



Bitcoin and the bailout

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ARTICLE INFO

Article history:

Received 1 December 2015

Received in revised form 18 January 2017

Accepted 23 January 2017

Available online 31 January 2017

JEL codes:

E40

E42

E49

Keywords:

Bitcoin

Cryptocurrency

Currency competition

Medium of exchange

Payment system

ABSTRACT

On March 16, 2013, Cyprus announced that it would accept a bailout that required imposing a one-time levy on bank deposits. It has been argued that, by making traditional deposit accounts seem less secure, the bailout announcement prompted some to consider—or reconsider—using the cryptocurrency bitcoin. Relying on rank data for a subset of apps, existing studies maintain that interest in bitcoin increased following the announcement, especially in countries with troubled banks. We argue that (1) focusing on a subset of apps does not allow one to distinguish a general increase in the demand for bitcoin apps from a substitution between bitcoin apps and (2) changes in rank data are a poor predictor of changes in the number of downloads. In order to address these concerns, we collect rank data for all fifteen bitcoin apps available at the time and use an established technique to estimate an index of downloads for each country considered. We find that, while downloads of bitcoin apps increased following the announcement, the observed effect was not especially pronounced in countries thought to have had troubled banking systems at the time.

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1. Introduction

On March 16, 2013, Cyprus announced that it would accept a €10 billion bailout to recapitalize its banking system. The agreement reached with the Eurogroup, European Commission, European Central Bank, and International Monetary Fund would require closing the country's second-largest bank and imposing a one-time levy on bank deposits. The initial terms announced included a 6.75% levy on deposit balances less than 100,000 euros and a 9.9% levy on deposit balances in excess of 100,000 euros (Christie & Ruhe, 2013).¹ A modified version of the plan ultimately saw no levies issued on deposit balances less than 100,000 euros—the maximum amount covered by European Union deposit insurance. Balances in excess of 100,000 euros were converted at just 37.5 cents on the euro (Tagaris, 2013).

The reactions of major commentators at the time of the initial announcement suggest that such a policy had not been anticipated. A BBC (2013a) headline described “Shock in Cyprus as savers face bailout levy.” Writing for Forbes, Tim Worstall (2013) warned that it “could be setting an entirely disastrous precedent for the entire European banking system.” Those with deposits in Cypriot banks had been caught off guard—and were none too happy about it. Those holding deposits in other countries with troubled banking systems worried they might be next.

If the announcement were a shock, as is widely believed, it might also correspond to a genuine shift in expectations regarding the set of policies a government might employ when dealing with undercapitalized banks. Prior to the announcement, few if any expected a deposit levy was on the table—and those acknowledging the existence of such a policy surely thought the odds it would be implemented were quite low. After the announcement, however, it was clear that such a policy could be adopted—and those acknowledging the prospect in advance almost certainly thought it more likely to be implemented.

If the announcement marks a genuine shift in expectations, where people no longer believe traditional deposit accounts are as secure as previously thought, it might prompt them to reconsider which liquid assets to hold. In particular, one might expect the bailout announcement prompted some to consider (or

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¹ There are conflicting reports concerning the extent to which Cypriot President Nicos Anastasiades supported the levy on small depositors. Traynor and Smith (2013) claim he was “keener on spreading the burden, fearful of scaring off the wealthy Russians with too punitive levies.” In public, Anastasiades vowed “to fight with the eurogroup to amend their decisions in the coming hours to limit the impact on small depositors” (BBC, 2013b).

reconsider) the relatively new cryptocurrency, bitcoin.² Like traditional deposit accounts, bitcoin can be transferred electronically to make payments. Unlike traditional deposit accounts, bitcoin cannot be acquired without the accountholder's permission. Hence, the bailout announcement—insofar as it represents a genuine shift in expectations concerning the risk that traditional deposit account balances would be seized—might prompt some to consider using bitcoin instead of traditional deposit accounts.

