THE IMPORTANCE OF THE RETAIL PAYMENT SYSTEM*

Hal S. Scott

Nomura Professor and Director,
Program on International Financial Systems
Harvard Law School

December 16, 2014

* Research on this paper was supported by MasterCard

THE IMPORTANCE OF THE RETAIL PAYMENT SYSTEM

ABSTRACT

This article explores the importance of an efficient retail payment system and develops an integrated framework for evaluation of the retail payment system by policy makers. It examines the costs and benefits of the various types of retail payment system, focusing on the seven desirable benefits of the retail payment system: (1) finality and reversibility; (2) universality (ability to use at point of sale and remotely); (3) recordkeeping; (4) liquidity (maximizing interest earning assets); (5) security and safety; (6) financial inclusion and access; and (7) fungibility and ease of use (seven benefits).

The article discusses the Coase Theorem, a proposition from transaction cost economics that provides a useful tool for analyzing transaction efficiency. Increased costs are not bad per se since parties are often willing to incur higher costs to achieve their desired results, e.g. higher costs for a more secure form of payment. Indeed, higher costs may often generate higher value to both parties to a transaction. What one wants to reduce are "friction" costs, costs that neither party wants to pay to achieve a desired result, e.g. higher costs produced by lack of information.

While each retail payment system provides certain advantages, e.g. cash for small transactions, overall the analysis suggests that debit and credit cards represent the most desirable payment system for achieving the seven benefits set forth above. This is supported by statistics that indicate that retail payments have increasingly moved toward card payments.

I. INTRODUCTION

This article examines the importance of a well-functioning retail payment system to meeting the needs of the markets. A country's payment system is the backbone of its economy. Without an effective system in place to settle financial obligations between parties, there will be reduced economic activity in a country, and everyday commerce will face significant obstacles.

The global economy executes about $500 trillion of "real economy" payment transactions a year, four fifths of which represent business to business commerce, the buying and selling of goods and services between non-financial, non-household entities, including governments.[1] This is roughly five times global GDP (a measure of final demand, not intermediate transactions) and is vastly larger than retail sales transactions and bill payments that make up the remaining $100 trillion or so.[2] 85% or more of the individual transactions (but a small percentage of the value) are executed in "cash," legal tender bank notes and coins.[3] The remaining 15% of transactions, representing over 90% of the value, are largely executed in the small value or retail payments system, in distinction from the large value or wholesale payment systems that today are operated by central banks to provide real time gross settlement (RTGS) in central bank funds.[4]

Beginning with the seminal article by Baxter (1983) that explored the network effect and externalities in the payment system, there have been several academic studies exploring this topic, in the areas of law, economics, and technology. Yet, apart from these

---

[1] KEVIN MELLYN, BROKEN MARKETS: A USER'S GUIDE TO THE POST-FINANCE ECONOMY 11 (2012).
[2] *Id*.
[3] *Id*. at 58.
[4] *Id*.

studies, and despite of the importance of the payment system, this topic has been given relatively little attention in academic literature. Authors of finance and economics typically assume the existence of a well-functioning payment system in developing their theories and models of how markets work. While a convenient assumption, this overlooks the complexity and importance of the payment system as a market ecology of its own.

This article develops a framework for how the retail payment system should be viewed by regulators and other public authorities worldwide, including courts of law, in formulating public policy, law, and regulation. A specific key aim of the research is to develop a more integrated and well-articulated framework for evaluating whether particular types of regulation will interfere with payment system efficiency. The article is based on existing literature, not on original empirical research.

An important starting point is understanding the costs and benefits of the retail payment system and the various payment methods that it includes. The article examines the costs of achieving seven desirable benefits of the retail payment system: (1) finality and reversibility; (2) universality (ability to use at point of sale and remotely); (3) recordkeeping; (4) liquidity (maximizing interest earning assets); (5) security and safety; (6) financial inclusion and access; and (7) fungibility and ease of use. In considering costs, the cost of cash payments is used as a benchmark. The article generally excludes a discussion of public benefits, such as the value to the society of eliminating illegal payments; it rather concentrates on the benefits to the private sector in conducting efficient transactions.

This article begins by defining the retail payment system. It then discusses the Coase Theorem, a proposition from transaction cost economics that provides a useful tool for analyzing transaction efficiency. Increased costs are not bad per se since parties are often willing to incur higher costs to achieve their desired results, e.g. higher costs for a more secure form of payment. Indeed, higher costs may often generate higher value to both parties to a transaction. What one wants to reduce are "friction" costs, costs that neither party wants to pay to achieve a desired result, e.g. higher costs produced by lack of information.

The article then proceeds to look at various factors that come into play in choosing a payment method, and looks at the strengths and weaknesses of various retail payment instruments in comparison to cash. It concludes by suggesting how these considerations should be incorporated into formation of public policy, law, and regulation.

II. DEFINITION OF THE RETAIL PAYMENT SYSTEM

A payment system is a network of interconnecting entities that facilitates the exchange of data required to initiate, authorize, clear, and settle cash or credit claims between payors and payees. An efficient payment system accomplishes these tasks at a relatively low cost to the parties involved. Payment systems are not mere infrastructure like roads and bridges—they come in various forms, as driven by the needs of transactors, to facilitate economic transactions. Payment systems can be broadly put into two categories: large value payment systems and the retail payment system.

Large value payment systems are payment systems with high volume of value transfer, typically used by financial institutions to settle mutual obligations, for example

FedWire in the U.S. Most developed countries have a form of real time gross settlement (RTGS) in place, allowing financial institutions to settle mutual obligations on a real time, gross settlement basis. [5] Many also have a large value net settlement system, for example CHIPS in the U.S. A significant number of countries (23%), typically low income countries, also use check clearing systems or other central bank systems for large value settlement.[6] While large value payment systems are clearly important to the efficiency, safety, and integrity of a country's financial system, they are not the focus of this study.

The retail payment system, which is the focus of this study, is the payment system that facilitates the exchange of data in the context of retail payments in daily commerce. The retail payment system has three primary characteristics, as suggested by the Committee on Payments and Market Infrastructures (CPMI) of the Bank for International Settlements (BIS) and adopted in this study.[7] First, a retail payment system settles transactions made in large numbers by a large number of transactors, as opposed to transactions of financial institutions and central banks. This definition is wide enough to cover business-business as well as individual-business and person-to-person payments. Second, it involves a wide range of payment instruments, including point-of-sale payment instruments and those used for remote transactions. Third, it makes extensive use of private networks, such as automated clearinghouses or credit card companies, in contrast to many forms of large value payment systems that are commonly operated by a country's central bank.

---

[5] It has been pointed out that in some cases, RTGSs are expressly designed to handle both large-value and small-value transactions, such that even some types of retail payments could be settled on a real-time, gross basis. *See* Peter Allsopp, Bruce Summers & John Veale, *The Evolution of Real-Time Gross Settlement* (Feb. 2009), at 13.

[6] *See* THE WORLD BANK, *Payment Systems Worldwide A Snapshot* (2010), at vii.

[7] *See* BANK FOR INTERNATIONAL SETTLEMENTS, *Policy Issues for Central Banks in Retail Payments* 6 (2003).

III. OVERVIEW OF MAJOR RETAIL PAYMENT INSTRUMENTS

For the sake of simplicity this paper discusses retail payment systems at the level of instruments used by payors and payees in almost all national payments markets, although there are significant differences in how they work in specific countries. Unless otherwise noted, this discussion is based on the U.S. retail payment system so that foreign developments like real-time ACHs are omitted. Access systems, which enable Internet access to existing payment systems, are not treated independently of the underlying payment systems in this paper.[8]

A. Cash

Cash is money in the form of physical objects, such as coins and banknotes, issued by governments that determine its supply and nominal value by fiat. As legal tender in most jurisdictions, cash enjoys very wide acceptance. However, it is difficult to transmit over distances and vulnerable to theft. Therefore, it is used primarily in face-to-face transactions, typically for small amounts. Cash is readily converted to and from ledger money in the banking system that forms the basis of all other payment instruments, physical and electronic.

A consumer survey conducted by the Bank of Finland suggests that handiness (in small amounts) and quickness of use are the top reasons why people use cash over other retail payment instruments.[9] 24.7% of survey respondents indicated handiness as the most important reason for cash usage, while 18.9% indicated the speed and quickness of use as

[8] Examples being PayPal, Google Wallet, and similar systems. *See The end of a monopoly*, THE ECONOMIST (May 10, 2014), http://www.economist.com/node/21601624/print.
[9] *See* Kari Takala & Matti Viren, *Efficiency and Costs of Payments: Some New Evidence from Finland*, BANK OF FINLAND DISCUSSION PAPERS (Nov. 2008), at 19.

the primary motivation.[10] As of late 2014, the amount of cash in circulation in the United States was approximately $1.29 trillion, while the figure stood at €971 billion for the Eurozone.[11]

B. Check

A check is a document in which one party, the payor, directs his bank to make a payment to another party, the payee, from the payor's bank account. The payee or his endorsee deposits the check and "pulls" funds back through the bank collection system from the payor's bank. Checks were devised for use in large trade transactions often over great distances to avoid the need to ship specie, something that was dangerous and, cross-border, often illegal.[12] Checks are universal because bills were for centuries the only universal payment and credit mechanism. Bank notes developed much later with deposit banking in 17th century Europe, and government currency monopolies emerged only in the 19th century.[13] Infrastructure for the use and clearing of checks is present in virtually every country in the world, regardless of income levels and regions.[14]

Check usage varies significantly by country, but the overall usage level of checks is on the decline worldwide. Check usage among CPMI countries saw an average decline of 3.96% per year from 2009 to 2013.[15] In many European countries, particularly in

---

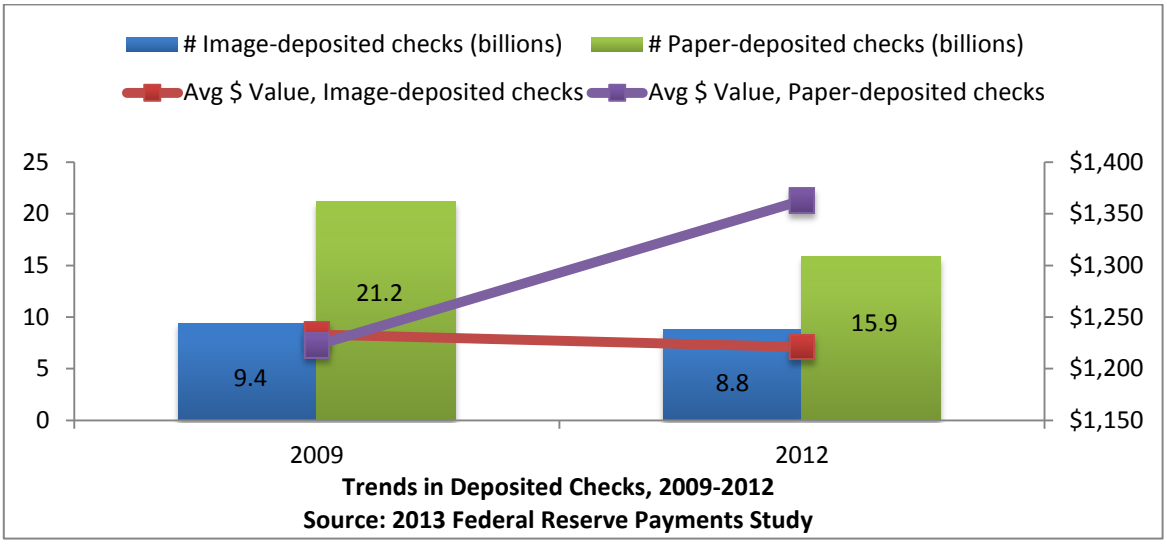
[10] *Id.*
[11] THE FEDERAL RESERVE SYSTEM, *How Much U.S. Currency is in Circulation?*, http://www.federalreserve.gov/faqs/currency_12773.htm; EUROPEAN CENTRAL BANK, *Banknotes and Coins Circulation*, http://www.ecb.int/stats/euro/circulation/html/index.en.html.
[12] *See generally* Stephen Quinn & William Roberds, *The Evolution of the Check as a Means of Payment: A Historical Survey*, 93 ECON. R. (NO. 4) 1 (2008).
[13] *See id*. at 8.
[14] Massimo Cirasino & Jose Antonio Garcia, *Measuring Payment System Development* (2008), at 37.
[15] *See* BANK FOR INTERNATIONAL SETTLEMENTS, *Statistics on Payment, Clearing and Settlement Systems in the CPMI Countries – Figures for 2013*, http://www.bis.org/cpmi/publ/d120.pdf.

Scandinavia, check usage has virtually disappeared in favor of direct bank transfers and electronic payment cards.[16] The United States remains one of the top users of checks. In 2012, a total of 18.3 billion check transactions took place in the United States for a total value of $25.9 trillion.[17] However, from 2009 to 2012 there was a 9.2% per year decline in the number of checks paid in the U.S. (with the value of such checks declining by 6.5% per year during the same period).[18]

Chakravorti and McHugh (2002)[19] suggest that the lack of financial incentives to move away from the check system, including the substantial revenue made by financial institutions from check usage (in particular from non-sufficient-funds fees), is the primary reason the United States lags behind other countries in replacing checks with electronic payment methods. For consumers, the incentive to switch away from checks is weak because merchants rarely impose additional fees for check payments, and the added cost saving from using electronic systems may not be great enough to justify abandoning the check system that they are more familiar with, although it may be increasingly hard for consumers to pay by check. The study also speculates that for merchants, the cost of processing checks, including the risk of not being able to convert the checks to good funds, may not be significantly greater than for electronic alternatives such as debit cards. The study also notes the Federal Reserve's continued effort to improve the check processing system may also impede the adoption of electronic alternatives. Interbank processing and

[16] A global survey of payment usage conducted for the year 2006 indicated that an average of 0.1 and 0.2 checks were used per capita in Finland and Norway, respectively. *See Payment Systems Worldwide A Snapshot*, *supra*, at 102, 103.
[17] The 2013 Federal Reserve Payments Study (July 2014).
[18] *Id.*
[19] *See* Sujit Chakravorti & Timothy McHugh, *Why Do We Use So Many Checks?*, 3Q ECONOMIC PERSPECTIVES 44 (2002).

clearing of checks are virtually all electronic, whether by electronic image exchange or conversion to ACH payments. Reinforcing this trend, in 2012, about one in six checks was deposited by accountholders as an electronic image rather than as a paper check[20]



Trends in Deposited Checks, 2009-2012
Source: 2013 Federal Reserve Payments Study

C. Payment Cards

A payment card is a device that can be used by the cardholder to make retail payments. It is typically in the form of a plastic card that electronically stores information in a magnetic strip or an embedded chip, which can be processed by the merchant's point-of-sale system to receive payments. Payment is made by transferring funds from the cardholder's account or line of credit to the payee's account through a card collection system.

