

Journal of
• Virtual Worlds Research

jvwresearch.org ISSN: 1941-8477

Lantern
Part 2/2



August 2014
Volume 7, No. 3

Volume 7, Number 3

Lantern part 2/2

August 2014

Managing Editor

Yesha Sivan,
Metaverse-Labs Ltd.
Tel Aviv-Yaffo Academic College, Israel

Issue Editors

Yesha Sivan,
Metaverse-Labs Ltd
Tel Aviv-Yaffo Academic College, Israel

Abhishek Kathuria,
The University of Hong Kong

David Gefen,
Drexel University, Philadelphia, PA, USA

Maged Kamel Boulos,
University of Plymouth, Devon, UK

Coordinating Editor

Tzafnat Shpak



The JVWR is an academic journal. As such, it is dedicated to the open exchange of information. For this reason, JVWR is freely available to individuals and institutions. Copies of this journal or articles in this journal may be distributed for research or educational purposes only free of charge and without permission. However, the JVWR does not grant permission for use of any content in advertisements or advertising supplements or in any manner that would imply an endorsement of any product or service. All uses beyond research or educational purposes require the written permission of the JVWR. Authors who publish in the Journal of Virtual Worlds Research will release their articles under the Creative Commons Attribution No Derivative Works 3.0 United States (cc-by-nd) license. The Journal of Virtual Worlds Research is funded by its sponsors and contributions from readers.



Volume 7, Number 3

Lantern (2)

August, 2014

Virtual Currencies, Micropayments and Monetary Policy: Where Are We Coming from and Where Does the Industry Stand?

Ruy Alberto Valdes-Benavides
University of Guanajuato, Mexico

Paula Lourdes Hernandez-Verme
University of Guanajuato, Mexico

Abstract

The exponential growth of the micropayments industry and the expansion of social networks in the last few years have produced the necessary conditions for the birth and growing importance of a distinct object that is fairly new to many disciplines: virtual currencies. The present work is a pioneering study in this field, in which we attempt to survey the main issues and challenges posed to Economic Theory and to the design and implementation of economic policy. Particularly, we are interested in the implications that virtual currencies may have for: 1) The economic principles associated with voluntary holdings of different kinds of money; 2) The rate-of-return dominance by some currencies that may coexist with currencies offering lower real returns; and 3) The state-of-the-art Monetary Dynamic Stochastic General Equilibrium models with micro-foundations. We believe that virtual currencies share some important features of both fiat currencies—whose value is mainly determined by the issuer's reputation and the people's beliefs regarding its future acceptability in exchange for goods or services—and commodity currencies, with intrinsic value. However, virtual currencies are typically issued by private agents, rather than by governments, and thus regulation and appropriate monitoring arise as potential problems that we may have to deal with in the near future.

1. Introduction

We investigate the implications of the growing use of virtual currencies in two dimensions: 1) the potential consequences on the scientific method applied to Economic and Monetary Theory; and 2) the operative changes implied for conducting monetary policy. As this is a fairly recent phenomenon, there are a limited number of serious academic studies on the topic. This is apparent even in the European Central Bank (2012) report on Virtual Currency Schemes.

One point to highlight is that the economic environment has recently been characterized by technological advancements that arise at break-neck speed, causing significant alterations to the way in which we carry out our day-to-day activities. However, the Arrow-Debreu benchmark only considers contingent commodities associated with uncertainty and location: even the most aggressive departures deal with physical environments where most people trade contingent commodities and where commerce takes place in traditional brick-and-mortar stores. The latter has been an appropriate characterization of trade until recently. A by-product of this is the emergence of a number of virtual currencies that aim to satisfy these new needs. These need to be complemented by a serious effort of the general equilibrium models to move forward as well.

The European Central Bank defines a virtual currency as a type of unregulated, digital (electronic) money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community. This definition also requires qualification with a number of other factors: first, there are examples of virtual currencies whose value is actually backed by tangible assets (as in the case of Ven); and second, a virtual currency can be issued either by a government¹ or by private agents (as in most cases). Third, as we will see below, not all virtual currencies are only accepted among the members of a specific virtual community; a few may also be accepted by users of other communities. Nevertheless, these currencies have in common with others the aspects, identified in Monetary Economics, that—whether or not a currency circulates in public hands—its value depends on how much one trusts the issuer and the advantages that the money provides us with.

