

Digital Checks as Electronic Payment Orders

*Katy Jacob, Anna Lunn, Richard D. Porter, Wade
Rousse, Bruce Summers and David Walker*

November 17, 2009

Digital Checks as Electronic Payment Orders

Katy Jacob, Anna Lunn, Richard D. Porter, Wade Rouse, Bruce Summers, and David Walker¹

November 17, 2009

Abstract

This paper explores the potential for a new type of electronic payment order (EPO), in the form of an entirely digital check. The digital check EPO could leverage the existing electronic check infrastructure and provide a convenient, low-cost payment option for both consumers and businesses, based on a payment method that they have found useful for many years. The overall efficiency of the payment system would increase as a result. We sketch out how this type of EPO might work both technically and legally. We suggest the opportunity might be ripe for a relatively small number of high-tech service providers to capture a significant share of the retail deposit market by building robust secure software on smart hand-held devices, rather than exclusively focusing on building bank branches to gather retail deposits.

1.0 Introduction

In the age of the modern mobile phone, paper checks seem quite antiquated. The paper check's history in the United States dates back centuries, with peak check activity occurring in the late 20th century. The estimated number of checks written quadrupled to 32.7 billion between 1952 and 1979. Check volume is estimated to have peaked at 49.5 billion per year in 1995 with the beginning of the electronic payment revolution, which changed the way that consumers and businesses thought about checks.² Estimates suggest that paper checks constitute about one half of this volume today.³

¹ The first four authors are staff members of the Payments Team in the Financial Markets Group at the Federal Reserve Bank of Chicago. Until his retirement in 2007, Bruce Summers was a career official with the Federal Reserve System, while David Walker is the President and CEO of the Electronic Check Clearing House Organization, (ECCHO). We wish to thank our colleagues Gene Amromin and Doug Evanoff, Fred Herr from the Retail Product office of the Federal Reserve Bank of Atlanta, and Professors Charles Kahn and Stephen F. LeRoy for comments on earlier versions of this material. The views expressed here are those of the authors alone and don't reflect the views of the Federal Reserve Bank of Chicago, the Federal Reserve System or ECCHO.

² Stephen Quinn and Will Roberds, "The Evolution of the Check as a Means of Payment," A Historical Survey, Federal Reserve Bank of Atlanta, *Economic Review*, November, 2008.

³ See Moebs Services new release, October 12, 2009

Part of the substitution away from checks reflects generational changes in payment, as older consumers have continued to use checks while younger consumers have embraced newer payment methods. But mostly, checks have appeared to follow the general trend of payments electronification, as consumers and businesses react to increased efficiencies in convenience and processing time with alternative emerging payment media.

Our paper develops an exploratory proposal to digitally rejuvenate the check payment instrument in order to extend the beneficial properties that has made it a viable payment option for centuries. Checks have been on a long decline since the mid 1990s. As a paper product in a digital age, they are just too expensive. But check processing in the last five years has become much more of a digital proposition resulting in significantly lower overall processing costs. Due to the Check 21 revolution, digital images have replaced paper items in the clearing and settlement process. We argue that a new kind of check, one never having any paper form whatsoever, could complete this transformation and enhance consumer welfare. The new kind of check would work equally as well for businesses, which have retained the check because of its convenience and simplicity. Float would generally be reduced as well.

For the technological-savvy depositories willing to embrace this proposed electronic banking opportunity, the concept could scale quickly and transform the retail banking experience through the Internet. We believe the costs to operate such a new system would not be large and allow the new product to compete quite successfully in terms of price and convenience with both debit and credit cards.

Of course, one might question prognostications about the future of banking, which have often proved to be wrong in the past. For example, when deposit rates were deregulated in the late 1970s and early 1980s, many thought the era of banking would change radically from “attractive tellers and free toasters” to more utilitarian warehouse banking arrangements. It was thought that when rates were deregulated and banks could directly compete on “price”, such freebees would vanish. Much has changed since then, but banks continue to attract retail depositors through brick and mortar branches—a very expensive way of doing business in our digital age. We don’t believe the utilitarian predictions about the future state of banking were so wrong headed but just premature.

Over the past four decades, like other industries, technology has played a major role in changing the banking business. Banks have developed a powerful utilitarian branch-equivalent called the ATM, and today's ATMs do much more than disperse and take in cash. They allow consumers to make deposits, add value to payment cards, deposit checks, make enquiries, print statements, pay bills, and accept ticketing and marketing offers, among other things. We believe a similar radical transformation for paper checks could be at hand using an instrument that consumers readily turn to more often than their wallet—a smart mobile phone.

