

# “Cash and financial innovation: a conceptual view”

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## Cash and financial innovation: a conceptual view

### Abstract

In a world with an ever evolving payments system, cash is becoming less accurate and less deterministic as a medium of exchange and as a standard of deferred payments, partly because it is physical and lacks the means of timely contractual execution. Technological revolution is gradually eliminating the traditional storefronts where cash is most effective. This qualitative research conducted between June and November 2011 compares payment types with available alternatives by their transactional motives. As informational insecurities like unauthorized access to funds and identity theft threaten current electronic systems, this could be the right moment to introduce an innovative system which could minimize insecurities, perhaps by implementing biometric payments into the banking technology sector. Payment substitutes in the forms of payment cards and digital currencies could well reduce this interval, as they become less attractive to users who wish to avoid monitoring and prefer off-the-record transactions.

**Keywords:** cash substitution, financial innovation, biometric payments system.

**JEL Classifications:** E42, E49, E59, Q55.

### Introduction

Successful daily transactions require a recognized medium of exchange. Over time, this medium has generally been cash. With the advent of electronic commerce, innovation in the banking and financial sectors have changed the perspective by giving birth to payment cards and digital currencies. Like cash, these substitute means of payment can fulfill transactions, sometimes much faster than the earlier methods, as in the case of online purchases and banking. In a world where borderless exchanges occur by a touch on the mouse pad, questions can be raised on how well cash can fulfill the very purposes for which it is being held. Some of these substitute means are measured in units of gold to better fulfill the precautionary motives for holding cash. With online foreign exchange trading and investment becoming more popular and better organized, digital currencies are getting into position to fulfill the speculative cash-holding motives. These substitute means of payment are very different from cash because they are more widespread and they facilitate banking transfers at almost any time and at virtually zero cost.

Consumers, producers and governments are key contributors to the health of any economy. The decisions they make on how and when to pay for exchanges, and with which means of payment affect the way in which institutions and governments address economic and social issues. A very good understanding of how these decisions are guided will provide an insight on how effective relationships can be drawn on revenue flows from individuals and firms to governments and will help economists and governments better explain behavioral approaches to payment choices.

Many different but not easily quantifiable qualitative attributes are responsible for consumer choices.

These attributes range from convenience to time and trends and may be less dependent on easily quantifiable attributes, such as price. More affluent, younger and educated consumers are likely to adopt Internet banking and electronic payment means because their previous satisfactory experiences with computer use and their adoption of other banking or digital technologies increase the probability that they will adopt cash payment substitutes.

With a growing concern for speedy checkouts, consumers use whatever means they have to get out of stores as quickly as possible. It is no wonder electronic payment methods are becoming more popular with our consuming public and the retirement of cash and paper checks is beginning to seem inevitable. Also, the rewards offered by electronic means, unlike cash means, influence consumer choices away from cash payment towards these substitute means.

As attractive as these electronic means of payment are, their existence and usage face a significant threat from information and identity theft which inhibits consumers from using them, as they can allow personal information transferred onto the Internet to become widely available accessible. Also, unauthorized access to funds becomes a bigger concern to consumers since individuals who possess unauthorized information may transfer funds on the medium without the owner's knowledge or consent. Amid these growing concerns, the argument for cash endures, but timidly. Merchants sometimes prefer a wire transfer as an alternative for most consumers that are not making purchases or exchanges in the locality where the online storefront is domiciled. In addition, bill payments favor the use of cash because bill payments by cash and check incur lower costs, allow better timing and limit fraud. Consumers are, therefore, very slow to change to electronic bill payment.

Innovation in the financial sector has supported the argument for electronic payment means. The ulti-

mate solution can be seen to be one with a flawless security, ubiquitous availability and timeless access. No other solution can uniquely match individuals to accounts as well as a biometric one. With a biometric payment system, information insecurities can be eliminated as unauthorized access will be almost impossible.