The micropayment industry was a necessary precursor to the development of virtual currencies as we know them now²: a micropayment is defined as an online or mobile, real-time or deferred, financial transaction below a certain arbitrary monetary amount (usually around \$6.5), which initiates the instantaneous delivery of a digital or virtual good. Related technological advances have created a rapidly expanding market for micro-products, which has led to the emergence of virtual currencies that facilitate these transactions. The latter requires that we agree on how we define new objects such as digital goods and virtual goods, for which we rely on Webopedia and The Computer Language Company Inc., respectively: a digital good describes any good that is stored, delivered and used in electronic format, while virtual goods are images of real things that are purchased to enhance online games and social networks (usually with a very low price).

2. Virtual Currencies

The main use of virtual currencies is to buy virtual goods in online games, social networks and massive multiplayer online role-playing games (MMORPG). On the one hand, Facebook Credits were an example of a virtual currency in online games and social networks. On the other hand, the Linden Dollars in Second Life is a virtual currency that works in a virtual world.

¹ Mintchips will be issued by the Canadian government. For more information see Boswell (2012, April).

² However, this market has outgrown the micro-payments industry.

The growing participation in online gaming and social networks has facilitated the rapid increase in the global virtual goods market. According to Burelli et al (2011), in 2010, Europeans spent over \$1 billion on virtual goods, the Asian market is already worth over \$5 billion annually, and Americans will spend over \$2 billion by 2011. Their growth is set to continue, as it is becoming easier and cheaper to be a part of this market.

Some virtual currencies are exchangeable with other virtual currencies, and a few with fiat money. One can purchase them via various payments' services³ and/or trade them at web sites like Virwox or First Meta Exchange. Because there are ways to create wealth in these virtual worlds and online games, this opens an interesting area of business to study. For example, players of Entropia Universe (an MMORPG) already exchange real money for virtual currency, and the virtual money they make in the game (through virtual hunting, mining, trading or other activities) can be cashed out into real money. (The virtual currency Project Entropia Dollars has a fixed 10:1 exchange rate to the U.S. dollar in the official site, but its value fluctuates if one exchanges it at other currency exchange sites.) Governments in different countries are aware of this, but not much has been done. Many of them consider taxes when virtual currencies are converted to real money, but it is difficult to supervise this due to the ease of carrying out these activities "under the table". According to Sandqvist and Zackariasson (2010), the USA National Taxpayer Advocate 2008 Annual Report to Congress recommends that the IRS begin working on ways to tax economic activities within these arenas. According to Salomon and Soudoplatoff (2010), in 2007 China's government made the first important attempt to regulate a virtual currency, establishing controls over a virtual currency named QQ coins. These tokens were first used as play-money for virtual gifts, but businesses began accepting them in exchange for real goods because users of the currency were frustrated by the nation's banking infrastructure. The Chinese Department of Commerce barred the practice due to the central bank's concerns over the possible impact on the value of the Renminbi, limiting trade in the currency to virtual goods and virtual services.

Credit card companies are aware of the potential of these new markets. For example, in 2011 American Express bought a company called Sometrics, which in 2010 did 3.3 trillion units of virtual currency on their platform. According to Leber (2012, March), this acquisition has allowed the company tap into the rapidly growing field of online gaming and to develop capabilities to manage virtual currencies, the business volume of which is projected to nearly double by 2014.

According to Yamaguchi (2004), there are two notable characteristics of virtual worlds. First, they do not control money supply by issuing money arbitrarily. The balance between goods and money is determined by collective consumption/saving decisions by players. Secondly, there are generally no interest rates in virtual worlds. The absence of interest rates, *ceteris paribus*, reduces the incentive for saving and increases that for consumption. Since many virtual worlds do not have inflation of the general price level, we cannot say in general that consumption is preferred in virtual worlds relative to the real world. Nevertheless, there should still be greater incentive for consumption compared to the case in which there are interest rates.

