



that money “is typically defined by economists as having three attributes: it functions as a medium of exchange, a unit of account, and a store of value” (p. 32). He then argues that, since bitcoin fares poorly in these three respects, it should not be considered money.<sup>4</sup>

In what follows, we offer a more conventional view. In Section 1, we consider Yermack (2015)’s argument. We maintain that the standard approach classifies an item as money if and only if it functions as a commonly-accepted medium of exchange. In Section 2, we show that the demand for bitcoin is comparable to the demand for many government-issued monies. Then, in Section 3, we discuss some problems with using this estimate as an indicator of the extent to which bitcoin functions as a medium of exchange. We argue that bitcoin is money—though perhaps only over a relatively small domain at present.

## 1. What is money?

Yermack’s view—that bitcoin is not really money—rests on the idea that a money functions as a medium of exchange, store of value, and unit of account. “Bitcoin somewhat meets the first of these criteria,” Yermack (2015, p. 32) concedes, “because a growing number of merchants, especially in online markets, appear willing to accept it as a means of payment. However, the worldwide commercial use of bitcoin remains minuscule, indicating that few people use it widely as a medium of exchange.”

It fares far worse, he claims, on the second and third criteria. Specifically, Yermack (2015) notes that the excessive volatility and prospect of theft make bitcoin a poor store of value, while the disparity of prices prevailing at any one time across different exchanges and the need to quote prices out to four or five decimal places with a string of leading zeros make bitcoin a poor unit of account.

Contrary to Yermack’s claim, economists do not typically define money as an item that functions as a medium of exchange, store of value, and unit of account. Rather, they define money as a commonly (or, generally) accepted medium of exchange. They then go on to note that monies often serve the three functions identified by Yermack and consider what attributes are likely to enable a money to serve those functions well. For example, in a leading money and banking textbook, Mishkin (2019, p. 49) writes, “Economists define *money* (also referred to as the *money supply*) as anything that is generally accepted as payment for goods or services or in the repayment of debts.” Likewise, a teaching resource made available by the Federal Reserve Bank of Philadelphia (2013) lists as its objectives that students will “1. Define money as anything widely accepted as final payment for goods and services. 2. Explain how money acts as a medium of exchange, unit of account, and store of value. 3. Evaluate an item’s usefulness as money based on the characteristics of ‘good’ money.” This standard textbook treatment of money as a commonly-accepted medium of exchange is also in line with the standard models of money employed by monetary economists following the pioneering work of Kiyotaki and Wright (1989, 1991, 1993).<sup>5</sup>

In addition to confusing the definition of money with the common functions of money, Yermack also confuses those functions with the characteristics of a good money. To say that an item functions as a store of value from the time it is acquired,  $t$ , to some future period,  $t+n$ , merely means that it maintains a positive exchange value through  $t+n$ . It might nonetheless be a *poor* store of value,

perhaps because its exchange value is highly volatile or declines significantly over the period. It seems reasonable to predict that buyers and sellers would be less likely to adopt an item as money if its value were unstable and unreliable and alternatives are available and permissible.<sup>6</sup> But “less likely” falls far short of “disqualifying,” as Cuadras-Morató (1997) makes clear. Much the same could be said with respect to the unit of account function.

The distinction between the definition of money, common functions of money, and characteristics of a good money matters for assessing whether an item should be classified as money. If an item meets the definition, then it is money. If it does not meet the definition, then it is not money. Whether it is capable of serving the other functions well might improve or diminish the likelihood that an item becomes money, but is irrelevant for the purpose of classification. All that matters for assessing whether an item is money is the extent to which it is accepted.

Since most monies perform the common functions reasonably well, extreme examples serve to illustrate. Consider, for example, episodes of hyperinflation (Hanke, 2019). Who would deny that a hyper-inflating money is a poor store of value and a poor unit of account? And, yet, it is not uncommon to see transactions executed in the hyper-inflating money, especially when alternatives are difficult to come by or prohibited by law. The standard approach maintains that a hyper-inflating money continues to be classified as such so long as it continues to function as a commonly-accepted medium of exchange (though perhaps less commonly than before).

