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Accounting for the Bitcoin: accountability, neoliberalism and a correspondence analysis

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Abstract

Purpose – Given its innovative characteristics and increasing popularity, the Bitcoin, and other virtual currencies, are expected to become mainstream, leading to the need for a generally accepted accounting treatment. Currently, however, there are no accounting standards which offer guidance on the recognition and measurement of these virtual currencies. To this end, the purpose of this paper is to determine a conceptual approach for accounting for the Bitcoin, grounded in the theories of neoliberalism and stewardship.

Design/methodology/approach – The research adopts an interpretive mixed-method approach. The relevant literature is analysed to identify key characteristics of the Bitcoin. These, as well as the elements of accounting policies inspired by neoliberalism and stewardship, form row and column headings in a correspondence matrix completed by 40 financial reporting experts. The correlations between rows and columns (developed using principal component analysis) are used to identify possible recognition and measurement requirements for the Bitcoin. Semi-structured interviews are used to complement the correspondence analysis.

Findings – The correspondence analysis and interviews reveal an emphasis on cost and fair value proposed by models grounded in stewardship and neoliberalism, respectively. The primary factor at work is the need to account for the underlying economics of the unit of account, something which is informed heavily by an organisation's business model. Cost and fair value may be conceptual opposites, but in the eyes of respondents, these need to be used to achieve the single goal of communicating the economic rationale for holding the Bitcoin.

Research limitations/implications – The study is based on a purposefully selected sample of experts and lacks the exploratory potential of purely qualitative research. Nevertheless, it makes novel use of a correspondence analysis to provide an initial frame of reference for developing an accounting policy for unusual transactions and balances.

Originality/value – The paper is the first to provide a normative perspective on the accounting for this poorly understood "currency". It also adds to the limited body of interpretive accounting research which dispenses with traditional finance paradigms and positivist models to provide practical recommendations. Finally, the paper offers an innovative approach, using a correspondence analysis and detailed interviews, for developing an accounting policy for transactions not specifically within the scope of existing accounting standards.

Keywords Neoliberalism, Stewardship, Financial reporting, Correspondence analysis, Bitcoin, Virtual currency

Paper type Research paper

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1. Introduction[1]

The Bitcoin is a virtual "currency" which, initially, appears similar to traditional currencies. It is, however, not subject to regulation by central banks, does not enjoy the backing of goods or services with intrinsic value and has a decentralised "production" and exchange platform which has contributed to its popularity as a means of settling e-commence transactions (Rees, 2014)[2]. The European Central Bank (2012), for example, commented that growing internet accessibility and proliferation of digital procurement systems has enabled the unprecedented use of virtual currencies, with some questioning whether the likes of Bitcoin have the potential to become the dominant means for settling transactions (Carmody, 2013). This is equally relevant in many jurisdictions where Luther (2013) and Kun (2014) cite a growing use of the Bitcoin as an investment vehicle and as a means of transacting with a mushrooming number of merchants eager to tap into e-commerce markets[3]. In spite of these applications, the Bitcoin itself is not well-understood (Southurst, 2014; Tatar, 2014).

While there is a large body of research on e-commerce (McKnight *et al.*, 2002; Leyshon *et al.*, 2005; Jank and Shmueli, 2006; Xiao and Benbasat, 2007; Lee, 2009; Huang and Benyoucef, 2013), there is, surprisingly, little formal academic research on the implications of the Bitcoin for governance, accountability and financial reporting paradigms. This is despite the daily estimated value of Bitcoin-based transactions exceeding US$68 million[4] (Quandl, 2014) and the value of the Bitcoin itself rising from US$0.75 to US$1,242 (Lee, 2014). The challenges which the virtual currency poses for policymakers having to grapple with the economic characteristics, legal implications and regulatory challenges of this digitised and ubiquitous type of money have also been overlooked. This is particularly curious, given the problems experienced at Mt Gox (a Bitcoin exchange based in Tokyo which was forced to suspend trade and file for liquidation after the loss of significant Bitcoin balances held in customer wallets) and the growing possibility of the Bitcoin being used for money laundering (Hill, 2014; Rees, 2014; Wagstaff, 2014). Consequently, the objective of this research is to analyse interpretively, using a correspondence analysis, the characteristics of the Bitcoin, with the aim to offering a normative perspective on the financial reporting for the Bitcoin grounded in theories of neoliberalism and stewardship.

The results of the study will be relevant for stakeholders interested in the characteristics of and accounting for the Bitcoin (Shcherbak, 2014). For governments concerned with the possibility of the virtual currency being used for money laundering (FBI, 2012), for the circumvention of exchange controls (Dwyer, 2014) or as a tool for tax evasion (Marian, 2013), for example, developing a basis of accounting for the Bitcoin can be useful for describing and communicating the underlying economic characteristics of the virtual currency. At the same time, as the use of the Bitcoin becomes more widespread[5] (European Central Bank, 2012), there is a clear practical need for exploring the possible accounting implications for reporting entities accepting the Bitcoin in exchange for goods and services (Luther, 2013; Kun 2014).

Finally, this research makes an important methodological and theoretical contribution. It relies on interpretive techniques to identify characteristics of the Bitcoins and a correspondence analysis to highlight the relationships between essential

features of the coins and the specific elements of accounting policies informed by the principles of neoliberalism and accountability (Whittington, 2008). This adds to the limited body of research adopting a social constructivist view on the development of financial reporting standards and provides a practical application of the theoretical accounting policy implications emerging from the chosen theoretical framework (Hopwood, 1987; Whittington, 2008; Ravenscroft and Williams, 2009). In doing so, the research addresses the calls for more interpretive-inspired accounting research which engages well-established theory and practical challenges with an aim to offering recommendations (Broadbent and Unerman, 2011 Coetsee and Stegmann, 2012; Maroun and Jonker, 2014). Related to this, by extending the use of correspondence analysis to a financial reporting context, this study offers a possible basis for developing accounting policies when a transaction or event is not specifically within the scope of an existing international financial reporting standard (IFRS, or other relevant standard, depending on the jurisdiction).

The remainder of this paper is structured as follows. Section 2 provides a brief outline of the approach used by this study. Section 2.2 highlights the characteristics or features of the Bitcoins. Section 2.3 establishes the theoretical framework for analysing the accounting for the coins. Section 3 discusses the method. Sections 4 and 5 present the results and interpret the findings, respectively. Section 6 concludes.

2. Literature review, theoretical framework and construction of the research instrument

In this section of the paper, we discuss the characteristics of the Bitcoin to provide the reader with an understanding of the nature of the unit of account (Section 2.2). We also highlight the application of principles of stewardship and neoliberalism to provide a theoretical framework for developing normative accounting policies (Section 2.3). In turn, these principles and characteristics inform the development of the data collection instrument administered to participants.

2.1 Research approach

The characteristics of Bitcoins are discussed in Section 2.2. The main features are identified by the researchers and labelled *R1-R17*. These serve as row headings in the data collection instrument. Similarly, the principles of neoliberalism and stewardship are discussed in Section 2.3 and the associated accounting recommendations are highlighted and labelled *C1-C13*. They serve as column headings in the data collection instrument (Appendix 1) which is used to generate the final correspondence analysis and plot (Section 4). (Please note that row and column headings were derived by the researchers as the relevant literature was analysed. Consequently, row and column headings are not presented in any specific order).

As discussed in Section 3, correspondence analysis is a useful technique which has been used in a number of different contexts to highlight correlations or interconnections between qualitative characteristics (Hoffman and Franke, 1986; Doey and Kurta, 2011; Maroun *et al.*, 2011; Kudlats *et al.*, 2014). In this case, the correspondence table is presented to a sample of 60 experts and used to identify which Bitcoin characteristics (row headings) are associated with different accounting policy options (column headings) to develop an accounting treatment for Bitcoin which draws on aspects of stewardship and neoliberalism. The choice of theoretical framework is informed by the

argument that a tension between cost and fair value models of accounting is a defining feature of the development of IFRS (Gjesdal, 1981; Ravenscroft and Williams, 2009; Zhang and Andrew, 2014) and that accounting for an item at cost less amortisation and impairment or at fair value are the essential features at the heart of most accounting standards (Whittington, 2008)[6].

