Cryptocurrencies as Producer’s and Consumer’s Durables, Efficient Liquidity Synchronization, Interest Rate and Prices

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ABSTRACT

Internet related technology disrupted many industries including postal delivery, banking, brick and wall chain retailers, and to some extent, higher education. The advent of cryptocurrencies in 2009 makes everyone wonder whether this new technology would disrupt one important institution in human history: money. Although cryptocurrencies are still at their beginning and are characterized by uncertainty peculiar to the infancy stage of any industry, their rapid popularity in 2017 deserves more attention from economists. Layers of Blockchain technology behind virtual currencies focused on trustless transactions, by eliminating the roles of intermediaries, would make them more acceptable in the financial system. Cryptocurrencies have the potential to augment transactional and speculative demand for money. The analysis in this paper shows that when fully integrated into mainstream economics, cryptocurrencies will serve as money and non-money assets; therefore, the problems of liquidity preference and optimal number of transactions in line with Baumol-Tobin will be eliminated. With a given growth rate of any cryptocurrency, however, an investor could find a critical interest rate where the demand for bonds are more attractive or vice versa. Furthermore, we show that cryptocurrencies could be treated as producer and consumer durable commodities. Just like durable assets increase in values along with expected rate of inflation while maintaining constant real values, cryptocurrency growth will stimulate changes in real demand for money, transactions and output.

JEL Classifications: E400, E410
Keywords: M1; Liquidity Preference; Money Demand; Cryptocurrencies

INTRODUCTION

The sudden rise in the values of many cryptocurrencies such as Bitcoins, Litecoin, Ethereum, and Ripple XRP, in 2017 is an awakening to financial experts and the economics community that virtual currencies cannot be ignored any longer. They will be significant financial variables that could distort the whole financial system in the near future. Currently, many investors are skeptical about the viability of these currencies that sprang up few years ago. However, owing to the technology behind these currencies, their continued growth has caught the attention of some investors. While skeptic investors thought virtual currencies would fade away, first mover investors watched their investments in cryptocurrencies grow a thousand-fold in 2017 and became billionaires or millionaires overnight.

With major commercial banks and investment banks poised to invest in cryptocurrencies in the next few years, and many chain retail stores making preparations to accept these currencies as a form of payment, it is time skeptics believed that cryptocurrencies are here to stay. Cryptocurrencies are gaining momentum in money and banking. While banks are waiting for regulators, the latter are cautious. The actions of regulators could bring negative perceptions about these virtual currencies or could legitimize
the industry. Moreover, cryptocurrencies, due to their format and decentralized technology, have the potential to provide an enormous boost to socio-economic fabric of commerce.

Cryptocurrencies ensure perfect income and expenditure synchronization for the households and firms who would want to keep some money for spending and at the same time make maximum returns on their savings. This is the transaction and speculative demands for money theorized by Keynes (1936), and reinvigorated by Baumol (1952) and Tobin (1958) in the portfolio balance liquidity preference model. Whereas the Keynesian analysis is based on aggregate money demand under certainty, Tobin derived money demand under uncertain conditions. Friedman’s (1982) quantity theory considers money to be producer and consumer goods. A producer good in the sense that firms hold money to satisfy efficient transaction cash flows; and a consumer good because households maximize utility by synchronizing between holding enough money or investing in interest earning assets. Cryptocurrency is a perfect solution to the rational behavior of households and firms switching between non-interest earning money and interest-bearing assets. Cryptocurrencies efficiently serve both transaction and speculative motives for holding money without incurring commissions and brokerage fees.

There are a number of articles on money demand in the economics and finance literature related to the Baumol-Tobin model including Sargent and Wallace (1983) and Serlelis (2007) that analyze the role of monetary policy and demand for money. Ostroy and Starr (1990) discuss the transaction role of money; while Smith (1986) is concerned with a dynamic Baumol-Tobin model of money demand. Alesina and Stella (2010) examine the political sustainability of currency union in which more than one country share the same currency. With cryptocurrencies, at this pace of development, more than one country will soon share one currency!