There are other types of virtual currencies that work directly in the global economy. One of these is Bitcoin, which was defined by its creator Nakamoto (2008)⁴ as a strictly peer-to-peer version of electronic cash that allows online payments to be sent directly from one party to another without going through a financial institution. The main challenge to developing this kind of currency is the "double spending" problem. According to Lowenthal (2011, June) and Cohen (2011, July), Bitcoin's solution

³ For example: PayPal, Zong, Dwolla or conventional payment systems like credit cards.

⁴ Nakamoto is an alias for the real author or authors (actual names unknown).

was to ensure that each coin was its own certificate of authenticity: as soon as a transaction takes place, the recipient publishes the transaction to the global Bitcoin network. Hence, every Bitcoin user has evidence that the coin has been spent, and users will only accept that coin from the new owner. Also, according to the European Central Bank (2012), Bitcoins are almost entirely anonymous and are divisible to eight decimal places, enabling their use in any kind of transaction, regardless of the value. According to Cohen (2011, July, n.p.): “In the Bitcoin system, a new coin is produced whenever a computer can calculate an answer to a difficult problem, and then attaches that answer to a digital record of every transaction of every Bitcoin ever traded.” Anyone is free to create a new coin, within prescribed supply limits, by providing computer power that helps to prove that it is in fact a valid Bitcoin. Bitcoins can also be traded for dollars (1 Bitcoin equals \$794.3) and they are accepted in different online retail stores as well as in a few “bricks and mortar” retail stores and cafés⁵. One can purchase not only digital and virtual goods with Bitcoin, but also physical goods in some retail businesses. In 2011 they were seven million of these “coins” in circulation and the rate of increase—currently, 50 coins are added every 10 minutes—will slow each year until the number tops out at 21 million coins around 2025. However, the EBC states in its report that Bitcoins are still relatively immature and illiquid: 6.5 million Bitcoins are shared by only 10,000 users, and this is a clear disincentive for its use.

The value of Ven floats against other currencies and the price is based on a basket of currencies, commodities (such as gold, silver, Brent crude oil) and carbon futures. This is intended to make the value of this currency very stable, because no single element of this basket has a strong influence relative to the other influences in the basket. Also, the introduction of carbon to the basket is intended to support and stimulate demand for carbon credits and social impact development, driving offsets for every transaction used with Ven. As this paper went to press, \$1 was equivalent to 9.35 Ven. Ven trades against other major currencies and is mainly used in an online community called Hub Culture, a site when members can trade goods and services as well as knowledge. It can also be used in Pavilions (retail places specially developed to accept the currency). According to Stalnaker (2012, January 11, in email correspondence with us), at the beginning of 2012 over \$100 million in assets were available for purchase in 130 hubs worldwide using Ven. As opposed to Bitcoin, Ven does not provide anonymity, and is generated centrally (though exchanged).

Nevertheless, almost all of today’s existing electronic currencies (with the exception of Bitcoin and Ven) are surrogates of fiat money: they are denominated in fiat currency, and their purchasing power fluctuates with the real value of the denominating currencies. Moreover, they are fiat in the sense that there is no backing of these electronic monies (except for Bitcoin,) and thus they are not redeemable to the issuers⁶.

On the other side of the spectrum, we have the case of Amazon Coins. Because Amazon is a massively popular company, it is easy to imagine that such a currency would be more generally accepted than others. Amazon Coins can only be used in the Amazon Appstore to buy virtual goods and currencies in online games, apps and some digital products such as movies or music. Nevertheless, Amazon also has a large and diverse market of real products (books, computers, clothes, etc.). If their currency works for digital and virtual goods, it is not difficult to imagine Amazon adopting this currency as an official or alternative medium of exchange at their site (or other sites). Whether or not this will occur, however, only time will tell.

⁵ A list of the businesses that exchange Bitcoins and stores accepting Bitcoins is available at the Bitcoin Wiki site.