Kuittinen (2013) is, to our knowledge, the first to note the possibility that the Cyprus bailout announcement would encourage some users to consider bitcoin. To be sure, it was too late for those holding funds in Cypriot banks to avoid the deposit levy. However, those concerned that future levies would follow—in Cyprus or elsewhere—might transition to bitcoin in order to avoid the risk of appropriation. Indeed, Kuittinen (2013) notes an increase in popularity—as measured by rank—for several bitcoin apps on the Spanish iPhone market immediately following the bailout announcement:

Bitcoin Gold shot up [...] from 498 to 72, and another app called Bitcoin Ticker zoomed from 526 to 52 in just one day. A leading service called Bitcoin App jumped from 194 to 151 between Friday and Sunday as Spaniards brooded over the Cyprus crisis.

Recall that Spain had a similarly troubled banking system at the time and, hence, might have been thought to be considering its own deposit levy.

The observation that bitcoin-related apps climbed the rankings in a country with a troubled banking system would seem to support the hypothesis that some turned to bitcoin following the bailout announcement. However, Kuittinen (2013) offers little more than anecdotal evidence. He notes that a similar surge does not appear to have happened in Cyprus, but does not make systematic cross-country comparisons; nor does he attempt to control for potential day-of-the-week biases.

With these objections in mind, Luther and Olson (2014) collect download rank data for the popular bitcoin app BitGold for ten countries (Cyprus, Portugal, Ireland, Italy, Greece, Spain, France, Germany, United Kingdom, and United States) over the seven-day periods before and after the bailout announcement. They find that the average increase in download rankings “were typically larger in countries suspected of having troubled banking systems than those occurring in non-troubled eurozone and non-euro countries” (p. 29).

We find two problems with the existing literature. First, in considering a subset of all bitcoin-related apps available at the time, Kuittinen (2013) and Luther and Olson (2014) are unable to distinguish a general increase in the demand for bitcoin apps from a substitution between bitcoin apps. As such, they cannot rule out that (perhaps for reasons entirely unrelated to the bailout) users were switching from other apps to the subset of apps they consider—i.e., that there was no change in the overall popularity of bitcoin following the bailout announcement. Second, since app download data is not publicly available, Kuittinen (2013) and Luther and Olson (2014) rely on app download rank data. If fewer downloads are required to move up the rankings from a lower starting point than a higher starting point, one cannot be sure that a large rank increase observed in Country A corresponds to larger increase in relative popularity than a small rank increase observed in Country B when the initial ranking of Country A is lower than that of Country B. Hence, the relatively large rank increases Luther and Olson (2014) find in countries suspected of having a troubled

Table 1

List of bitcoin tracker apps available March 9–22, 2016.

Name	Price	Introduced	Category
Bitcoin App	2.99	6/2/2011	Finance
Bitcoin App FREE	Free	9/16/2011	Finance
Bitcoin Explorer	Free	7/15/2011	Finance
BitCoin Gold	Free	5/17/2012	Finance
Bitcoin Miner Stats	0.99	7/1/2011	Utilities
BitCoin Price	Free	7/18/2011	Finance
Bitcoin Quote	Free	Unavailable	Finance
BitCoin Stats	Free	2/26/2013	Utilities
Bitcoin Ticker	Free	6/30/2011	Finance
BitCoins Mobile	2.99	7/22/2011	Finance
BitRate Bitcoin Monitor	Free	7/21/2011	Utilities
BTCmon Bitcoin Monitor	0.99	9/13/2011	Utilities
btCReport	Free	7/7/2011	Finance
Coinbits	Free	8/25/2011	Finance
Scanbook	Free	7/14/2012	Finance

banking system might merely reflect the initial rankings in those countries relative to others.