The two major types of payment cards are debit cards and credit cards. Debit cards are electronic payment instruments that, when processed, transfer funds directly from the cardholder's financial institution account to the payee's bank account. Credit cards, while

[20] The 2013 Federal Reserve Payments Study (July 2014).

similar in practical usage to debit cards, transfer funds from the cardholder's line of credit with the financial institution that issued the card. Typically, the cardholder does not incur a charge for the line of credit when the balance is paid within a month of the date the debt arises, plus some number of days (e.g. 10 or 15). After this "grace period," the remaining balance incurs interest and is carried over to the next payment period as a revolving balance.[21]

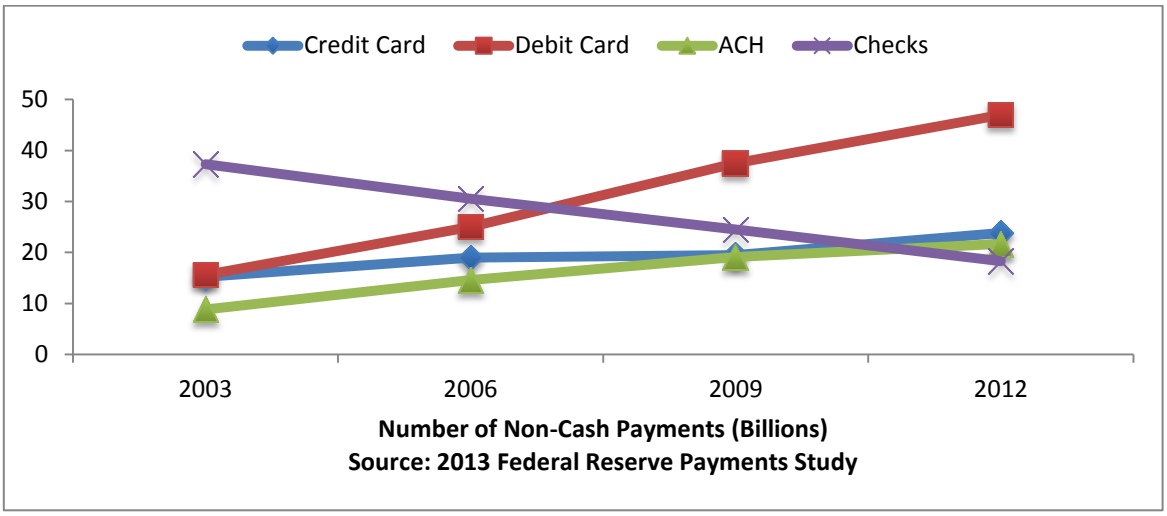
Card payments are usually processed through a private network, which can be either an "closed" system or a "open" system. In closed systems, such as Discover and American Express, the card issuer directly issues cards to consumers and merchants enroll to accept the card. In an open system, such as MasterCard and Visa for credit cards and NYCE and Pulse for debit cards, cards are issued by the member financial institutions as opposed to the card scheme (such as MasterCard) itself.[22]

The Bank of Finland consumer survey suggests convenience is a major factor leading consumers to use payment cards for transactions.[23] 30.6% of respondents indicated the most important reason they use card payments is the more troublesome nature of cash usage (for example, in needing to take back change at the point of sale), and 9.5% cited the troublesomeness of withdrawing cash from ATMs and banks.[24] According to a 2010 World Bank survey, almost all developed countries had an average of more than one card

---

[21] CONSUMER FINANCIAL PROTECTION BUREAU, *What is a Grace Period? How Does it Work?* (Mar. 22, 2012), http://www.consumerfinance.gov/askcfpb/47/what-is-a-grace-period-how-does-it-work.html.
[22] MasterCard and Visa both started as an association of card-issuing banks that was owned and funded by those banks and acted as the licensor for the respective card brand. Today, they are both investor-owned, standalone companies, but their general role in the payment card landscape remains mostly unchanged. *See* Marc Rysman & Julian Wright, *The Economics of Payment Cards* (Nov. 2012).
[23] *See* Kari Takala & Matti Viren, *Efficiency and Costs of Payments: Some New Evidence from Finland*, BANK OF FINLAND DISCUSSION PAPERS (Nov. 2008), at 20.
[24] *Id.*

per capita in circulation, reflecting their widespread usage.[25] In 2012, 51.7 billion and 26.2 billion transactions were made using debit and credit cards in the United States, respectively.[26] The number of credit card payments, having grown by only 1% annually from 2006 to 2009, exhibited annual growth of 6.8% from 2009 to 2012.[27] Debit card payments increased more than any other payment type during this period.[28]



D. Automated Clearing House Transfers

Automated Clearing House transfers refer to payments made through an Automated Clearing House (ACH), an electronic payment network that connects all financial institutions and acts as the central clearing facility for electronic fund transfers that occur nationwide. ACH payments are processed in batch form in the U.S.—transactions are accumulated throughout the day and transmitted periodically in groups on a net basis, in contrast to real-time gross settlement systems in which funds are transferred transaction-by-

[25] *See Payment System Worldwide A Snapshot*, *supra*, at 59.
[26] *See Statistics on Payment, Clearing and Settlement Systems in the CPMI Countries – Figures for 2013*, *supra*.
[27] The 2013 Federal Reserve Payments Study (July 2014).
[28] *Id.*

transaction on a real-time basis.[29] In the U.S., the development and administration of the ACH network is managed by the National Automated Clearing House Association (NACHA), a non-profit association of financial institutions that form part of the network, in contrast to networks for debit and credit card transactions, which are maintained and run by the respective card association such as MasterCard and Visa.[30]

ACH transactions are mainly used for recurring preauthorized transactions between payors and payees, such as utility bills or monthly salaries. An ACH transfer can be a debit or credit transfer. In a debit transfer, the payee (e.g. utility firm), through the payee's bank, sends a request to the payor's bank (e.g. utility customer's bank), with the payor's approval, for funds to be removed from the payor's bank account and credited to the payee's account. In an ACH credit transfer, a request is made by the payor (e.g. salary provider) for funds to be removed from its account and credited to the payee's (e.g. salary recipient) account.

Recently, however, a new trend in ACH transactions has developed whereby payors can make a one-time authorized payment to the payee without an ongoing recurring payment. Some of the more common recent uses of ACH transfers are point-of-sale payments and remote payments over the Internet.[31] In a typical point-of-sale ACH transfer, the payor gives a paper check (or, in the remote payments context, provides the bank routing and account numbers found on the check) to the payee, who then uses the check information to initiate a one-time ACH debit transfer from the payor's account to the

---

[29] THE FEDERAL RESERVE SYSTEM, *Automated Clearinghouse Services* (Aug. 10, 2012), http://www.federalreserve.gov/paymentsystems/fedach_about.htm.
[30] *About Us*, NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, https://www.nacha.org/aboutus.
[31] Other common forms of one-time ACH transfers, commonly termed "electronic checks" or "e-checks," include an account-receivable conversion (in which the payor's check is used as a source document to make a debit transfer to the payee, but not at the point-of-sale) and telephone-initiated transfer (in which the payor makes the payment authorization over telephone).

payee's account instead of going through the traditional check processing process. Similarly to debit and credit card transactions, and in contrast to traditional ACH transfers, the payee would not be permitted to draw subsequent funds from the payor's account without getting a new authorization. Point-of-sale ACH transfers, which accounted for approximately 204 million transactions in 2003, had risen to 406 million by 2013.[32] Internet-initiated ACH transfer saw an even more rapid increase from 689 million transactions in 2003 to 3.28 billion transactions in 2013.[33] Overall, as of 2013, the ACH system processed about 17.55 billion transactions per year.[34]

E. Virtual or Digital Currencies

Virtual or digital currencies like Bitcoin are an emerging form of non-governmental or "private" money. Such currencies depend on complex encryption techniques and dispersed community ledgers to create transferable tokens of exchange. Since such currencies are not backed by the government but are issued by dispersed user communities, they fluctuate in value against sovereign currencies, taking on the traits of a speculative commodity as well as a medium of exchange. As of November 2014, the market capitalization of Bitcoin stood at approximately $5.77 billion, up from $1.32 billion in May 2013.[35] Although their use is to date very limited and circumscribed by legal and regulatory uncertainty, they bear watching. Indeed, virtual currencies (of which there are

---

[32] NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, *Overall ACH Volume Nearly 22 Billion in 2013* (2014), https://www.nacha.org/system/files/resources/ACH%20Network%20Statistics%202013.zip; NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, *Ten Billion ACH Payments in 2003, NACHA Announces* (Mar. 22, 2004), https://www.nacha.org/node/789.
[33] *Overall ACH Volume Nearly 22 Billion in 2013*, *supra*.
[34] *Id.*
[35] COINDESK, *Bitcoin Market Capitalization Chart*, (November 13, 2014), http://www.coindesk.com/data/bitcoin-market-capitalization/.

many) were largely developed to challenge fiat money and the power of government to determine its supply and value.

IV. COASE THEOREM

The analysis of the economics and regulation of the retail payment system requires a consistent framework within which the costs and benefits of different retail payment instruments, and the costs and benefits of regulations imposed on them, can be evaluated.

The Coase Theorem, a proposition pioneered by Ronald Coase in the 1960s in the field of law and economics, is helpful in this regard.[36] In summary, the theorem posits that private transactors, in the absence of transaction costs and acting in their best self-interest, will tend to reach transactions and asset distribution that maximize their combined private welfare. This is true because if the parties involved can bargain freely, they can simply agree to distribute the excess welfare generated in a way that is profitable for both parties. That is to say, as long as parties can bargain freely, generating a large pie and dividing it between the parties will always be more desirable than generating a small pie and redistributing the same, leading the parties to structure their transactions in a way that maximizes the size of the pie. This simple idea has had a large impact on, and forms the basis of, modern economic analyses of government regulation.

One of the central ideas derived from the Coasian reasoning is that government regulations are not very effective at helping the parties reach the "optimal" solution, that is, one that maximizes the size of the pie from which the parties can bargain to obtain their share. This is because government regulations are often simply redistributive in nature,

[36] *See* Ronald Coase, *The Problem of Social Cost*, 3 JOURNAL OF LAW AND ECONOMICS 1 (1960).

mandating the method by which the generated pie should be shared, and do not necessarily favorably alter the fundamental underlying economic nature of the transaction. Further, mandated distribution not in line with the will of the parties could cause the parties to produce smaller pies, or less joint welfare.

Another important idea derived from the Coase Theorem is the critical importance of transaction costs, that is, the cost of entering into and executing a transaction. Transaction cost includes the direct cost of performing a transaction. For example, survey and conveyance fees that must be paid in a real estate transaction are direct transaction costs. More subtly but perhaps more importantly, transaction costs also include those costs that arise primarily from the asymmetry of knowledge between the transacting parties. Continuing with the real estate example, the purchaser in the transaction may incur significant costs in investigating possible defects or encumbrances on the real estate property that are known but undisclosed by the seller. The cost involved in the investigation is a transaction cost that arises from the asymmetry of information between the buyer and the seller, which would not be incurred if the parties had the same knowledge. When the asymmetry of information and the cost of resolving the asymmetry are sufficiently great, parties may decide not to transact at all even when there is a potential mutual benefit to be had from the transaction, representing lost value.

In the context of the retail payment system, the two classes of costs, the direct costs and the information asymmetry costs, are manifested in various ways. Direct costs of retail payment instruments to transacting parties may include the cost of creating the physical payment instruments such as coins, banknotes, checks, and payment cards, and the cost of

processing those payments, including counting cash, clearing checks, and processing card payments. The information asymmetry costs may include the cost involved in investigating the validity of a payment and the creditworthiness of the payor if goods are to be exchanged immediately for a payment that may not be completed until later, as is usually the case with checks and ACH transfers. Features of different retail payment instruments can mitigate or exacerbate these costs to varying degrees.

Coase characterized transaction costs as "friction" that added expense to the goods and services being bought and sold, not value.[37] His theory of the firm maintains that business organizations exist to reduce friction that exists in market contracting, but also create their own friction. However, in the payment context, payment systems do not merely add costs to the expense of goods and services, since without efficient payment mechanisms, the optimal amount of exchange of goods and services will not occur.

It is useful to break down Coase's transaction cost categories into sub-components subject to measurement. An expanded set of transaction costs for market contracting between two firms would include, among other things:

1. Cost of Counterparty Discovery
2. Cost of Price Discovery
3. Cost of Negotiation
4. Cost of Fulfillment
5. Cost of Financial Settlement
6. Cost of Counterparty Default Risk

[37] Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

   a. Counterparty Monitoring Costs
   b. Contract Enforcement Costs
   c. Cost of Contract Replacement
   d. Costs of Collection
7. Cost of Internal Control
8. Cost of Fraud and Theft
9. Cost of Asset Management
10. Cost of Working Capital
11. Cost of Third Party Liability

Digital technology has been widely deployed to lower these costs, essentially through improved information logistics between and within the counterparties, often integrated with physical logistics.

An important lesson of the Coase Theorem is that the government should regulate to reduce the transaction costs that may prevent parties from reaching efficient and mutually beneficial outcomes, rather than acting in a redistributive role by defining the division of generated value among transaction participants. In other words, an efficient regulation would be one that tends to reduce direct transaction costs, particularly the information asymmetry among the parties. Furthermore, while costs in some way could be thought of as accruing to one party or the other in a transaction, the regulatory focus should be on the minimization of combined total transaction cost for the parties. As long as a payment system is an efficient one, parties (consumers and merchants) will find their own redistributive mechanisms to reach a cost and welfare-sharing scheme that is acceptable to

both parties. Indeed, attempts by the government to redistribute costs are often nullified by further reactive measures by the parties. Nyberg (2008)[38] gives an example of this idea where, despite a payment system regulation seeming to impose costs on merchants and banks, a large portion of the cost was ultimately borne by consumers through increased fees. This has played out in practice following the Durbin Amendment to the Dodd-Frank Act, with banks responding to the mandated reduction in interchange fees by increasing other bank fees and reducing access to fee-free accounts.[39]

V. OVERALL COST OF PAYMENT

Almost all retail payments (except transfers between accounts owned by the same entity) serve to settle or discharge a formal or implied market contract between two entities (gifts, for example, would be an exception). For example, a payment in response to an invoice settles the market contract for a purchase of goods and services, swiping a credit card creates a contractual obligation to pay the issuing bank which must be settled, and handing over a dollar bill in exchange for a newspaper settles an implied contract instantly with finality.

All market contracts are to a degree asymmetrical or incomplete in terms of the information or bargaining power of the counterparties. When a merchant hands over goods in return for cash, for example, the customer bears the risk of defective goods and the merchant bears the risk of counterfeit currency. In many cases these asymmetrical risks can be substantial, for example, when accepting checks for large value purchases, or shipping

[38] *See* Lars Nyberg, Deputy Governor of the Sveriges Riksbank, Speech at the Finansförbund Congress, Bålsta (May 23, 2008).
[39] *See* Todd J. Zywicki, Geoffrey A Manne & Julian Morris, *Price Controls on Payment Card Interchange Fees: The U.S. Experience* (George Mason Law & Economics Research Paper No. 14-18, June 4, 2014).

goods in advance of payment as is normal commercial practice in business-to-business commerce.

When a payment balances the interests and reduces the risks undertaken by counterparties to a market contract, it reduces the total cost of contracting along one or more of the dimensions listed out above. In so doing, in Coasian terms the payment system, by reducing transaction costs, increases the scope for market contracting between parties. For this reason, the notion that the total cost of the payment system is frictional waste to the economy and a misallocation of societal resources is fallacious, because it assumes that a payment is a payment without regard to the manner in which a payment reduces or increases the total transaction costs and the volume of contracts (which is to say commerce) it facilitates. The fallacy leads directly to the notion that cheaper payments are better by definition and further that public policy should act to reduce the cost of using specific payment instruments.