⁶ Avios is a clear example. See www.avios.com/gb/en_gb

Amazon should learn from the mistakes made by Facebook when, in mid-2010, they introduced their promising virtual currency called Facebook Credits: game developers had many problems in terms of pricing their own in-game currencies, as well as with the charges that Facebook took per sale. Also, users complained that the currency complicated their purchase-experience, and that this was more easily done through the standard payment systems. The Facebook Credits initiative was officially shut down in February 2013. Some experts expected Facebook Credits to expand their reach in virtual, digital and real goods markets, but this is clearly no walk in the park. Although Amazon may face similar problems, it has two advantages: first, as Hudson (2013, February 9) argues, they are not asking developers to make any modifications to their apps and they are charging the same amount per sale as they did before. Secondly, they already possess a large market of real goods, unlike Facebook that still focuses on the markets of virtual worlds and virtual goods. This means that Amazon Coins may have an easier task if the company decides to expand the currency to real goods markets.

There are several advantages to virtual currencies: their value would not fluctuate with the value of fiat currencies, but would instead depend on the value of the commodity bundle backing it and/or maintaining its reputation as an issuer. According to Hernandez-Verme et al (2004), this type of electronic currency has parallels with commodity money, and it is now the product bundle that serves as the anchor. This new form of electronic money has the potential to be more stable in value than fiat currency. In addition, a global Internet currency would eliminate the need for foreign exchange. This is also why the issuer of such a currency should be a firm that is recognized worldwide, such as Amazon⁷ or Facebook.

Hernandez-Verme et al (2004) claimed that three technical elements are necessary for any virtual currency to be accepted by the public: low cost, security, and privacy. In particular, these authors highlight the importance of low costs in micropayment transactions, almost regardless of the payment method utilized. They also point out, nonetheless, that there are alternative ways of reducing costs; in this regard, they emphasized the importance of avoiding expensive intermediaries, such as banks and credit card associations, in these kinds of transactions, since they could act as an indivisible sunk cost that may reduce the firms' margins and their profitability within the network. According to Mas (2012, March), about 2.5 billion people in the world are financially excluded; these types of virtual currencies help partly to overcome this fact. Security plays an important role in generating trust in an electronic environment: it becomes a must for electronic payments, where cryptographic security mechanisms are often used to provide the desired security for the transactions. Finally, Hernandez-Verme et al (2004) argued that privacy, the third crucial element, has become a much bigger concern in today's information world; so much so that an ideal virtual currency needs to provide anonymity or at least a high level of privacy if it is to compete against fiat money.

Bitcoin satisfies two of the three characteristics mentioned above: it has a low cost and is anonymous, but it has a bad reputation with regard to safety and has been the subject of speculation, which has caused its exchange rate to fluctuate unpredictably over time. One reason for this could be that, as Simonite (2012, March, p.14) argued: "In the United States and Europe, Bitcoin's meteoric rise was mostly driven by speculators; hardly anyone used the currency to actually pay for goods and services." Nevertheless, the Bitcoin has gained significant value in terms of exchange rate. Also, according to Bishop (2012, December 7), Bitcoin-Central, a known exchange institution for Bitcoins, has been authorized to operate as a bank under French law. Although Bitcoin-Central will not for the

⁷ According to Matthews (2012, July 6), Amazon is the biggest Internet retailer in the US and is expanding in more than 15 countries around the world.

moment issue credit, with formal financial institutions accepting deposits in this new currency, people and corporations may start to take Bitcoins more seriously.

It is important to clarify that these currencies achieve the three basic functions of any object used as money: 1) medium of exchange, because they work for exchanging different types of goods and services and facilitate this exchange by avoiding the double coincidence of wants; 2) unit of account, because the price of the majority of the goods and services that one purchases with them are denominated in the specific virtual currency that will be used to purchase them; and 3) store of value, because these currencies can be saved or stored and retrieved in the future⁸.

Most of the disadvantages of virtual currencies are shared by conventional fiat currencies. Historically, fiat currencies have been used for money laundering and the financing of illegal activities. Also, because of their lack of intrinsic value, fiat currencies are similarly prone to speculation, and particularly to the kind of self-fulfilling attacks that make their value fluctuate without any noticeable alteration in the fundamentals of the economy⁹.

3. The Future of Monetary Policy

The change of the conventional means of payment from paper-based systems to electronic-based systems, together with the use of alternative means of payment, has accelerated dramatically over the years changing the incentives and costs structures of particular institutional arrangements in payment systems. Thus, the ratio of central bank money to total value of payments has decreased considerably. This development has given rise to concerns about the future role of money and the central bank. Although we are still a long way from a cashless society, the role of monetary policy is on the verge of changing dramatically, especially because of two elements: a) the declining use of cash as a form of payment, and b) changes of regulation.