The case of Brazil’s *Plano Real* in 1994 provides an especially extreme example (Flynn, 1996). The *cruzeiro real* was a poor store of value and a poor unit of account, but continued to serve as a commonly-accepted medium of exchange. Prior to replacing it with the *real*, the Brazilian government first introduced a new unit of account called the *unidade real de valor* (URV). Each day, the government announced the exchange rate between the *cruzeiro real* and the URV. Since there were no URV in circulation—and, indeed, would never be any URV in circulation—it could not function as a medium of exchange or store of value. But shopkeepers found it convenient to post prices in URV, while accepting *cruzeiro real* as payment at the current exchange rate. Four months later, the government introduced the *real* at parity with the URV. But, during those four months (and the brief transition period that followed), Brazilians continued using the *cruzeiro real* as a medium of exchange despite its poor performance as a store of value and its significantly diminished role as a unit of account. In other words, the *cruzeiro real* continued to serve as money in Brazil until it was ultimately replaced.

## 2. Demand for bitcoin

As discussed in Section 1, the standard approach requires that an item be classified as money if and only if it is a commonly-accepted medium of exchange. This approach is not without its shortcomings, to be sure. For one, there is no obvious demarcation between occasionally accepted and commonly accepted. One might circumvent the issue, however, by comparing the extent to which an item is accepted with that of other items widely thought to warrant the label of money.

Although transactions data is not readily available for the base monies used throughout the world, one might estimate the demand for these monies by calculating the market capitalization of their supplies. And, since the market capitalization of bitcoin is readily available, such estimates would facilitate comparisons with

<sup>4</sup> Luther and Olson (2015) discuss bitcoin’s similarities to the concept of memory—or, record-keeping device—in the monetary economics literature.

<sup>5</sup> Luther (2016c) surveys the literature. See also Lagos and Wright (2005), Luther (2014), Rupert, Schindler, Shevchenko, and Wright (2000) and Hogan and Luther (2019).

<sup>6</sup> On the debate between Milton Friedman and F.A. Hayek regarding the extent to which individuals would switch between monies in the absence of legal restrictions, see Luther (2013).

**Table 1**  
Missing government-issued monies.

Money	Money
Argentine peso	Jordanian dinar
Aruban florin	Kiribati dollar
Bahraini dinar	Lebanese pound
Barbadian dollar	Liberian dollar
Bermudian dollar	Malawian kwacha
Bhutanese ngultrum	Mauritanian ouguiya
British pound	Netherlands Antillean guilder
Burmese kyat	New Taiwan dollar
Cambodian riel	Nigerian naira
Central Pacific franc	Omani rial
Eritrean nakfa	renminbi
Ethiopian birr	Rwandan franc
euro	Saudi riyal
Fijian dollar	Singapore dollar
Ghanaian cedi	Sri Lankan rupee
Guinean franc	Sudanese pound
Indian rupee	Swiss franc
Iranian rial	Uzbekistani som
Israeli shekel	Vanuatu vatu
Jamaican dollar	Yemeni rial
Japanese yen	

bitcoin.<sup>7</sup> In what follows, we briefly describe the data used to make these estimates and then compare the demand for bitcoin with the demand for government-issued base monies.

The market capitalization of a given base money can be calculated by multiplying the total quantity of the base money outstanding by its market price. We retrieved data from the [International Monetary Fund \(2019\)](#) on monetary base supplies and exchange rates in 2018, the most recent year for which data is available. There are four series for the monetary base. In selecting a measure of the base for each country, we employ the following preference ranking:

1. Monetary, Central Bank Survey, Monetary Base, Domestic Currency (FASMB.XDC).
2. Monetary, Central Bank Survey, Monetary Base, US Dollars (FASMB.USD).
3. Monetary, Base Money, Domestic Currency (FMA.XDC).
4. Monetary, Base Money, US Dollars (FMA.USD).