This broad misunderstanding has become the basis of public policy orthodoxy in payments systems, often with spillovers into concerns like financial inclusion and economic development. The assumption is that the costs of the payment system are a "market failure" that needs to be corrected by regulatory intervention or direct government investment. This, of course, assumes that a payment system is fundamentally a utility or public infrastructure like a power grid rather than a means to an end of better fulfillment of contractual objectives. So mere comparisons of costs of payments are incomplete unless such costs are judged against the benefits they produce.

The cost of payment refers to the fact that payment systems, the retail payment system especially, are services with real production costs, both direct and indirect. Direct costs of retail payment include the cost associated with verifying and clearing various payment instruments and the cost of infrastructure such as point-of-sale terminals and computer systems necessary to process electronic payment transactions. Indirect costs include expected losses from fraudulent payment instruments such as counterfeit cash and fake credit cards, and the implicit cost of holding non-interest bearing cash. It is these indirect costs which are crucial.

Different payment systems have different cost components. For example, the Bank of Finland's 2008 report identifies several factors that contribute to the cost of cash.[40] For the purpose of that study, the authors consider the cost of cash as accruing to four separate, identifiable parties: the central bank, the banking sector, merchants, and consumers. The cost of cash to the central bank includes procurement of new banknotes and coins, transportation of cash between central bank branches, issuing, sorting, and destroying unfit banknotes, vault and storage, and other miscellaneous costs such as real estate, IT services, and security. The cost of cash to the banking sector includes transportation of cash, the cost of procuring and operating ATMs, and back office functions to count, sort, and process cash, among others. The retail sector's cost of cash includes the cost of deposit and withdrawal, point-of-sale cashier operation, back office functions, storage, transportation, and security. Finally, consumers incur costs from fees paid on withdrawal of cash, personal

[40] *See* Takala & Viren, *supra*, at 25 et seq.

effort of using cash (for example, time spent withdrawing and depositing cash), and seigniorage, that is, implicit loss of interest income from holding non-interest bearing cash.

Many efforts have been made to estimate the actual cost of various components of the retail payment system. However, due to the difficulties in adequately estimating the various costs involved, studies are typically inconclusive and incomplete. For example, Shampine (2007)[41] criticizes the study by Garcia-Swartz et al. (2005),[42] which quantitatively estimates the cost of various retail payment instruments, as non-robust and open to challenges surrounding the underlying assumptions. Shampine points out that Garcia-Swartz et al. disregard the cost of interest payments made by credit card users from their analysis, despite the fact that 54% of cardholders carry a credit card balance. Shampine also suggests that the study overemphasizes the cost of making an ATM trip to retrieve cash, and underestimates the consumers' valuation of privacy. Much of the difficulty of measuring payment system cost comes from the fact that some necessary data are proprietary and therefore difficult to obtain, such as the cost of banking operations, and because some costs are inherently difficult to quantify, such as the cost of personal efforts in using cash.

Studies have also been done to estimate the relative cost of each payment method within a country. Brits and Winder (2005)[43] estimate the costs of retail payment instruments, and find that cash (7 billion transactions), debit cards (1 billion transactions),

---

[41] *See* Allan Shampine, *Another Look at Payment Instrument Economics*, 6 REVIEW OF NETWORK ECONOMICS 4 (2007).
[42] *See* Daniel D. Garcia-Swartz, Robert W. Hahn, & Anne Layne-Farrar, *The Move Toward a Cashless Society: A Closer Look at Payment Instrument Economics*, 5 REVIEW OF NETWORK ECONOMICS 1 (2006).
[43] Hans Brits & Carlo Winder, *Payments are No Free Lunch*, DE NEDERLANDSCHE BANK OCCASIONAL STUDIES (2005).

and credit cards (46 million transactions) cost a total of €2.122 billion, €520 million, and €165 million in the Netherlands, respectively. Guiborg and Segendorf (2004) estimate the unit cost of check (20.02 SEK), debit card (0.65 SEK), and credit card (3.46 SEK) payments in Sweden.[44]

Despite the difficulties with cost estimates, two facts seem relatively clear.

First, significant differences exist between countries in the total cost of the retail payment system as a percentage of GDP. A 2012 study by the European Central Bank divides EU member states into clusters, ranked by the cost of retail payments as a percentage of GDP.[45] The study finds that Denmark, Sweden, and Finland have the lowest cost of retail payments, at an average of 0.80% of GDP, whereas countries such as Cyprus, Malta, Greece, Italy, Ireland, and France incur higher cost in their retail payments, at an average of 1.20% of the GDP in each country. The lower cost in the first cluster seems largely attributable to the greater reliance on electronic payment methods. The cost of the payment system is higher in the United States. Humphrey et al. (2000) [46] estimate the total cost of the payment system to be over $225 billion in the United States, comprising approximately 2-3 percent of GDP. Banka et al. (2012) estimate the total cost of the paper-based payment system in the United States (including coins, paper currency, and paper

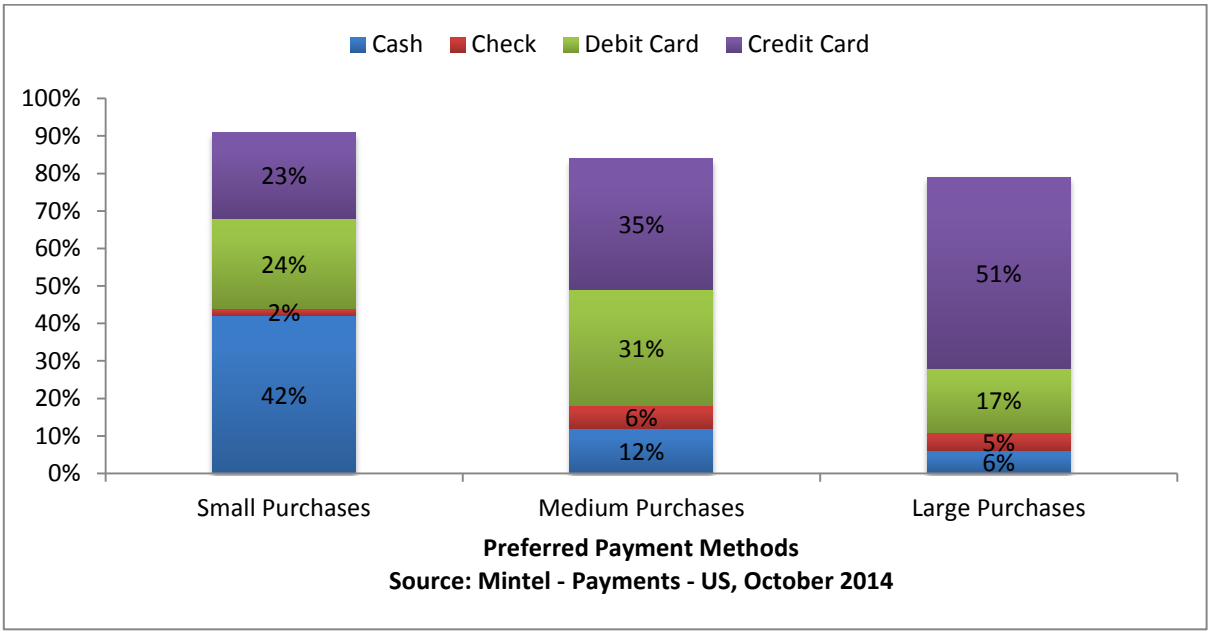
[44] Gabriela Guibourg & Björn Segendorf, *Do Prices Reflect Costs? A Study of the Price- and Cost Structure of Retail Payment Services in the Swedish Banking Sector 2002* (2004).
[45] *See* Heiko Schmiedel, Gergana Kostova, & Wiebe Ruttenberg, *The Social and Private Costs of Retail Payment Instruments: A European Perspective* (Sept. 2012), at 41.
[46] *See* David Humphrey, Lawrence Pulley & Jukka Vesala, *The Check's in the Mail: Why the United States Lags in the Adoption of Cost-Saving Electronic Payments*, 17 JOURNAL OF FINANCIAL SERVICES RESEARCH 17 (2000).

checks) in 2010 at $506 billion, corresponding to 3.5% of the country's 2010 GDP.[47] A Fletcher School study (2012) estimates the cost of cash in the United States to be approximately $200 billion.[48] The high cost of payment in the United States is probably explained by the historic patterns of payment preferences, notably the continued use of checks to a much greater extent than in other countries.[49]

Second, the cost of using a retail payment instrument depends largely on the transaction amounts involved. Studies find that cash payments are relatively cheap for small transaction amounts, whereas debit and credit cards are much more efficient payment methods for larger transaction amounts. For example, Arango and Taylor (2008)[50] find that cash is the cheapest payment method for transactions of very small value in Canada, while debit cards on average are the least costly throughout a broader cross-section of transactions including higher value transactions. This is driven by the variable costs of cash, including the labor costs of tendering and depositing cash and the risks of cash theft or counterfeit loss, which increase significantly for large transaction amounts. Arango and Taylor also suggest that smaller merchants may perceive cash as less costly than other forms of payments because of the relatively high fixed cost, due to necessary infrastructure, associated with receiving electronic payments.

---

[47] Holti Banka et al., *From Cash to Electronic Payments: Quantifying and Measuring the Costs of Paper Based Payment Instruments to the U.S. Society* (Apr. 2012).
[48] CENTER FOR EMERGING MARKET ENTERPRISES, *Cost of Cash in the United States* (2012).
[49] There has been little empirical research on the cost of the retail payment system in the United States. Hayashi and Keeton (2012) suggest a need for central banks to conduct studies on retail payment costs to identify potential gains from cost savings, particularly in the United States. Fumiko Hayashi & William R. Keeton, *Measuring the Costs of Retail Payment Methods*, FEDERAL RESERVE BANK OF KANSAS CITY ECONOMIC REVIEW (2012).
[50] *See* Carlos Arango & Varya Taylor, *Merchants' Costs of Accepting Means of Payment: Is Cash the Least Costly?*, BANK OF CANADA REVIEW, winter 2008-2009, at 15.



VI. RETAIL PAYMENT INSTRUMENTS AND IMPORTANT TRANSACTION COSTS AND BENEFITS

As discussed above, the "utility" or "public infrastructure" view of the payments system ignores the often disparate interests of the two contracting counterparties and how well they are accommodated by specific payment instruments and modalities. These interests, independent of costs, include: (1) finality and reversibility; (2) universality (ability to use at point of sale and remotely); (3) recordkeeping; (4) liquidity (maximizing interest earning assets); (5) security and safety; (6) financial inclusion and access; and (7) fungibility and ease of use. The real cost of a payment system must be judged by how the form of payment achieves the objectives of parties with respect to these issues.

Some of these characteristics are in the interests of all parties, like security and ease of use, but many involve conflicting interests of the parties. For example, finality favors sellers while reversibility (or stop payment) favors buyers. Recordkeeping may be sought

by some but others may prefer anonymity. Remote commerce may increase the ease of purchase but it also requires the use of the Internet and cellular infrastructure which have security vulnerabilities.

Using existing literature, this section evaluates the most common retail payment instruments—checks, payment cards, and ACH transfers (and cash) against these characteristics and arrives at the conclusion that payment cards have considerable advantages to the counterparties using them, over and above mere cost. Cash is used as the benchmark of comparison when looking at non-cash payment instruments.

A. Payment Finality and Reversibility

Payment finality refers to the property of a payment that through its performance permanently discharges the payor from further debt or obligation, and which cannot later be revoked. This occurs, for example, in cash but not check payments. Kahn and Roberds (2002)[51] discuss the economics of payment finality and the critical importance of its role in modern society. Finality gives assurance to the payor that once payment is made, he will not be subject to further liabilities or obligations. Similarly, it gives assurance to the payee that she can rely on the validity of the payment when performing her part of the bargain, such as turning over or shipping of goods or performance of a service. Non-final payments create a credit risk to the payee, that is, the risk that the payor will not in fact end up honoring his obligation to pay.

Payment or transaction reversibility is a related and somewhat opposite property that allows the payment made to be reversed, typically through the action of the payor or

[51] Charles M. Kahn & William Roberds, *The Economics of Payment Finality*, FEDERAL RESERVE BANK OF ATLANTA ECONOMIC REVIEW, Q2 2002, 1.

the financial intermediary processing the payment in question. There are two primary situations where reversal of payment may be desirable. First, if there is a fraud, mistake, or other failure to perform on the part of the payee, such as delivery of the wrong or defective products, the payor will rightly want his payment to be reversed. Second, when a transaction is initiated by an unauthorized third party in the name of the payor, such as in the case of identity theft and credit card fraud, the unwitting payor will also want a mechanism by which the payment could be reversed. Finality and reversibility, while each desirable in its own right, are opposite features of a payment system. Drawing on Coase, the parties would strike a balance between these two properties that would maximize joint-welfare. In the absence of the ability to bargain, due to a large number of parties and the high cost of bargaining, law and regulation should seek to strike the balance that the parties would reach absent the transaction costs of bargaining.

1. Cash

Cash can be considered the most final of all payment methods; there is typically no legal means of reversing a cash transaction without resorting to the courts and litigation. A purchaser paying for his purchase with cash takes the risk that the payee may not have honored his promises, for example by delivering defective goods, in which case the recovery of his payment may be impossible or prohibitively expensive.

2. Checks

Checks, in contrast, are one of the least final of retail payment methods. For basic checks,[52] the payor can typically put a stop on the completion of the payment by instructing his bank, even after the check is transferred to the payee but before the check is debited to his account, to refuse to honor his instruction. The payor may do so to defraud the payee, even when the goods he received are perfectly acceptable. This ability to stop payment gives rise to a risk to the payee of eventual nonpayment; it also creates an incentive to collect on the check quickly. However, the picture is reversed once the fund transfer is completed. Under normal legal rules, the payor has no recourse once the fund transfer from the payor's account to the payee's account is completed by the debiting of the payor's account.[53] This normal legal rule could be altered by changing the law to make checks reversible for some period even after they are delivered, as there is nothing inherent in the check instrument to prevent this,[54] but this has never been done in practice.

The end result of U.S. check rules is that checks offer very little in the way of finality or reversibility. Payees are always at the risk that a dishonest payor could, for example, engage in check fraud, in which the payor withdraws funds from his account before the check is paid, or uses checks written on an account without sufficient funds to

---

[52] Exceptions are the types of checks where the bank guarantees the validity of the check at the time it is written by setting aside an amount from the payor's account, as is the case with certified checks.

[53] U.C.C. § 3-418(c) ("The remedies [by processing bank] may not be asserted against a person who took the instrument in good faith or who in good faith changed position in reliance on the payment or acceptance.").

[54] The New Uniform Payments Code, an attempt in the 1980s to reconcile the Uniform Commercial Code with the then-emerging electronic transfer technology, proposed a rule whereby a consumer (but not a business) may require his bank to stop payments or to reverse payment and re-credit his account within three days of giving any transfer order. New Uniform Payments Code § 425(2). *See also* Craig H. Weber, *Overcoming the Obstacles to Implementation of Point-of-sale Electronic Fund Transfer Systems: EFTA and the New Uniform Payments Code*, 69 VA. L. REV. 1351 (1983).

cover them. Payors, on the other hand, chance that dishonest payees can obtain funds without fulfilling their contracts, particularly if a contract stipulates that the check must clear before the seller will ship the good. Since the dishonest party in each situation is almost always the party with greater information, check usage heightens the cost of information asymmetry, with parties possibly incurring additional costs to investigate the credibility of the counterparty and the product in question.