3.1 The Declining Use of Cash as a Form of Payment

The use of cash as a payment method has clearly been decreasing over the years, substituted by cards, mobile devices and alternative means of payment like the ones described in this paper.

The role to be played by the central bank in the near future will be as important as it is today, and will remain the same for quite a while. As Schmitz (2008) argued, almost all new payment instruments in the retail payment market (e.g. electronic bill presentment and payment; person-to-person payments via PayPal; stored value prepaid cards; phone-based payments) are linked to the banking system and eventually settle in central bank money. The demand for virtual currencies that are not denominated in fiat currencies is still low, but is increasing at such a pace that it is important to improve the way we study them. The existence of private monies is hardly new, but technological innovations could lead the way to a situation in which private monies play an important role in the world's economy.

3.2 Regulation

Money and banking are highly regulated, so improvements in technology in the payment systems have a slow effect on the change of policies. According to Mas (2012, March, p. 3), "the intricacies of regulation make it difficult for banks to be truly customer-centric".

⁸ They do not achieve the function of *Standard of deferred payment* because they are not recognized or officially used to make future contracts (at least not yet).

⁹ For more information about the disadvantages of virtual currencies shared with fiat currencies see Wolman (2012).

According to Schmitz (2008), in recent history central banks have demonstrated their determination, and political ability, to maintain control of the monetary system in the face of institutional change in the payments system. They have a large range of instruments at their disposal to react to as well as to influence institutional change in the economy-wide payment system. For example, they can adapt the instruments of monetary policy implementation and their own payment systems policies to cope with institutional changes in the payments system. Changes in the reserve-maintenance system of the generally accepted medium of exchange (GAME) are of particular relevance in this respect (i.e. the averaging of minimum reserve requirements, the averaging period, its relation to the interval of central banks' refinancing operations and the potential employment of minimum reserves for settlement purposes). Nevertheless, the effects of QQ coins in China and the fact that Bitcoin-Central has been given a license to work as a bank are sufficient reasons to ask ourselves if central banks' tools are really all that strong.

Important points to bear in mind are that one can only pay one's taxes with fiat money, and that virtual currencies do provide the possibility of creating a positive return by saving or lending (other than to one's friends, such as at RipplePay) or making futures contracts on a large scale. Thus, fiat money will remain of importance. Nevertheless, it is important to improve the way we study these markets in order to develop appropriate banking policies. One example of how far we still are from adapting to this alternative means of payment is the fact that almost all virtual currencies are still not taxable. The profits ones make online can be converted into real monies without tax deductions. Also, as the European Central Bank (2012) pointed out, most virtual currencies are not confined to a particular country or currency area, which complicates law making, regulation and law enforcement.

4. Conclusion

The analysis carried out in this paper attempts to provide readers with an insight into the list of tasks facing academic researchers in furthering their study of both virtual currencies and the micropayment systems. It intends to achieve a more unified means of using the definitions of virtual currencies, micropayments and virtual and digital goods.

Modern payment systems have facilitated the emergence of virtual currencies by lowering the costs of entry to this new market and by making this alternative means of payment easier to manage. Virtual currencies are still in an early stage of development. At present, they are primarily used in the micropayments market for virtual goods, and they, therefore, do not represent a real threat to price and financial stability, nor can they be considered a widely recognized substitute of fiat money, as the European Central Bank (2012) stated. But the impressive recent growth of this market's size and scope – as in the case of Bitcoin and Ven, or QQ coins in China – indicates that sooner or later they will come to play a crucial role in the design and implementation of monetary policy and thus be a vital aspect of future discussions of political and economic agendas.