The purpose of this paper is to incorporate cryptocurrencies into existing economic and financial models and analyze the impacts of the new technology in money demand and liquidity preference. Since cryptocurrencies will play major roles in the transaction and speculative motives for holding money, it becomes imperative for researchers to analyze and predict the influence of cryptocurrencies in the monetary system. Theoretically, money demand and investment are functions of interest rate, income and prices. How would these variables be affected as cryptocurrencies become popular in transactions and speculations? Section two describes the vital technology behind these currencies, their contribution and improvement to the existing system. Section three gives quality comparisons of money supply and circulating supply of cryptocurrencies. Section four describes cryptocurrencies as producers’ and consumers’ durables that accumulate capital gains as the general price level increases. A situation where capital gains increase faster than general price level could lead to an increase in transaction and speculative demand for real balances. Since cryptocurrencies are alternatives to money, bonds and other non-money assets, what would be the impacts of increase or decrease in real balances on interest rates, inflation and output? Section five concludes.

There are a couple of assumptions here: first, although cryptocurrencies are going through adolescence stage, they will fully be adopted by the public just like internet related technologies are now part of the mainstream. Second, the up and down swings will eventually smoothen, thereby they are used like credit cards and debit cards but they are different from credit and debit cards because cryptocurrencies change in values owing to their speculative attribute. Would cryptocurrencies disrupt the banking sector just like other internet based firms disrupted their sectors? For example, emails disrupted postal services; Amazon along with e-bay disrupted brick and wall national chain stores; Uber disrupting cab services; and autonomous transportations could disrupt markets for cars and insurance.
CRYPTOCURRENCY TECHNOLOGY AND CHARACTERISTICS

If cryptocurrencies function as a store of value, medium of exchange, and efficient fund synchronizer between money and non-money assets do not convince skeptics the validity of cryptocurrencies, there are other fundamental political and economic reasons to expect these currencies to occupy a major portion of modern economies. Cryptocurrencies are autonomous money in that they enhance spontaneous and natural order of things and free will associated with human liberty. They are self-originating through mining and free market valuation; the peer-to-peer nature, financial transactions free of intermediaries and trustless attributes make cryptocurrencies self-organizing. They are also self-correcting through a self-policing decentralized record-keeping platform (Swan 2015).

Will the invention of cryptocurrencies affect monetary aggregates? We can answer this question by examining the long run functions, capabilities and objectives of the technology behind virtual currencies. According to Swan (2015), the Blockchain technology behind Bitcoin is broken into three phases. Blockchain 1.0 which is the platform for currencies is constructed for transfers, remittances, and digital payment systems. Blockchain 2.0 covers financial contracts: stocks, bonds, futures, loans, crowdfunding, mutual funds, derivatives (futures, options, swaps, etc.), annuities, pensions, mortgages, titles, smart properties and smart contracts. Whereas Blockchain 3.0 is envisaged to assist in the areas of “government, health, science, literacy, culture and the arts” (Swan 2015, p ix). Implementations of these financial functions under Bitcoin protocol will be trustless; meaning that the cost associated with asymmetry of information resulting in adverse selection and moral hazard in the banking industry would be eliminated. The peer-to-peer transactions created by cryptocurrencies are effectively beneficial to societies.

Also, financial intermediaries exist to match borrowers and savers. Blockchain 2.0 and its offspring Bitcoin protocol maintains trustless public transaction ledgers through decentralized apps (DAPP) and decentralized autonomous organization (DAO). Trustless because counterparty and default risks are neutralized by the system (Swan 2015). Furthermore, public deposits taken for granted by commercial banks would now be competing with demands for cryptocurrencies. Without a doubt crypto currencies would win deposit competition owing to speculative demand and finite supply characteristics among many of the currencies. The values of cryptocurrencies against the dollar and other currencies of the world would only be determined by demand – how well the public decides to acquire virtual currencies.

Blockchains 1.0 and 2.0 could possibly interfere with current monetary policies. An asset with growing capital gains which can be used for purchases, transfers and remittances (Blockchain 1.0) and also bestowed with lending capability (Blockchain 2.0) would create demand deposits (money supply) outside the Federal Reserve System. Investments in cryptocurrencies could pull funds away from current stock and bond markets and could inject funds into the financial markets since investors could speculate between stocks and bonds versus cryptocurrencies. Conventional money supply, for example, through Open market operations (FOMC) and Quantitative Easing (QE) designed to expand output and employment would have to accommodate the impact of extra money created by cryptocurrencies.