Since check usage has been declining, one could imagine that the paper check will soon become extinct because it will become simply too expensive to continue to process paper.⁴ While the disappearance of paper check is well within the realm of possibility, we believe that this basic means of payment has more to offer in the future as a fully electronic form of payment. We prefer to call such an all-electronic payment a *digital check* or an *electronic payment order* (EPO).⁵ In fact, we are already approaching the point where paper checks only exist until they can be imaged. It seems plausible to consider pushing the point of imagery just a little farther – all the way to the check writer.

Imagine a world where consumers could write and send completely digital checks or EPOs, from their mobile phones. The banking application could exploit the computing properties of the platform to provide built-in authentication, communications, and security for electronic check writers. The EPO would embody all of the unique characteristics that a paper check has, plus some added qualities that the digital medium affords.⁶ In fact, this idea is not much of a stretch for the imagination because the technology to do this is currently available. The next paragraph briefly describes how we envision an EPO could be implemented for consumers into today's payments universe.

⁴ Conceivably it might continue to exist on some fringes as the bulk of check collection and processing takes place on much cheaper electronic platforms.

⁵ A different but related concept is a demand draft, also known as a remotely created check or a tele-check; this is a check created by a merchant with a payer's checking account number on it, but without the payer's signature.

⁶ See section 4 for a discussion of the properties of EPOs.

A consumer wishing to make a payment writes an EPO on a smart mobile phone, such as Apple's iPhone, Motorola's Droid, or Palm's Pre.⁷ They access their address book or other account list information on the mobile phone for a list of potential payees or add the name of a new payee. They then select the amount of the check, the date, and write their signature on the screen. This last step is comparable to the way that signatures are now commonly written on screens at checkout counters.⁸ The software check program then creates a visual image, of both the front and back of a check and automatically takes a screen shot of the image.⁹ By construction, the screen-shot image, the electronic payment order or EPO, would be identical to an actual image of a real paper check. Indeed, one could download an actual image of the best picture of check stock to use as the backdrop for the screen-shot generated check image. The program would then transmit an encrypted version of the imaged check to the payee automatically and the payee would deposit it electronically into their own demand deposit account (DDA) account, email account, or other designated secure location.

We contend that such an electronification procedure could completely eliminate the remaining paper part of the check process. As a result, the payment system would be more socially efficient with fewer real resources devoted to checks, more rapid clearing and settlement, and lastly, substantial gains in consumer convenience. In this paper, we will describe the electronification process in the check industry, discuss how EPOs could become a part of this process, and explore the public policy ramifications of EPOs.

2.0 Transformation of Check Processing and Clearing: Truncation

⁷ One-off checks for businesses could conceivably be drafted in the same fashion. To be sure, a business writing a large number of checks would undoubtedly wish to use more automated procedures.

⁸ The only difference is the screen on the iPhone is somewhat smaller. Assuming the handheld device is taller than it is wide, the device could be rotated to write the signature on the screen. As a security safeguard, the pressure the writer used in making the signature could be recorded for the transaction. The loss of this security information in the Check 21 legislation was one reason the Consumers Union initially opposed the legislation—,“However, the substitute check will not be as useful as the original check for proving forgery or alteration, because it can't be used to determine pen pressure, and it is less useful for handwriting analysis,” at.”
<http://www.consumersunion.org/finance/ckclear1002.htm>.

⁹ For example, an iPhone owner can take a screenshot of the iPhone display by quickly pressing and releasing the Sleep/Wake and Home buttons at the same time. A white flash of the screen indicates the screenshot was taken. The resulting picture is automatically added to the camera roll. As an application on a mobile phone, these steps would, of course, be made automatic.

About a decade ago, it became clear to many that the U.S. payment system's love affair with *paper* checks had to end. While consumer and business use had been declining, checks were still a dominant payment media. But the sheer effort of continuing to support legacy systems for processing paper checks, which at their core are materials-handling operations not unlike processing banknotes, just didn't make sense any more.¹⁰ After all, much of the rest of the world was already far along a digital payments path. For the United States to continue to maintain and extend the large infrastructure for handling the billions of paper checks processed by the banking system seemed completely at variance with overall payment trends, which were otherwise increasingly becoming electronic. It was not smart public policy to continue to support large-scale paper check processing. Something had to give, but what?

The problem as seen by the Federal Reserve and commercial banks was to agree on a path for the transition from paper to electronics given the large dependency of the economy on checks, and the check processing infrastructure. In the face of considerable uncertainty on how fast a transition away from paper to electronics would occur, an attempt was made to redirect check processing toward electronics. Specifically, the Federal Reserve and commercial banks settled on a strategy in which paper checks would gradually be converted to electronic images in the clearing and settlement process. An alternative strategy would have been to mandate an abrupt and costly transition such as a drop-dead date for processing paper checks. This seemed too sudden: No one wanted to disrupt a well-functioning means of payment in this way.¹¹

In 2000 the National Automated Clearing House Association (NACHA) adopted rules that provided the initial catalyst for a sequence of actions that led to a reduction in the amount of

¹⁰ For a comparison of the processing similarities and differences between paper checks and banknotes, see Carrie Jankowski, Richard D. Porter, 2008, "Rumours about the demise of American banknotes are greatly exaggerated," *Journal of Payments Strategy & Systems*, Volume 2, Number 3, April, pp. 273-283.