3. Payment Cards

Debit and credit cards afford a degree of consumer protection through reversibility of payment, to some extent as a result of private rules of card associations and to some extent as a result of law. Credit cards typically allow for a period of time during which a consumer can contest or reverse a transaction, after which the transaction becomes final and the card issuer, rather than the merchant, bears the risk of nonpayment by the consumer. The primary law governing debit card transactions in the United States is the Electronic Fund Transfer Act and the Consumer Financial Protection Board's implementing regulation, commonly known as Regulation E.[55] Regulation E requires financial institutions to notify consumers in cases of adverse changes in fees or liabilities to consumers,[56] creates a framework of preauthorized transfers and error resolution,[57] limits consumer liability for unauthorized transfers[58] and provides protections to consumers in relation to payments made to overseas counterparties.[59] Credit cards are regulated through the Consumer

[55] The Electronic Fund Transfer Act, 15 U.S.C. §§ 1693 et seq.; 12 C.F.R. § 1005 et seq. In force from 28 October 2013.
[56] 12 C.F.R. § 1005.8.
[57] *Id*. at § 1005.11.
[58] *Id*. at § 1005.6(b).
[59] *Id.* at § 1005.30.

Financial Protection Bureau's Regulation Z, implementing the Truth in Lending Act and its subsequent amendments, in particular the Credit CARD Act of 2009.[60] Similar to Regulation E, Regulation Z contains general disclosure requirements[61] and provisions providing billing error resolution procedures and consumer liability limits.[62] The error resolution and unauthorized use provisions of Regulations E and Z provide a degree of reversibility. Card associations such as MasterCard and Visa have their own rules that apply to issuing and acquiring member banks in their network,[63] and these rules often provide additional consumer protection in addition to the baseline minimum set by legal rules.[64]

Consumers are not the only beneficiaries of these protective measures. Merchants benefit from these measures because some risk-averse consumers would not enter into a transaction without the possibility of reversal. Naturally, this right could be abused—a consumer could claim the goods are defective when they are not. To avoid misuse of the right, card issuers undertake the obligation to investigate and resolve reversal disputes between consumers and merchants. This, of course, adds an additional cost to this payment

[60] The Truth in Lending Act, 15 U.S.C. 1601 note; 12 C.F.R. § 1026 subpart B.
[61] 12 C.F.R. § 1026.5.
[62] 12 C.F.R. § 1026.13.
[63] Some of the reasons Visa mentions as being valid causes for a consumer request for reversal in a credit card or debit card transaction include: processing of transaction at a different time than the consumer expected, merchandise that never arrived, failure by seller to perform a service as expected, and fraudulent purchases. VISA, *Chargeback Management Guidelines for Visa Merchants*, (2011), at 40.
[64] To be specific, card association rules regarding chargebacks govern the relationship between issuing banks and acquiring banks, while Regulation E governs the relationship between the consumer and her bank (the issuing bank). The rules allowing issuing banks to request chargeback from acquiring banks when faced with a consumer complaint is what ultimately allows consumers to obtain reversal rights above the legal baseline. Issuing banks would have little incentive to pursue a chargeback if they could not be reimbursed for the amount credited to the consumer's account.

mechanism. We have not examined whether the chargeback rules for credit cards (or other payments) reach the optimal solution in Coasian terms.

4. ACH Transfers

The finality and reversibility of ACH transfers flow from the legal rules governing the ACH system and from its nature as a net-basis, batch processing system. ACH transfers, similar to debit cards, are governed by the Electronic Funds Transfer Act and the Consumer Financial Protection Bureau's Regulation E, in addition to applicable NACHA rules. ACH transfers tend to offer a greater degree of finality and less reversibility than credit and debit cards. The NACHA rule governing ACH transfers, for example, recognizes only three reasons for which consumers can dispute ACH charges to their account: lack of transfer authorization, transfer occurring earlier than authorized, and transfer for an amount different than authorized.[65] Furthermore, the receiving bank does not have any obligation to initiate a reversal if the reversal would cause the payee's account at the receiving bank to be overdrawn or if the account does not exist anymore.[66] This procedural difficulty makes it more difficult for consumers to reverse payments, compared to card payments in which payments can be unilaterally reversed with minimal documentation or proof, and thus ensures a greater degree of finality for the payee.

Net-basis batch settlement, a major distinguishing feature of ACH transfers, has a further finality implication for parties involved. Under current Federal Reserve policy,

[65] 2012 NACHA Operating Rules & Guidelines § 3.12.1. (defining the circumstances in which a debit entry is considered non-authorized).
[66] *See, e.g.*, BANK OF FAIRFIELD, *ACH Rules & Facts Guide for ACH Originators* (Mar. 2011).

ACH forward credit items[67] processed by the Federal Reserve only become final at 8:30 A.M. ET on the day following the transaction request.[68] The Federal Reserve has the right to reverse payments until the payment becomes final, which may make ACH payments undesirable for highly time-sensitive payments in which parties desire immediate finality.

5. Virtual or Digital Currencies

Bitcoin and other digital currencies are based on account entries, i.e. ledger money systems, so in principle they could allow for the reversal of transactions. However, unlike other ledger money systems, like cards or wire transfers, there is no rulebook or legal authority to determine the rights and obligations of the parties, particularly in relation to reversibility and finality. Lack of such a legal framework is a general problem with digital currencies. Taking Bitcoin as an example, the irreversibility of payments creates heightened transaction risk for consumers, who are at the mercy of payees in the event of an accidental or unwanted payment due to the lack of a mechanism to forcefully retake funds.[69]

B. Universality: Electronic and Remote Commerce

Ever since its emergence in the early 2000s, retail electronic commerce (which by its very nature involves remote commerce) has been gradually accounting for a greater percentage of retail sales every year. In 2012, U.S. retail e-commerce spending was

---

[67] A forward credit item refers to funds sent from payor to payee via the ACH system.

[68] The Federal Reserve wants to make sure that a receiving bank's settlement account has sufficient funds to cover any returns or chargebacks before allowing the bank to use the credit given for a debit item. THE FEDERAL RESERVE BOARD, *Federal Reserve Bank Operating Circular No. 4 Automated Clearing House Items*, at 15.

[69] Rainer Böhme, Nicolas Christin, Benjamin Edelman, Tyler Moore, *Bitcoin* 14 (Harvard Business School NOM Unit Working Paper No. 15-015), *available at* http://ssrn.com/abstract=2495572.

estimated at $343.43 billion dollars, a 14% increase from the $301.69 billion in 2011.[70] Consumers mention low prices, convenience, and ease of comparison among multiple products as some of the reasons why they prefer online purchases.

The role of the payment system in enabling and facilitating electronic commerce is critical. Indeed, remote transactions involved in electronic commerce simply cannot occur without a reliable payment method that meets the needs of both the buyer and the seller. In particular, due to the inherent risk to the buyer in making a purchase online without inspecting the good to be purchased, buyers want the consumer protection, e.g. reversibility, afforded by some but not other retail payment instruments. Oxley and Yeung (2001)[71] identify the existence of credible and reliable payment systems, in addition to the rule of law governing electronic commerce, as a prime factor that enables electronic commerce. Sorkin (2001)[72] finds that consumers engaging in online auctions favor online payment systems, in contrast to traditional payment methods such as personal checks, mainly for reasons of speed and convenience, with relatively little consideration for other factors such as product quality risk or risk of financial information theft.

1. Cash

Cash is inherently unsuitable for remote transactions. The physical nature of the currency requires that for remote transactions, cash must be transmitted by mail or other means. This is costly in terms of time and expense, and risky in that cash transmitted by

---

[70] EMARKETER, *Ecommerce Sales Topped $1 Trillion for First Time in 2012*, (Feb. 5, 2013), http://www.emarketer.com/Article/Ecommerce-Sales-Topped-1-Trillion-First-Time-2012/1009649.
[71] *See* Joanne E. Oxley & Bernard Yeung. *E-Commerce Readiness: Institutional Environment and International Competitiveness*, 32 JOURNAL OF INTERNATIONAL BUSINESS STUDIES 705 (2001).
[72] David E. Sorkin, *Payment Methods for Consumer-to-Consumer Online Transactions*, 35 AKRON LAW REVIEW 1 (2001).

mail could be lost or stolen. Furthermore, an unwitting buyer who sends cash by mail would have a difficult time proving that cash was sent when a dishonest seller claims ignorance of its receipt. Cash on delivery, where the purchaser pays cash to the delivery agent at the time of delivery of a remotely purchased product, is cumbersome and does not seem to be favored by most consumers or retailers.[73]

2. Checks

Checks share many characteristics with cash in the context of remote transactions and are likewise an unsuitable form of payment in most cases. The payor would have to transmit the check physically to the payee, which is often costly and time-consuming. Often online purchasers want to receive their merchandise as soon as possible—waiting for checks to be sent and cleared would delay the process substantially. Checks offer an advantage over cash in that the processing of the check leaves a verifiable record, which prevents the payee from denying the receipt of payment and makes checks less vulnerable to theft in transmission than cash. Nonetheless, checks incur significant transaction costs when used as a payment mechanism between remote parties.

3. Payment Cards

Payment cards are the norm in remote transactions.[74] With payment cards, payors enter the card number with authenticating information and submit it to the payee over the

[73] It should be noted, however, that cash on delivery remains popular in places without sufficient credit card penetration. In China, for example, cash on delivery accounted for 43% of all online purchase payments, compared to 31% for debit cards and 10% for credit cards. *See* CYBERSOURCE, *Payment Methods in Select Countries: Global Payment Options* (2012).

[74] Credit card was the most popular payment option for online purchases in most countries in 2010, except in a few European countries (e.g. Finland, Germany) where direct bank transfers ranked at the top, and developing countries such as China, where cash on delivery was the preferred option. *See Payment Methods in Select Countries: Global Payment Options*, *supra*.

Internet, which causes the transfer of funds from the buyer's bank through the payment network and other intermediaries to the payee's bank account. The exceptional convenience of using payment cards to make purchases online means that the transaction cost barrier of such transactions has been substantially reduced to the benefit of all parties. The lack of the need to transfer any physical instrument for the payment allows a purchase to be made quickly and conveniently, which is one of the main advantages offered by online transactions as opposed to purchases in a traditional store.

Furthermore, the consumer protection measures offered by payment cards, as previously discussed, are particularly desirable in the context of remote transactions, where the quality of the product or the trustworthiness of the vendor cannot be easily ascertained by the buyer before making the purchase. This is particularly significant given that goods are delivered after the payment is made and the consumer's account is charged in virtually all cases of Internet merchandise transactions.

4. ACH Transfers

ACH transfers have played an important part in remote transactions throughout the history of the ACH system. Payment of recurring bills from a remote provider has always been an important function of ACH transfer. Recent innovations such as Internet-based ACH transfer have increased the applicability of this form of payment, and today, web-based merchants frequently accept payments in the form of ACH transfers in addition to debit and credit cards.

While a convenient way of making remote payments, ACH transfers suffer from a weaker consumer protection compared to credit and debit cards, which is particularly

relevant in online transactions in which the information asymmetry problem is especially severe. There does not appear to be any inherent technological limitation on the ACH system that would prevent the law from affording a degree of consumer protection equivalent to credit and debit cards, but this is a policy decision that must be made after considering the costs and benefits to the parties involved.

5. Virtual or Digital Currencies

Bitcoin or other digital currencies can be used for transactions between parties anywhere on earth provided they accept them as payment. This global and relatively frictionless transfer of value capability is a logical extension of virtual commerce, but carries with it risks of cybercrime and illicit financial activities.

C. Transaction Recordkeeping

Recordkeeping is the practice of maintaining records of an organization, particularly of financial events. Having a comprehensive financial record allows businesses to obtain a detailed knowledge of the operation of the business, including costs. In addition, retaining transactional and financial records facilitates detection of fraud or theft. In many cases, recordkeeping is required for corporate law compliance, taxation, and accounting purposes, particularly in the wake of the increased recordkeeping requirements under the Sarbanes-Oxley Act in the United States. Recordkeeping is also important to consumers with respect to budgeting and tax planning, but the principal focus here is on businesses.

Recordkeeping is not free. Business owners must spend time and resources on obtaining computer hardware and software, and on training employees in their use. There is also an implicit cost of creating records, since they may inadvertently come into the

hands of competitors or government authorities. Thus, businesses spend millions of dollars every year in an effort to make their records secure and only available to intended parties. An efficient retail payment system will allow businesses to minimize the costs involved in recordkeeping while maximizing the benefit gained. This could be accomplished, for example, by obviating or lessening the need to train employees in recordkeeping skills or to spend funds on security. This aspect of a payment system has little to do with law or regulation, or even contract—the recordkeeping potential of a payment system is largely determined by the inherent nature of the form of payment itself.

1. Cash

Cash transactions present several difficulties in the way of transaction recordkeeping. Cash must be counted and transaction amounts recorded manually, which may give rise to frequent errors and may take a substantial amount of time. This also allows dishonest employees to create fraudulent records, which may record revenue at less than its actual value while the employee pockets the difference. Furthermore, the cash method of accounting, which records revenue when cash is received or paid, often does not comply with accrual-based accounting rules required of public companies in most jurisdictions, making it necessary for the companies to prepare costly reconciliatory statements.

For consumers trying to manage their budget and control their expenses, cash is inherently disadvantageous. It has a limited recordkeeping function since it leaves no trace of payment. However, cash's anonymity and lack of audit trail can be an advantage as well,

since the consumer is not obliged to divulge his financial information, which could increase the chance of identity theft or unauthorized access to his account.

2. Checks

Checks offer some advantage over cash for the purposes of recordkeeping. They leave a paper trail, which both facilitates recording of transactions and makes it more difficult to falsify records. However, checks still usually require businesses to manually enter the transactions into their books, exposing them to the possibility of errors or omissions.

3. Payment Cards

Payment cards offer unique advantages in facilitating recordkeeping compared to cash. Due to the nature of electronic payments, all transactions processed are recorded in the system, which facilitates the accurate and real-time recording of transactions. Furthermore, use of debit and credit cards can tie each transaction to a particular customer, such that valuable marketing information on customer tendency and preference can be compiled.[75]

With electronic payments, there is some risk that business records that reside with third party processors are less secure than if the record stayed exclusively within the business. But almost all payments other than cash involve third party processing; perhaps the issue is the ease of obtaining electronic rather than paper records. Whether the increased cost of the risk of sharing the financial information is enough to deter businesses from using payment cards is an empirical question that can only be answered by

[75] Naturally, the flip side of this is that privacy-conscious consumers suffer and are less likely to use these payment options.

quantitative studies. However, the popularity of electronic payment options, including payment cards, among consumers and businesses would suggest that the potential privacy or information theft concern is at least not great enough to completely deter the use of these payment options in most cases.

Similarly, for consumers, privacy implications of retail payments can be a significant consideration. For example, concerns over privacy motivated some private parties to create alternative currency addressing this issue, most notably Bitcoin, which employs principles of computer cryptography to enable transfer between parties electronically without leaving a traceable transaction record.

4. ACH Transfers

In almost all relevant recordkeeping aspects, ACH transfers are very similar to payment cards as a form of electronic payment. Financial institutions providing ACH transfer services retain a record of transactions, which are accessible by their customers and potentially the government.

5. Virtual or Digital Currencies

Digital currencies like Bitcoin exist only as digital information, so they should in principle support record keeping. However, record keeping is decentralized and community based, so transactions are extremely difficult to track by design. Indeed, the decentralized ledger has been cited as a key innovation of digital currencies in that it allows payments directly between payor and payee, eliminating the credit risk, liquidity risk, and operational risk posed by the intermediary banks and central bank in a centralized ledger

system.[76] Anonymity is a claimed feature rather than a fault in these schemes, making their use in illegal transactions highly attractive, as the notorious Silk Road drug marketplace amply demonstrated.