COMPARISON OF CRYPTOCURRENCY AND CONVENTIONAL MONEY

Money is rightly defined by its functions. Three major functions of money are (1) medium of exchange; (2) store of values; and (3) unit of account. As of December 2017, Cryptocurrencies leader (Bitcoin) is gaining momentum fulfilling its function as a medium of exchange. As more national chains and global online retailers are contemplating on accepting virtual currencies in the coming years, Bitcoin
and other leading cryptocurrencies will measure up to their role as a medium of exchange. Investment bankers are beginning to have strong faith in the currencies. Although, at this initial stage, it is characterized by volatility, it would be too early to conclude the stability of cryptocurrencies in its function as a store of values. As the number of users increase, buying and selling by one or few entities may not cause significant volatility as it presently occurs. Lastly, these virtual currencies are expressed mostly in Yuan and dollars; thus their function as a unit of account is close to zero. Their non-function as a unit of account could have inflationary implications as discussed in section four.

There are two types of money in the history of the world: fiat and commodity monies. The difference is that the latter has intrinsic values. Without doubt, cryptocurrencies have no intrinsic values per se but are commodity monies because of the Blockchain technology behind their usage (Bagus 2009). They also rise and fall depending on events, which gives them speculative values. So, are Cryptocurrencies money? Let’s examine characteristics of a good money. Money should be acceptable, durable, divisible, lendable, homogenous, portable, stable, popular, and hard to counterfeit. See Table 1 for comparison of money characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Fiat Money</th>
<th>Commodity (Gold)</th>
<th>Cryptocurrencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptability</td>
<td>100%</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Durable</td>
<td>Yes</td>
<td>Yes</td>
<td>Perfect</td>
</tr>
<tr>
<td>Divisibility</td>
<td>Denominated</td>
<td>Ounces</td>
<td>Perfect</td>
</tr>
<tr>
<td>Lendable</td>
<td>Yes</td>
<td>Yes</td>
<td>Near future</td>
</tr>
<tr>
<td>Homogenous</td>
<td>Yes</td>
<td>Yes</td>
<td>In Technology</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>None</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Portable</td>
<td>Slow</td>
<td>Low</td>
<td>Fast</td>
</tr>
<tr>
<td>Stable</td>
<td>Low volatility</td>
<td>Perfect</td>
<td>High volatility</td>
</tr>
<tr>
<td>Popularity</td>
<td>Perfect</td>
<td>Low %age</td>
<td>Growing</td>
</tr>
<tr>
<td>Decentralize</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>International Transfer</td>
<td>Slow and Costly</td>
<td>Paper gold, low</td>
<td>Fast and cheap</td>
</tr>
<tr>
<td>counterfeiting</td>
<td>Hard</td>
<td>Never</td>
<td>Hacking</td>
</tr>
</tbody>
</table>

As can been seen in Table 1, fiat money has the upper hand over cryptocurrency when it comes to acceptability, lending, popularity, stability, and counterfeiting. This is only temporary, however, and not surprising because, in 1994, older generations preferred postal mail services to sending and receiving emails. As more people and entities including banks and government agencies acquire cryptocurrencies, fiat money would have no advantages over cryptocurrencies. Moreover, cryptocurrencies will always be preferred to fiat money regarding decentralization, speculation function, intrinsic, durability, portability, intermediary-free, low fees and perhaps divisibility. Currently, cryptocurrencies also have an advantage over fiat money in areas of fund synchronization and anonymity as governments are yet to crackdown on anonymous holders of cryptocurrencies completely.