In order to address the aforementioned concerns, we collect download rank data for all fifteen bitcoin apps available in ten countries (Cyprus, Portugal, Ireland, Italy, Greece, Spain, France, Germany, United Kingdom, and United States) over the seven-day periods before and after the bailout announcement. We then use an established technique to estimate an index of downloads for each country considered. We find that, while downloads of bitcoin apps increased following the announcement, the observed effect is not especially pronounced in those euro area countries thought to have had troubled banking systems at the time. Consistent with Kuittinen's (2013) initial observation, however, the estimated effect is strongest in Spain.

2. Data

App Annie, an analytics company, provides historical in-country download rank data for apps available through Apple's App Store. Table 1 shows the apps we include. It also details the retail price of the app, the date the app was launched, and the iPhone downloads category under which the app is classified. The 15 apps we consider come from the 'Finance' and 'Utilities' categories of iPhone app downloads and comprise the totality of bitcoin tracker apps followed by App Annie that existed prior to the Cyprus announcement.³

The apps considered herein perform various functions for actual and potential bitcoin traders. For example, the app 'Bitcoin App FREE,' allowed users to keep track of the activity in various bitcoin markets and allows them to observe the exchange rate of bitcoin to major currencies, such as the dollar or the pound. It also provided general information of interest to miners of bitcoin, such as the total number of bitcoin mined and the estimated difficulty of the cryptographic problem required to create new bitcoin.⁴ Bitcoin Gold, the app Luther and Olson (2014) examine, listed bitcoin exchange rates on MtGox, a popular online bitcoin exchange market at the time. Other apps, such as Bitcoin Miner Stats, contained data purely for miners. None of the apps allowed users to purchase bitcoin directly.

We collect in-country rank data from App Annie for each app listed in Table 1 for the period March 9 to March 22, 2013. Each country is considered a distinct market. Each app receives a

³ App Annie also tracks 14 apps that were launched after the period considered herein. The app Bitcoin Quote, which is included herein, has since been removed from the app store.

⁴ For an overview of how bitcoin works, see Velde (2013). Lo and Wang (2014), Dwyer (2015), Selgin (2015), and Harwick (2016) discuss the economics of bitcoin. White (2015) considers the market for cryptocurrencies more broadly.

² Luther (2016) considers forces that might preclude individuals from adopting bitcoin. See also: Hendrickson, Hogan, and Luther (2016), Hendrickson and Luther (2016), Luther (2016a, 2016b), Luther and White (2014), and McCallum (2015).

Table 2
Number of missing observations before and after the bailout announcement, by app.

Name	March 9–15	March 16–22	Total
Bitcoin App	14	14	28
Bitcoin App FREE	0	0	0
Bitcoin Explorer	37	34	71
BitCoin Gold	0	0	0
Bitcoin Miner Stats	65	68	133
BitCoin Price	7	8	15
Bitcoin Quote	13	19	32
BitCoin Stats	70	69	139
Bitcoin Ticker	0	0	0
BitCoins Mobile	0	0	0
BitRate Bitcoin Monitor	69	68	137
BTCmon Bitcoin Monitor	59	57	116
btcReport	0	0	0
Coinbits	7	11	18
Scanbook	22	17	39
Total	363	365	728

Table 3
Number of missing observations before and after the bailout announcement, by country.

Country	March 9–15	March 16–22	Total
Cyprus	56	56	112
Portugal	34	35	69
Ireland	46	52	98
Italy	32	35	67
Greece	23	25	48
Spain	35	29	64
France	42	42	84
Germany	24	24	48
UK	41	38	79
US	30	29	59
Total	363	365	728

ranking for each day in each country. Countries considered include Cyprus, France, Germany, Greece, Ireland, Italy, Portugal, Spain, United Kingdom, and United States. These countries were selected to represent three distinct categories: troubled euro area countries (Cyprus, Greece, Ireland, Italy, Portugal, Spain), non-troubled euro area countries (France, Germany), and non-euro area countries (United Kingdom, United States). Fourteen days of data for fifteen apps in ten countries yields 2100 unique observations.