D. Excess Liquidity and Maximization of Interest-Bearing Assets

Liquidity is the ability of an asset to be used immediately and without delay to perform basic economic activities such as purchases of products and services and repayment of debt. On the one hand, every consumer and household must maintain a certain minimum level of liquidity in order to meet their immediate financial obligations. On the other hand, excess maintenance of non-interest bearing liquidity imposes an implicit foregone interest cost. Minimization of non-interest bearing assets is also an important consideration for businesses. Merchants want to minimize the time between the customer's payment and the availability of the funds as interest-bearing assets or working capital in the merchant's own business. This aspect of the payment system has more to do with the way a payment is made than any law or regulation, or even contract.

1. Cash

Cash, as the most liquid asset, provides the means necessary for consumers to make daily payments. Cash in the pocket, however, is a non-interest bearing asset, and an excessive level of cash holding is costly in terms of foregone interest. Similarly, when businesses accept cash, cash in the cash register cannot be considered a productive asset until deposited and credited to the merchant's bank account.

[76] *See* Robleh Ali, John Barrdear, Roger Clews, and James Southgate, *Innovations in Payment Technologies and the Emergence of Digital Currencies*, BANK OF ENGLAND QUARTERLY BULLETIN, 2014 Q3.

2. Checks

Checks would not seem to offer significant advantages in managing liquidity. Given the low acceptability of checks in everyday transactions, they cannot be used as replacement for cash in meeting daily obligations. Further, checks are typically drawn from liquid checking accounts, which offer very little or no interest, and are in theory required to be funded. For the payee, a check represents a significant delay between when the payment instrument is received and when the payee's account is credited, although regulations set maximum limits on time delays for the availability of funds from check deposits, and banks typically receive credit on checks within one or two days following deposit.[77] In practice, delays in the US check collection system have been used to engineer elaborate liquidity management schemes in which corporate payors seek to maximize mail and clearing delays and corporate payees seek to minimize them. Recently the number of checks deposited as electronic images by payees has grown, and interbank clearing of checks has become virtually 100 percent electronic, [78] both of which will likely reduce the delays inherent in check payments.

3. Payment Cards

Debit and credit cards have different implications in the management of liquidity. Debit cards usually access funds from low-interest checking accounts, and thus are not generally a favorable choice for maximization of productive assets, since funds must be placed in the checking account to support the debit card activity. Debit cards that access

[77] *See* THE FEDERAL RESERVE BOARD, *Corporate Compliance Handbook, Regulation CC,* http://www.federalreserve.gov/boarddocs/supmanual/cch/efaa.pdf.
[78] The 2013 Federal Reserve Payments Study (July 2014).

funds from savings or money market fund accounts would seem to be more attractive, where the assets earn interest and can be withdrawn at a moment's notice. However, restrictions are typically placed on such accounts. To be used as transaction accounts, such arrangements typically require a large minimum account balance and significant fees. In the United States, regulatory reserve requirements[79] generally limit the number of combined withdrawals and outgoing transfers to six per month for non-checking debit accounts in depository institutions. Occasionally, non-depository money market mutual funds offer debit cards linked to the customer's investment account, which are not directly regulated in terms of usage but still require significant minimum investment balances.[80]

Credit cards can obviate the need for individuals to hold large amounts of liquidity. The effect of credit cards on liquidity management has been widely studied. Chakravorti and Emmons (2001)[81] link the payment function of credit cards to the implicit liquidity function for liquidity-constrained consumers. Telyukova (2011)[82] looks at the "credit debt puzzle," an empirical observation that households incur high-interest credit card debt while having deposit money in a bank checking account. The study suggests that despite the high credit card interest rates, the precautionary demand for liquidity largely explains why many households prefer to use their credit cards for daily spending. Chakravorti and To (2006)

[79] 12 C.F.R. § 204 et seq.; § 209 et seq. The regulation is commonly known as Regulation D.
[80] For example, in the United States, American Century Investments offers Visa debit card access to money market fund investors with a $10,000 minimum investment. In South Africa, Sanlam offers a similar debit card linked to its money market fund investments.
[81] *See* Sujit Chakravorti & William R. Emmons, *Who Pays for Credit Cards* (Feb. 2001).
[82] *See* Irina A. Telyukova, *Household Need for Liquidity and the Credit Card Debt Puzzle* (Oct. 9, 2012).

point out that merchants benefit from this function of credit cards because they can make sales to illiquid customers who would otherwise not be able to make the purchase.[83]

4. ACH Transfers

ACH transfers are similar to debit card transactions in terms of liquidity management. Transfers are typically made from the payor's checking account, but other types of accounts, such as a savings account, could be used, in which case an ACH transfer would count against the six transfer limit imposed by Regulation D. A notable difference between ACH transfers and some card transactions, from the perspective of the payee, is the inherent delay with which payment occurs. All ACH transactions are batched, whereas some card transactions occur at the time of the transaction. Delays in payment lower the interest-bearing assets in the payee's account.

However, the automated nature of many ACH transactions means that fund transfers can occur quickly and reliably on a periodic basis. Businesses such as insurance companies and utilities benefit from the ability to make monthly transfers from a customer's account with preauthorization, ensuring a swift and reliable cash flow. Consumers, on the other hand, benefit from the speed with which they can receive paychecks and government benefits through direct deposit (i.e. an ACH credit transfer) as opposed to the traditional paper checks. There is evidence that the exposure to the ACH system through direct deposit affects the probability that consumers will use ACH payments in other contexts as well. A study by Hayashi and Klee (2003) find that the fact that a consumer is receiving a

[83] *See* Sujit Chakravorti & Ted To, *A Theory of Credit Cards* (Jun. 2006).

direct deposit represents a 21 to 24 percentage point increase in the probability that a consumer would use ACH debit transfer to make bill payments.[84]

5. Virtual or Digital Currencies

Digital currencies are difficult to invest without conversion into conventional money because of the limited number of assets denominated in such currencies. On the other hand, the holder of a digital currency can speculate on the value of the digital currency in terms of other sovereign currencies. Tax authorities in the US have recently deemed Bitcoins property subject to capital gains treatment rather than a currency, in itself representing a material recordkeeping challenge for holders.

E. Security and Safety

Payment security is one of the primary considerations for all parties in a transaction. Both the payor and the payee want to make sure the payment transmitted by the payor reliably and safely reaches the intended payee and that the financial information carried with the payment stays confidential to the intended parties. A series of payment system breaches in recent years, in which millions of card numbers and other personal information have potentially been stolen, has highlighted the importance of payment system integrity and safety of financial information, and brought the issue to the public arena.[85] We have already touched on this issue in the discussion of recordkeeping concerns.

Security and safety of a payment system is a broad topic that encompasses multiple related issues. One of the most obvious security risks involved in any form of payment

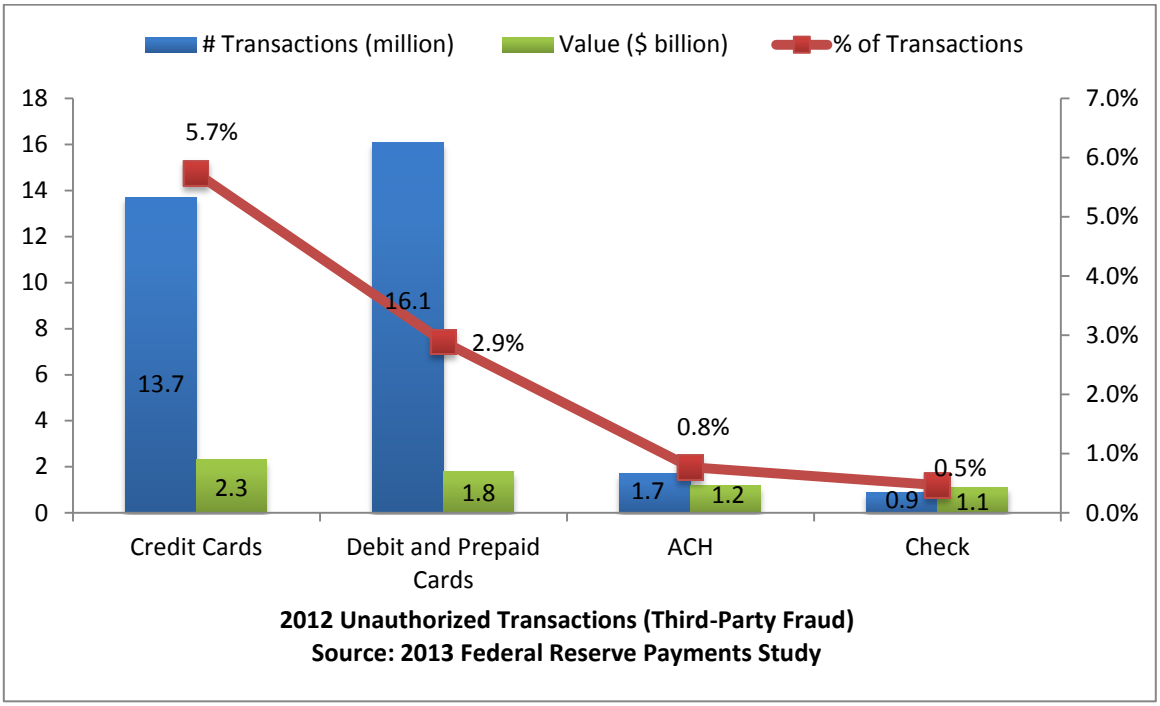
[84] Fumiko Hayashi & Elizabeth Klee, *Technology Adoption and Consumer Payments: Evidence from Survey Data*, 2 REVIEW OF NETWORK ECONOMICS 8 (2003).
[85] *See, e.g.*, Nicole Bullock, *Scale of credit card breach revealed*. FINANCIAL TIMES, Apr. 2, 2012.

instrument is fraud. This includes fraudulent use of payment cards through identity theft and use of counterfeit currencies. Moreover, theft is a risk in carrying or storing any payment instrument. To avoid theft of payments or payment information, substantial resources must be spent on security measures. The Centre for Retail Research estimates the global total of shrinkage loss (which primarily consists of employee theft of cash and inventory) in the retail industry at $119 billion, which represents approximately 1.45% of the revenue in the sector.[86] Perception of risk plays a great role in people's choice of payment instruments. A 2009 study by the Bank of Canada suggests that perception of risk, including the risk of exposing financial information, has a significant impact on the choice of payment method used, even at a moderate risk level.[87] Law and regulation play a major role in assigning liability for fraud risk—in part this is due to the difficulty in allocating fraud among multiple parties to a payment that may not be in a contractual relation to each other outside of the payment relationship itself. Generally, the law has tried to achieve the Coase efficiency objective by allocating fraud loss to the party in the best position to avoid and/or absorb the loss, a major objective of tort law in general.

---

[86] *See* CENTRE FOR RETAIL RESEARCH, *The Global Retail Theft Barometer 2011* (2012), http://www.retailresearch.org/grtb_currentsurvey.php.

[87] The study defines risk broadly to include the possibility of information theft, counterfeiting, loss, rejection of payment method by merchants, and any other factor that contributes to the consumers' perception of a payment as risky. Carlos Arango & Varya Taylor, *The Role of Convenience and Risk in Consumers' Means of Payment* (2009).



1. Cash

Cash presents particular challenges in providing security and safety for its user and the recipient. Cash is a uniquely attractive target of theft and robbery, including employee theft and embezzlement, as the anonymity and liquidity of cash affords the least risk for the perpetrator after the crime (albeit if in large quantities such cash may have to be laundered). In addition, cash is subject to counterfeiting, which leads many retail vendors to refuse to accept banknotes in large denominations. Recent technological improvements such as digital printing have made banknote counterfeiting cheaper and easier for counterfeiters, presenting a concern for consumers and merchants alike.[88] Banknotes and coins, when lost, usually cannot be recovered because they are indistinguishable from one another. Cash's

[88] *See* Bill McCleery, *Fake Money: Counterfeiters Use Digital Technology to Their Advantage*, USA TODAY, Mar. 12, 2013.

anonymous nature makes it less likely that the finder of cash will return it to the original owner, especially without valid proof of ownership, which may be difficult to provide.

An advantage of cash is that loss of cash involves a precise and limited damage, the amount of cash lost, whereas an unknown larger amount could be at risk in situations involving check and payment card frauds (although not in the case of payment card fraud perpetuated against consumers, who benefit from fraud liability protections in Regulations E and Z and from ritual payment network's "zero liability" policies). While the amount of fraudulent cash transactions and the rate of usage of counterfeit cash are difficult to estimate, the U.S. Treasury estimated in 2001 that less than 0.01% of all U.S. currency in circulation was counterfeit.[89] Of course, there is a real cost to constantly upgrading currency printing and production to lessen counterfeiting.

2. Checks

Checks feature unique risks in security and safety. In particular, checks are vulnerable to fraud in several ways, most of which take advantage of the possibility of float,[90] during which a payee can withdraw funds deposited from a check before the payor's account is debited, which could be exploited by a payor who writes a check to himself drawn on an account with insufficient funds. Some common fraud methods include deliberate writing of non-sufficient fund checks and its variations. Check forgery is also a typical security concern.[91] It can involve alteration of a legitimate check, often stolen, to

[89] *See* THE U.S. TREASURY DEPARTMENT, *The Use and Counterfeiting of United States Currency Abroad* (Sept. 2006), http://www.federalreserve.gov/boarddocs/rptcongress/counterfeit/default.htm.
[90] Float refers to the time between the payment of the check and its clearance at the payor's bank.
[91] Frank Abagnale, a security consultant and a check forgery expert, emphasizes the great ease with which check forgery could be committed. *See* Luke Mullins, *How Frank Abagnale Would Swindle you*, U.S. NEWS

inflate the payment amount or to change the payee. It can also take the form of a fabricated check written on a non-existent account. The possibility of alteration makes theft or loss of check a significant risk to the original owner. However, checks nonetheless present a much less desirable target for thieves and muggers than cash, partly due to the risk of being traced upon usage and partly due to the original check owner's ability to put a hold on the check upon theft or loss. The American Bankers Association estimated a loss of $648 million from check fraud in the United States in 2012.[92]

The allocation of risks of unauthorized payment involves complex legal rules, primarily governed by Articles 3 and 4 of the Uniform Commercial Code in the United States. Under the current law, the general rule of loss allocation is that the payor's bank bears the ultimate loss should a fraudulent transfer occur.[93] For example, if a fraudster writes a check on A's account purporting to be authorized by A (perhaps with the forged signature of A) and the payee deposits the check to her bank account, A's bank will debit the value of the check from A's account and the payee's bank would credit the payee's account. However, once A discovers the fraud, he can demand that his bank re-credit his account since he never authorized the transaction. Thus, A's bank, unless it can recover from the fraudster or show negligence on A's part in the fraud, will be required to re-credit A's account and bear the ultimate loss under the current legal rules. The purported payor's bank would thus attempt to minimize the losses by verifying the authenticity of checks and

---

& WORLD REPORT, May 19, 2008, http://money.usnews.com/money/blogs/the-collar/2008/05/19/how-frank-abagnale-would-swindle-you.

[92] AMERICAN BANKERS ASSOCIATION, *Banks Stop $13 Billion in Fraud Attempts in 2012* (Dec. 12, 2013), http://www.aba.com/Press/Pages/121213DepositAccountFraud.aspx.