The rest of this paper will contain section 1: Transactional demand for cash, where I explain the primary motive for physical cash-holding as transactional, section 2: Financial innovation, where I briefly explain a few innovations in the payments sector, section 3: The future of cash, where I present a historical perspective of the changes in cash use and its next phase, section 4: Policy implications, where I propose that central banks should appropriate all retail banking functions so that any other bank would be an investment bank, and final section: Conclusion, where I offer my concluding remarks.

### 1. Transactional demand for cash

The primary reason for physical cash-holding is to enable transactions. Speculative and precautionary monies can be held in inventories, savings accounts, stocks, the futures market or other assets. The choice of payment is based on the quality of transaction fulfillment. Several economists have conducted research to broaden our horizon on the relationship between payment type choices, their uses and cash-holding. Humphrey, Pulley and Vesala (1996) addressed some crucial questions on this relationship and its varying patterns across some fourteen developed countries. They postulated that the social cost to the payments system of the selected country could be reduced through increased use of electronic means. Cash use and non-cash transactions were seen to be related as the time-series relationship between non-cash transactions and cash is negative and significant at  $r = -.79$ . In addition, an increase in the total number of credit and debit cards and their terminals reduced the overall use of cash, while an increase in the number of ATMs did the opposite. This is because debit and credit cards are very close substitutes for cash since both these means affect small-value retail exchanges.

Because there are no data series on the actual value or volume of cash transactions in most countries, the (rate of) substitution of non-cash payments for cash transactions may be difficult to gauge. Knowledge of the accurate value of this rate of substitution is important because of its relationship with central bank and governments' seigniorage revenue. Snellman, Vesala and Humphrey (2000) used public information on currency stocks and non-cash payments in some ten European countries to estimate

the volume of cash transactions and found a similar trend across the examined countries. Debit and credit cards were largely responsible for the move away from cash payments since they are more frequently used for point-of-sale, bill and disbursement transaction payments.

The costs of handling payments and cash, and the services involved in issuing cash are not negligible. Hancock and Humphrey (1997) examined the question why cash (with its positive opportunity cost) continues to be used for transactions in comparison to other less costly means of payments. Another problem concerned the systemic risk which is a cause of moral hazard for the banking system's government-provided deposit insurance and discount window borrowing. The authors observed that payment literature, an area where institutional structure and economic theory are linked, is undergoing a substantial shift from paper-based systems (in the form of cash) to technologically advanced electronic payments (such as plastic chip cards and e-cash means). They maintained that technological change has been an important factor contributing to cost reduction in electronic payments processing.

While the efficiency of transactions in market economies is determined by the efficiency of existing payments systems comprising institutions and technical mechanisms for the transfer of money, it may be said that the payments system is an inherent part of the monetary and financial system of a smoothly-run market economy. To access the function of transaction characteristics in the use of payment instruments, I examined the unique data set of a representative sample from the French population used by Bournie and Francois (2006) to explain the chance of a transaction being paid by bank cards, check or cash in terms of transactional and individual characteristics. Evidence revealed a marked effect of the size of transactions compared to payment instruments. In addition, there was a special distribution among payment instruments according to the type of goods, contact and spending place. This finding indirectly confirms the influence of the organization of the payment process on the choice of payment instrument so that supply-side constraints can influence the use of a payment instrument. Cash is mainly used in face-to-face transactions, checks in postal transactions and bank cards in electronic transactions.

### 2. Financial innovation

World economies are getting very close to the verdict on how many more days cash will be around because the increasing usage of cash substitutes affects how much cash the central banks should supply. The development of payment systems has gone through several transformational stages re-

flecting the technological advances of the past. At this time, the movement towards formal systems of identity can only be a natural part of the development process as it appears to be the most feasible means of monitoring identity theft and minimizing fraud.