For example, if a country reports (1), (2), (3), and (4), we select (1). If a country reports (2), (3), and (4), we select (2). And so on.<sup>8</sup> We then multiply the selected base supply by Exchange Rates, Domestic Currency Per US Dollar, Period Average, Rate (ENDA.XDC.USD.RATE), which is set equal to 1 for those countries reporting their base supplies in US dollars, to calculate the dollar value of the market capitalization. Finally, we combine countries that operate in a common currency union.<sup>9</sup>

We identify 41 missing government-issued monies in [Table 1](#). Many of these monies circulate in relatively small regions, among relatively small populations, or both. However, a few of the listed

<sup>7</sup> [White \(2015\)](#) offers an earlier analysis along these lines for the cryptocurrency market more generally.

<sup>8</sup> Our preference ranking is based exclusively on the fact that there are more observations available via the central bank survey. As of April 29, 2019, the selection scheme is inconsequential since no country reports more than one observation for 2018.

<sup>9</sup> The West African CFA franc includes the monetary bases reported by Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo. The Central African CFA franc includes Cameroon, Central African Republic, Chad, Republic of the Congo, Equatorial Guinea, Gabon, which also uses the Central African CFA franc, did not report. The East Caribbean dollar includes Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines.

monies—including the British pound, euro, Indian rupee, renminbi, and Japanese yen—seem likely to have a relatively large market capitalization. One should keep these omissions in mind when considering the relative standing of bitcoin in the global monetary system.

The market capitalization of bitcoin is available from [CoinMarketCap \(2019\)](#). To facilitate comparisons with the aforementioned government-issued base monies, we focus initially on the market capitalization of bitcoin in 2018. From January 1, 2018 to December 31, 2018, the market capitalization of bitcoin ranges from a low of 56.40 (December 15) to a high of 294.22 (January 6) billion USD. The mean market capitalization is 129.27 billion USD, while the median is 117.51 billion USD (July 7). The standard deviation is 40.54 billion USD.

We present the market capitalizations of one hundred six government-issued monies in [Table 2](#) alongside the mean market capitalization of bitcoin for 2018. They range from 0.07 (São Tomé and Príncipe dobra) to 3411.50 (United States dollar) billion USD. The mean market capitalization of government-issued monies is 56.72 billion USD, while the median is just 5.47 billion USD. The standard deviation is 332.07 billion USD. The combined market capitalization of all government-issued monies for which data is readily available is 6012.63 billion USD, suggesting that the US dollar accounted for around 56.74 percent of the government-issued base money market in 2018.

Demand for bitcoin in 2018, as estimated by its market capitalization, was comparable to that of many government-issued monies. Only six of the government-issued monies for which data is readily available had a market capitalization (measured in billion USD) greater than the mean market capitalization of bitcoin: United States dollar (3411.50), Russian ruble (256.33), Hong Kong dollar (217.71), Brazilian real (195.91), South Korean won (156.61), Czech koruna (134.40). At its low, the market capitalization of bitcoin exceeded all but 18 of those for which data is readily available, putting it in the 83rd percentile of monies considered herein. At its high, the market capitalization of bitcoin exceeded all but the United States dollar, putting it in the 98th percentile. Finally, when the mean market capitalization of bitcoin is included with the other base monies presented in [Table 2](#), we find that bitcoin accounted for roughly 2.10 percent of the base money market in 2018.

To consider demand for bitcoin over time, we present the market capitalization of bitcoin in billion USD from January 2014 to September 2019 in [Fig. 1](#). We also include market capitalizations for the Russian ruble, South Korean won, Polish złoty, Australian dollar, Bangladeshi taka, and Honduran lempira, all of which were calculated with data from the [International Monetary Fund \(2019\)](#) using the approach outlined above. These monies were selected for comparison because they correspond roughly to the 98th, 95th, 90th, 85th, 75th, and 50th percentiles of government-issued base monies in 2018.