[93] U.C.C. § 3-418(c).

charging a premium to the payor to cover for the expected loss, possibly in the form of a reduced interest rate on the purported payor's deposit account.[94]

3. Payment Cards

Fraud is a significant risk for the issuers and payees of card payments, but this risk bas largely been eliminated for card users through a combination of consumer protection laws and retail payment network polices discussed above. Whereas losses and thefts of cards can be reported for a cancellation and replacement with little repercussion before any fraudulent use, or issuers can suspend payments (pending confirmation from the cardholder) if they detect an unusual pattern of payments, the risk of fraud in completed transactions remains a major concern of issuers and merchants.

Credit card security breaches can take several forms. Skimming is a common technique by which the information from a valid credit or debit card is copied, unbeknownst to its owner, to another card, by extracting the information from the magnetic strip or the chip with a specialized scanner. A properly created fake card would be a duplicate of the original and would allow the fraudster to enter into transactions as if he were the cardholder. Perpetrators may also attempt to generate valid credit card numbers (including expiry dates and any security code), which could then be used to make fraudulent online purchases. One of the most significant and publicized risks, however, is the breach of security on the part of the merchant or financial institution's computer system that stores the financial information of customers that made the payment card purchases. This relates to the risk of exposure of private information beyond the risk of fraudulent

[94] There are further loss allocation rules for forged endorsements, which basically put liability with the taker from the thief.

purchases. The total fraud loss from debit and credit cards amounted to $4.1 billion in the United States in 2012 arising from 29.8 million unauthorized transactions.[95] Debit card transactions that require a PIN have the lowest estimated fraud rates by both number and value of all card types.[96] This suggests that with the adoption of Chip and Pin technology (EMV)[97] in the US, rates of fraud on debit and credit cards will decline. EMV cards are harder to clone than traditional magnetic strip cards and create a unique code for each transaction, a process called "tokenization," which makes multiple fraudulent uses hard to achieve by processing payments without storing sensitive card information that could be vulnerable to an attack on a merchant's computer system. Tokenization is also being implemented by MasterCard and Visa for electronic credit card payments (such as online purchases or in-store purchases made using a smartphone application),[98] a potentially important development given concerns that increased use of EMV technology will shift fraud to the online payments channel.[99] The major credit cards have set October 2015 as the deadline for retailers to adopt EMV technology for processing payments. However, the cost of the terminals and the perceived slow roll-out of chip enabled cards in the US market has made some retailers resistant to adopting this technology.[100]

Efforts have been made to deal with the allocation of payment card fraud risk. One of the common initiatives is the limitation of cardholder liability in cases of unauthorized

---

[95] The 2013 Federal Reserve Payments Study (July 2014).
[96] *Id.*
[97] EMV means Europay, Mastercard and Visa and is a global standard for inter-operation of integrated circuit cards or "chip and pin" cards, which have been more generally adopted in Europe to date.
[98] Robin Sidel, *Credit-Card Industry Ramps Up Security Efforts*, WALL STREET JOURNAL, (Sep. 4, 2014), http://online.wsj.com/articles/credit-card-industry-ramps-up-security-efforts-1409869142.
[99] *See* LEXISNEXIS, *2014 LexisNexis True Cost of Fraud Study* (Aug. 2014).
[100] *Why US retailers are still vulnerable to card fraud*, BLOOMBERG BUSINESS WEEK, Technology (April 10, 2014).

transactions, particularly for credit cards. The United Kingdom's Consumer Credit Act limits credit cardholder liability to £50 in all cases of fraud.[101] U.S. federal law limits consumer liability in credit card fraud to $50,[102] which in practice is often waived by card issuers such that the entire amount is covered. For debit cards, consumer liability is limited to $50 if notice is given to the issuing financial institution within two business days after learning of the loss or theft, and no higher than $500 if reported within 60 days.[103] Because card issuers can ultimately be liable for fraudulent transactions, as in cases where the seller cannot be charged back, they have an incentive to monitor and prevent fraudulent transactions. In a sense, card issuers can be seen as providing insurance for fraudulent transactions, by spreading out, planning for, and bearing the risks of fraud, with the normal card fees serving partly as the insurance premium. Furthermore, many jurisdictions have enacted legislation to protect personal and financial information stored by merchants and financial intermediaries, such as the requirement to encrypt stored information and mandatory disclosure to consumers when a security breach may have occurred.[104]

4. ACH Transfers

The issue of fraud and payment information security has been a central topic in the policy debate surrounding the ACH system. Furst and Nolle (2005) identify three features of ACH systems that make it particularly susceptible to fraud in comparison to debit or

[101] The U.K. law also provides some protection to debit card users in cases of fraud, except when they acted "without reasonable care" leading to the fraud.
[102] Fair Credit Billing Act § 161(e), 15 U.S.C. 1601 note.
[103] 205 C.F.R. § 6(b). The financial loss occurring after the 60th day following delivery of a statement on which the fraudulent transaction appears could be unlimited if the fraud is not reported within such 60 day period.
[104] For example, Massachusetts enacted a mandatory disclosure law in 2007 in cases of security breaches involving customers' personal information. Mass. Gen. Laws § 93H-1 et seq. (2007).

credit card transactions.[105] First, the ACH system does not feature a system-wide way to link a payor's name, address, and deposit account number. Second, the ACH system does not feature a real-time authorization of transactions unlike credit and debit cards. Third, ACH systems do not have the kind of fraud detection mechanisms provided by credit and debit card issuers, such as the identification of seemingly anomalous transactions for a particular account, which may signal fraudulent activities. There is evidence that the relatively recent one-time authorization ACH payments are particularly susceptible to fraud, compared to the traditional prearranged payments scheme. For example, in 2004, about 0.21% of all telephone-authorized ACH transfers were ultimately determined to be fraudulent, three times higher than the 0.07% in prearranged ACH payments.[106] This could be partly explained by the lack of a preexisting relationship in these one-time ACH payments, which makes it difficult for the payor's financial institution to determine the authenticity and identity of the payee requesting a transfer or the alleged payor giving an authorization.

5. Virtual or Digital Currencies

Virtual currencies are dependent on the security and integrity of a dispersed and self-governing digital framework. This is a magnet for hackers and cyber criminals, as losses at the Mt.Gox Bitcoin exchange amply demonstrate. Essentially, digital currencies are “bearer instruments” that must be secured in virtual safes and wallets against theft. Recently, the Consumer Financial Protection Bureau warned U.S. consumers about the

[105] Karen Furst & Daniel E. Nolle, *ACH Payments: Changing Users and Changing Uses* (Oct. 2005).
[106] *Id*. at 16.

dangers of digital currencies, possibly foreshadowing the implementation of regulations designed to enhance the security and safety of these currencies.[107]

F. Financial Inclusion and Access

Financial inclusion is the delivery of financial services, such as credit, deposit services, and insurance, to disadvantaged and low income segments of the society that typically have limited access to financial services. Financial exclusion is defined by the European Commission as "a process whereby people encounter difficulties accessing and/or using financial services or products in the mainstream market that are appropriate to their needs and enable them to lead a normal social life in the society in which they belong."[108] Financial inclusion has been identified as one of the goals of central banks throughout the world, and efforts continue worldwide to improve financial access for the low-income population.

Consequences of financial exclusion can be direct and dire for the people affected. People without financial access have limited choice of goods and services, as their payment options are severely limited, particularly in remote transactions. They incur higher costs when trying to access financial services, such as remittance or check cashing services. Furthermore, financial exclusion often leads to further social exclusion in other areas of society that require financial access. A 2007 study by the U.K. Treasury found that the total cost borne by a typical low-income family as a result of financial exclusion exceeded

[107] Rachel Witkowski, *Will CFPB Write Rules on Digital Currencies?*, AMERICAN BANKER (Aug. 11, 2014), http://www.americanbanker.com/issues/179_154/will-cfpb-write-rules-on-digital-currencies-1069330-1.html.
[108] EUROPEAN COMMISSION, *Financial Services Provision and Prevention of Financial Exclusion* (2008).

£1000 over the course of a year, a significant amount to an already impoverished segment of society.[109]

While the problem of financial exclusion is more common and relevant in developing countries, where more than two-thirds of people don't have access to any sort of bank account (rising to around 80% in rural sub-Saharan Africa),[110] developed countries are not immune to the problem. A study by the FDIC reported in 2014 that in 2013, an estimated 7.7% of the U.S. population was "unbanked," that is, without a checking or savings account.[111] The U.K. Treasury estimates that about 5% of the U.K. population, and about 13% of the low-income population, was unbanked in 2007.[112]

For payment systems to effectively serve the poor, they have to have: robust functionality; a low cost and a low price; and effective coordination between service providers. The Gates Foundation (2013) proposes that cost reduction and innovation in existing payment systems are the most effective means of improving financial inclusion. By lowering costs, the pool of customers that can be profitably served by retail payment systems is expanded, which spreads knowledge about such systems among previously under-served communities.[113]

---

[109] *See* HM TREASURY, *Financial inclusion: the Way Forward* (2007), at 5.
[110] Fighting Poverty, Profitably: Transforming the economics of payments to build sustainable, inclusive financial systems. Gates Foundation. Sept 2013.
[111] *See* FEDERAL DEPOSIT INSURANCE CORPORATION, *2013 FDIC National Survey of Unbanked and Underbanked Households* (Oct. 2014).
[112] *See Financial inclusion: the Way Forward*, *supra*.
[113] Fighting Poverty, Profitably: Transforming the economics of payments to build sustainable, inclusive financial systems. Gates Foundation. Sept 2013.

1. Cash

Cash is the standard payment instrument for financially excluded populations. It is the only widely accepted payment that can be used without a bank account. However, continued reliance on cash can drive the excluded population further from financial access. A cash-only payor typically finds it difficult to finance large purchases such as homes and cars, even in developing markets where such transactions are common. Personal security concerns from accumulating and handing over big sums are material. Payors could also incur cash usage surcharges in advanced economies.

2. Checks

Checks present a hardship for unbanked payees, often in the context of employment compensation. They must usually resort to non-bank check-cashing services in order to redeem their checks, which can have a hefty surcharge of 2% to 5% of the check value.[114]

3. Payment Cards

A credit card is a potential source of unsecured credit for people with limited banking access, and would eliminate the need for holding excessive liquidity. It fares competitively with other loan options, and its streamlined application and settlement process makes it easier for card issuers to provide services to a low-income population. Low income and financially excluded people often find it difficult to get a typical bank loan due to the complex process involved, particularly as a result of their low credit score.

[114] Checks can also usually be cashed at the bank in written from, with or without fee, but a branch of the bank may not necessarily be accessible to the unbanked payee.

Alternative sources of loans, such as payday loans,[115] are known for their high interest rate, sometimes reaching an effective rate of 300% per annum or more.

The problem for the financially excluded population, unfortunately, is that obtaining a credit card and building a credit score often requires having a bank account and a good credit history in the first place, presenting a kind of vicious circle or chicken-and-egg problem that hampers their ability to access financial services. One alternative is the use of prepaid cards. Prepaid cards are payment cards to which a customer loads in a fixed dollar amount, and then uses the balance to make purchases. Unlike debit or credit cards, a typical prepaid card is not tied to any particular bank account. Prepaid cards are usually branded by card associations, such as Visa and MasterCard, and are processed by those card associations under rules similar to the rules that apply to debit and credit cards processed by those card associations. As a result, prepaid cards can be beneficial to the unbanked or underbanked population by giving them access to transactions requiring use of payment cards without a need for a bank account. However, the need for prepayment, like a bank deposit to support checks, restricts liquidity. U.S. regulations provide consumer protections for prepaid payroll cards, prepaid cards that receive federal government payments and prepaid gift cards. Furthermore, the Consumer Financial Protection Bureau in November 2014 released proposed regulations that would expand protections for users of general-use prepaid cards, including provisions regulating fees, disclosures, and consumer

[115] A payday loan is a small, short-term loan, either unsecured or secured by the borrower's future paycheck, advanced by a nonbank business at an interest rate far higher than traditional loans.

liability in the event of fraud.[116] Also, competitive market forces compel prepaid card issuers to provide some protection and features to consumers of these cards (such as limitations on liability and 800 numbers used to obtain transaction information).[117]

4. ACH Transfers

Some of the advantages provided by ACH transfers, such as accelerated liquidity from paychecks through direct deposit instead of traditional paper checks, are particularly relevant to the low-income population, which is more likely to be underbanked or unbanked. Unfortunately, the same problem plagues the beneficial use of the ACH system by these members of the society as in the case of payment cards: having a bank account is a precondition for ACH transactions because both ACH debit and credit transfers require an account from which funds can be accessed. There is no indication that any development in the ACH system would work to improve financial inclusion and access to the system.

5. Virtual or Digital Currencies

Digital money schemes offer the potential of extremely low transaction costs but depend on a technology infrastructure that excluded communities have limited access to (although cheap smart phones may change this), therefore they do not necessarily advance financial inclusion. Mobile money schemes like M-Pesa in Kenya have been very successful in expanding financial inclusion, but represent a means of transferring and accessing conventional cash and deposit money rather than digital currency.

---

[116] Rachel Witkowski, *Cheat Sheet: Details of the CFPB's Sweeping Plan to Regulate Prepaid Cards*, AMERICAN BANKER (Nov. 13, 2014), http://www.americanbanker.com/news/regulation-reform/cheat-sheet-details-of-the-cfpbs-sweeping-plan-to-regulate-prepaid-cards-1071208-1.html.

[117] While some U.S. states tried to establish consumer protection rules for prepaid cards, courts have ruled that these rules are preempted by the federal law in cases of federally-chartered financial institutions issuing prepaid cards. *See*, *e.g.*, SPGGC, LLC v. Ayotte, 488 F. 3d 525, 527 (1st Cir. 2007).

G. Fungibility and Ease of Use

Fungibility of a payment instrument refers to the idea that having one or few methods of payment, rather than many, is convenient for the consumer. The problem of having to carry too many retail payment instruments is akin to an individual having too many IDs or passwords, resulting in general consumer inconvenience and difficulties in financial management, in addition to a higher chance of theft or loss.

Studies have been conducted to measure or estimate the value of convenience of various retail payment methods. Arango at al. (2012),[118] based on a 2009 survey by the Bank of Canada of the transaction diary of 3,500 consumers over three days, find that both cash and card payments are widely used in varying circumstances. Debit and credit card payments comprised close to 80% of consumers' transaction value, but cash accounted for over 54% of transaction volume, suggesting the widespread usage of cash in relatively small transactions.[119] Arango and Taylor (2009)[120] find that convenience is a statistically significant factor in the choice of method of payment by consumers, particularly in case of cash.

For a payment instrument to be fungible, it must be widely, if not universally, accepted by merchants, and must also be convenient to use and carry. An efficient retail payment system would have a high degree of acceptability such that consumers would not need to carry multiple payment instruments for different situations.

---

[118] *See* Carlos Arango, Dylan Hogg, & Alyssa Lee, *Why Is Cash (Still) So Entrenched? Insights from the Bank of Canada's 2009 Methods-of-Payment Survey* (2012).
[119] *Id.*
[120] *See Role of Convenience and Risk in Consumers' Means of Payment*, *supra*.