Opportunity costs of withdrawing cash have an affective relationship with the demand for money in terms of cash holding. Fernando and Francesco (2009) explore the argument in economic literature that financial innovation is an important factor in the understanding of money demand by proposing a simple parameterized extension of the classic Baumol-Tobin model to capture important empirical regularities characterizing cash management in households. According to them, the opportunity cost of cash withdrawal has a deterministic effect on cash holdings because rational agents (with zero withdrawal costs) withdraw more cash than the needed amount as a precautionary motive.

One of the interesting revelations by Amromin and Chakravorti (2007) is that electronic alternatives have yet to successfully mimic all the benefits of cash, most especially the anonymity feature, which makes it very beneficial for tax evasion and illegal transactions: This is one of the factors contributing to the continued demand for physical cash. This observation definitely appeals to cash supporters because the demand for cash may become stronger as a result of cash's anonymity and store of value functions.

To show that the total volume of physical cash in circulation diminishes as the acceptance and use of financial technology increases, Amromin and Chakravorti (2007) attempted to understand the relationship between electronic cash substitutes like debit cards and demand for currency by using panel estimation techniques to analyze the change in transaction demand for cash resulting from greater usage and adoption of electronic payment alternatives such as debit cards in some thirteen countries in the periods between 1988 and 2003. They were able to separate Cash's store of value function by dividing cash into three denominational categories and found that the demand for low denomination notes as well as coins declined as debit card usage increased because merchants needed to make less change for customer purchases.

The author strongly criticize Amromin and Chakravorti (2007) for selection-bias in terms of the countries they used to reach their conclusions. The selected countries were European (Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Sweden, Switzerland and the United Kingdom), North American (Canada and the United States) and East Asian (Japan) countries where the negative

effect of the use of electronic alternatives may be less pronounced. I could fully accept their reasoning only if they revise the paper with a random selection of countries within continental regions including South America (Brazil, at least), Africa (South Africa and Nigeria, at least), Asia (India, at least) and the Middle East (Qatar, at least).

Reductions in the stock of currency outstanding have been associated with rapid phases in the ongoing substitution of non-cash for cash payments in the past. If payment innovations such as electronic cash become popular, central banks may no longer be bothered with the redemption of large cash amounts. Rolnick, Smith and Weber (1996) identified some major issues such as the lemons problem and high transaction costs for the users of privately-issued bank notes with the intention of presenting preliminary historical evidence. They concluded that par circulation of privately-issued monies will not occur without some government intervention. One of their important conclusions is that the density of EFT-POS terminals was a key factor affecting the speed of the cash substitution process. Proponents of electronic cash market it as a true replacement for physical cash, particularly with open circulation that would mimic the anonymity and re-usability characteristics of cash.

Academics like Hett (2008) have argued that the advantages presented by some electronic substitutes could be used for national ill will. Hett claimed that the low financial cost of carrying out terrorist attacks should necessitate a focus on informal means of value exchange such as the commodities trade and digital currencies like PayPal, e-gold, and Liberty Reserve. While PayPal is tied to a bank account or credit card and may be viewed as a credit card processing service, other currency types or services such as e-gold and Liberty Reserve require users to load money into their accounts before spending or transferring. This means that these digital currencies are not tied to credit cards or bank accounts and they accept the convertibility of a national currency in exchange for a digital one.

Identification of transactors is also a subject of concern. For example, the Liberty Reserve requires only a valid email address as a verifiable identity requirement. Unlike transfers between traditional financial institutions, the Liberty Reserve transfers are at zero cost (irrespective of whether or not they are done in Costa Rica). This means that international transfer charges do not apply. In addition, there are no regulations on transfer limits, suspicious activities report filing, or mandatory reports on transactions over certain amounts. Detection of cash flow becomes almost impossible. Hence, digital currency becomes an extremely useful tool for

individuals and firms intending to evade tax or avoid monitoring. This, of course means that seigniorage revenue will decrease as the use of these substitutes becomes more wide-spread.