Although the demand for bitcoin varied considerably over the period, it was nonetheless comparable to that of government-issued monies and, indeed, exceeded the demand for most government-issued monies over much of the period.<sup>10</sup> From January 2014 to January 2016, the demand for bitcoin was similar to that of the Honduran lempira. The mean (median) market capitalizations of bitcoin and the Honduran lempira were 5.35 (4.87) and 4.05 (4.07) billion USD, respectively. In May 2017, demand for bitcoin surpassed that of the Bangladeshi taka. It rose above the Australian dollar and then the Polish złoty in August 2017; briefly dipped back below them in September 2017; and remained above

<sup>10</sup> Recall that each government-issued base money presented in [Fig. 1](#) has a market capitalization in the top half of the distribution of all government-issued base monies for which data is readily available in 2018.

**Table 2**  
Market capitalization of government-issued monies and bitcoin, billion USD, 2018.

Money	Market cap	Money	Market cap
United States dollar	3411.50	Honduran lempira	5.42
Russian ruble	256.33	Kenyan shilling	5.15
Hong Kong dollar	217.71	Paraguayan guaran	4.98
Brazilian real	195.91	Afghan afghani	4.62
South Korean won	156.61	Belarusian ruble	4.23
Czech koruna	134.40	Trinidad & Tobago dollar	3.94
bitcoin	129.27	Albanian lek	3.92
United Arab Emirates dirham	103.38	Uruguayan peso	3.76
Turkish lira	101.75	Salvadorian centavos	3.38
Mexican peso	87.00	Zimbabwean dollar	3.26
Polish złoty	82.61	Georgian lari	3.10
Indonesian rupiah	82.01	Tanzanian shilling	3.09
Egyptian pound	76.45	Mauritian rupee	2.97
Canadian dollar	69.80	East Caribbean dollar	2.97
Philippine piso	63.39	Haitian gourde	2.92
Australian dollar	60.82	Moldovan leu	2.59
Thai baht	59.67	Armenian dram	2.54
Algerian dinar	57.10	Mozambican metical	2.11
Iraqi dinars	56.78	Mongolian tögrög	2.10
Pakistani rupee	46.12	Brunei dollar	2.07
Libyan dinar	44.98	Ugandan shilling	2.06
Malaysian ringgit	38.56	Macedonian denar	2.05
Colombian peso	33.18	Nicaraguan córdoba	1.95
West African CFA franc	31.55	Panamanian balboa	1.82
Moroccan dirham	30.11	Tajikistani somoni	1.70
Hungarian forint	28.28	Papua New Guinean kina	1.60
Bangladeshi taka	27.93	Kyrgyzstani som	1.59
Romanian leu	25.46	Malagasy ariary	1.55
Kuwaiti dinar	25.16	Congolese franc	1.54
Qatari riyal	22.77	Botswana pula	1.44
South African rand	20.55	Israeli shekel	1.41
Bulgarian lev	20.31	Icelandic krna	1.34
Kazakhstani tenge	19.29	Bahamian dollar	1.33
Swedish krona	19.18	Zambian kwacha	1.30
Peruvian sol	18.67	Guyanese dollar	0.86
Chilean peso	17.61	Maldivian rufiyaa	0.75
Croatian kuna	16.65	South Sudanese pound	0.71
Danish krone	16.26	Surinamese dollar	0.67
Ukrainian hryvnia	16.02	Namibia dollar	0.62
Bolivian boliviano	11.79	Cape Verdean escudo	0.62
Guatemalan quetzal	11.56	Belize dollar	0.40
Costa Rican colón	11.46	Solomon Islands dollar	0.39
Norwegian krone	10.45	Djiboutian franc	0.38
New Zealand dollar	10.13	Burundian franc	0.32
Dominican peso	7.82	Sierra Leonean leone	0.31
Serbian dinar	7.77	Seychellois rupee	0.27
Tunisian dinar	7.43	Gambian dalasi	0.25
Central African CFA franc	7.00	Comorian franc	0.18
Angolan kwanza	6.76	East Timor centavo	0.18
Bosnia & Herzegovina convertible mark	6.28	Lesotho loti	0.15
Azerbaijani manat	6.26	Tongan pa'anga	0.15
Nepalese rupee	5.78	Samoan tālā	0.14
Macanese pataca	5.55	São Tomé & Príncipe dobra	0.07
Ecuadorian centavo	5.53		