1. Cash

While cash is widely acceptable, the acceptability of cash is no longer, if it ever was, universal. Cash is either not available or logistically impossible to use in transactions involving very large value. Vendors routinely refuse large denomination banknotes, as they are free to do,[121] for fear of receiving counterfeit currencies. Cash, by its nature, cannot be used in remote transactions. An increasing number of vendors are implementing non-cash policies for their business or, at the least, imposing extra fees for consumers using cash instead of the vendor's preferred method of payment.[122] Thus, in many parts of the world, a typical consumer is unlikely to find that carrying cash as the only payment instrument is feasible, especially considering the added risk of theft, robbery, and loss from carrying large amounts. Despite these forces, a 2014 study of payment diary surveys from the U.S. and six other countries showed that, for the time being, cash remains the predominant method of payment for the smallest 50% of transactions.[123]

2. Checks

Checks, it appears, rank low on fungibility. Checks are not a common method of payment anymore in many parts of the world, and their acceptability is low. Retail vendors may be deterred by the cost involved in processing small value checks, and the risk of non-sufficient funds, whether due to fraud or inadvertence, when a large value is involved.

---

[121] More specifically, vendors may be obligated to accept cash as the settlement of debt for obligations already incurred by the purchaser. However, in many jurisdictions, vendors are free to refuse to enter into a transaction in the first place where the vendor does not like the consumer's intended method of payment.

[122] *See*, *e.g.*, Anna Tims, *Why Cash is No Longer King*, MONEY BLOG (Jul. 5, 2012), http://www.guardian.co.uk/money/blog/2012/jul/05/cash-no-longer-king-penalties.

[123] John Bagnall, David Bounie, Kim P. Huynh, Anneke Kosse, Tobias Schmidt, Scott Schuh and Helmut Stix, *Consumer Cash Usage: A Cross-Country Comparison with Payment Diary Survey Data* 15 (ECB Working Paper No. 1685) *available at* http://ssrn.com/abstract=2436365.

Similar to cash, checks cannot be used in remote transactions. Carrying a checkbook seems to be more cumbersome than carrying payment cards and possibly even cash. As a result, checks seem to offer little in the way of fungibility and ease of use.

3. Payment Cards

Payment cards rate high in their ease of carrying, but their limited acceptance in some developing countries prevents them from being as fungible a retail payment instrument in developing countries as they are in developed countries. In particular, the acceptance rate of payment cards is lower in developing countries without the sophisticated payment-processing infrastructure present in developed countries. Payment cards are affected by the network effect. That is, like the classical example of telephones, cards are only worth having and using when a certain threshold percentage of vendors accept them, and the utility of payment cards go up as the usage rate and acceptance rate rise. Thus, usage and acceptance of payment cards can start a self-fuelling adoption throughout a developing country, in which more vendors become willing to incur the cost of infrastructure to accept card payments in order to prevent foregone sales from card-preferring consumers that would take their business elsewhere. This suggests an even greater role for policy makers in developing parts of the world, in which even a small increase or decrease in the incentive to adopt cards can have a large ramification in the country's eventual retail payment system environment.

4. ACH Transfers

While the recent development of one-time authorized ACH transactions has expanded the scope of their use, ACH transfers cannot be considered a fungible payment

instrument that can replace other retail payment instruments. In particular, the use of ACH transfers is both uncommon and arguably cumbersome at the point-of-sale, requiring the payee to manually enter the payor's financial information from the paper check provided by the payor.

5. Virtual or Digital Currencies

Digital cash currently ranks very low on fungibility due to its limited acceptance and use to date. It almost always needs to be converted into conventional money. The digital money exchange function represents an added layer of cost, complexity and risk to users.

VII. CONCLUSION

This paper has reviewed the costs of the components of the retail payment system, based on existing literature, with respect to seven desirable characteristics: (1) finality and reversibility; (2) universality (ability to use at point of sale and remotely); (3) recordkeeping; (4) liquidity (maximizing interest earning assets); (5) security and safety; (6) financial inclusion and access; and (7) fungibility and ease of use. The following table is a summary of the findings. Overall, as the summary below suggests, debit and credit cards seem to be the most desirable payment system across these seven characteristics.

Both cash and digital currencies do not offer reversibility, with consumers bearing the transaction risk of payees not honoring their promises. Checks have limited finality within the time between payment and the actual debiting of the payor’s account, but have no reversibility once the funds transfer is complete, creating the risk of fraud by both payors (who can stop payment on a check before it is debited even where goods received

are perfectly acceptable) and payees (who can obtain funds from a check and subsequently fail to fulfill their contract). The legal rules surrounding ACH transfers make it difficult to reverse payments, as consumers may dispute ACH charges to their accounts only in limited circumstances, and receiving banks are not required to reverse a charge if doing so would overdraw the payee's account or the account no longer exists. Payment cards offer the greatest degree of reversibility, providing protection to consumers by allowing unilateral reversal of payments with minimal documentation or proof under card association and legal rules, which in turn benefits merchants by incentivizing risk-averse consumers to enter into transactions. Card issuers, who investigate and resolve reversal disputes between consumers and merchants, mitigate the risk of consumer abuse of these protections.

Universality is a key feature of payment cards, as they offer both a high level of convenience for online transactions and strong consumer protections, substantially reducing the cost barrier of remote transactions for parties. In contrast, cash and checks are unsuitable forms of payment for most remote transactions. ACH transfers offer convenience for remote payments, particularly for payment of recurring bills; however, reduced consumer protection compared to payment cards increase the risk of these types of payments for consumers. Digital currencies, for their part, allow for global and relatively frictionless transfers of value, but currently suffer from limited acceptability.

Payment cards offer significant advantages in facilitating recordkeeping, as they provide accurate, real-time electronic recording of payments, with the only cost to parties being the potential risks stemming from the fact that electronic records are not always secure. ACH transfers, as a form of electronic payment, offer similar recordkeeping

advantages to cards. Cash is especially problematic for recordkeeping, as it requires manual recordkeeping by parties that may not detect fraud and is susceptible to error. While checks offer recordkeeping advantages over cash through the creation of a paper trail, they require users to make manual entries of transactions. Digital currencies offer anonymity as a claimed feature, thus they generally provide limited recordkeeping despite their digital nature.

In terms of liquidity, credit cards provide a unique benefit to consumers by allowing liquidity-constrained individuals to make purchases, which benefits merchants as well by enabling transactions that would not otherwise be possible. Cash is unmatched in its ability to provide the means necessary for consumers to make daily payments; however, consumers bear the costs of foregone interest when holding excess cash, a non-interest bearing asset. Debit cards, which typically access funds from low-interest checking accounts, pose the same costs of foregone interest as cash; meanwhile, checks drawn from these same types of accounts have additional transaction costs due to low acceptability in everyday transactions, and the delay between payment receipt and funds transfer. While ACH transfers are similar to checks in terms of liquidity management, in that they involve foregone interest and delayed payment costs, the automated nature of the ACH system benefits businesses paid through recurring transfers by providing a timely, reliable cash flow. Digital currencies, while difficult to invest due to the limited number of assets denominated in such currencies, allow for speculation on the value of the digital currency relative to sovereign currencies.

Fraud poses a significant security risk to issuers and payees of payment cards, particularly through card skimming and computer system breaches; however, consumer protection laws and card network policies have largely eliminated the security risks to consumers. Cash, which is both an attractive target of theft and subject to counterfeiting, poses risks to consumers and merchants alike, though loss of cash poses necessarily limited damage. Checks are subject to forgery and alteration; moreover, the possibility of float creates a unique risk of fraud by payors. The ACH system is particularly susceptible to fraud for three reasons: the lack of a system-wide method for linking a payor's name, address, and deposit account number; the lack of real-time authorization of payments as is done for credit and debit card payments; and the lack of fraud detection mechanisms similar to those used by payment card issuers. Digital currencies, for their part, have proved particularly fertile ground for hackers and cyber criminals, given the currencies' dependence on the security of a dispersed, self-governing digital framework.

Cash is the standard payment instrument for individuals lacking financial inclusion and access, though it can drive that population further away from financial access due to the difficulty of financing large transactions (such as home and car purchases) with cash alone. Checks present a hardship for unbanked payees, who must resort to high-fee cash-checking services to redeem checks; similarly, ACH transfers require a bank account, and thus the ACH system is largely unable to improve financial inclusion. Payment cards possess multiple features that would be of benefit to financially excluded individuals, such as access to unsecured credit and reduced need for excessive liquidity, yet obtaining a payment card often requires a bank account and good credit history. An alternative is the

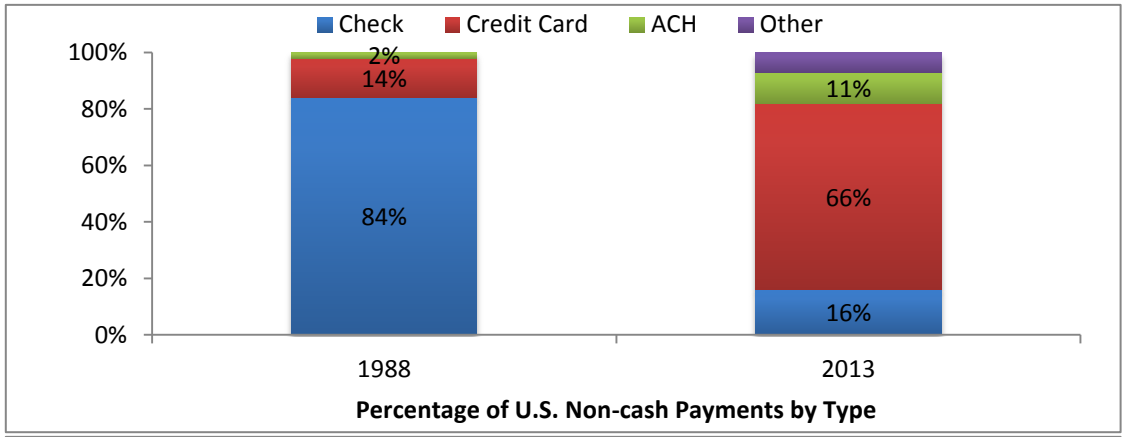
use of prepaid cards, which are not tied to a bank account and thus can be beneficial to persons lacking financial access, despite the restricted liquidity that results from the need for prepayment. Digital currencies, while offering extremely low transaction costs, depend on technology that is often out of reach for financially excluded communities.

Payment cards represent an extremely fungible payment method in developed countries, where payment-processing infrastructure is ubiquitous. While cash is widely acceptable, it is not universally so, particularly in large or remote transactions, due to security and logistical risks for both consumers and merchants. Checks rank low on fungibility, with limited acceptability due to fraud risks and processing costs, and less convenience for consumers than cash or payment cards. Both ACH transfers and digital currencies lack wide acceptance, and thus are not fungible payment methods.

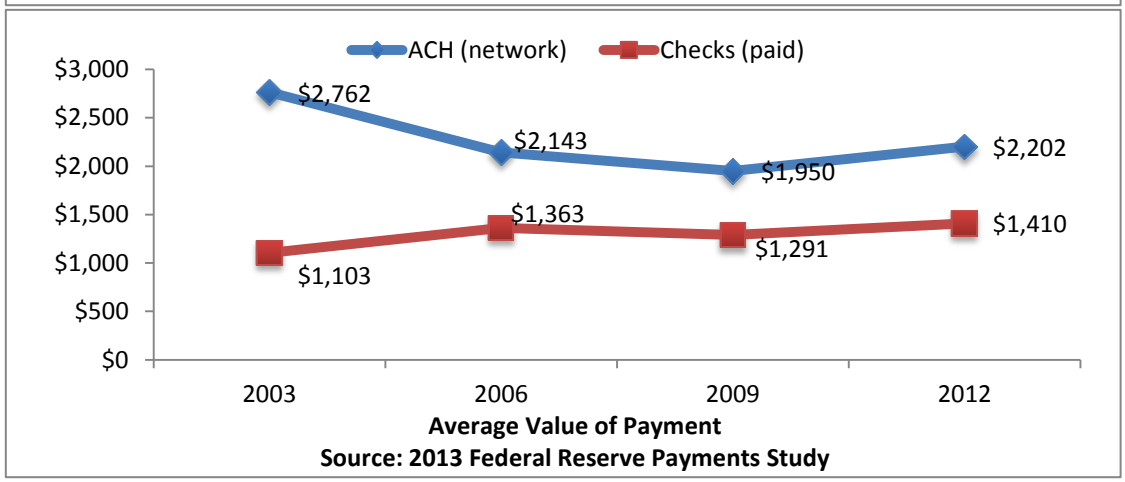
Looking at use statistics overall, based upon BIS CPMI studies, it would appear the Coase Theorem has been vindicated, as retail payments have increasingly moved toward card payments,[124] the relative costs and benefits of which best achieve the interests of the parties and therefore maximize Coasian efficiency. In 1988, 84% of non-cash payments in the US were by check, 14% by credit card, and the remaining 2% by ACH, which had gained almost no traction since its inception 20 years before. Some 80% of non-cash payments were processed by the Federal Reserve (most checks, all ACH), and debit cards (useable also at ATMs) had yet to reach significant use for transactions. The payment system was simple: banks cleared checks and dispensed cash, which dominated POS transactions. Few merchants dealt in any other form of tender. Today, however, about 66%

[124] *Statistics on Payment, Clearing and Settlement Systems in the CPMI Countries – Figures for 2013, supra*.

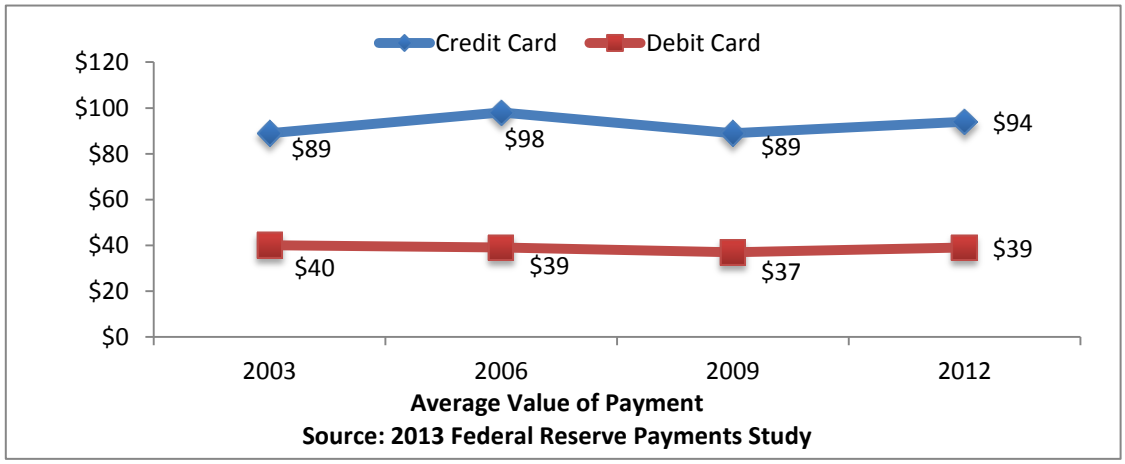
of non-cash payment is by card, a majority by debit card, with 11% by ACH and only 16% by check.



Percentage of U.S. Non-cash Payments by Type



Average Value of Payment
Source: 2013 Federal Reserve Payments Study



Average Value of Payment
Source: 2013 Federal Reserve Payments Study

Between 1988 and 2012, payment cards have gone from very small levels of use (1% or less in several countries) to as much as 77% in Canada and 43% or above in every CPMI country except Germany and Singapore (both of which have experienced significant growth in card payments in recent years). Checks have effectively disappeared in 6 of the 11 countries, and are above 10% of retail payments in only four countries.