It may be generally acceptable for an innovation in the payment system eradicating all security flaws and eliminating identification theft to be biometric in the form of fingerprinting, or facial and iris recognition. Critics may argue that a fingerprint degradation will affect the accuracy of identification but with very well-developed matching algorithms using phase spectra of fingerprint images, fingerprint degradation due to inadequate fingertip conditions is not a problem for identification performance (Ito, Nakajima, Kobayashi, Aoki & Higuchi, 2004; Mahri, Shahrel & Rosdi, 2010). With the invocation of a biometric payment system by a centralized clearinghouse domiciled in a nation's central bank, the marginal implementation cost becomes very small. Hence, affordability by store fronts as well as mini shops becomes achievable and an eradication of ETR machines can occur within the least possible time. Taxation can, therefore, become more efficient and absolutely accurate through this reliable means as seigniorage revenues will tend to soar.

Barriers to cash transfers are no longer technical, but political, say Gelb and Decker (2011) as they discussed some of the new biometric identification technologies and reached conclusions about prospective benefits for developing countries. They questioned whether developing countries successfully operate a cash-transfer program, especially one motivated by the long-run objective of creating the conditions for better governance and public accountability with their current record of corruption and leakages in the management of public finances. Despite their several proofs on the relationship between the parameters, it seems that one of their very basic principles that transaction (and opportunity) costs on cash withdrawals are zero, is unrealistic.

### 3. The future of cash

For most developed countries, biometric systems are mostly associated with the areas of law enforcement and security. The use of the technology, in the form of fingerprinting, and facial and iris recognition, is becoming more widespread. Implementation of biometric technology in the payment processing systems may involve some costs upfront. These costs may be significant but the benefits that will ensue for the general public will outweigh them, and such a result may not be accomplished by a non altruistic institution. As a rational entity and the most altruistic banks in existence, central banks should offset these one time costs with the continual

cost of issuing bank and chip-cards. My conjecture here is that a much larger savings will be made, from the middle to the long run, on payment systems management and this will result in an increased effectiveness and efficiency.

In a post-dollar bubble world, currency hoarding will become pronounced and black markets will become more popular. The existence of these black markets and the consequent smuggling will produce a rise in volatility due to speculative forces in transitional economies. By studying, explicitly, the likelihood of overshooting exchange rates and prices, Goldberg and Karimov (1997) provided insights into the observed patterns of this relatively high volatility of nominal and real exchange rates in emerging markets. Their results support criticisms of the use of black market exchange rates as a guide to equilibrium-fixed exchange rates in transitional economies. According to them, both real and nominal black market exchange rates can overshoot in response to goods market events, as well as actual or pending foreign exchange market reforms. The point here is that the future of cash should be free from hoarding. Speculative bubbles created by unregulated markets are largely responsible for a lot of price variations. An innovative resolve to use biometric payment systems will significantly minimize the existence of such bubbles in the formal sectors when foreign exchange supply will be no longer mediated by commercial banks. Goldberg and Karimov (1997) also documented the behavior of hoarding activity and foreign currency holdings in an economy with under-developed financial markets and smuggling activity. The authors believe that restrictions hamper free market transactions in financial markets for some developing countries and shortages arising from these restrictions bring about the hoarding of stable and easily convertible foreign currencies for both consumption and investment motives as part of an optimizing decision by households.

The interaction of liquidity creation by financial intermediaries with capital flows and crises was developed in a model highlighted by Goldfajn and Valdes (1999) who remarked that the intermediaries' role of transforming maturities would result in larger movements of capital and a higher probability of crises. The authors showed that the probability of a currency (banking) crisis is higher in the presence of a banking (currency) crisis. A numerical representation of the model illustrates a case where capital inflows grow prior to the crisis, and the existence of inter-mediation substantially magnifies the initial shock. Financial intermediaries offer short-term deposits which make early withdrawal from investment less costly for potentially illiquid foreign

investors. Such contracts may attract capital from abroad, but at the same time they make the economy vulnerable to the risk of runs against the intermediaries. This is why the responsibility of achieving the future of cash should be enforced by central banks' direct dealings with producers and consumers so that retail bank intermediaries are non-existent.