them from October 2017 to November 2018 and then after March 2019. Over the whole period, the mean (median) market capitalization of bitcoin was 53.46 (11.35) billion USD, while those of the Russian ruble, South Korean won, Polish złoty, Australian dollar, Bangladeshi taka, and Honduran lempira were 211.88 (214.64), 126.16 (121.93), 59.70 (56.63), 55.12 (55.83), 22.77 (23.76), and 4.60 (4.45), respectively.

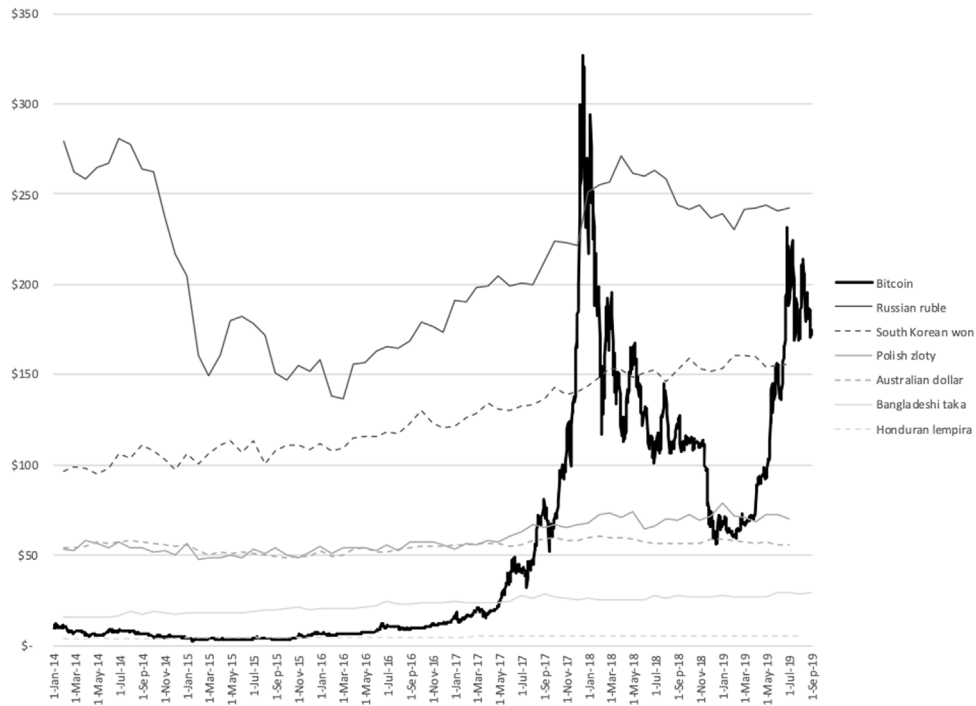
### 3. Further considerations

As shown in Section 2, the demand for bitcoin was comparable to that of many government-issued monies in 2018. However, that is not sufficient for classifying bitcoin as money. Recall that, to be considered money, bitcoin must function as a commonly-accepted medium of exchange. While we have shown that the demand to

hold bitcoin is comparable to that of other items widely regarded as money, we have not shown that the *transactions demand* for bitcoin is comparable to that of those other items.

What is the alternative? It is possible that the *speculative demand* for bitcoin is high. Indeed, Yermack (2015, p. 42) maintains that its “excessive volatility [...] is more consistent with the behavior of a speculative investment than a currency.” If the primary source of bitcoin’s demand is speculative in nature, rather than transactional, then it would be inappropriate to conclude that bitcoin is money in the conventional sense of the term.