Demand and supply are the determinants of asset value including currencies. As of mid-December 2017, the finite supply and circulating supply of six cryptocurrencies could be found in Table 2 below. Five of the currencies listed in Table 2 have finite supply; only Ethereum has an infinite supply. Whether or not the creators of cryptocurrencies will change the finite supply in the future is a matter of concern.
Table 2: Circulating Supply of Money and Cryptocurrencies

<table>
<thead>
<tr>
<th>Currencies</th>
<th>Supply</th>
<th>Circulating(12/2017)</th>
<th>Trans. Speed</th>
<th>Date Launched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar</td>
<td>Unlimited</td>
<td>$1,524 billion</td>
<td>Days</td>
<td>Historical</td>
</tr>
<tr>
<td>Bitcoin</td>
<td>21 million</td>
<td>16,736,137</td>
<td>300 minutes</td>
<td>01/03/2009</td>
</tr>
<tr>
<td>Bitcoin Cash</td>
<td>21 million</td>
<td>15,490,000</td>
<td>*2 min. 30 sec.</td>
<td>08/01/2017</td>
</tr>
<tr>
<td>Litecoin</td>
<td>84 million</td>
<td>54,268,358</td>
<td>2 minutes</td>
<td>10/07/2011</td>
</tr>
<tr>
<td>Ethereum</td>
<td>infinite</td>
<td>95,343,248</td>
<td>2 minutes</td>
<td>08/07/2015</td>
</tr>
<tr>
<td>Ripple XRP</td>
<td>100 billion</td>
<td>38.7 billion</td>
<td>4 seconds</td>
<td>2012</td>
</tr>
<tr>
<td>Etheroll</td>
<td>7,001,622</td>
<td>7,001,622</td>
<td>Casino Dice</td>
<td>02/2016</td>
</tr>
</tbody>
</table>

*target processing speed

The relevant question at this point is how the circulation of cryptocurrencies will affect the supply and demand of conventional money? In economic sense, monetary aggregates are measured by M1, M2 and monetary base known as high powered money. M1 equals currency, demand deposits plus travelers’ checks. This is narrowly defined money, more liquid and readily spendable. M2, a broadly defined money, equals M1 plus savings accounts including small time deposits and money market mutual funds. As at the end of November 2017, M1 equaled $3,615.4 billion of which $1,524.2 billion were currency plus travelers’ checks and M2 totaled $13,785.4 billion. The monetary base is two items on the liabilities side of Federal Reserve’s balance sheet – currency in M1 + total reserves of banks. Money creation by Federal Reserve System is the practice of expanding banks’ reserves and public demand deposits by periodic decisions of FOMC.

The impact of money supply on output and employment depends on how money demand reacts to changes in interest rates. The advent of financial innovations such as e-money, ATMs, credit cards, smart money and electronic transfers are known to affect interest elasticity demand for money (Ireland 1995). Investment in cryptocurrencies could lead to less demand for M1 or M2. The demand for these categories of money is a function of the interest rate (r). The demand for M1 rises when the interest rate falls, because the opportunity cost of holding money drops and economic entities demand products with lower costs. At this initial stage, cryptocurrency values are solely controlled by the demand since the supply of most (including Bitcoin, Bitcoin Cash, Litecoin, and Ripple XRP) are perfectly inelastic.

CRYPTOCURRENCIES, MONEY MARKET, AND OUTPUT

Assuming that as more entities (individuals, firms and government agencies) acquire cryptocurrencies and more financial intermediaries including investment banks and chain retailers accept cryptocurrency, the volatility in the value of cryptocurrencies would be minimized. Assuming also that with improvement in the blockchain technology, the degree of hacking in the industry is reduced. Cryptocurrencies would gain more credibility and serve as both money (M) and non-money (N) assets, since they perform transactions (medium of exchange) and savings (store of values) functions of money. Transactions, not only for buying daily needs, but paying salaries, buying and selling stocks or bonds and paying dividends (St. Onge, 2017). These transactions are supported by Blockchain 2.0, which is designed for buying and selling in financial markets. The availability of cryptocurrencies that serve both transaction and speculative motives for holding money spontaneously eliminates liquidity and default risks that currently plague complicated transactions and would increase returns on investments.

Without Cryptocurrencies, individuals’ wealth is split into money and non-money assets. The price of money (M) and non-money (N) assets depends on the demand and supply in both markets. If we define
money (M) to be M1 comprising currencies and demand deposits, and all other financial instruments including savings, stocks and bonds to be non-money (N) assets, households would, over time, substitute between both categories of assets.

Md=money demand; Ms=money supply, Nd=non-money demand; and Ns=non-money supply.