¹¹ On the other hand, other countries with smaller and less complex banking sectors were able to move very quickly away from paper to electronic processing. In Finland for example, "As soon as the technology became available, Finnish banks introduced the debit card as a substitute for the check. Pricing was used to persuade consumers to use debit cards. A small price was introduced on checks – about 10 cents per check – while debit card payments remained free of charge to the card holder". See http://www.chicagofed.org/news_and_conferences/conferences_and_events/files/2000_electronic_payments_conference_proceedings.pdf.

transactions cleared as paper payments.¹² These NACHA rules authorized one-time Automated Clearing House (ACH) debits (which would take place on the digital highway) to consumer demand deposit accounts at a given point in the paper check clearing process.¹³ Truncation entailed *removing* (truncating) paper checks from the forward collection and return processes, while sending the essential payment information captured from the paper check electronically forward through the ACH system. In essence, the parties agreed that *check truncation* would be the simplest means by which to shrink the existing paper check infrastructure. An early example of this concept was ARC (Accounts Receivables Conversion). ARC entails converting paper checks, drawn on consumer accounts and sent to lockboxes, to ACH debit transactions. ARC had a very immediate impact in reducing check processing volumes after the check was received in the lockbox. Three other ACH-based truncation mechanisms eventually covered the breadth of retail transactions: at the checkout (POP for point of purchase), on the phone (TEL), and over the internet (WEB).¹⁴

While these initiatives removed paper checks from the clearing and settlement process, replacing them with ACH items, together they did not result in major efficiencies in the payments infrastructure. More scope was needed to squeeze out (inefficient) paper processing steps in clearing and settlement. The problem was how to promote check truncation at an early point in the check collection or return process without forcing individual banks to accept checks in electronic form. In 2002, Roger Ferguson, Vice Chairman of the Federal Reserve Board, testified to Congress that there was one truncation step that could solve a longstanding dilemma that had plagued the paper check system.¹⁵ Ferguson proposed a new negotiable

¹² The concept of check truncation was not new since at this time credit unions had been truncating checks for dozens of years. Additionally, safekeeping, a form of truncation, was slowly growing among commercial banks.

¹³ See Stephanie Heller, "An Endangered Species: The Increasing Irrelevance of Article 4 of the UCC in Electronics-Based Payment System," *Loyola of Los Angeles Law Review*, 20007, Vol. 40, pp. 513-538. The Federal Reserve has interpreted Regulation E to mean that in certain scenarios a consumer check can be converted to an ACH payment by simply providing the consumer with "notice" of the intended conversion. Once that occurs, the check ceases to be a check and becomes a "source document".

¹⁴ Other truncation procedures exist and have reduced the role of paper in processing checks, such as Back Office Conversion (BOC), which was authorized later. BOC truncates check processing at the merchant's back office for checks drafted written by consumers.

¹⁵ The terrorist attacks of September 11, 2001 also added considerable urgency to modify the existing legacy check system. In the event, the shutdown of the nation's air transportation following the attacks created considerable delays in paper check processing, negatively affecting consumers, businesses, and the overall economy.

instrument called a *substitute check*.¹⁶ Instead of the original paper check, a copy of it made by printing the electronic image of a check would, under Ferguson's proposal, be legally and operationally acceptable for presentment. Such substitute checks would permit banks to truncate the original checks, process the check information electronically, and deliver such substitute checks to banks and their customers that wanted to continue receiving checks in paper form.¹⁷ Once the original check had been truncated, the collecting bank had two options, present a substitute check under Check 21 to those institutions that wished to continue to receive paper payments or to present electronic images of the original check for payment to the paying institution under an image exchange agreement (the need for agreements is addressed in Section 6). Once on the digital highway as an image, the item would cost very little to process, relative to the cost of continuing to process it as a paper item.

Congress passed the Check Clearing for the 21st Century Act (Check 21) on October 28, 2003, and the Act went into effect on October 28, 2004. The Act stated that a printed image of an original check would have the same legal standing as the original check, provided the image met certain standards. Prior to the act, most banks returned the cancelled copies of checks to their customers in their monthly statements. Banks were generally reluctant to discontinue this practice. They feared that doing so would give their competitors an advantage. Most banks continued to return cancelled checks until Check 21 offered them an alternative focal spot for coordinating the processing and return of cancelled checks to customers, namely, the substitute check.