App Annie only records a ranking for those apps among the top 1500 in a country on a given day. Many bitcoin apps fall outside this range in a given country for all or part of the period considered. As such, roughly a third (34.67%) of the observations are missing. The number of missing observations for each app are presented in Table 2. The number of missing observations for each country are presented in Table 3. In both tables, we present the number of observations missing in the seven-day periods before and after the announcement as well as the total.

3. Analyzing rank data

To facilitate comparisons with earlier studies, we first analyze the raw rank data described above. In doing so, we show that the rank for the BitCoin Gold app is not a reliable estimate for the ranks of bitcoin apps in general. This bolsters our case for expanding the dataset beyond the single app considered in Luther and Olson (2014).

In order to deal with missing observations in this section, we attribute a rank of 1501 to each app unranked on a given day. In doing so, we minimize the increase in rankings for an app moving into the App Annie rankings following the announcement. For example, BTCmon Bitcoin Monitor is unranked in Greece from March 9 to March 17. It ranks 976, 1105, 1122, 1284, and 1287 from

March 18 to March 22. Given our method for dealing with missing observations, the average rank prior to the bailout announcement is 1501. The average rank following the bailout announcement is 1254. The average rank increase is 247. Unless BTCmon Bitcoin Monitor fell out of the rankings by exactly one spot on each day prior to the bailout announcement, our reported results likely understate the actual increase in rank.⁵

As in Luther and Olson (2014, p. 13), we calculate average download rankings for the seven-day period preceding (March 9–15) and following (March 16–22) the Cyprus announcement for each app in each country. We then subtract the March 16–22 average from the March 9–15 average to see how average rankings increased following the announcement. The average rank and average rank increase of each bitcoin app for all countries are presented in Table 4.

Although previous studies drew conclusions from relative increases in download rank, we caution the reader from doing so. As noted above, an observed rank increase offers little information in and of itself about the magnitude of the increase in downloads. Consider, for example, rank data for Bitcoin App Free in Ireland and Italy. In Ireland, the app has an initial rank of 302 and a subsequent rank of 234. In Italy, it has an initial rank of 507 and a subsequent rank of 349. The average rank increases are 68 and 157, respectively. However, it might take more downloads to move from a rank of 302 to 234 than it does to move from a rank of 507 to 349. If so, one relying exclusively on rank data would inappropriately conclude that Bitcoin App Free downloads increased to a greater extent in Ireland than in Italy when, in fact, the opposite is true.

The information in Table 4 serves only to facilitate comparisons with Luther and Olson (2014). In particular, we find that expanding the dataset beyond the single app BitCoin Gold to include all apps available during the seven-week periods before and after the bailout announcement is not trivial. Some apps moved up in the rankings. Others fell in the rankings. Simply put: the average rank increase for Bitcoin Gold is not a good estimate of the average rank increase for all other bitcoin-related apps available at the time for each country.

4. Estimating and analyzing an index of downloads from rank data

The available ordinal measure of download rank is an imperfect predictor of interest in bitcoin. Assessing the hypothesis that some turned to bitcoin following the bailout announcement in Cyprus requires a cardinal measure. Unfortunately, app download data is not publicly available. Nonetheless, we are able to estimate an index of downloads using an established technique. After briefly discussing the method employed, we consider the estimated index of downloads to make the relevant cross-country comparisons.

Garg and Telang (2013) devise a method for estimating app downloads from publicly-available rank data.⁶ Although they primarily focus on deriving a demand relationship for the top 200 paid apps, they note that the “methodology could be scaled to incorporate a ranking list of any size as long as data is available” (p. 1256). Following others in the literature, Garg and Telang (2013, p. 1255) “assume a Pareto distribution for inferring downloads from rank”. Their estimation takes the general form $d_r = b(r^{-a})$, where

⁵ It is at least conceivable that the actual (though unobserved) ranks of BTCmon Bitcoin Monitor on March 16 and 17 were so much lower than the average rank over the period prior to the announcement that our reported results overstate the increase. However, given the set of potential methods for dealing with the missing observations, we believe the method chosen is most likely to cut against the hypothesis that interest in bitcoin increased following the announcement.