Equilibrium exists in the financial market if Md – Ms = Ns – Nd. That is, excess demand for money is cleared by excess supply in the non-money markets. The link between these markets is the opportunity cost of holding money, the interest rate (r). The theory of liquidity preference posits that at a higher interest rate, individuals demand less M and more N and at a lower interest rate, individuals demand more M and less N until equilibrium is established. Furthermore, when the interest rate rises, the price of financial instruments (non-money assets) falls and vice versa. In the liquidity preference model, people demand money when they expect non-money asset (e.g. bonds) prices to fall and interest rates to rise.

**Transaction Cost**

The household’s problem is to reduce transaction costs by finding the optimal number of transactions during a period (Freidman 1982; Branson 1989). The optimal number of transactions is given as, \( n = \left(\frac{rTy}{2a}\right)^{1/2} \); where \( r \) = the interest rate; \( T \) = time say 30 days; \( y \) = real income and \( a \) = fixed transaction cost in the conversion of non-money assets to money. In this model, the optimal number of transactions increases with the interest rate, time and real income but decreases with transaction costs. A household holding cryptocurrencies which serve as both spendable money and investment would not engage in converting money into cryptocurrencies (non-money assets) or vice versa; because by the popularity assumption above, it is money and simultaneously store of value; there is a perfect money synchronization all through the periods. Therefore, the opportunity cost of holding money rather than holding return-earning assets does not exist. The only transaction cost associated with using cryptocurrencies would be minimal compared to brokerage fees and commissions involved with converting bonds and stocks to money.

**Cryptocurrency as Producer and Consumer Durables**

Investment in cryptocurrencies is money and also non-money assets. Moreover, just like other producer and consumer durables, cryptocurrency price move with the general price level. There are two sources for changes in the values of cryptocurrencies: trading through speculation and expected inflation. The latter becomes important because cryptocurrencies are not units of accounts and are expressed in different currencies. As the values of those currencies change so also does the value of cryptocurrencies. Their values would also get a boost from the market force of higher demand relative to other assets.
Without cryptocurrencies in a closed economy, income \( Y \) is a function of Consumption \( C \), Investment \( I \), and government spending, \( G \), the IS curve; and money balances is a function of interest rate, \( r \) and income \( y \), the LM curve. These are written as

\[
Y = C(Y-T) + I(r) + G \quad \text{IS} \\
M / p = L(r, y) \quad \text{LM}
\]

In the literature and as mentioned above, the average price of real assets such as capital, buildings, land and producer and consumer durables move with the price level. In figure 1, \( \dot{\alpha} = \) growth rate of cryptocurrencies arising from speculations and \( \dot{P} \) is the increase in the general price level. We assume here that cryptocurrencies are classified as producer and consumer durables and their rate of growth is independent of the rising price level. At the initial stage of these currencies, their values could move faster than general price levels. In the Modigliani (1975) wealth effect composition of real assets, an increase in the rate of inflation denoted by \( \dot{P} \) would reduce the buying power of consumers, firms and the government, thereby shifting the IS curve to the left in panel (a). Also, an increase in expected inflation would reduce real money balances causing a shift in the LM curve to the left. However, the rate of growth of cryptocurrencies in the goods and money markets could be greater than the increase in the rate of inflation \( (\dot{\alpha} > \dot{P}) \). The net effects on both goods and money markets are shifts in IS and LM curves, respectively, to the right leading to a rise in output from \( y_1 \) to \( y_2 \). (Shown in panel (a)).

Panel (b) in Figure 1 is the reverse scenario. Here the net effect of cryptocurrencies growth is less than a rise in inflation rate. This would lead to reduction in real output, as indicated in panel (b). If their growth rates are equal to the expected inflation rate, \( (\dot{\alpha} = \dot{P}) \), real values remain constant, cryptocurrencies would have no impact on output. Thus, the impacts of virtual currencies on output depend on the size of cryptocurrency growth through speculations and the rate of inflation. The difference between the growth rate of cryptocurrencies and general price level would be reflected on output without changing the interest rate as it would be through conventional monetary system. This outcome would be critical for policy purposes.