It seems ironic that to do away with the mountains of paper checks clogging the clearing channels we had to create another form of paper, the substitute check; but apparently this innovation was just what was needed to jumpstart check imaging. In less than five years, Check 21 has achieved far more than almost anyone believed was possible. All the resources devoted to the clearing of checks between the payee's and payer's banks – the airplanes and specialized clearing and trucking operations, the physical clearing houses – have shrunk

¹⁶ Alan Slater from Citibank suggested this concept to Governor Ferguson, and the banking industry rallied behind the proposal to garner Congressional support.

¹⁷ While broad, industry-wide truncation would not work without this critical component, Check 21 also allowed the collecting bank to image and truncate all of their transit checks to a particular destination.

significantly. Today, check imaging is beginning to approach complete diffusion.¹⁸ Thus, as a practical matter, the back-end of check payment is *already* well on its way to being fully electronic. This transition to electronic has led to significant efficiency gains throughout check clearing and settlement procedures.

We do not have to look further than the Federal Reserve to find dramatic evidence of this important achievement. As the use of paper checks has declined, the Federal Reserve has reduced its number of check processing locations and overall resource commitments to paper check processing. Ultimately, the Federal Reserve will have reduced its paper check imprint from 45 processing centers in 2003 to just *one* center, located in Cleveland. As part of this process, the Federal Reserve System will have about one eighth of its check processing staff.¹⁹

Figure 1 shows the impressive growth in check imaging through August 2009. Initially, the new activity resulted in a relatively large number of substitute checks being printed. This printing activity occurred because many banks initially were not ready to receive images electronically. But this substitute check activity peaked at around 250 million items per month at about the beginning of 2008 and declined thereafter. The overall pattern for the total

¹⁸ Three types of items have not been imaged: 1) items that produce poor quality images or that produce incomplete images; e.g., where the quality printing on the original paper check was poor or where the original paper has been damaged prior to imaging, so called non-imageables, 2) items that are not eligible for imaging such as Treasury savings bonds and TT & L payments, and 3) foreign items-- items drawn on non U.S. institutions that are not eligible for clearing under either FRB's operating circular on the Collection of Cash Items and Returned Checks (OC3) or ECCHO Rules. Checks drawn on Canadian banks, for example, fall into the last category. On October 20, 2009, ECCHO adopted new rules to provide that items of poor quality are eligible for exchange between its members.

¹⁹ We don't believe the relatively prompt decline of paper in Federal Reserve operations was accidental but owed importantly to the discipline imposed on the System by the 1980 Depository Institutions Deregulation and Monetary Control Act. That act forced the Federal Reserve to engage in financial sector payment operations such as check and ACH as if it were a private sector competitor. Thus, they had to compete directly with private commercial banks. And in setting prices, the Federal Reserve had to take into account the special status it had with respect to payment of taxes, the cost of capital, and deposit insurance, among other things. If for a given payment activity, it could not cover these full costs, (direct costs plus the imputed costs it would incur if it were a private sector payments provider), then it needed to exit from that payment activity. The only exemption it would be permitted to consider involved "competition and the provision of an adequate level of such services nationwide."

number of images follows an S-shaped pattern of a sigmoid curve. It appears that the inflexion (or halfway) point for total images was reached during the summer of 2007.

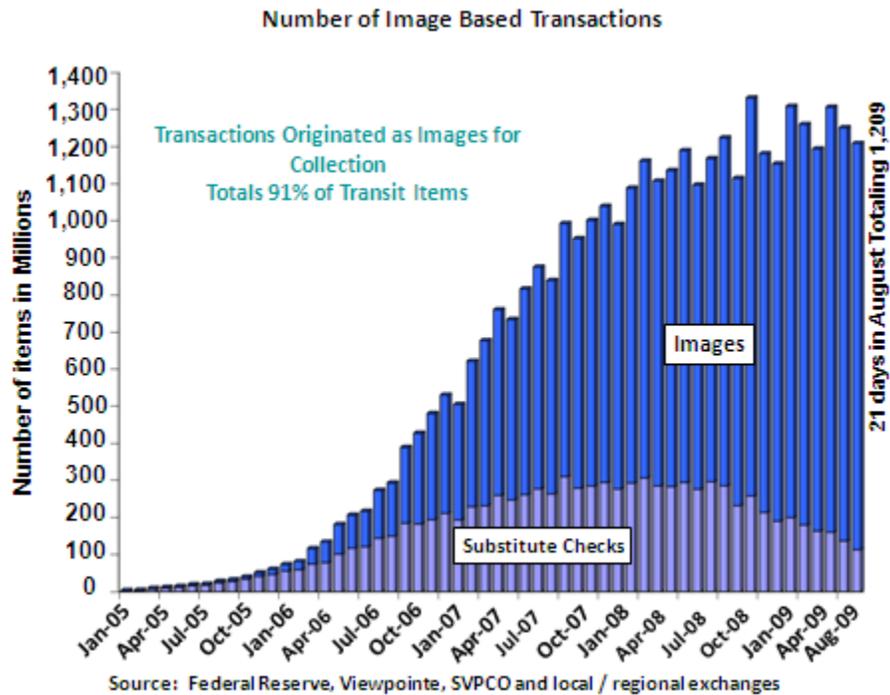


Figure 1: Success of Check 21 Initiative

The U.S. check imaging achievement is impressive. Nevertheless, there is considerable unrealized potential remaining to improve the check system, by extending the benefits of electronic processing all the way to check writers.