⁶ See also: Brynjolfsson, Hu, and Smith (2003), Brynjolfsson, Hu, and Smith (2010), Chevalier and Goolsbee (2003), and Chevalier and Mayzlin (2006), Ghose, Smith, and Telang (2006).

Table 4
Average rank and average rank increase of each bitcoin app, by country.

	Seven-day average rank March 9–15	Seven-day average rank March 16–22	Average rank increase		Seven-day average rank March 9–15	Seven-day average rank March 16–22	Average rank increase
Cyprus				Spain			
Bitcoin App	1501	1501	0	Bitcoin App	203	157	47
Bitcoin App FREE	649	654	–6	Bitcoin App FREE	303	106	197
Bitcoin Explorer	1398	1415	–17	Bitcoin Explorer	1501	891	610
BitCoin Gold	1166	577	589	BitCoin Gold	367	131	236
Bitcoin Miner Stats	1501	1501	0	Bitcoin Miner Stats	1501	1501	0
BitCoin Price	1501	1501	0	BitCoin Price	1242	566	676
Bitcoin Quote	1419	1437	–18	Bitcoin Quote	988	793	195
BitCoin Stats	1501	1501	0	BitCoin Stats	1501	1501	0
Bitcoin Ticker	857	871	–14	Bitcoin Ticker	460	166	295
BitCoins Mobile	182	185	–3	BitCoins Mobile	357	364	–7
BitRate Bitcoin Monitor	1501	1501	0	BitRate Bitcoin Monitor	1501	1501	0
BTCom Bitcoin Monitor	1501	1501	0	BTCom Bitcoin Monitor	1501	1501	0
btReport	1434	1452	–18	btReport	506	241	265
Coinbits	1501	1501	0	Coinbits	654	217	436
Scanbook	1501	1501	0	Scanbook	1123	581	542
Portugal				France			
Bitcoin App	1501	1501	0	Bitcoin App	295	306	–11
Bitcoin App FREE	480	642	–163	Bitcoin App FREE	674	438	236
Bitcoin Explorer	509	929	–420	Bitcoin Explorer	1501	1501	0
BitCoin Gold	407	342	66	BitCoin Gold	646	638	8
Bitcoin Miner Stats	1501	1501	0	Bitcoin Miner Stats	1501	1501	0
BitCoin Price	515	984	–469	BitCoin Price	907	847	60
Bitcoin Quote	510	750	–240	Bitcoin Quote	1501	1501	0
BitCoin Stats	1501	1501	0	BitCoin Stats	1501	1501	0
Bitcoin Ticker	393	453	–60	Bitcoin Ticker	649	654	–4
BitCoins Mobile	523	521	1	BitCoins Mobile	727	796	–69
BitRate Bitcoin Monitor	1330	1501	–171	BitRate Bitcoin Monitor	1501	1501	0
BTCom Bitcoin Monitor	1501	1501	0	BTCom Bitcoin Monitor	1501	1501	0
btReport	487	591	–104	btReport	892	840	52
Coinbits	448	632	–184	Coinbits	909	1023	–114