One cannot ignore the potential benefits these monies may provide. Although they are not perfect, many of their defects are similar to those associated with fiat money. It is not only a matter of how to control or regulate these innovations; we also have to learn from their technological substructure and the reasons why they were created. Ultimately, money has been a changing technology throughout history, and it may be the case that these currencies are not only introducing new kinds of monies, but are establishing the basis for the next technological step that even fiat money will take. It is plausible that the generalization of alternative ways of payment could also prevent central banks from acting in an irresponsible way, for political purposes. As Bishop and Green (2012, p. 1402) argued:

As governments take risks with the value of money through massive experiments such as quantitative easing, the system of national monetary monopolies of fiat currencies may increasingly be challenged by capital markets that respect no national borders. We now live in a globalized world, where citizens are better able to avoid and protect themselves from such governmental control.

It is necessary to point out that there is a significant dearth of academic studies related to these emergent currencies. However, the work by Schmitz (2008) presents an interesting proposal for studying the effects of private currencies on monetary policy from an institutional perspective. Also, the works by Castronova (2010) provides a helpful approach to the study the ways that virtual currencies are used in virtual arenas and online gaming.

It seems crucial for both academics and banks to reconcile the benefits of fiat and virtual currencies, and to try to find ways to integrate physical cash into the electronic world. Academics could start changing some aspects in the modeling of monetary policy, while banks could start being more flexible to allow their clients to take full advantage of this novel means of payment.

For future works we aim to apply a theoretical approach for studying modern systems of private electronic currencies by designing a dynamic stochastic general equilibrium that satisfies some of the arguments that we provide in this paper. In particular, we hope to propose the general foundations for a theoretical framework that can be used for the analysis of virtual currencies. We would like to analyze an economy in which fiat money and a virtual currency (that is produced by a private entity) coexist in spite of having different real rates of return. We think that, at least in a primary stage, this will be possible because each of these currencies is used for purchasing different kinds of goods and they fulfill a different function in the economy. In such as case, the real rate-of-return will not be the only thing that agents look at when deciding how much to hold of each currency. Some features that we may add to the model are debt issuance, default, anonymity and privacy.

Along with the model, we may also update the challenges to both law makers and policy makers on how to design new settlement rules, how to regulate and supervise the financial system, the elements needed for this regulation and supervision to be a successful one, and the new technological advances that may affect the forms of legal tender or other virtual currencies take in the future. Finally, we may compare and complement the economic concept of money with the perspectives and concepts of other sciences such as anthropology and sociology¹⁰.

Acknowledgments

We would like to gratefully acknowledge the support of Stan Stalnaker, founding director of Hub Culture, for providing us with helpful information about virtual currencies.

¹⁰ For instance, we may use Niklas Luhmann's concept of money as a social contract (Luhmann, 2000) and the need for trust for this medium of exchange to work.

References

- Bishop, M. and Green, M. (2012). In gold we trust?: The future of money in an age of uncertainty. [e-reader]. *The Economist Newspaper*. New York, NY.
- Bishop, R. (2012, December 7). Bitcoin-Central approved to operate as actual bank, end of the world clearly nigh. *Geekosystem*. Retrieved from <http://www.geekosystem.com/bitcoin-bank-licensed/>
- Boswell, R. (2012, April). Mint promotes digital-chip currency for penniless future. *Technology News at Canada.com*. Retrieved from <http://www.canada.com/technology/Mint+promotes+digital+chip+currency+penniless+future/6418545/story.html>
- Burelli, F., Chua K., Alty, H., Morris, C., Rothkopf, M., Rofagha, M. ... Schneeberg, D. (2011). *Capturing the micropayments opportunity*. London: Value Partners Management Consulting Ld.
- Castronova, E. (2010, February). On money and magic. *Journal of Virtual Worlds Research*, 2(4), 4-6. Retrieved from <http://journals.tdl.org/jvwr/index.php/jvwr/article/view/861/626>
- Cohen, N. (2011, July). Speed bumps on the road to virtual cash. *The New York Times*. Retrieved from <http://www.nytimes.com/2011/07/04/business/media/04link.html?pagewanted=all>
- Costa, C. and De Grauwe, P. (2001). *Monetary policy in a cashless society*. SUEF Meeting, Brussels, October 25-27 2001. Retrieved from http://www.econ.kuleuven.be/ew/academic/intecon/Degrauwe/PDG-papers/Work_in_progress_Presentations/cashless.pdf
- Erb, C. B. and Harvey, C. R. (2013). The golden dilemma. *National Bureau of Economic Research (NBER) working papers, 18706*. Retrieved from <http://www.nber.org/papers/w18706>
- European Central Bank (2012, October). *Virtual Currency Schemes*. European Central Bank, Frankfurt am Main, HE. Retrieved from <http://www.ecb.int/pub/pdf/other/virtualcurrencyschemes201210en.pdf>
- Glenbrook Partners (2011). *Digital goods, virtual currencies, and social networks*. 2011 Payments Conference, Federal Reserve Bank of Chicago. Retrieved from http://www.chicagofed.org/digital_assets/others/events/2011/payments/mccune_0520_845.pdf, presented by Erin McCune.
- Hernandez-Verme, P. L., Huang, H. and Whinston, A. B. (2004). Private electronic money, fiat money and the payments systems. *Department of Economics and Finance of the University of Guanajuato Working Papers, C200902*. Retrieved from <http://economia.ugto.org/WorkingPapers/EC200902.pdf>
- Hudson, C. E. (2013, February 9). Amazon Coins are steroids for the Amazon appstore. Retrieved from <http://techcrunch.com/2013/02/09/amazon-coins-are-steroids-for-the-amazon-appstore/>
- Leber, J. (2012, March). American Express looks beyond credit cards. *Business Impact: The Future of Money*, 18-19. Cambridge, MA: MIT Technology Review.
- Luhmann, N. (2000). Familiarity, confidence, trust: Problems and alternatives. In D. Gambetta (ed.). *Trust: Making and Breaking Cooperative Relations* [electronic edition], (pp. 94-107). Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.23.8075&rep=rep1&type=pdf&a=bi&pagenumber=1&w=100>