3.0 The Rationale for EPOs

If we could electrify the front-end, from the drafting of the check until its delivery at the bank of first deposit (BOFD), we would get rid of many costs incurred: the transportation costs associated with delivering the paper check to the BOFD, as well as, the cost of printing paper checks, the processing resources to prepare, process and control the checks. At that point, the entire check edifice devoted to processing paper would have been eliminated, and the huge investment that has been made to modernize and electrify the back-end of the check processing system could be leveraged. Specifically, software improvements and related procedures to implement such software, say on a mobile phone for consumers, would

complement the existing electronic investments in image exchange but without necessarily incurring the costs of large upfront business fixed investments. Beyond the banking system, it would also save the check writers enormous amounts of time, reduce record keeping burdens, and even save on the cost of envelopes and stamps.²⁰ We assert that eliminating this remaining paper part of the check process would lead to a more socially efficient payment system; and substantial gains in consumer convenience would be one element of such a system.

All current truncation methods—ARC, BOC, Check 21, Image Exchange, POP, and safekeeping—represent back-end initiatives, that is, actions that take place after the check is drafted. Each of these developments was undertaken by entities operating on the supply side of check processing. For the most part, the Federal Reserve and commercial banks went about the business of eliminating expensive paper processing operations after the check was written and with little to no understanding by the check writers of the processes that were eliminated.²¹ A well-designed EPO would represent a convenient payment method that would reestablish that the check writers' choice of payment method would be honored, with the EPO that they “wrote” appearing in their monthly DDA statement.²²

The technology to do this is readily at hand and could have a large impact on consumers and some businesses almost immediately. In particular, the option of EPOs would be highly valuable for person-to-person (P2P) and business-to-business (B2B) payments. Apart from the traditional media, namely checks and cash, P2P transactions are limited to newer, relatively expensive, payment services such as PayPal, which often run as a layer of service on top of established clearing and settlement systems, such as credit cards. And in regard to B2B transactions, information limitations of the alternatives have forced many businesses to stick

²⁰ While not that large on a per-item basis, the postage cost of mailing one billion checks at current prices is \$44 million.

²¹ Strictly speaking, ARC, POP, WEB, TEL and BOC require consumer check writers to agree to the truncation of their original paper checks through one or more processes to “notify” them. After this notification their paper checks will be replaced in their statements with a description of the replacement electronic transaction.

²² When checks get converted to other forms of payments such as ACH, tracking it in their statements may become more difficult.

with the traditional check platform.²³ An EPO would add value to and provide convenience for participants in these types of transactions.

To illustrate this last point, consider the payment operations of Illinois Tool Works (ITW). At the Chicago Fed's Payments conference in 2005, Felix Rodriguez, the treasurer of Illinois Tool Works (ITW), explained that at the time ITW had 236 separate units in the United States located in all 50 states with 26,000 employees. The separate units were each managed in a highly decentralized fashion. All unit-to-unit transactions were handled by the central Treasury staff, consisting of only nine staff members who used zero balance cash concentration accounts and around 120 to 130 lockboxes for 138 accounts payable accounts. At the time, ITW wrote around 721,000 checks a year in the United States. For Illinois Tool Works, the savings in converting to EPOs and not having to mail these checks would have amounted to over \$317,000 a year in savings on postage alone. Considering this, if ITW's EPO payments could be made in the same fashion as its check payments were, presumably ITW would switch to the EPO technology and it would not have to change its basic operations.

EPOs are essentially indistinguishable from traditionally imaged checks, i.e., items that began as paper checks and were then imaged. That is, it is impossible to tell an EPO from an image of an actual paper check. This interchangeability is not magic but the most basic operation that can be performed on a digital camera. Since an EPO created on a mobile phone would be cheaper to produce than a traditional check image, it would likely drive out the higher priced paper-imaged items.²⁴ From this cost perspective, it appears likely that an EPO product could gain market traction relatively swiftly.

Interestingly, since EPO images are indistinguishable from other check images, they have already been routinely created in the course of day-to-day commerce. The typical application involves a payment situation in which speed is of the essence so the paper step is eliminated in order to have the check payment clear as fast as possible, e.g., to make a mortgage or car payment so that credit standing can be preserved or enhanced. Though such

²³ For example, researching to which account a given wire should be posted typically costs firms \$25-\$35.