According to Humphrey et al. (1996), a high rate of violent crimes will very likely lead to a much lower reliance on cash as well as an increase in the use of non-cash instruments. The trio's research showed that the cash holdings per person is low and there is a high non-cash use because of the high rate of violent crimes in the United States while in Japan, the low rate of violent crimes is responsible for the high cash holdings per person and the low non-cash use. Japan's low violent crime rate suggests that the need to formulate and use alternative non-cash substitutes for retail payments has been very weak. As the availability of data might have been responsible for the exclusion of developing and third world countries from their study, the reverse of the above-stated conclusions may be true for developing and third world countries. The paper failed to define the nature and forms of "a high rate of violent crimes". If information theft and non-authorized possession of the electronic payment means of one party by another is a violent crime, then a higher reliance on cash may be the consequence of a high rate of violent crime. The feasibility of the reliance on cash seems evident because ATMs are virtually omnipresent. As a policy recommendation, they proposed that the more concentrated the banking industry is, the more likely it is that individual banks will agree to establish a collectively owned and concentrated electronic payment network for bill payments, point of sale transactions, and payments among businesses. One of the interesting conclusions made by the trio was that the evolution of a country's payment system advances from barter to widespread cash use, to paper-based non-cash instruments, to electronics. And, the shift from cash to non-cash payments has advanced at different rates and taken different tracks in some developed countries.

#### 4. Policy implications

Central banks regulate money supply and interest rates while exercising their supervisory powers over financial institutions in their respective countries. One of the goals of central banks is to have stable prices, financial markets and interest rates as they strive to minimize unemployment and curtail crises. Whenever a financial crisis occurs, it causes individuals to move from less liquid assets to more liquid financial assets as a response to increased financial vulnerability. During such times, governments reduce expenditure, indirectly reducing the per capita capital and real spending as national output plunges. Cecchetti, Kohler and Up-

per (2009) revealed that the national output losses were usually higher when accompanied by a currency crisis as there is a tendency for any systemic banking crisis to have long lasting negative effects such as unemployment and usually, underemployment. Not only do these negative effects endure, but bank runs may also occur. Covitz, Liang and Suarez (2009) found evidence of extensive runs in the early stages of a turmoil and concluded that the asset-backed commercial paper market was subjected to bank-like panics.

To better fulfill their tactical and macroeconomic objectives, central banks should involve innovative methods in the exercise of their functions. Because macroeconomic vulnerabilities like outstanding government debt and fiscal balance affect the severity of a financial crisis, the central bank should consider exercising a more innovative approach in its influence on currency demand and supply in order to minimize any negative impact.

Economic activities are also affected through inconsistencies in exchange rate fluctuations as these lead to currency depreciation which may result in capital flight and sometimes, dollarization, as individuals and firms seek the protection against inflation provided by a hard currency. Some of these dollarized countries suffer asymmetric shocks originating from the center country's (US, in most cases) monetary policies and business cycles. This contagion exposes the dollarized country to price and real wage decreases. Over time, some countries have resolved to increase foreign debt acquisition to offset the inflationary tendencies caused by the dollarization.

An argument posed by Schmitz (2006) emphasized the impact of new technologies on the demand for central bank money as forming the core issue in the debate of the future of central banks in the advent of electronic money, with the presumption that a cashless economy can be attained if we let monitoring get perfect, since the information technology revolution seem to make this absolutely possible. He further analyzed the impact of the diffusion of electronic money on the future of central banking and highlighted the emergence of new and rapidly changing technology, which has led to a renewed interest in the possible economic impact of the parallel use of multiple units of account. It is clear that Schmitz (2006) was unsure whether the parallel use of multiple units of account could be efficient and sustainable if transaction cost appropriations by intermediaries (in the form of commercial banks) still prevailed. Commercial banks are profit-maximizing entities and their objective to maximize share-holders' wealth may require them to economize on the fraction of the central bank reserves they hold. This insight helps consolidate our understanding of the nature of (diverging) preferences as they relate to the optimal costs in the payment systems.