2.2 The Bitcoin

Nakamoto (2008)[7] proposed an electronic payment system, known as the Bitcoin, in place of the traditional payment systems and delineated the system and specifics of the Bitcoin protocol. The paper did not attempt to determine the nature/classification of the Bitcoin, representing an area which needs to be investigated further. In this regard, it is important to determine if the Bitcoin is virtual or electronic money.

2.2.1 Bitcoin as a currency. "Electronic money" refers to a monetary value that is accepted for payment purposes by persons other than the issuer, with the unit of account matching that of the physical currency (Bal, 2013). "Virtual money", a solely digital instance of money, also refers to a monetary value accepted for payment purposes, but the unit of account is no longer a "physical" currency unit. It is expressed in an independent digital form (Bal, 2013). The unit of account is Bitcoin, divisible as follows: A "Satoshi" represents the smallest denomination of Bitcoins, being one millionth of a Bitcoin, followed by microBitcoin, milliBitcoin and centiBitcoin (Bitcoin Denominations, 2014). Consequently, the Bitcoin falls into the latter of Bal's (2013) categories and is virtual money. As such, the following characteristic is included in the correspondence analysis used to determine the accounting for the Bitcoin (Section 3):

R3. The Bitcoin exists only digitally.

Bitcoin differs from conventional currency in that it is not fiat (Sunderland, 2013) or specie money[8] (Christopher, 2014). In other words, it is not regarded as legal tender by a central authority (such as a reserve bank) or backed by goods or services having an intrinsic value (Christopher, 2014). The Bitcoin is also decentralised in the sense that it is not issued by a government or single institution[9] (Bamert *et al.*, 2013; Elms, 2013; Weisenthal, 2013), with the added characteristic of being unregulated (Gallagher, 2014). As such, the following are included in the correspondence analysis:

R2. The Bitcoin is not overseen by any central body and is not legislated.

R12. Bitcoins have no intrinsic value.

These characteristics effectively mean that the Bitcoin cannot be controlled by a government and it is, therefore, not directly influenced by macroeconomic variables such as interest rates, gross domestic product (GDP) or fiscal policy (Ciaian *et al.*, 2014; Wandery, 2014). Another effect of this decentralisation is the speed at which Bitcoin remittances can be accomplished. The average speed of transfers by traditional money transfer companies is two days. In contrast, the transfer of Bitcoins is an instant process (Van Eyk, 2014). The downside of this is that Bitcoin transactions are irreversible (Thill, 2013). In this context, the Bitcoin is characterised by the following properties, each of which is included as row headings in the correspondence table:

R4. Bitcoins are easily transferrable but transactions are irreversible.

R13. Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy.

2.2.2 Electronic system. The lack of regulation leads to a dilemma: If there is no trusted central authority issuing the Bitcoin, how can one be certain that it is not counterfeit, holds its stated value and that the underlying amount has not been double-spent? The answer lies in the design of the "currency". Bitcoin is built on a peer-to-peer network and uses internet communication to make public all purchases, sales and other exchanges of all Bitcoins in circulation via a history of transactions to date, known as a block chain (see definitions in Appendix 4) (Woo *et al.*, 2013). As transactions occur in the Bitcoin network, they are aggregated into groups, known as "blocks", which must be added to the block chain. To ensure that the network is secure, and that the Bitcoins in the transactions have not been double-spent, there must be a verification process. The verification process is undertaken by computers in the network which ensure that the sender had the requisite funds for the transaction (Luther, 2013):

R1. All Bitcoin transactions are recorded on a public digital record to ensure that the Bitcoins are authentic and not duplicated.

To connect to the peer-to-peer network, the foundation of the Bitcoin system, the individual must download and install a Bitcoin software programme. Once the programme is downloaded and installed, the programme must download the block chain, a record of all Bitcoin transactions, akin to a general ledger. This is necessary to ensure that the transactions are valid, and that new transactions are properly verified and recorded by the computers in the network, known as miners (CoinDesk, 2014a).

2.2.3 Demand dynamics. Luther (2013) and Kun (2014) note a growing use of the Bitcoin as an investment vehicle and as a means of transacting with Bitcoin-accepting merchants[10], although the Bitcoin market is also characterised by speculative trading and volatile prices (in relative US$ terms):

R7. Bitcoins can be used for speculative purposes.

R8. Bitcoins can be used as a store of wealth.

R10. The value of the Bitcoin has ranged from US$0.75 to a high of US$1,242.

Bitcoins can be acquired in a number of ways. The easiest is to purchase them on a Bitcoin exchange (e.g. BitX is a South African exchange) (Cutcher, 2013). The Bitcoin exchanges merely match bids and offers (Cronimund, 2014) resulting in the Bitcoin trading at different prices on different exchanges, creating an uncertain pricing reference point (Yermack, 2014). Bitcoins can also be purchased directly from a willing seller (Shandrow, 2014a). The Bitcoin exchanges and resellers trade in Bitcoins in the ordinary course of their business, in addition to holding Bitcoins to provide exchanging services:

R5. The Bitcoin trades at different prices on different exchanges.

R14. Bitcoins are items traded in the ordinary course of business.

Another way to acquire Bitcoins is to accept them as payment for goods or services (Shandrow, 2014a). The majority of Bitcoin-accepting entities make use of Bitcoin payment processors (Shandrow, 2014b) which will hold Bitcoin balances to convert to

fiat (Spano, 2014). In this way, the Bitcoin represents a contractual right to a fixed or determinable amount of money, in addition to acting as a consumable to facilitate the exchange of goods or services (Shandrow, 2014a):

R6. Bitcoins can be used to pay for goods or services offered by Bitcoin merchants.

R15. Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency.

R16. Bitcoins can be seen as assets used in the production or supply of goods or services.

R17. Bitcoins are akin to a consumable used in the facilitation of a transaction.

2.2.4 Acquisition. Before the acquisition of any Bitcoins can take place, the individual will need a place to store them. This involves obtaining a Bitcoin wallet. The wallet is stored on the local hard drive or the cloud and an encrypted peer-to-peer system is used to exchange Bitcoins (Luther, 2013). Additional software is needed to enable the "mining" of Bitcoins (Sankin, 2014) which involves a complex cryptographic function (hashing) which computer processors use effectively to solve or decode hash strings to "generate" Bitcoins (Weusecoins, 2013; CoinDesk, 2014a; Dupont, 2014). Only when the hash meets a specific criterion will the miner receive a reward for contributing to the network. The reward is currently 25 Bitcoins[11] and any transaction fees associated with the transactions in that block. "Mining", however, requires computing power with the result that the "miner" must incur capital and operating costs to generate additional Bitcoins (CoinDesk, 2014a). Given the exponentially increasing complexity of the hash codes, which must be solved as part of the mining process, the supply of Bitcoins (for a given level of technology) is effectively limited to 21 million Bitcoins (Mayer, 2014):

R9. Bitcoins can be "produced" using a computer but this requires enormous computing power.

R11. The supply of Bitcoins is limited at 21 million Bitcoins.

Figure 1 summarises the key characteristics of the Bitcoin identified in the preceding analysis.

These key characteristics form the basis of the rows (*R1-R17*) of the correspondence table in Sections 3 and 4.

2.3 Theoretical frameworks

The economic phenomena should inform the accounting for the respective transaction or event (Hyland, 2014; International Accounting Standards Board (IASB), 2012). In this case, the Bitcoin (Section 2.2) is the item under review. Based on the discussion in Section 2.2, it does not appear to be a "currency" (possibly invalidating the application of IAS 21) and does not necessarily meet the definition of "inventory", "property, plant and equipment" or a "financial instrument".