²⁴ It is reasonable to think of this as a Gresham's law phenomenon. Why would anyone waste real resources when the cheaper substitute is as good as the "real thing"?

payments have already entered the commercial sphere, their legal status is unclear because they are not sanctioned by existing check law, which requires that a check be a paper document.²⁵

4.0 Properties of EPOs

While an all-electronic check, which we are calling a digital check or an electronic payment order (EPO), might suitably leverage existing check investments, it is reasonable to ask whether this innovation is necessary? Indeed, one might argue that private sector developments in the second half of the twentieth century (credit and debit cards, as well as the new means of payments such as prepaid cards and mobile payments), together with the continuing array of new payment types migrating to the low-cost ACH platform, make EPO products unnecessary? Given the plethora of new payment choices now available both to consumers and businesses, who would want to use EPOs?

It is true that several new payment infrastructures, such as ACH and credit, debit, and prepaid cards, have become mainstream payment media. In the process, these payment products have displaced some of the types of transactions that cash and checks used to perform and garnered many new types of transactions, for example, Internet commerce. Nonetheless, checks continue to occupy a prominent place, maintaining an overall position as the second largest non-cash payment method in the United States in terms of the volume of payments.²⁶ Thus, it appears that there are still many potential EPO users.²⁷ We contend that this is true because checks embody several unique characteristics.

In general, a desirable payment instrument should embody the following characteristics:

²⁵ See section 5 for a discussion of the legal issues surrounding these items.

²⁶ See Moebs Services Press Release, October 12, 2009. This estimate suggests that debit card transactions will be 33 billion in 2009 while transactions originated as paper checks will be 24 billion, one billion more than the estimate for credit card transactions.

²⁷ We will argue later that price considerations might induce some debit card users to switch to a more inexpensive EPO option.

- (1) Convenience—required payment instructions are not too burdensome to initiate or receive and making a payment automatically results in the creation of good records.
- (2) Universality—the means of payment is widely accepted by banks and most payees and payers and supported by an infrastructure that is widely available.
- (3) Certainty—processing time is nominal, and the legal framework clearly demarcates when value exchange occurs between the payer and payee with certainty about the value being transferred.
- (4) Security—the value transfer and supporting transactional identity information are protected from fraud and data breach.
- (5) Economy—the cost of the transaction is viewed by all parties as being reasonable and acceptable given the effort being expended to produce the transaction.
- (6) Information—the specific knowledge to record and process the transaction in accounts receivable or otherwise is readily available and the authorization and payee names are readily recognizable.

Considering these characteristics, the overall utility of the check remains quite attractive and would be even more so if it becomes an all-electronic instrument. As with credit, debit, and prepaid cards, checks can be used to compensate merchants for the receipt of a specific good or service. The transaction can occur by mail, in person or online. In addition, checks can also be used to transfer funds between individuals, P2P, who do not have established credit/debit relationships. These are all very convenient qualities.

Currently, there is still a considerable element of universality in the traditional check domain, in that checks are widely understood and accepted as a means of payment. It is not clear how well this acceptance would carry over to the EPO as a new check form. Marketing this new payment form would take some effort. We think that an elegant application on a mobile phone like an iPhone might generate significant buzz among upwardly mobile households that most banks would be eager to have as depositors. The sheer convenience of

having access second-by-second to a slick EPO payment application on a mobile device – without having to log into a computer and go to a website – would undoubtedly drive some adoption. For the EPO provider, the return per individual transaction might be small but the opportunity to process billions of transactions might make the product profitable for a few technically-savvy financial intermediaries.

It is also worth noting that the expected processing time for an EPO would be significantly less than that for an imaged paper check transaction, which is currently on the order of one day plus the elapsed time for a paper check to get to the BOFD. Thus, the elapsed time it would take an EPO to clear would clearly be less than for either a traditional or an imaged check.

4.1 Security

In terms of security, we believe the EPO provides significant opportunities to reduce check fraud. To be sure, a well-designed EPO needs as robust fraud deterrence capabilities as technology will economically support. In the end, what would be economical will depend on the appropriate scale of the operations and on the specific technology. Without getting into the technical details, here we sketch the various security methods that could be used in processing EPOs. We don't have enough information to determine the precise combinations of these methods that would achieve a balanced and secure platform most economically.

Historically, paper checks have been subject to a fair amount of opportunistic fraud. Undoubtedly, the ease by which forgers can alter checks has probably continued to increase in the twenty-first century, as the cost per unit of altering a document by scanning or copying has continued to fall. Thus, fraud has been a genuine problem for paper checks. We believe that there are straightforward means of overcoming these difficulties in an all-electronic environment.