- Lowenthal, T. (2011, June 8). Bitcoin: Inside the encrypted, peer-to-peer digital currency. *Ars Technica*. Retrieved from <http://arstechnica.com/tech-policy/2011/06/bitcoin-inside-the-encrypted-peer-to-peer-currency/>
- Matthews, C. (2012, July 16). Will Amazon take over the world? *Time: Business & Money*. Retrieved from <http://business.time.com/2012/07/16/will-amazon-take-over-the-world/>
- Mas, I. (2012, March). Me, my money, and my devices. *Business Impact: The Future of Money* (2-3). Cambridge, CA: MIT Technology Review.
- Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Retrieved from <http://bitcoin.org/bitcoin.pdf>
- Pontin, J. (2011). The new money. *Technology Review*, March/April 2011. Retrieved from <http://www.technologyreview.com/featuredstory/422785/the-new-money/>
- Salomon, M. and Soudoplatoff, S. (2010). Why virtual world economies matter. *Journal of Virtual Worlds Research*, 2(4), 3-14. Retrieved from http://academia.edu/1014679/Why_Virtual_World_Economies_Matter
- Sandqvist, U. and Zackariasson, P. (2010). The dematerialisation and democratisation of currencies: A historical description of currencies and how the physical has been replaced with the virtual. [Unpublished manuscript]. Retrieved from http://www.academia.edu/767584/The_Dematerialisation_and_Democratisation_of_Currencies_a_historical_description_of_currencies_and_how_the_physical_has_been_replaced_with_the_virtual
- Schenker, J. L. (2012, January 23). The future of money. *Informilo*. Retrieved from <http://www.informilo.com/20120123/future-money-488>
- Schmitz, S. W. (2008). Will central banking survive electronic money? In A.G., Haldane, Millard, S. and Saporta, V. (eds.), *The Future of the Payment Systems* (pp. 233-254). Abingdon, Oxon: Routledge.
- Simonite, T. (2012, March). Bitcoin seeks new life in Africa. *Business Impact: The Future of Money*, 14. Cambridge, MA: MIT Technology Review.
- Stalnaker, S. (2012, January). The rise of private money. *Cayman Financial Review*. Retrieved from <http://www.compasscayman.com/cfr/2012/01/11/The-Rise-of-Private-Money/>
- Wolman, D. (2012). *The end of money: Counterfeiters, preachers, techies, dreamers – and the coming cashless society*. Boston, MA: Da Capo Press.
- Yamaguchi, H. (2004). An analysis of virtual currencies in online games. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=544422