Scanbook	523	603	–81	Scanbook	1259	1128	131
Ireland				Germany			
Bitcoin App	210	295	–85	Bitcoin App	205	198	7
Bitcoin App FREE	302	234	68	Bitcoin App FREE	280	250	30
Bitcoin Explorer	1501	1501	0	Bitcoin Explorer	1166	1091	75
BitCoin Gold	630	417	213	BitCoin Gold	501	466	35
Bitcoin Miner Stats	1501	1501	0	Bitcoin Miner Stats	1501	1501	0
BitCoin Price	877	654	223	BitCoin Price	713	645	69
Bitcoin Quote	1448	1501	–53	Bitcoin Quote	1168	969	199
BitCoin Stats	1501	1501	0	BitCoin Stats	1501	1501	0
Bitcoin Ticker	374	456	–82	Bitcoin Ticker	367	202	165
BitCoins Mobile	344	615	–271	BitCoins Mobile	489	541	–51
BitRate Bitcoin Monitor	1501	1501	0	BitRate Bitcoin Monitor	1501	1481	20
BTCom Bitcoin Monitor	1501	1501	0	BTCom Bitcoin Monitor	783	1139	–355
btReport	590	404	185	btReport	463	395	68
Coinbits	1141	1164	–23	Coinbits	631	393	238
Scanbook	1501	1380	121	Scanbook	1118	897	221
Italy				UK			
Bitcoin App	336	336	0	Bitcoin App	311	297	14
Bitcoin App FREE	507	349	157	Bitcoin App FREE	170	146	24
Bitcoin Explorer	1357	1501	–144	Bitcoin Explorer	1501	1501	0
BitCoin Gold	610	370	240	BitCoin Gold	366	394	–27
Bitcoin Miner Stats	1501	1501	0	Bitcoin Miner Stats	1501	1501	0
BitCoin Price	1269	851	418	BitCoin Price	782	839	–57
Bitcoin Quote	1156	1017	139	Bitcoin Quote	1228	1086	143
BitCoin Stats	1501	1501	0	BitCoin Stats	1501	1501	0
Bitcoin Ticker	627	475	152	Bitcoin Ticker	336	304	32
BitCoins Mobile	816	771	45	BitCoins Mobile	566	650	–84
BitRate Bitcoin Monitor	1501	1501	0	BitRate Bitcoin Monitor	1501	1501	0
BTCom Bitcoin Monitor	1501	1501	0	BTCom Bitcoin Monitor	1358	1189	169
btReport	817	807	10	btReport	192	206	–14
Coinbits	826	486	340	Coinbits	918	626	292
Scanbook	1373	997	376	Scanbook	1495	1090	405
Greece				US			
Bitcoin App	332	328	4	Bitcoin App	346	230	115
Bitcoin App FREE	306	357	–52	Bitcoin App FREE	730	756	–26
Bitcoin Explorer	594	766	–172	Bitcoin Explorer	1501	1491	10
BitCoin Gold	248	243	5	BitCoin Gold	926	878	48
Bitcoin Miner Stats	1224	1501	–277	Bitcoin Miner Stats	1501	1411	90
BitCoin Price	1149	1143	6	BitCoin Price	1281	1198	83
Bitcoin Quote	919	1416	–498	Bitcoin Quote	1096	1039	57