Signatures are the standard identification mechanism in the traditional paper check domain. In a digital world, they can play a significant role as well. Indeed, the sophisticated use of electronic signatures can greatly enhance security for EPOs as compared with traditional

checks. The key idea is that the capture of an electronic signature indicates not only information about the pen stroke pattern in which the letters are formed but also the speed and the pressure.²⁸ Moreover, in a dynamic setting with repeated signature observations from the same check writer, the *variance* of each of these characteristics—pattern, speed, and pressure—can be recorded. This time-series sequence of signatures can provide virtually a unique identification without the additional need for biometrics.²⁹

On the other hand, there is no necessary reason to steer clear of biometrics in EPO applications. This technology appears to have come of age and provides a convenient method for avoiding unauthorized entry to smart handheld mobile devices, as well as portable and desktop computers, and networks. The Achilles heel for all of these devices is the careless use of passwords, such as never bothering to reset default passwords, which would make the device vulnerable to hackers. Thus, another potential security method in EPO applications would be to use biometrics to prevent an unauthorized use on a mobile or home-based device. For example, Apple is reported to have taken out patents to permit hiding a biometric reader inside an iPhone or Mac computer.³⁰ Assuming this biometric reader could also be invoked in EPO applications, the facility would enhance security on digital check applications. Such biometrics would then permit a company to offer lower rates for identity-theft insurance for those having biometric security, in much the same way that having a burglar and other alarm systems lowers homeowner's insurance rates.

Another security method to complement an EPO environment, which might be considered, would be a national check registry. Such a national registry would have been

²⁸ Since mobile phone ownership ordinarily involves a single user and is not shared, it is conceivable that this dynamic signature information could be stored on the mobile phone itself without invoking any connection to a centralized data base. That is, the authentication step could be locally computed on the mobile phone itself. Of course, the inherent U.S. strength in telecommunications might induce some providers to offer an additional authentication step to a central data base as an extra layer of security. Such connections or connections to backup information would be clearly helpful when phones are lost or destroyed.

²⁹ The electronic signature would be dynamic instead of static and, thus, much more effective in preventing fraud. The electronic signature has characteristics such as speed, patterns, habits, and pressure of the pen strokes. "Together these characteristics represent a biometric footprint, or dynamic signature, which is unique to every individual and cannot be reproduced by a forger even if the forger is aware of what the real signature they are forging looks like" (SOFTPRO Group White Paper, 2006).

³⁰ Katie Marsal, *AppleInsider*, March 27, 2009.

totally impractical to implement in an all-paper environment, but would be relatively straightforward in a digital environment. Given a national registry operating as a utility, EPO users could download blank check images from the national check registry. As EPOs were processed and cleared through the banking system, the existence of each item could be verified in the national registry.³¹ Each device could obviously have its own internal check registry for each separate account. As items cleared against an individual account, the update would be reflected on the internal registry so account holders would have an up-to-date picture of their account balances. In addition to helping with budgeting and self-control issues, this concurrent information would also be useful to detect potential fraud.³²

While straightforward conceptually, a national registry could end up being a roadblock to enhanced security over time. A national registry would be organized as a top-down utility. As a utility, it might not have a sufficient incentive to upgrade its own security procedures over time. It could be too slow to upgrade security procedures when warranted in order to preserve the short-term rents it received by virtue of being a utility. So, a surer path to enhanced security innovation might be found in the marketplace through competition between alternative EPO providers. This could arise spontaneously. For example, an initiator of a specific EPO transaction could register its device with its paying institution. This is common for online customer activities and would add a new level of control on checks. Also, it would be possible to design a system whereby an EPO would be sent to the payee and also to the paying institution at the time it was initiated. This information sharing would create more or less a positive-pay system for all EPOs.³³

³¹ Another layer of protection in this process could be added by using tokens (the concept we have in mind is something like digital versions of Chuck-E-Cheese tokens) rather than explicit account numbers for bank and payer or payees. Then the need for encryption could be conceivably reduced.

³² Indeed, items much out of sequence from the point of view of the national registry or items without a previous entry in the local registry could be automatically scrutinized or flagged for fraud review.

³³ In a positive pay system for an EPO, the date, amount of the transaction, payee name, account, and check number would be transmitted to the paying and payee institution. Before the paying institution honors an EPO drawn on a payer's account, it would compare the information on the EPO against the information sent by the customer. When the information doesn't match, further examination would be undertaken before the transaction is honored.

In the paper check domain, fraud crops up again and again, since it is not that difficult to forge the dollar amount of a check. In general, digital payments are less susceptible to fraud. But if a hacker is able to breach electronic system defenses, the fraud is potentially much more scalable in the digital world since the perpetrators potentially have much greater scope for mischief if they execute an attack on a large number of accounts.³⁴ Thus, significant barriers to entry and watchful monitoring must be essential ingredients of risk deterrence plans for EPOs. It should be noted that this vulnerability is shared by all other electronic payment methods.³⁵

