahrain
								176	Djibouti
								177	Vanuatu