IAS 8 states that where there is no existing standard or interpretation which applies to a specific transaction, the developed accounting policy must result in information which is both relevant and reliable (IASB, 2012). To achieve this, one must first refer to the requirements in IFRS dealing with similar issues. Failing that, the *Conceptual Framework* must be consulted, looking specifically at the definition of an "asset",

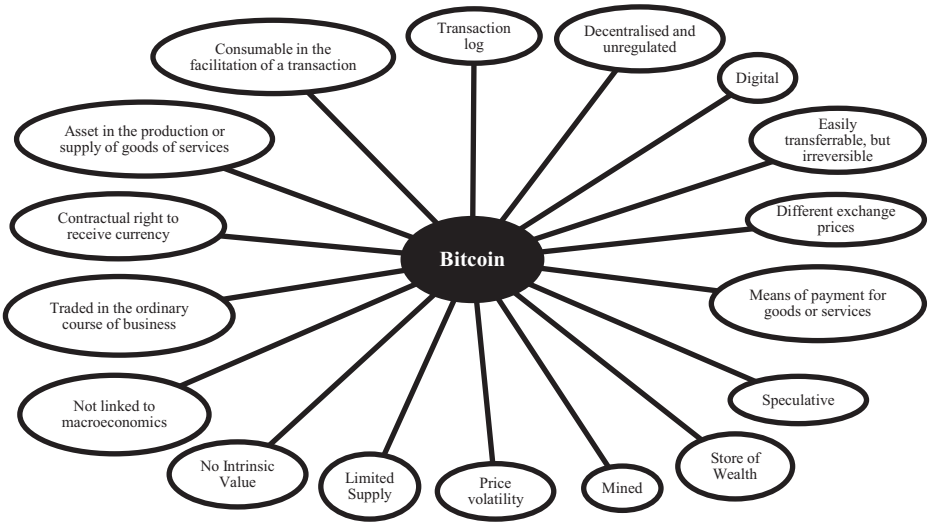

Figure 1.
Characteristics of the Bitcoin

"liability", "equity", "income" and "expense" (IASB, 2012)[12]. This research follows a similar approach but also considers how the principles derived from neoliberalism and stewardship (in a financial reporting context) can be used to inform the accounting for Bitcoins.

These paradigms were selected because of their widespread use in prior literature (Gjesdal, 1981; Ravenscroft and Williams, 2009; Zhang and Andrew, 2014) and the argument by Whittington (2008) that they represent the main "elements" in the development of financial reporting. Each of the accounting "themes" or "principles" is identified as column headings in the correspondence analysis and is used to inform how the characteristics of the Bitcoin (Section 2.2 and row headings) correlate with different elements of possible accounting policies (Section 2.3 and column headings)[13].

2.3.1 Stewardship. Accounting has its genesis in the need to "keep account" to hold individuals accountable, a function which continues to be relevant in contemporary organisations (Hopwood, 1987; Ravenscroft and Williams, 2009). Murphy *et al.* (2012), for example, analysed the accounting landscape through the lens of social jurisprudence. They identify a "living law" rooted firmly in the principles of accountability and stewardship which, in turn, affects the development of accounting systems. From a classic agency perspective, the information asymmetry between management and shareholders can also be seen as requiring an accounting function to ensure monitoring and control (Young, 1998). This can be linked to Gjesdal's (1981) view that there is a demand for financial statements to facilitate corporate stewardship. Ravenscroft and Williams (2009) confirm this view, arguing that accounting assists an organisation by presenting facts which can be used to enhance the organisation and provide a basis for comparison of management's performance. This leads to a clear focus on objective measures of financial position and performance and an emphasis on determination and allocation of costs (Gjesdal, 1981; Whittington, 2008). Accounting policies, grounded in stewardship, are also based on the assumption that markets are

imperfect (Whittington, 2008). Reliability is, therefore, championed as the essential characteristic of reporting:

C1. The Bitcoin should be recognised at cost.

C5. Accounting needs to reflect the future cash flows inherent in the Bitcoin only to the extent that these are reliably measurable.

This is achieved through the emphasis on past transactions and events giving rise to control of the underlying and the associated cost allocations. The financial statements should reflect the specifics of the entity itself and should cater for the endogeneity of future cash flows (Whittington, 2008):

C4. The emphasis should be on evaluating management's decision to acquire or "produce" Bitcoins rather than on accounting for changes in the market value of the Bitcoin.

C7. Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity.

C8. Bitcoins are recognised when acquired or available to be used as intended by management.

Cost can also be used as a predictor variable and is a relevant measurement basis (Whittington, 2008). This, therefore, precludes the recognition of unrealised gains in comprehensive income (Whittington, 2008):

C1. The Bitcoin should be recognised at cost.

C6. The accounting should not result in the recognition of unrealised gains.

C2. Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality.

Principles of prudence – which preclude the recognition of unrealised gains – also suggest that the assets should not be stated at amounts greater than the expected economic benefits to be derived from those assets (Whittington, 2008):

C3. The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary.

2.3.2 Neoliberalism. Recently, financial reporting has experienced a fundamental shift characterised by a neoliberal paradigm (Ravenscroft and Williams, 2009; Murphy *et al.*, 2012; Zhang and Andrew, 2014). At the heart of the neoliberal accounting agenda is the "information metaphor" which sees the primary purpose of financial reporting as the provision of useful information to users (Whittington, 2008; Ravenscroft and Williams, 2009)[14]. Neoliberalism requires accounting to reflect the future, de-emphasising the relevance of past transactions, prudence and cost, and shifting the focus to fair value and non-entity-specific market prices (Whittington, 2008):

C9. The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.

C10. The past transaction giving rise to the Bitcoin does *not* provide useful information for users.

Comprehensive income, which forms an essential element of the financial statements (Whittington, 2008), should also be presented in the financial statements. In this regard, *any* changes in net assets (as opposed to just impairments) must be reported to users:

C11. Volatility should not preclude the recognition of the Bitcoin.

C12. Volatility in the price of Bitcoins on hand must be communicated to users.

Representational faithfulness is given greater standing, resulting in a greater emphasis on presenting economic substance, as opposed to focusing on statistical precision (Whittington, 2008).

C13. Emphasis should be placed on capturing the economic substance of the Bitcoin.

2.3.3 On the relevance of the business model. An important issue arises from the application of neoliberalism and stewardship. According to the Institute of Chartered Accountants of England and Wales (ICAEW) (2010), where there is a disconnect between the ownership and management of an entity, there needs to be accountability for the ownership structure. This speaks to stewardship. Neoliberalism is apparent when choosing between the economic activity undertaken by the entity and the market equivalent (ICAEW, 2010). In terms of applying these issues to an accounting policy, the ICAEW (2010) argues that the activities of the entity are considered integral in informing this choice[15]. The internal activities of the entity determine its business model, which then "provides a link between the issues raised by the theory of the firm and its potential application to financial reporting by individual firms" (ICAEW, 2010, p. 24). The following options are presented by the ICAEW (2010), based on the internal activities of the entity:

- historical cost or replacement cost, where there is a transformation of assets to create new outputs;
- fair value, where no transformation of assets takes place but assets are traded to profit from changes in market prices; or
- a hybrid system, with cost for some items and market prices for others.

2.4 Application of neoliberalism and stewardship in accounting for the Bitcoin

Rather than seeing neoliberalism and stewardship as opposing forces, these theoretical perspectives can be meaningfully used to shed light on how transactions and events can be "portrayed" in financial statements. According to Hopwood (1987), accounting has evolved as a result of more than just an economic imperative. Its development is socially constructed, reflecting the changing needs of constituents and context over time (Hopwood, 1987). The "craft" has transitioned from being a passive tool for reporting on the economic performance and environment of the entity, to one that can be manoeuvred actively to "create a particular economic visibility" (Hopwood, 1987, p. 213), shaping and moulding the perceptions of users and conditioning expectations (Hopwood, 2009; Zhang and Andrew, 2014).