The demand for cryptocurrencies is not a function of the interest rate as it is in money demand function but would be a function of investment, \( I \); consumption, \( C \); and money balances, \( M/p \). Currently, cryptocurrencies are classified in many countries including the United States as commodities which
equivalently could be treated according to the IRS as accumulating taxable capital gains. Therefore the theories of producer and consumer durables (capital gains) in the users cost of capital in economic and finance literature would be appropriate in analyzing the impacts of cryptocurrencies in investment, consumption and real money balances. The user cost of capital, $C$, is expressed as:

$$C = rP_t + \delta P_t - dP_t/dt.$$  

The first term on the right of the expression is the interest payment; the second equals the periodical depreciation cost; and the third, $dP_t/dt$, which is relevant to this paper, equals the price increase over time. The proportional capital gains denoted as $\alpha$ above are assumed here for simplicity to equal $(dP_t/dt)/P_t$ expressed as $\dot{P}_t$. The above identity could be written as $C = P_t(r + \delta - \dot{P}_t)$. With cryptocurrencies as part of producer and consumer durables, the IS and the LM curves could be written as a function of $\dot{P}_t$, where $\dot{P}_t$ represents the expected rate of inflation after acquisition which could be equal to, greater or less than the proportional capital gains $\alpha$. The IS and LM equations would be

$$y = C\{(y(1+\dot{P}_t)-T) + I(r, \dot{P}_t) + G(\dot{P}_t)\} \quad \text{IS}$$

$$M/P = m = m(r, y) = L[(r, y(\dot{P}_t)] \quad \text{LM}$$

From equations (3) and (4), IS and LM curves, representing Investment-Savings and Liquidity-Money, respectively, in the presence of cryptocurrencies are different from equations (1) and (2) without the virtual currencies. From equation (4), $L(r)$ denotes speculative demand for money and $L[y(\dot{P}_t)]$ denotes transaction demand for money arising from capital gains or an increase in general prices. Appreciation or depreciation in cryptocurrencies would result to changes in transactions demand for real balances. From (3) and (4), respectively

$$dy/d\dot{P}_t = dy/dC.dC/d\dot{P}_t + dl/d\dot{P}_t + dG/d\dot{P}_t$$

$$dy/dr = dy/dI.dI/dr$$

$$d(M/P)/dr = dm/dr$$

$$d(M/P)/d\dot{P}_t = dm/dy.dy/d\dot{P}_t = dm/d\dot{P}_t$$

From equation (5), $dy/d\dot{P}_t$ equals a change in income resulting from changes in consumption, investment and government purchases owing to households, businesses and government holding cryptocurrencies, $dC/d\dot{P}_t$, $dl/d\dot{P}_t$ and $dG/d\dot{P}_t$, respectively. The impacts of holding cryptocurrencies are positive with respect to GDP ($dy/d\dot{P}_t > 0$); gains result to higher GDP and losses leads to lower GDP. Equation (6) is the usual interest rate, investment and income relationships where a lower interest rate would stimulate investment in property, plant and equipment leading to higher production.

Equation (7) shows the relationship between changes in interest rate and demand for real money balances (speculative motive) and equation (8) is the changes in expected inflation rates and demand for real money balances (transaction motive). The demand for real money balances decreases with respect to an increase in the interest rate. Therefore, $dm/dr$ is negative, so also is demand for real money balances with respect to an increase in the expected rate of inflation, $dm/d\dot{P}_t < 0$.

The demand for cryptocurrency is alternative to demand for money and bonds and these currencies are demanded for both transaction and speculative motives. Just like producer and consumer durables that maintain constant real values during inflation times, cryptocurrencies would maintain constant buying power in times of rising inflation rate, $\dot{P}_t$. However, the capital gains, $\alpha$, could rise faster than the rate of inflation especially at the initial growing stage of these currencies. Therefore, we expect the LM curve in Figure 1 to shift to the right (shown in Figure 1 as LM$_2$ in panel (a)). Capital gains are recognized only when realized. The gains on cryptocurrencies are readily spendable. Will the popularity of cryptocurrency gains create an additional exogenous variable in the form of transaction demands for money? This would be a new research area for economists.
Interest rate