As stated earlier, when a payment system balances the interests and reduces the risks undertaken by counterparties to a market contract, it reduces the total cost of contracting and thereby increases the scope for market contracting between parties. For this reason, the notion that the total cost of the payment system is frictional waste to the economy and a misallocation of societal resources is fallacious. An efficient payment system increases commerce because it facilitates productive transactions. The issue is not how cheap it is to make a payment, but how and to what extent payments increase productive economic activity. A recent study by Moody's Analytics estimates that greater use of credit and debit cards in 2008-2012 raised consumption by an average of 0.7% of GDP across a range of 56 countries, and raised it more for emerging markets (0.8%) than for developed countries (0.3%).[125] Greater use of these card payments increased global economic growth by $983 billion.[126] Economies grow faster when people are free and able to contract, and make payments, according to their desires.

Regulation should generally require some demonstration of market failure beyond mere cost to end users of the payment system. The costs of the payment system are largely

[125] Mark Zandi, Virenda Singh & Justin Irving, *The Impact of Electronic Payments on Economic Growth* (Feb. 2013), at 3.
[126] *Id.*

a result of the mix of instruments used, which in turn reflects the desires of the parties for particular features and results. As we have demonstrated, these market forces have led to products like credit cards achieving widespread adoption based on perceived value while less feature rich methods like cash and checks are in secular decline. Regulation should be mindful of unintended consequences and be based on economic analysis rather than abstract, if admirable, principles of best practice. For example, the introduction of low cost public networks or price controls on private operators may achieve cheaper payment systems, but at the much higher cost of less economic activity, since payment systems will not be flexible enough to accommodate the needs of businesses and households in a rapidly changing global economy. The summary below suggests that overall card payments maximize the benefits to be achieved by different forms of payment.

DESIRABLE PAYMENT SYSTEM CHARACTERISTICS

	Cash	**Check**	**Debit Card**	**Credit Card**	**ACH Transfer**	**Digital Currencies**
Finality	High	Low	Medium	Medium	Medium	High
Reversibility	Low	Low	Medium	High	Medium	Low
Usability in Remote Commerce	Low	Low	Medium	High	Medium	Low
Recordkeeping	Low	Medium	High	High	High	Medium
Liquidity Management and Maximization of Interest-bearing Assets	Low	Low	Medium	High	Medium	Medium
Security and Safety	Low	Medium	Medium	Medium	Medium	Low
Financial Inclusion	High	Low	Medium	Medium	Medium	Low
Fungibility and Ease of Use	Medium	Low	High	High	Low	Low*

***Based on existing low levels of usage**

REFERENCES

Allsopp, P., Summers, B., & Veale, J., *The Evolution of Real-Time Gross Settlement* (2009).

AMERICAN BANKERS ASSOCIATION, *Banks Stop $13 Billion in Fraud Attempts in 2012* (Dec. 12, 2013), http://www.aba.com/Press/Pages/121213DepositAccountFraud.aspx.

Robleh Ali, John Barrdear, Roger Clews, and James Southgate, *Innovations in Payment Technologies and the Emergence of Digital Currencies*, BANK OF ENGLAND QUARTERLY BULLETIN, 2014 Q3.

Carlos Arango, D. Hogg & A. Lee, *Why Is Cash (Still) So Entrenched? Insights from the Bank of Canada's 2009 Methods-of-Payment Survey* (2012).

Carlos Arango & Varya Taylor, *Merchants' Costs of Accepting Means of Payment: Is Cash the Least Costly?* Winter 2008-2009 BANK OF CANADA REVIEW 15.

Carlos Arango & Varya Taylor, *The Role of Convenience and Risk in Consumers' Means of Payment* (2009).

John Bagnall, David Bounie, Kim P. Huynh, Anneke Kosse, Tobias Schmidt, Scott Schuh and Helmut Stix, *Consumer Cash Usage: A Cross-Country Comparison with Payment Diary Survey Data* 15 (ECB Working Paper No. 1685) *available at* http://ssrn.com/abstract=2436365.

BANK FOR INTERNATIONAL SETTLEMENTS, *Statistics on Payment, Clearing and Settlement Systems in the CPMI Countries – Figures for 2013*, http://www.bis.org/cpmi/publ/d120.pdf.

BANK OF FAIRFIELD, *ACH Rules & Facts Guide for ACH Originators* (Mar. 2011).

Holti Banka et al., *From Cash to Electronic Payments: Quantifying and Measuring the Costs of Paper Based Payment Instruments to the U.S. Society* (Apr. 2012).

W. F. Baxter, *Bank interchange of transactional paper: legal perspectives*. 26 JOURNAL OF LAW AND ECONOMICS 541 (1983).

Why US retailers are still vulnerable to card fraud, BLOOMBERG BUSINESS WEEK, Technology (April 10, 2014) http://www.businessweek.com/articles/2014-04-10/u-dot-s-dot-retailers-behind-schedule-for-card-payment-system-upgrade.

Rainer Böhme, Nicolas Christin, Benjamin Edelman, Tyler Moore, *Bitcoin* 14 (Harvard Business School NOM Unit Working Paper No. 15-015), *available at* http://ssrn.com/abstract=2495572.

Rhys Bollen, *The Legal Status of Online Currencies: Are Bitcoins the Future* (2013).

Hans Brits & Carlo Winder, *Payments are No Free Lunch*, DE NEDERLANDSCHE BANK OCCASIONAL STUDIES (2005).

Nicole Bullock, *Scale of credit card breach revealed*. FINANCIAL TIMES, Apr. 2, 2012.

CAPGEMINI, *World Payments Report* (2011).

CENTER FOR EMERGING MARKET ENTERPRISES, *Cost of Cash in the United States* (2012).

CENTRE FOR RETAIL RESEARCH, *The Global Retail Theft Barometer 2011* (2012), http://www.retailresearch.org/grtb_currentsurvey.php.

Sujit Chakravorti & W. R. Emmons, *Who Pays for Credit Cards?* (2001).

Sujit Chakravorti & T. McHugh, *Why Do We Use So Many Checks?* 3Q/2002 ECONOMIC PERSPECTIVES 44 (2002).

Sujit Chakravorti & T, To, *A Theory of Credit Cards* (2006).

Howard H. Chang, D. S. Evans & D. G. Swartz, *The Effect of Regulatory Intervention in Two Sided Markets: An Assessment of Interchange-Fee Capping in Australia*. 4 REVIEW OF NETWORK ECONOMICS 328 (2005).

Massimo Cirasino & J. A. Garcia, *Measuring Payment System Development* (2008).

Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

Ronald H. Coase, *The Problem of Social Cost*. 3 JOURNAL OF LAW AND ECONOMICS 1 (1960).

COINDESK, *Bitcoin Market Capitalization Chart*, (November 13, 2014), http://www.coindesk.com/data/bitcoin-market-capitalization/.

CONSUMER FINANCIAL PROTECTION BUREAU, *What is a Grace Period? How Does it Work?* (Mar. 22, 2012), http://www.consumerfinance.gov/askcfpb/47/what-is-a-grace-period-how-does-it-work.html.

CYBERSOURCE, *Payment Methods in Select Countries: Global Payment Options* (2011).

The end of a monopoly, THE ECONOMIST (May 10, 2014), http://www.economist.com/node/21601624/print.

eMARKETER , *Ecommerce Sales Topped $1 Trillion for First Time in 2012*, (Feb. 5, 2013), http://www.emarketer.com/Article/Ecommerce-Sales-Topped-1-Trillion-First-Time-2012/1009649.

Allison Enright, *Retail e-commerce spending rebounds* (2010), http://www.internetretailer.com/2010/08/10/retail-e-commerce-spending-rebounds.

EUROPEAN CENTRAL BANK, *Banknotes and Coins Circulation*, http://www.ecb.int/stats/euro/circulation/html/index.en.html.

EUROPEAN COMMISSION, *Financial Services Provision and Prevention of Financial Exclusion* (2008).

FEDERAL DEPOSIT INSURANCE CORPORATION, *2011 FDIC National Survey of Unbanked and Underbanked Households* (Sept. 2012).

FEDERAL RESERVE BOARD, *Corporate Compliance Handbook, Regulation CC*, http://www.federalreserve.gov/boarddocs/supmanual/cch/efaa.pdf.

FEDERAL RESERVE BOARD, *Federal Reserve Bank Operating Circular No. 4 Automated Clearing House Items*.

FEDERAL RESERVE SYSTEM, *Automated Clearinghouse Services* (Aug. 10, 2012), http://www.federalreserve.gov/paymentsystems/fedach_about.htm.

FEDERAL RESERVE SYSTEM, *How Much U.S. Currency is in Circulation?*, http://www.federalreserve.gov/faqs/currency_12773.htm.

FEDERAL RESERVE SYSTEM, *Noncash Payment Trends in the United States: 2006-2009* (2011).

FEDERAL RESERVE SYSTEM, *The 2013 Federal Reserve Payments Study: Recent and Long-Term Trends in the United States: 2000 – 2012. Detailed Report and Updated Data Release* (2014).

Karen Furst & Daniel Nolle, *ACH Payments: Changing Users and Changing Uses* (Oct. 2005).

Karen Furst & Daniel Nolle, *What's Your Risk with the Growing Use of ACH Payments?* 24 QUARTERLY JOURNAL (2005).

See Daniel D. Garcia-Swartz, Robert W. Hahn, & Anne Layne-Farrar, *The Move Toward a Cashless Society: A Closer Look at Payment Instrument Economics*, 5 REVIEW OF NETWORK ECONOMICS 1 (2006).
GATES FOUNDATION, *Fighting Poverty, Profitably*: Transforming the economics of payments to build sustainable, inclusive financial systems. Sept 2013.

Benjamin Geva, *Payment Finality and Discharge in Funds Transfers*, 83 CHICAGO-KENT LAW REVIEW 641 (2009).

Gabriela Guibourg & Björn Segendorf, *Do Prices Reflect Costs? A Study of the Price- and Cost Structure of Retail Payment Services in the Swedish Banking Sector 2002* (2004).

Fumiko Hayashi & William R. Keeton, *Measuring the Costs of Retail Payment Methods*, FEDERAL RESERVE BANK OF KANSAS CITY ECONOMIC REVIEW (2012).

Fumiko Hayashi & E. Klee, *Technology Adoption and Consumer Payments: Evidence from Survey Data*, 2 REVIEW OF NETWORK ECONOMICS (2003).

HM TREASURY, *Financial inclusion: the way forward* (2007).

David Humphrey, Lawrence Pulley & Jukka Vesala, *The Check's in the Mail: Why the United States Lags in the Adoption of Cost-Saving Electronic payments*, 17 JOURNAL OF FINANCIAL SERVICES RESEARCH 17 (2000).

Charles Kahn & William Roberds, *The Economics of Payment Finality*. 2Q FEDERAL RESERVE BANK OF ATLANTA ECONOMIC REVIEW 1 (2002).

LEXISNEXIS, *2014 LexisNexis True Cost of Fraud Study* (Aug. 2014).

Bill McCleery, *Fake Money: Counterfeiters Use Digital Technology to Their Advantage*, USA TODAY, Mar. 12, 2013.

KEVIN MELLYN, BROKEN MARKETS: A USER'S GUIDE TO THE POST-FINANCE ECONOMY (2012).

Luke Mullins, *How Frank Abagnale Would Swindle you*, U.S. NEWS & WORLD REPORT, May 19, 2008, http://money.usnews.com/money/blogs/the-collar/2008/05/19/how-frank-abagnale-would-swindle-you.

NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, *About Us*, https://www.nacha.org/aboutus.

NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, *Overall ACH Volume Nearly 22 Billion in 2013* (2014), https://www.nacha.org/system/files/resources/ACH%20Network%20Statistics%202013.zip

NACHA – THE ELECTRONIC PAYMENTS ASSOCIATION, *Ten Billion ACH Payments in 2003, NACHA Announces* (Mar. 22, 2004), https://www.nacha.org/node/789.

Nyberg, L. (2008, May 23). [Speech]. Bålsta, Sweden.

Tonny Omwansa, *M-Pesa: Progress and Prospects* (2009).

Joanne E. Oxley & Bernard Yeung. *E-Commerce Readiness: Institutional Environment and International Competitiveness*, 32 JOURNAL OF INTERNATIONAL BUSINESS STUDIES 705 (2001).

Stephen Quinn & William Roberds, *The Evolution of the Check as a Means of Payment: A Historical Survey*, 93 ECON. R. (NO. 4) 1 (2008).

Marc Rysman & Julian Wright, *The Economics of Payment Cards* (Nov. 2012).

Heiko Schmiedel, Gergana Kostova, & Wiebe Ruttenberg, *The Social and Private Costs of Retail Payment Instruments: A European Perspective* (Sept. 2012).

Björn Segendorf & Thomas Jansson, *The Cost of Consumer Payments in Sweden* (2012).

See Allan Shampine, *Another Look at Payment Instrument Economics*, 6 REVIEW OF NETWORK ECONOMICS 4 (2007).

Robin Sidel, *Credit-Card Industry Ramps Up Security Efforts*, WALL STREET JOURNAL, (Sep. 4, 2014), http://online.wsj.com/articles/credit-card-industry-ramps-up-security-efforts-1409869142.

David E. Sorkin, *Payment Methods for Consumer-to-Consumer Online Transactions*, 35 AKRON LAW REVIEW 1 (2001).

SPGGC, LLC v. Ayotte, 488 F. 3d 525, 527 (1st Cir. 2007).

Kari Takala & Matti Viren, *Efficiency and Costs of Payments: Some New Evidence from Finland*, BANK OF FINLAND DISCUSSION PAPERS, Nov. 2008.

Irina Telyukova, *Household Need for Liquidity and the Credit Card Debt Puzzle* (Oct. 9, 2012).

Anna Tims, *Why Cash is No Longer King*, MONEY BLOG (Jul. 5, 2012), http://www.guardian.co.uk/money/blog/2012/jul/05/cash-no-longer-king-penalties.

U.S. TREASURY, *The Use and Counterfeiting of United States Currency Abroad* (2003).

VISA, *Chargeback Management Guidelines for Visa Merchants*, (2011).

Craig H. Weber, *Overcoming the Obstacles to Implementation of Point-of-sale Electronic Fund Transfer Systems: EFTA and the New Uniform Payments Code*, 69 VA. L. REV. 1351 (1983).

Rachel Witkowski, *Will CFPB Write Rules on Digital Currencies?*, AMERICAN BANKER (Aug. 11, 2014), http://www.americanbanker.com/issues/179_154/will-cfpb-write-rules-on-digital-currencies-1069330-1.html.

Rachel Witkowski, *Cheat Sheet: Details of the CFPB's Sweeping Plan to Regulate Prepaid Cards*, AMERICAN BANKER (Nov. 13, 2014), http://www.americanbanker.com/news/regulation-reform/cheat-sheet-details-of-the-cfpbs-sweeping-plan-to-regulate-prepaid-cards-1071208-1.html.

WORLD BANK. (2010). *Payment Systems Worldwide: A Snapshot*.

Mark Zandi, Virenda Singh & Justin Irving, *The Impact of Electronic Payments on Economic Growth* (Feb. 2013).

Todd J. Zywicki, Geoffrey A Manne & Julian Morris, *Price Controls on Payment Card Interchange Fees: The U.S. Experience* (George Mason Law & Economics Research Paper No. 14-18, June 4, 2014).