To this end, neoliberalism and stewardship provide a theoretical frame of reference for analysing the characteristics of Bitcoin (from the prior literature) and informing the development of accounting policies for the "pseudo currency". In other words, the link between the practicalities of the Bitcoin and the principles which can inform an

accounting policy is made visible (Hopwood, 1987, 2009), ultimately making the economic reality of the Bitcoin apparent through the accounting. This exercise will result in the unearthing of an initial accounting treatment for the Bitcoin.

3. Data and method

The research relies on a mixed method and is grounded in an interpretive epistemology (Saunders *et al.*, 2009; Creswell, 2014; Broadbent and Unerman, 2011). In the first phase, a detailed content analysis of the prior literature on Bitcoins defines the characteristics of the unit of the account (Section 2.2 and 3.1). Phase 2 uses principal component analysis to identify correlations between these characteristics and elements of different accounting policies (Section 3.2). Finally, the correspondence analysis is used as a basis for additional analysis with accounting experts during semi-structured interviews (Section 3.3).

3.1 Inductive thematic analysis

In the first phase, a content analysis was carried out. The aim was to develop a normative recommendation for the accounting for Bitcoin by exploring the characteristics of Bitcoin (Section 2.2) and linking these to the main themes or principles identified in the theoretical frameworks in Section 2.3 (Guest *et al.*, 2013).

Research papers, comment letters and articles in the popular press (Bitcoin literature) were purposefully selected by the researcher and analysed for key themes (Leedy and Ormrod, 2014). As the intention is not to quantify or generalise results but to illuminate the characteristics of the Bitcoin, a random sampling technique was unnecessary (Saunders *et al.*, 2009; Leedy and Ormrod, 2014). Instead, validity and reliability was ensured by the sampling of papers (until saturation) from reputable databases: EBSCO, Elsevier, JSTOR, Social Science Research Network (SSRN) and Wiley. The researchers included all sources found in these databases dealing with Bitcoins, excluding only those sources which repeated information and, therefore, did not highlight any additional features of the Bitcoins.

The Bitcoin literature was then subjected to open coding. Each paper was analysed for commonalities which were then aggregated into recurring themes (Guest *et al.*, 2013; Leedy and Ormrod, 2014). The initial themes (or open codes), identified during the preliminary literature review, are discussed in Section 2.2 and summarised in Figure 1. Following this, the themes were analysed by the researcher using the accounting principles highlighted in Section 2.2 (axial codes) (Leedy and Ormrod, 2014). The aim is not to prove a statistical relationship but to identify initial links between the themes and draw interconnections with the principles of neoliberalism and stewardship. The final open and axial codes are also used as row and column headings, respectively, in the correspondence analysis (Section 3.3).

The subjectivity of the process is not, in itself, a threat to research quality (Creswell and Clark, 2007), as a result of the exploratory nature of the study (Maroun, 2014). The unrestricted coding exercise, informed by the prior Bitcoin literature, and a clearly defined theoretical framework, avoids the reductionist aim of positivist techniques (Saunders *et al.*, 2009; Guest *et al.*, 2013), which would be a significant limitation, given the absence of prior research on the accounting for the Bitcoin.

3.2 Correspondence analysis

In the next phase, a correspondence analysis (Kudlats *et al.*, 2014) was carried out with accounting experts. These included accounting academics, auditors and practitioners, with a minimum of 3 years' experience[16]. The aim of the correspondence analysis is to represent the relationship between the characteristics of the Bitcoin and the themes drawn from the inductive thematic analysis. The intention is to complement the content analysis carried out by the researcher with perspectives of a purposeful sample of experts on the correlation between characteristics of the Bitcoin (open codes or row headings) with motifs of neoliberalism and stewardship and the related financial reporting recommendations (axial codes or column headings).

The use of correspondence analysis is appropriate, as this technique is becoming increasingly popular as an exploratory tool, rather than as a means of pure statistical analysis (Beh, 2004). Correspondence analysis has, for example, been used in archaeology (Clouse, 1999), architecture (Habib *et al.*, 2012), auditing (Maroun, 2014), family business research (Kudlats *et al.*, 2014), marketing (Hoffman and Franke, 1986; Bendixen, 1996), psychology (Doey and Kurta, 2011), taxation (Maroun *et al.*, 2011) and tourism (Chen, 2001), where the emphasis was on *exploration* of the relevant subject matter.

As discussed in Section 3.1, a wide variety of sources was considered when developing the summary of Bitcoin characteristics used as row headings (Kudlats *et al.*, 2014). Similarly, the development of column headings (based on the theoretical frameworks in Section 2.2) relied on high-quality peer-reviewed publications and was peer-reviewed by the support researchers. The final correspondence table is presented in Appendix 1 (Habib *et al.*, 2012). It cross-tabulates accounting principles from the prior literature (as the columns "*C1*" to "*C13*"), with characteristics of the "currency" (as the rows "*R1*" to "*R17*"). The result is a 13-column × 17-row correspondence table. The order of the entries in the correspondence table and the assigned symbols have no specific meaning.

The correspondence table was completed by a sample of 40 experts[17]. The researcher contacted respondents directly and informed them of the purpose and nature of the research. They were provided with a brief explanation of the technique and the final correspondence table. Instructions on how to complete the correspondence table were also provided. As an added quality safeguard, the correspondence table was piloted with accounting academics at the University of the Witwatersrand to ascertain its validity and suitability. The participants were asked to mark with a "1" cells where they felt that the characteristics of the Bitcoin (rows) correspond positively with the accounting principles (columns). Each cell could be marked or left blank depending on the opinion of the participant. Each response and non-response was assigned a value of "1" or "0" respectively, so that the data were standardised to enable analysis. The results were aggregated into a single frequency table.

A "map" was then developed (Kudlats *et al.*, 2014). Firstly, the masses of the rows and columns were determined, including the column and row profiles (Habib *et al.*, 2012). Next, these values were used to determine the inertia of each point in the table (Maroun *et al.*, 2011). Correspondence analysis uses a concept known as inertia to ascertain the relationship between the variables under analysis (Kudlats *et al.*, 2014). Each data point in the analysis has a set of coordinates, assigning it a location in the visual map. These points are a certain distance away from the average of all the data points, known as the

centroid (Kudlats *et al.*, 2014). The maximum number of dimensions was then computed as 12, being the lesser of the number of columns (13 accounting themes) and rows (17 Bitcoin characteristics), less 1 (Kudlats *et al.*, 2014) (i.e. the degrees of freedom). Following this, principal component analysis (Kudlats *et al.*, 2014) was used to ascertain the plot coordinates of each point and position them in a visual map, also known as a correspondence plot (Doey and Kurta, 2011; Maroun, 2014).

STATA was used to generate the summary statistics and correspondence plot (Doey and Kurta, 2011; Habib *et al.*, 2012; Kudlats *et al.*, 2014). Once these were generated, they were interpreted by the researcher. This involved a visual inspection of the map to determine the relationship between the row and column points (Kudlats *et al.*, 2014). This was carried out by identifying which row or column points contributed significantly to the total inertia of the analysis. Only those points with an above-average inertial contribution (or which were only marginally below average) were included in the final plot. Based on inertial contributions, the correlation coefficients and the sign of the points, column headings were used to label the x- and y-axes in the final correspondence plot (Section 4). The same approach was used to assign row points to the different dimensions of the plot[18]. Finally, the association between the dimensions (column headings) and Bitcoin characteristics (row points) was interpreted by the researchers, generating an initial set of accounting policy choices based on the views of the experts who completed the plot (adapted from Maroun *et al.*, 2011; Kudlats *et al.*, 2014).