Table 4 (Continued)

	Seven-day average rank March 9–15	Seven-day average rank March 16–22	Average rank increase		Seven-day average rank March 9–15	Seven-day average rank March 16–22	Average rank increase
BitCoin Stats	1501	1312	189	BitCoin Stats	1501	1501	0
Bitcoin Ticker	380	432	–52	Bitcoin Ticker	200	170	30
BitCoins Mobile	757	683	74	BitCoins Mobile	844	773	71
BitRate Bitcoin Monitor	1501	1501	0	BitRate Bitcoin Monitor	1501	1501	0
BTCmon Bitcoin Monitor	1501	1254	247	BTCmon Bitcoin Monitor	985	926	58
btcReport	627	860	–233	btcReport	785	525	260
Coinbits	365	386	–21	Coinbits	927	433	494
Scanbook	1200	1032	168	Scanbook	1441	1183	258

Table 5

Average download index (low) value of bitcoin apps, by country.

	Seven-day average estimated downloads March 9–15	Seven-day average estimated downloads March 16–22	Average estimated downloads increase	Percent change	T-stat
Cyprus	18781	20816	2035	10.83**	2.73
Portugal	33921	31547	–2373	–7.00	–1.11
Ireland	28102	28760	659	2.34	0.22
Italy	28267	34070	5803	20.53	1.74
Greece	37038	37867	829	2.24	0.34
Spain	33094	53991	20897	63.14*	4.84
France	25079	26739	1660	6.62	1.15
Germany	37871	42107	4236	11.18	1.02
UK	33105	38603	5498	16.61	1.09
US	30051	34809	4758	15.83	1.46
All Countries	305309	349309	44000	14.41	1.74
Troubled Countries	179203	207051	27848	15.54**	2.20
Non-Troubled Euro Countries	62950	68846	5896	9.37	1.08
Non-Troubled Non-Euro Countries	63156	73412	10256	16.24	1.29
All Non-Troubled Countries	126106	142258	16152	12.81	1.22

*, **, and *** denote significance at the 1, 5, and 10% level, respectively.

the term d_r represents downloads of an app with an observed rank of r . The other terms govern the shape of the distribution: b is the scale parameter, which depends on the size of the market, and a is the shift parameter, which governs the shape of the Pareto curve. The authors use this relationship as an input into the distribution for the top-grossing apps, in terms of total revenues, by multiplying the right-hand side by the market price. This yields an equation that, after taking logs of both sides, is linear in coefficients, and can be estimated by truncated least squares (p. 1246). The parameters of interest, including downloads, are determinate functions of the estimated coefficients.

Garg and Telang (2013, p. 1256–1258) consider all categories of apps in their estimation.

Their estimated shift parameter (a) for the Pareto distribution governing all downloads on the iPhone app market is 0.45 (p. 1263, fn. 15). We use their estimated shift parameter on the assumption that shift parameters do not differ systematically across countries.⁷

In order to estimate the number of downloads for bitcoin-related apps in each country, one would need to know the unique scale parameter for each country. We do not have access to the aggregate download data required to estimate the scale parameter for each country. However, since we are not strictly interested in the number of downloads but rather in the change in downloads across countries, we can use the same scale parameter for all countries to estimate an index of downloads for each country. Indeed, an index of downloads for each country facilitates relative comparisons across countries by removing differences related to the overall market size in each country. Although the precise scale

⁷ While we believe the estimate of the shift parameter employed herein is the most plausible, we have considered alternatives within the range of those observed in other markets. Our results are robust to specification.

parameter employed is irrelevant when constructing indices, we use the estimate of 52,958 provided by Garg and Telang (2013, p. 1260).

While analyzing raw rank data in Section 2, we dealt with missing observations by assuming a rank of 1501. Recall that missing observations are not missing in the usual, random sense. Rather, each missing observation denotes a particular app in a particular country on a particular day intentionally left unranked because it fell below the threshold ranking of 1500. In other words, we know that a given unranked app was downloaded d_u times, where $0 \leq d_u < d_{1500}$, and d_{1500} is the number of downloads required to achieve a ranking of 1500.⁸ With this in mind, we construct two download indices. For the first index, we estimate the number of downloads for ranked apps as $d_r = 52,958 (r^{-0.45})$ and unranked apps as $d_u = 0$. For the second index, $d_r = 52,958 (r^{-0.45})$ and $d_u = d_{1500} - 1$. We refer to these two indices as “low” and “high,” respectively.

The seven-day average download index value and average download index value increase of all bitcoin apps for each country and country grouping considered using both low and high estimation procedures are presented in Tables 5 and 6, respectively. We also include the percent change and a two-sample t-statistic to test whether the average download index values before and after the announcement are equal for each country.

We find that, across the board, downloads for bitcoin-related apps increased by more than 10% following the bailout

⁸ Note that, since all of the observed rankings are greater than or equal to 1500, linearly estimating the missing observations from those observed would result in estimated downloads greater than or equal to y .

Table 6
Average download index (high) of bitcoin apps, by country.