Furthermore, Schmitz (2006) suggests that the main drivers of institutional change in the payment system are politico-economic factors and the demand of commercial banks and final customers rather than technological innovations. The development and adoption of specific payment technologies are endogenous to the politico-economic tensions that drive institutional change in the payment system. Central banks should therefore retain their monopoly to issue the generally accepted medium of exchange at zero marginal cost so as to retain control of money supply as well as its purchasing power. My proposition is that central banks achieve this by eliminating retail banks and annexing their duties. Schmitz (2006) also postulates that an investigation of the future of central banking should build on an analysis of the impact of electronic money diffusion on the payment system's institutional characteristics.

As soon as retail banking functions have been assumed by the central bank, other (non central) banks will adopt a strict investment banking responsibility, as moral hazards and financial asset maneuvers will be minimized and individuals as well as firms will hold their currencies with the central bank of their country of domicile. Better accountability for cash and its use by individuals and firms alike, reduction of cash flow problems, better savings rate estimation, increased seigniorage and minimized fraud are only some of the achievable advantages that will accompany the take over.

The recent global financial crisis and its government bailouts has indeed re-enforced the "too big to fail" concept in the banking world. This may be partly due to the fact that those institutions are mostly owned and managed by private entities whose interest is strict profit maximization, no matter what. Unfortunately, the successful running of a lot of economies depends on the ability of these individuals to manage the national funds. A very common behavioral revelation is that individual interests do not always coincide with national interest in the same way that common sense may suggest that national interests do not always coincide with individual interests. In the interests of the nation, therefore, central banks should manage the entire retail banking operation of the country. The strength and survival of the economy depends on the successful running of retail banks and a nation's growth and development ought not to be stifled by individual selfishness. I strongly suggest that anyone who would argue against the takeover of retail banking functions by central banks should review Rolnick et al. (1996). Information on private bank notes in the United States before 1984 helped these authors establish that privately issued bank notes did not circulate at par outside of the locality where they had been issued. If private banks may not serve the purposes for which

they exist after several corrections in the industry, a take-over by central banks may be in the better interest of the country.

The size of central banks coupled with their network effects can be advantageous to the implementation of a biometric payment system in the sense that they can benefit from the very marginal cost of economies of scale. Also, central banks can implement technological change more easily than profit-maximizing, cost-minimizing intermediary retail banks. One other advantage of a biometric payment system is that the government can have increased seigniorage revenue if retail banking functions are handled directly by the central bank. A phase-in approach may be the most appropriate in the handover of retail banking responsibilities. Of course, this measure should involve a great deal of moral suasion for acceptance. This time round, commercial (or otherwise retail) banks will be left out in the implementation of monetary policies since their functions will have been integrated into those of the central bank and they may have ceased to exist. Hence, the intermediary profits would be appropriated, monitoring effectiveness and efficiency would be better monitored, and the supply of cash and electronic funds would be better controlled.

## Conclusions

Over time, demand for cash transactions has favored the acceptance and wide-spread use of innovative financial solutions from payment cards to digital currencies. As young and educated people flow with the trend, the informal sector and people seeking to avoid monitoring by conducting off-the-record transactions are reducing the rate at which cash is becoming permanently obsolete. Security issues in the form of identity theft and unauthorized access to funds threaten the use of these electronic payment means, and this is why I have proposed an innovative revolutionary means of minimizing insecurities through the implementation of a biometric payments system in the banking technology sector by central banks. Because problems arising from retail banking failures have been largely responsible for banking and currency crises, assigning the responsibilities accorded to these institutions to central banks may better serve the interest of nations so that monitoring and accounting may be more accurate. This annexation will also help countries have more stable prices, financial markets and interest rates as unemployment and the probability of a systemic crisis would be reduced to the barest minimum.

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