3.3 Semi-structured interviews

Once the correspondence analysis was completed and analysed by the researcher, the final correspondence plot (Figure 2) was analysed further during semi-structured interviews with an additional ten experts. These included practitioners (four), academics (three) and representatives from the technical accounting units at two of the Big 4 (three). To ensure that the data were relevant and reliable, the approach followed

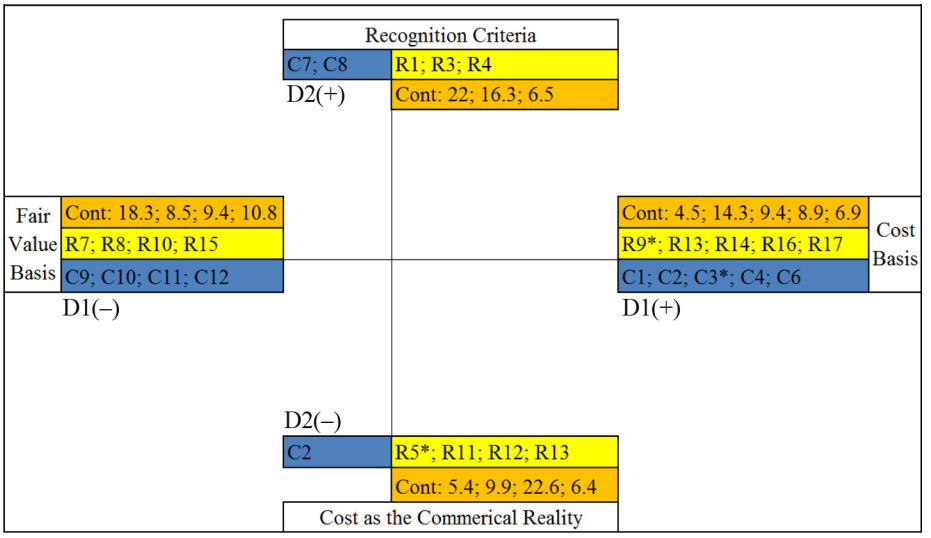

Figure 2.
Correspondence plot

by Holland (1998) was used. A time was set up with each respondent. At the start of the interviewees, participants were reminded of the nature and purpose of the research and that there were no "correct" or "incorrect" answers. They were then given a copy of the correspondence plot and provided with a brief explanation of how the plot was developed (adapted from Maroun, 2014).

Questions were semi-structured and based on the correspondence plot. The interviewees were encouraged to interpret the plot freely and explain how Bitcoins could be accounted for and the reasons for their views. Where necessary, respondents were asked to elaborate on particular points to ensure that the researcher was correctly interpreting their explanations. The highest levels of research ethics were maintained throughout the process. Notes were taken manually during the course of the interviews which lasted between 30 min and 1 h. Themes, concepts or principles emerging from each interview were highlighted and contrasted with the prior literature on Bitcoins (Section 2.2) and the chosen theoretical framework (Section 2.2). This allowed the detailed interviews to be used in a type of triangulation process where the content analysis, the correspondence plot (based on the views of 40 experts) and the findings from the detailed interviews (with an additional ten experts) were used to provide insight and to reinforce views on the accounting for Bitcoin (adapted from Holland, 1998; Leedy and Omrdod, 2001; Maroun, 2014).

4. Results

Table I presents the descriptive statistics. At 192 degrees of freedom, the χ^2 statistic of 440.41 is in excess of the critical value (at a 99.9 per cent confidence level), providing evidence to suggest that there is a statistically significant dependence between rows and columns. The total inertia is explained by 12 dimensions. Table I also shows that the first two dimensions (which are the x- and y-axes in the final correspondence plot) account for just over 73 per cent of the total inertia and, thus, for most of the exploratory potential of the graphical plot. While the inclusion of more dimensions will increase the percentage of the inertia explained, the result would be difficult to interpret (Hair *et al.*, 2010), in light of the only marginal increase in exploratory potential. The choice of two dimensions is consistent with the fact that the study is interpretive in nature, and does not strive to create generalisable results[16].

Only those characteristics and accounting themes which make an above-average inertial contribution are included in the correspondence plot (Figure 2) to ensure ease of interpretation[19]. In this regard, Bitcoin characteristics (*R*'s) with a contribution exceeding 5.88 per cent (100 per cent/17) and accounting themes (*C*'s) with a contribution exceeding 7.69 per cent (100 per cent/13) were included in the correspondence plot. Row and column labels are summarised as follows:

Table I.
Descriptive statistics

Active rows	17
Active columns	13
Number of observations	2955
Pearson's χ^2 (192)	440.41
Prob > χ^2	0.0000
Total inertia	0.1490
Number of dimensions	2
Explained inertia (two dimensions)	73.23%

(1) Accounting policy themes (column headings):
- *C1*: The Bitcoin should be recognised at cost.
- *C2*: Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality.
- *C3**: The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary.
- *C4*: The emphasis should be on evaluating management's decision to acquire or "produce" Bitcoins rather than accounting for changes in the market value of the Bitcoin.
- *C6*: The accounting should not result in the recognition of unrealised gains.
- *C7*: Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity.
- *C8*: Bitcoins are recognised when acquired or available to be used as intended by management.
- *C9*: The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin.
- *C10*: The past transaction giving rise to the Bitcoin does not provide useful information for users.
- *C11*: Volatility should not preclude the recognition of the Bitcoin.
- *C12*: Volatility in the price of Bitcoins on hand must be communicated to users.

(2) Bitcoin characteristics (row headings):
- *R1*: All Bitcoin transactions are recorded on a public digital record, to ensure that the Bitcoins are authentic and not duplicated.
- *R3*: The Bitcoin exists digitally.
- *R4*: Bitcoins are easily transferrable, but transactions are irreversible.
- *R5**: The Bitcoin trades at different prices on different exchanges.
- *R7*: Bitcoins can be used for speculative purposes.
- *R8*: Bitcoins can be used as a store of wealth.
- *R9**: Bitcoins can be "produced" using a computer, but this requires enormous computing power.
- *R10*: The value of the Bitcoin has ranged from US$0.75 to a high of US$1,242.
- *R11*: The supply of Bitcoins is limited at 21 million Bitcoins.
- *R12*: The Bitcoin has no intrinsic value.
- *R13*: Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy.
- *R14*: Bitcoins are items traded in the ordinary course of business.
- *R15*: The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency.

- *R16*: Bitcoins can be seen as assets used in the production or supply of goods or services.
- *R17*: Bitcoins are akin to a consumable used in the facilitation of a transaction.

Taking into account the sign of each accounting policy theme, its correlation coefficient and inertial contribution (Appendices 2 and 3), the x- and y-axes are labelled (Table II). Each row-point's sign, correlation coefficient and chi-squared value-variance are then used to position the row points on the positive or negative x- and y-axes (adapted from Bendixen, 1996; Maroun *et al.*, 2011). The sign of any point is only indicative of its positioning relative to the axes (both x and y) and does not, in itself, indicate a favourable or unfavourable relationship.

The allocation of column headings to axes of the correspondence plot is presented in Table II. The name assigned to each axis was developed interpretively by the researchers.

Axis	Characteristics	Label
Positive x-axis (Dimension 1 per Figure 2)	*C1*: The Bitcoin should be recognised at cost *C2*: Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality *C3**: The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary *C4*: The emphasis should be on evaluating management's decision to acquire or "produce" Bitcoins rather than accounting for changes in the market value of the Bitcoin *C6*: The accounting should not result in the recognition of unrealised gains	Cost basis
Negative x-axis (Dimension 1 per Figure 2)	*C9*: The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin *C10*: The past transaction giving rise to the Bitcoin does *not* provide useful information for users *C11*: Volatility should not preclude the recognition of the Bitcoin *C12*: Volatility in the price of Bitcoins on hand must be communicated to users	Fair value
Positive y-axis (Dimension 2 per Figure 2)	*C7*: Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity *C8*: Bitcoins are recognised when acquired or available to be used as intended by management	Recognition criteria
Negative y-axis (Dimension 2 per Figure 2)	*C2*: Accounting for changes in the market price of the Bitcoin is imprudent and fails to reflect commercial reality	Cost as the commercial reality

Table II.
Names of the axes

Table III sets out the axes, their labels and the characteristics of the Bitcoin which correlate with the axes, based on the results generated by the principal component analysis (Appendices 2 and 3).