	Seven-day average estimated downloads March 9–15	Seven-day average estimated downloads March 16–22	Average estimated downloads increase	Percent change	T-stat
Cyprus	34541	36576	2035	5.89**	2.73
Portugal	43489	41397	–2092	–4.81	–1.05
Ireland	41047	43395	2347	5.72	0.97
Italy	37273	43920	6647	17.83***	2.01
Greece	43511	44902	1391	3.20	0.55
Spain	42944	62152	19208	44.73*	4.73
France	36899	38559	1660	4.50	1.15
Germany	44625	48861	4236	9.49	1.26
UK	44644	49297	4654	10.42	1.10
US	38494	42970	4477	11.63***	2.04
All Countries	407468	452030	44563	10.94***	2.00
Troubled Countries	242805	272342	29537	12.16**	2.47
Non-Troubled Euro Countries	81525	87420	5896	7.23	1.25
Non-Troubled Non-Euro Countries	83138	92268	9130	10.98	1.45
All Non-Troubled Countries	164662	179688	15026	9.13	1.38

*, **, and *** denote significance at the 1, 5, and 10% level, respectively.

announcement.⁹ However, there is no statistically significant difference between the increase observed in those countries thought to have had a troubled banking system (Cyprus, Greece, Ireland, Italy, Portugal, Spain) and all non-troubled countries (France, Germany, United Kingdom, United States) or non-troubled euro area countries (France, Germany).

The general increase observed is largely driven by increases in just four countries: Cyprus, Italy, Spain, and the US.¹⁰ The estimated effect is especially large in Spain, where downloads of bitcoin-related apps increase by 44.73–63.14% following the bailout announcement. Italy saw downloads increase by 17.83–20.53% following the announcement. Downloads increased in Cyprus by 5.89–10.83%, which was somewhat lower than the 11.63–15.83% increase observed in the US.

Changes in other countries thought to have had a troubled banking system are statistically indistinguishable from zero. The observed changes were small in Greece (2.24–3.20%) and Ireland (2.34–5.72%). In Portugal, between 4.81 and 7.00 fewer bitcoin-related apps were downloaded in the week following the announcement. For comparison, downloads increased by 9.13 to 12.81 percent in all non-troubled countries (France, Germany, United Kingdom, United States), though this result is also statistically insignificant.

5. Conclusion

We have considered the oft-cited view that, following the Cyprus bailout announcement and, in particular, the discovery that deposit balances would be subject to a one-time levy, depositors were more likely to turn to bitcoin. To assess the claim, we have followed the existing literature by looking at the popularity of bitcoin apps downloaded from Apple's App Store. While existing studies have relied on rank data for a subset of apps available, we have extended the analysis to include all fifteen bitcoin apps available for download at the time and used an established technique to estimate an index of downloads for each country considered. As such, we are able to (1) take into account the standard view that ranked app downloads follow a Pareto distribution and (2) distinguish a general increase in the demand for bitcoin apps from a substitution between bitcoin apps.

Our analysis suggests there was a general spike in downloads of bitcoin-related apps in the seven-day period immediately following the initial Cyprus bailout announcement. To that extent, our results are consistent with [Kuittinen \(2013\)](#) and [Luther and Olson \(2014\)](#). However, our analysis calls into question the claim that the effect was especially pronounced in euro area countries with troubled banking systems. While downloads increased markedly in Spain and Italy, the increase observed in Cyprus was somewhat smaller than that of the US. Changes observed in Ireland and Greece were positive, but small and not statistically significant. Portugal saw fewer (though statistically indistinguishable from zero) downloads following the announcement. Hence, overall, the results are mixed.

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⁹ Using the high index, this result is significant at the 10% level. It is not quite significant at the 10 percent level using the low index.

¹⁰ The estimated increases in Italy and the US are statistically significant at the 10% level when using the high index, but not when using the low index.

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