That bitcoin is primarily a speculative asset seems readily apparent to many commentators, though evidence for this view is rarely given. Still, it is worth considering the source of that supposed speculation. “Because bitcoin has no intrinsic value,” Yermack (2015, p. 36) writes, “it’s worth ultimately hinges on its usefulness as



**Fig. 1.** Market capitalization of bitcoin and select government-issued monies, billion USD, January 2014–September 2019.

a currency in the consumer economy.”<sup>11</sup> Bitcoin serves no non-monetary purpose. Its only usefulness, if it has any use at all, is in functioning as a medium of exchange. Hence, speculation must ultimately be concerned with the extent to which bitcoin will function as a medium of exchange. In other words, the high demand for bitcoin described in Section 2 implies either that (i) bitcoin is widely-used as a medium of exchange, (ii) is expected to be widely-used as a medium of exchange in the future, or (iii) some combination thereof, since any speculative demand for bitcoin—an intrinsically worthless item—is merely an estimate of future transactions demand.

Without reliable transactions data, it is difficult to assess the extent to which bitcoin is employed as a medium of exchange relative to other items usually classified as money. However, even if such data were available, classifying bitcoin would nonetheless be challenging. Although it might seem relatively straightforward (i.e., just compare the number of bitcoin transactions with those of government-issued monies), the standard conception of money is, in fact, a bit more nuanced than that. Indeed, a given item can be money and not money at the same time—a sort of Schrödinger’s money, if you will.

To see this, consider similar questions for which there is widespread agreement. Is the Guatemalan quetzal money? No one would deny that it is money in Guatemala, where it functions as a commonly-accepted medium of exchange. But few would maintain that it is money in the United States, since one would be hard-pressed to find anyone willing to accept quetzales in exchange for most goods and services there. The United States dollar, in contrast, is routinely accepted in the United States, but also in major cities around the world, like Guatemala City, and sometimes in less-densely populated areas as well. Its status as money holds over a much larger domain.

When considering whether an item is money, then, one must specify the domain over which the item is being evaluated. The number of transactions required to state that an item is commonly accepted over a large domain is greater than that required for a small domain, where the size of a domain corresponds to the total number of transactions in the domain. With this in mind, one might readily concede that bitcoin is not currently a global rival to the dollar, though its market capitalization suggests it might someday get to that point. And, yet, it would be hard to deny that there is a small corner of the internet where transactions are routinely conducted with bitcoin serving as the medium of exchange. Over that domain, bitcoin is money.

#### 4. Conclusion

Is bitcoin money? Yermack (2015) answers in the negative. However, his analysis rests on a non-standard conception of money. In particular, he confuses the definition of money (i.e., a commonly-accepted medium of exchange) with the common functions of money (i.e., medium of exchange, store of value, unit of account) and the characteristics of a good money (i.e., stability, durability, portability, divisibility, uniformity, etc.). Contra Yermack, the standard approach to considering whether an item is money merely requires one assess the extent to which it functions as a medium of exchange over the relevant domain.

We use the market capitalizations of government-issued monies as an estimate of their respective demands and show that the demand for bitcoin, similarly measured, is comparable to the demand for many government-issued monies. Indeed, only six of the one hundred six government-issued monies for which data is readily available had a market capitalization greater than the mean market capitalization of bitcoin in 2018. We are unable to determine the extent to which the demand for bitcoin is transactional, rather than speculative. Hence, we cannot conclude definitively whether bitcoin is widely-accepted or expected to be widely-accepted at some point in the future. Nonetheless, we argue that bitcoin’s routine use as a medium of exchange among some digi-

<sup>11</sup> As Luther (2018) explains, the term “intrinsic value” is not meant to imply an objective exchange value apart from the subjective valuations of market participants. It merely denotes whether an item serves any purpose other than as a medium of exchange.

tal transactors makes it worthy of the label money, if only over a relatively small domain.

### Conflict of interest

There are no conflicts of interests to be reported.

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