Figure 2 represents the correspondence plot. The results were stratified into four quadrants based on the coordinates in each dimension. For example, *R1* was statistically significant in Dimension 2 (contribution of 22 per cent exceeded the average of 5.88 per cent) and the coordinate was positive in Dimension 2, meaning that it lies on the positive y-axis. "Cont" represents the percentage contribution of the Bitcoin characteristic to the relationship. The labels of each quadrant are shown on the diagram, as discussed above.

5. Discussion and results

Bitcoins are recorded on a digital record (*R1*), thereby ensuring that they exist as an authentic and unique unit of account (*R1*; *R3*). The fact that Bitcoins are easily transferrable (*R4*) was also reasonably correlated with the principle of recognising the coins when there is objective evidence of the reporting entity having control over the unit of account (*C7*) and the coins being available to be used in the manner intended by management (*C8*). Collectively, these findings are in line with the Conceptual Framework, which defines an "asset" as a resource under the control of the reporting entity and requires the recognition of assets only when there is a probable inflow of economic benefits inherent in the asset under review (IASB, 2012). This sentiment was

Positive x-axis (Dimension 1 per Figure 2): *Cost basis*	*R9**: Bitcoins can be "produced" using a computer, but this requires enormous computing power
	R13: Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy
	R14: Bitcoins are items traded in the ordinary course of business
	R16: Bitcoins can be seen as assets used in the production or supply of goods or services
	R17: Bitcoins are akin to a consumable used in the facilitation of a transaction
Negative x-axis (Dimension 1 per Figure 2): *Fair value basis*	*R7*: Bitcoins can be used for speculative purposes
	R8: Bitcoins can be used as a store of wealth
	R10: The value of the Bitcoin has ranged from US$0.75 to a high of U$1,242
	R15: The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency
Positive y-axis (Dimension 2 per Figure 2): *Recognition criteria*	*R1*: All Bitcoin transactions are recorded on a public digital record, to ensure that the Bitcoins are authentic and not duplicated
	R3: The Bitcoin exists digitally
	R4: Bitcoins are easily transferrable, but transactions are irreversible
Negative y-axis (Dimension 2 per Figure 2): *Cost as the commercial reality*	*R5**: The Bitcoin trades at different prices on different exchanges
	R11: The supply of Bitcoins is limited at 21 million Bitcoins
	R12: The Bitcoin has no intrinsic value
	R13: Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy

Table III. Relationship between the x- and y-axis and Bitcoin characteristics

shared by all of the accounting experts participating in the detailed interviews who also pointed out that the accounting is consistent with the principles in existing IFRS dealing with the initial recognition of inventory (IAS 2), plant and equipment (IAS 16) and intangible assets (IAS 38).

Having recognised the Bitcoin when the reporting entity is able to demonstrate that it has control over the instrument, respondents highlighted two possible measurement options. In the first instance, the Bitcoin is interpreted as an integrated part of the reporting entity's ordinary production process. The fact that Bitcoins can be produced (*R9*), are traded in the ordinary course of business (*R14*), can be used as a consumable (*R17*) or can be used in the production of goods and services (*R16*) were characteristics strongly correlated with measurement at cost. One expert explained the correlations in Figure 2 in more detail:

> One view is that the Bitcoin is a type of financial instrument. But what the correspondence analysis tells me is that when these things are being used as an integral part of a non-financial operation (in the production process or for resale in the ordinary course of business) the economics is that they are very similar to inventory and [plant and equipment]. Presently, the IFRS give us guidance on how to account for these – at cost less impairment (Technical Accounting Unit).

The Conceptual Framework (IASB, 2012) provides no theoretical basis for measuring an asset after initial recognition. What respondents, however, seemed to be taking into account was the underlying business rationale for acquiring or producing the coins (ICAEW, 2010). The fact that the coins were akin to inventory or plant and equipment in traditional (non-financial) production or exchange transactions precluded recognition at fair value (*C1*). Instead, respondents appeared to place emphasis on the costs of producing the respective goods and services (*C4*) and on understanding management's ability to deploy the reporting entity's resources to generate a profit (*C4*). Accounting for changes in the value of the Bitcoins due to market forces (*C6*) was not a primary concern:

> In these instances, what your users are probably going to be the most interested in is the cost of the Bitcoins and the revenues that are generated […]. One may argue that fair value accounting brings a measure into the accounting which management does not control and which does not help with understanding how management is dealing with the operating variables in the business (Accounting Academic).

In other words, in instances where the Bitcoin forms a part of the normal production or merchandising activities of the reporting entity, respondents favoured an accounting model grounded in principles of stewardship (Whittington, 2008). This model requires the tracking and allocation of costs to cost objects (Whittington, 2008) and the impairment (but not revaluation) of an inherently non-financial item (*C3*). A disconnect between the Bitcoin as an "element" of a non-financial process and reliance on exit price information offered by fair value accounting (see IFRS 13) was regarded as undermining the usefulness of financial reports (*C2*). As argued by Ravenscroft and Williams (2009), however, the growing relevance of the information content of financial reports – and the relaxing of the importance of the reliability of measurements as an objective of financial reporting – cannot be overlooked (IASB, 2012). For example, one interviewee commented:

> If you look at our economy today with all these things […] Just look at Bitcoins, just look at all these deals that they do with the financial instruments and all of those things, to even think

> that a cost model is actually appropriate within our economic environment doesn't make a lot of sense to me anymore […] (Technical Accounting Unit).

Many of those completing the correspondence analysis were in favour of a fair value measurement basis for the Bitcoin. In cases where the Bitcoin is being used for speculative purposes (*R7*) or as a store of wealth (*R8*), for example, the weak correlations between *R7* and *R8* and the positive x-axis imply that accounting for and allocating changes in the cost of the coins would not achieve fair presentation. As explained by one interviewee:

> If there is no clear link to the tangible items (like inventory and PPE) then to superimpose the cost model does not provide useful information. The accounting must reflect the economics and if the Bitcoins are being used in a manner where management would be interested in changes in fair value, then these changes needs to be communicated to the users (Practitioner).

For example, when Bitcoins are regarded as similar to a type of currency unit or financial instrument[20] (*R15*), accounting for changes in the fair value appears to be regarded as better reflecting the nature of the underlying economic resource under the control of the reporting entity. Consequently, the past transaction giving rise to the Bitcoin (*C10*), and resulting costs, is not as important as accounting for changes in realised and unrealised gains (*C9*). The preliminary correlations between *R7*, *R8*, *R10* and *R15* and the negative x-axis suggest (Figure 2) that, where the Bitcoin is far removed from the normal consumable and production cycles of the reporting entity, reliable measures of cost take second place to recording changes in market value (see IFRS 13), even if this results in volatile measures of comprehensive income (*C11*; *C12*). Consider, for example, the following comment:

> If volatility is genuine – if it is telling you about the underlying nature of the resource, then why don't you want to include that in the financial statements? Remember that neutrality is a qualitative characteristic of useful financial statements. You can't just exclude the fair value because earnings become more difficult to predict. If that's the nature of the business, that's what the users need to know about (Technical Accounting Unit).

For this interviewee, the emphasis was more on the provision of relevant information than on objective measures of the value of the Bitcoin which were totally verifiable (cf Whittington, 2008). Contrary to an accountability-orientated perspective (which champions prudence and reliability of measures), the position of those supporting accounting for the Bitcoin at fair value was that if "the economic reality […] is volatility […] fair value has even a more important role [to play]". This view is consistent with the correlations in Figure 2. *R10* is highly correlated with *C11* showing that the significant spread in the price of the Bitcoins over the past 12 months (*R10*) necessitates the use of a fair value accounting model, especially given the fact that, under such circumstances, cost information would become quickly outdated.

This is not, however, to say that volatile prices of the underlying should always be regarded as an indicator of the appropriateness of a fair value measurement basis. Consider, for instance, the following rebuttal:

> That which you report should have a predictive value. It should allow me to predict, or enable me to predict. If it's [the Bitcoins' value] so volatile that it's inherently unpredictable […] you should just show me the cost (Practitioner).