Cryptocurrencies are direct investment alternatives to money (M1) and non-money assets. Since they are speculative, investors would decide which assets are better: money, cryptocurrencies, bonds or stocks. In the literature, the demand for money falls with an increase in real interest rate. Assuming the current interest rate on bonds, dividends on equity are denoted by r, and capital gain rate for both equal g. Therefore, total returns on bonds and stocks would be equal to \( r + g \). In the regressive expectation model in finance and economics (Branson 1989), bonds capital gain, \( g = (r/r^e) - 1 \), where \( r \) denotes current interest rate and \( r^e \) is bondholders expected interest rate. Substituting for \( g \) total returns on bonds is found to be

\[
e = r + g = r + (r/r^e) - 1. 
\]  

(9)

Owing to the financial protocol in Blockchain 2.0 integrity platform that is producing trustless transactions, cryptocurrencies have no liquidity and default risks associated with bondholding. However, cryptocurrencies have minimal counterfeiting (hacking) risk. Assuming liquidity plus default risks counsels out counterfeiting risk associated with cryptocurrencies, and the latter have capital gains equal to \( \alpha \). There would be a critical interest rate \( r_c \) where investors would be indifferent between putting their savings in non-money assets such as bonds or buying cryptocurrencies. This critical interest rate, \( r_c \) must be from equation (9) where \( \alpha = e \).

\[
\alpha = r + g \rightarrow \alpha = r + (r/r^e) - 1 \quad (10)
\]

Solving for the critical \( r_c \) in equation (10)

\[
r_c = [r^e(\alpha + 1)]/(r^e + 1). \quad (11)
\]

If, for example, the interest rate is expected to be 5% and a particular cryptocurrency grows on average at 50%, \( r_c \) would equal 7.14%. The expected interest rate would have to be equal or higher than 7.14% for bonds to be attractive to investors. Otherwise investments in cryptocurrencies would be more rewarding.

Inflation

As the general price level rises the values of producer and consumer durables values rise equally if we assume \( \alpha = \hat{P}_t \). While their purchasing power remains constant, however, the purchasing power of money declines with an increase in the general price level. Therefore, an increase in expected inflation will cause a fall in money demand \( (dm/d\hat{P}_t < 0) \) and higher demand for producer and consumer durables that maintain constant real values such as cryptocurrencies. From equation (2), re-written here as (12) with a proportional change in prices, \( \hat{P}_t \) included, money demand is also a function of expected inflation which reflects on the proportional capital gain, \( \hat{P}_t \).

\[
M/p = m = L(r, y, \hat{P}_t) \quad (12)
\]

Thus, the demand for real money balances would increase with a rise in real income, \( y \), but falls with a rise in the expected rate of inflation, \( \hat{P}_t \). Thus, cryptocurrencies fulfilling the roles of transactional and speculative demand for money could positively augment the money market through the interest rates and inflation rate. Monetary policies would have to accommodate or take into account the impact of changes in the values of cryptocurrencies.

CONCLUSION

The growing popularity of cryptocurrencies in 2017 brought global awakening regarding virtual currencies. Although, these currencies are presently undergoing large up-and-down swings, it is anticipated that this volatility will dampen as many of these currencies are globally adopted. The sophisticated layers of Blockchain technology backing these currencies and the decentralized irreversible
record-keeping ledger phenomenon provide invaluable assets for global commerce. Blockchain 1.0 and 2.0 protocols are envisaged to support the financial markets ranging from payments, transfers of funds, buying and selling stocks, bonds, derivatives to smart contracts, smart properties and lending. Moreover, compared to fiat money, cryptocurrencies surpasses fiat qualitatively in their speculation function, intrinsic value, durability, portability, intermediary-free, fees and perhaps divisibility. Cryptocurrencies have the potential to enhance transaction efficiency.

Cryptocurrencies, as alternatives to money and non-money assets, would consistently create efficient liquidity synchronization for economic entities. There would be no reason for holders of these currencies to face insufficient cash flows because they are both money and non-money assets. There would also be a critical interest rate where bonds are more attractive or vice versa. As alternatives to non-money assets classified in this paper as producer and consumer durables that generate capital gains along with changes in the general price level, they could raise transaction demand for real money balances leading to more transaction and increase in output. The question is, will they be parallel currencies or their presence and circulation could disrupt the current monetary system, especially the impact of their lending ability on the money multiplier? The answer to this question is complicated bearing in mind how many of these existing cryptocurrencies will survive. However, answering this and some other questions would enable policy makers to put in place appropriate regulations.

REFERENCES