The correspondence analysis identified several characteristics of the Bitcoin (*R5*; *R11*; *R12*; *R13*) which suggested that accounting for changes in the market price of the Bitcoins may not necessarily reflect economic reality (*C2*). Firstly, the Bitcoin has no intrinsic value (*R12*), unlike precious metals or "traditional" financial instruments which derive value from an underlying resource (Practitioner). Related to this, the supply of the Bitcoin is limited as a result of the mathematical complexity of the mining process and given information processing technology (*R11*). Finally, the price of the Bitcoin is not directly impacted by well-known macroeconomic variables such as GDP, interest rates or fiscal policy (*R13*).

> The economic reality is that the Bitcoins could be just pie in the sky. The correlations [per Figure 2] are showing you that fair value makes theoretical sense *if* Bitcoins are like genuine financial instruments. The problem is that they are not. They don't track underlying economic indicators […] I'm not saying that we can predict how derivative markets will behave but we can at least understand some of the major movements with reference to what's happening in global markets. For me, that just is not happening with the Bitcoins. That's what the correspondence graph is showing and that's why some of your participants can't understand the fair value accounting (Practitioner).

In a similar light, several respondents indicated that the Bitcoin could not be regarded as a form or currency and, as a result, failed to represent a contractual right to receive a fixed or determinable quantum of currency. This would preclude carrying the instrument at fair value (see IFRS 9 and IAS 21). The correlations between *R5*, *R11*, *R12* and *R13* and *C2* also call into question the appropriateness of communicating changes in the value of the coins to the users of financial statements. If the Bitcoin's price is not driven directly by macroeconomic forces (as would be the case with fiat currency), even a neoliberal model may question the information content of this price volatility.

A counterargument is that the market price is an indication of the economic resources inherent in the Bitcoin at a point in time. Provided that the coin is not being used in the process of manufacture or production, the cost of the coin – and the allocation of costs to different line items in the statement of comprehensive income – does not communicate reliably the returns being generated by the reporting entity from its given asset base (Ravenscroft and Williams, 2009; Whittington, 2008). Where the coin is being used as a store of wealth or for speculative purposes (*R7*; *R8*), reporting changes in the market prices of the coins to users of the financial statements gives them information which is consistent with the entity's business model and which is, more likely than not, being monitored by management. This is true even if the market price of the coin is very volatile and its value does not appear to be directly linked with underlying macroeconomic variables (as evidenced by the weak correlations of *R11* and *R13* with the negative x-axis).

Overall, the correspondence (supported by additional analysis during semi-structured interviews) has identified two possible accounting polices based on cost (and principles of accountability) or fair value (informed by a neoliberal paradigm). Our interviewees agreed that this was not indicative of an inconclusive outcome. On the contrary, the interpretive analysis of the Bitcoin's characteristics has highlighted the essential principle of ensuring that the chosen accounting policy reflects the underlying economic reality (IASB, 2012). When it comes to Bitcoins, this is interconnected with the reporting entity's business model. While interviewees (and the experts completing the

correspondence plot) have raised arguments for and against the use of fair value or cost, the general view was that accounting for the Bitcoin needs to give the user an understanding of "why management invested resources in Bitcoins" and "how it intends to realise their wealth" (Technical Accounting Unit). Having to take the internal decision-making processes of the reporting entity into consideration when determining how to account for the coins may lead to additional subjectivity. The general consensus of the interviewees was that this was no more subjective than the process of applying specific IFRSs which, despite the increase in the use of rules, remain essentially principles-based.

6. Conclusion

Bitcoins are gaining popularity as a means of settling transactions, as stores of wealth and in the speculative trading arena (Rees, 2014). Nevertheless, we know very little about how this virtual "currency" should be accounted for by reporting entities and communicated to the users of their financial statements. Accordingly, the objective of this research is to offer the first (albeit normative) recommendations for the initial recognition and subsequent measurement of the Bitcoin.

The characteristics of the Bitcoins were identified using an inductive thematic analysis of a wide range of sources to gain an understanding of the economic nature of the unit of account. These served as row headings in the final correspondence table and plot. Given their widespread use in the financial reporting academic literature, the principles of neoliberalism and stewardship informed the accounting policy options available and were included as column headings in the analysis. The correlations between rows and columns were determined using principal component analysis and reduced to an easy-to-interpret plot. This correspondence plot highlighted recognition criteria for the Bitcoin, based on an objective assessment of the ability of the reporting entity to control the Bitcoin. The plot also revealed two distinct measurement policies.

In cases where the Bitcoin is being used as a store of wealth or for speculative purposes, respondents favoured measurement at fair value. The correlations between the respective row and column headings suggest that fair value information is best suited to communicating the underlying volatility of the price of the Bitcoins and their nature as a financial resource. In contrast, when the Bitcoin is used in the production or supply of goods or services, respondents appear to prefer a cost basis for measurement. Information about the historic cost of the coin, and the allocation of these costs to cost objects, was seen as giving more useful information for evaluating stewardship and the ability of the reporting entity to generate profits from the sale or use of the coins. Under these circumstances, fair value information is not necessarily objective and reliable – especially given the fact that the price of the Bitcoin does not appear to be linked to underlying macroeconomic variables. It also results in the inclusion of exogenous information, over which management has little control, in the determination of how well the management has deployed the resources under its control.

Overall, the correspondence analysis reveals the emphasis on cost and fair value proposed by models grounded in stewardship and neoliberalism, respectively. At first glance, these measurement bases appear to be alternatives. The correlations between row and column headings, however, suggest that the primary factor at work is the need to

account for the underlying economics of the unit of account, something which is informed heavily by the organisation's business model. Cost and fair value may be conceptual opposites but in the eyes of our respondents, these need to be used to achieve the single goal of communicating the economic rationale for holding the Bitcoin.

This paper has provides an initial perspective on how this objective could be achieved. Additional research will, however, be needed. Most notably, the correspondence analysis has been developed by the researchers and interpreted by a small group of experts. More exploratory research techniques are, therefore, required to provide additional insights. As part of this, the views of multiple user groups need to be examined, including how these views differ and how reporting entities will balance the information needs of competing stakeholders to account for the Bitcoin. Nevertheless, this study offers a novel technique to provide insights into the accounting for unusual transactions. As with any research method, there are inherent limitations but at a minimum, this study demonstrates that content and correspondence analysis, complemented by semi-structured interviews, can be used to aggregate relatively large amounts of data and provide practical recommendations for accounting for transactions which are not specifically within the scope of current accounting standards.

Notes

1. Definitions of terms are included in Appendix 4.
2. Definitions of uncommon terms can be found in Appendix 4.
3. For example, South African online retailer, Takealot (Wong, 2014).
4. On average, from 1 January 2014 to 10 August 2014.
5. In 2014 alone, over US$300 million was invested in Bitcoin-related entities, with further global adoption expected (Mauldin, 2014).
6. This research deals only with the cost and fair value accounting implications of "stewardship" and "neoliberalism". As discussed by Zhang and Andrew (2014), Ravenscroft and Williams (2009) and Whittington (2008), these theories include interesting political and social dimensions. These are, however, beyond the scope of this paper.
7. "Nakamoto" is most likely a pseudonym (Piotrowski, 2013).
8. The aim of this paper is not to debate whether Bitcoin is akin to a "currency" or to anything that is currently governed by IFRS. Rather the study determines the characteristics of Bitcoin which should influence the accounting.
9. Even some digital currencies are controlled by a central agency. An example is the Linden Dollar, which is used in the massively popular multiplayer online game, Second-Life, and which is controlled by Linden Labs (Jacobs, 2011).
10. For example, US computer giant Dell (Flacy, 2014) and South African online retailer Takealot (Wong, 2014).
11. This reward halved from 50 Bitcoins on 28 November 2012.
12. The suggestion to consult standards set by other standard-setting entities is not considered, and is an area for future research.
13. We appreciate that other theoretical frameworks could have been applied. For example, a finance paradigm could have been used to analyse the measurement of the Bitcoins at fair

value. This study, however, uses the primary theoretical issues informing the development of IFRS as per Whittington (2008) and Ravenscroft and Williams (2009). Examining alternate theoretical perspectives is beyond the scope of this research.

14. This is possibly corroborated by the release of IFRS 13: *Fair Value Measurement*, by the IASB in 2011.
15. This approach is also followed by the IASB when accounting for financial instruments under IFRS 9.
16. The respondents' ages ranged from 28 to 65 years. Differences between the opinions of the categories of respondents were not considered.
17. Consistent with prior exploratory studies (Kudlats *et al.*, 2014; Maroun, 2014).
18. It is important to keep in mind that this is a normative process but is consistent with studies by Bendixen (1996), Clouse (1999), Doey and Kurta (2011) and Kudlats *et al.* (2014).
19. The Appendices include row and column statistics used to determine the final plot. For additional analysis based on the interview data, some marginally statistically significant elements were included in the correspondence plot and are marked with an asterisk.
20. In this respect, respondents appeared to disregard the technical features of fiat currency when drawing parallels between traditional forms of money and this virtual unit of account.

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Appendix 1

Table AI.
Data collection instrument

Row headings		Column headings C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Accounting themes Bitcoin characteristics	Bitcoin should be recognised at cost	Accounting for changes in the market value of the Bitcoin is imprudent and fails to reflect commercial reality	The carrying value of a Bitcoin should not exceed its market price and should be tested for impairment when necessary	The emphasis should be on evaluating management's decision to acquire or "produce" Bitcoins rather than accounting for changes in market value	Accounting needs to reflect the future cash flows inherent in the Bitcoin only to the extent that these are reliably measurable	The accounting should not result in the recognition of unrealised gains	Bitcoins are recognised when there is objective evidence that control of the Bitcoins vests with the reporting entity	Bitcoins are recognised when acquired or available to be used as intended by management	The emphasis should be on accounting for realised or unrealised changes in the market value of the Bitcoin	The past transaction giving rise to the Bitcoin does *not* provide useful information for users	Volatility should not preclude the recognition of the Bitcoin	Volatility in the price of Bitcoins on hand must be communicated to users	Emphasis should be placed on capturing the economic substance of the Bitcoin
R1	All Bitcoin transactions are recorded on a public digital record, to ensure that the Bitcoins are authentic and not duplicated													
R2	The Bitcoin is not overseen by any central body and is not legislated													
R3	The Bitcoin exists digitally													
R4	Bitcoins are easily transferrable, but transactions are irreversible													

(*continued*)

Row headings	Column headings												
	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
R5	The Bitcoin trades at different prices on different exchanges												
R6	Bitcoins can be used as a means of payment for goods or services offered by Bitcoin merchants												
R7	Bitcoins can be used for speculative purposes												
R8	Bitcoins can be used as a store of wealth												
R9	Bitcoins can be "produced" using a computer, but this requires enormous computing power												

(*continued*)

Table AI.

Table AI.

Row headings		Column headings C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
R10	The value of the Bitcoin has ranged from US$0.75 to a high of US$1,242													
R11	The supply of Bitcoins is limited at 21 million Bitcoins													
R12	The Bitcoin has no intrinsic value													
R13	Bitcoin supply and demand is not linked to macroeconomic variables such as interest rates, GDP or fiscal policy													
R14	Bitcoins are items traded in the ordinary course of business													
R15	The Bitcoin can be regarded as a type of currency or contractual right to receive a fixed or determinable amount of currency													

(*continued*)

Row headings	Column headings												
	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
R16	Bitcoins can be seen as assets used in the production or supply of goods or services												
R17	Bitcoins are akin to a consumable used in the facilitation of a transaction												

Table AI.

Appendix 2

Categories		Overall		Dimension 1 (x-axis)			Dimension 2 (y-axis)		
Rows	Mass	Quality	(%) Inertia	Coord	Sqcorr	Contrib (%)	Coord	Sqcorr	Contrib (%)
R1	0.055	0.857	0.059	0.065	0.007	0.10	0.854	0.850	22.00
R2	0.032	0.02	0.053	−0.008	0.000	0.00	−0.165	0.020	0.50
R3	0.043	0.709	0.054	0.138	0.028	0.30	0.839	0.681	16.30
R4	0.05	0.62	0.046	−0.383	0.295	2.70	0.489	0.324	6.50
R5	0.064	0.545	0.041	−0.29	0.244	2.00	−0.393	0.301	5.40
R6	0.066	0.232	0.016	−0.08	0.050	0.20	0.187	0.182	1.30
R7	0.067	0.89	0.109	−0.868	0.850	18.30	−0.231	0.040	1.90
R8	0.073	0.829	0.052	−0.565	0.828	8.50	0.027	0.001	0.00
R9	0.065	0.645	0.04	0.436	0.568	4.50	0.196	0.077	1.40
R10	0.07	0.872	0.065	−0.609	0.730	9.40	−0.328	0.142	4.10
R11	0.028	0.774	0.029	0.046	0.004	0.00	−0.804	0.771	9.90
R12	0.043	0.747	0.094	0.49	0.201	3.80	−0.985	0.546	22.60
R13	0.06	0.778	0.111	0.811	0.647	14.30	−0.445	0.131	6.40
R14	0.068	0.75	0.067	0.616	0.710	9.40	0.180	0.041	1.20
R15	0.069	0.891	0.062	−0.655	0.877	10.80	0.099	0.013	0.40
R16	0.074	0.817	0.056	0.574	0.807	8.90	0.075	0.009	0.20
R17	0.073	0.747	0.046	0.507	0.747	6.90	0.009	0.000	0.00

Table AII. Statistics for Bitcoin characteristics

Appendix 3

Categories		Overall		Dimension 1 (x-axis)			Dimension 2 (y-axis)		
Columns	Mass	Quality	(%) Inertia	Coord	Sqcorr	Contrib (%)	Coord	Sqcorr	Contrib (%)
C1	0.073	0.61	0.103	0.662	0.570	11.70	−0.213	0.040	1.80
C2	0.037	0.927	0.158	1.086	0.502	15.70	−1.218	0.425	29.40
C3	0.069	0.543	0.04	0.369	0.437	3.40	−0.222	0.106	1.90
C4	0.053	0.807	0.09	0.859	0.802	14.30	0.078	0.004	0.20
C5	0.087	0.276	0.039	−0.25	0.255	2.00	0.086	0.020	0.40
C6	0.054	0.692	0.08	0.702	0.617	9.70	0.298	0.075	2.60
C7	0.1	0.897	0.084	0	0.000	0.00	0.781	0.897	33.20
C8	0.099	0.85	0.05	0.072	0.019	0.20	0.582	0.831	18.20
C9	0.076	0.849	0.102	−0.738	0.754	15.20	−0.321	0.095	4.30
C10	0.047	0.654	0.073	−0.736	0.648	9.40	−0.089	0.006	0.20
C11	0.088	0.839	0.058	−0.505	0.714	8.20	−0.258	0.125	3.20
C12	0.091	0.702	0.087	−0.554	0.590	10.20	−0.294	0.111	4.30
C13	0.125	0.032	0.037	0.028	0.005	0.00	−0.080	0.027	0.40

Table AIII. Statistics for accounting policy themes

Appendix 4

Definitions

- *Block chain*: An electronic log of all Bitcoin transactions (Woo *et al.*, 2013).
- *Cryptography*: The science of altering and/or transmitting data so that it can only be read by the intended recipient (Kessler, 2014).
- *Fiat money*: Money which is regarded as legal tender by a central authority, and is backed by the assurances of that authority (Christopher, 2014).
- *Mining*: The process by which mathematical puzzles are solved through the use of computing power in order to add Bitcoin transactions to the block chain (Shcherbak, 2014).
- *Neoliberalism*: In accounting, this represents a shift towards reporting that is focused on faithful representation, and less on reliability (Ravenscroft and Williams, 2009).
- *Specie money*: Money which is backed by a valuable commodity, such as gold or other precious metals (Christopher, 2014).
- *Stewardship*: In accounting, this represents the idea that reporting should ensure accountability (Murphy *et al.*, 2012).

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