4.2 Economical

Finally, EPOs should also embody the last characteristic of a desirable payment instrument: they should be viewed by all parties as economical. As a result of imaging, checks have become relatively inexpensive to process at the margin and would be even cheaper if the front-end paper-handling parts of the process could migrate to the digital sphere. Check payments have traditionally been priced on an item basis, at a markup over production cost. Extending this approach to the digital check EPO would be a powerful competitive advantage compared to the approaches followed for other types of electronic payments, where prices are set as a percentage of the value of the purchase. Thus, EPOs would have a natural marketplace niche for many purchases and assuredly for larger-valued transactions.³⁶

Furthermore, since the majority of B2B payments have largely remained in the check domain, it is evident that such payments have distinct characteristics that have been difficult to replicate in other payment systems. That is, the check writing process carries with it certain

³⁴ A recent DOJ press release on the RBS World Pay hack provides an instructive example of the scope of electronic fraud occurring on electronic networks today. The perpetrators of this hack stole \$9.5 million dollars by withdrawing funds from 2,100 ATMS in at least 280 cities worldwide using *only* forty four counterfeit payroll debit cards. U.S. Department of Justice, "Alleged International Hacking Ring Caught in \$9 Million Fraud, *Major Credit Card Processor Victimized in Elaborate Theft of Account Numbers.*" November 9, 2009.

³⁵ Would some version of FICO's card alert system be necessary in this system? Approximately 60% of the debit transactions in the United States are backed up by FICO's card alert system, which has sophisticated procedures and analysts to detect the sources of counterfeit debit card fraud. The technology for EPOs by itself would avoid some aspects of this fraud, such as that arising from hidden illicit skimmers. To the extent that banking networks embody more sophisticated security procedures already, the need for FICO's sophisticated technology maybe less relevant.

³⁶ This begs the question of why banks would be willing to give up the relatively high interchange income obtained on debit cards for EPOs. We take up this issue below, see section 6.

practical payment information that alternative payment vehicles have had difficulty in replicating. Additionally, the transition from paper payments to non-check electronic payments would require additional investments in systems for businesses. In the absence of a significant advantage to be gained from that transition, there is little reason for businesses to invest moneys to fix a payment that is providing good service. We believe social welfare would be improved by leveraging the existing investments in check imaging to capture the benefits already enumerated above. The cost of handling checks will fall, such that the marginal cost of processing a “fully imaged check from start to finish” will necessarily be a very small fraction of a penny – a very desirable result.

4.3 The Properties of an EPO versus that of a Debit Card

It might appear that an elegant “new” digital check or EPO on a smart phone would be just another form of a debit card. After all, if we cut through everything, aren’t debit cards just “plastic checks”? At first glance, one might have thought they were, but historically they have more in kinship with the ATM-credit card world than anything having to do with checks. Both the debit card and the EPO connect to a DDA account but that is where the similarities end.

The origins of the debit card go back to the 1970s when it was basically an ATM card. The debit card increasingly became a popular means of getting cash out of DDA accounts from ATM machines at any time, day or night. Over the next couple of decades, the technology became available to directly use a debit card as a payment instrument. However, such cards were initially slow to gain traction. In 1995 debit cards were used in only about one half of one percent of all retail payment transactions.³⁷ Around this time, the cost to process and clear paper checks was relatively expensive, very roughly a dollar or two per transaction.³⁸ On the other hand, fees associated with pin debit was relatively cheap, perhaps no more than eight cents per transaction. Thus, it seemed logical that it would only be a matter of time before the

³⁷ This estimate survey was undertaken as a part of a survey on transaction usage executed in 1995; for other results from this survey see Table 1 of Richard D. Porter and Ruth A. Judson, “The Location of U.S. Currency: How much of it is abroad?” *Federal Reserve Bulletin*, October 1996, pp. 883-903.

³⁸ See Proceedings from the Workshop on Promoting the Use of Electronic Payments... at http://www.chicagofed.org/news_and_conferences/conferences_and_events/files/2000_electronic_payments_conference_proceedings.pdf

debit card would become a prominent means of payment since at the time it was a much cheaper way to transfer funds out of a DDA than a check.

About this time, the four-party card associations, VISA and MasterCard, sought new profit opportunities, after they had grabbed much of the low-hanging fruit in the credit card space. They thought that putting debit card transactions on credit card rails would open new business opportunities and permit them to leverage their existing network infrastructure. So they engaged in large advertising campaigns to induce consumers to use debit cards.³⁹ Part of the associations' strategy was to encourage signature debit cards that mimicked the credit card experience in opposition to PIN debit cards that were being promoted by competing payment networks at grocery stores and other retail outlets. The underlying similarities and economics led them also to adopt a comparable business pricing model for signature debit as they had for credit cards. Merchants who accepted signature debit cards would have to pay interchange fees, and rewards programs for the card users eventually followed.

Apparently, the card associations timed their entry into debit cards at the right time. By 2003, there were almost twice as many signature based debit card transactions (10.3 billion) than PIN-based (5.3 billion). As previously mentioned, interchanged fees are charged to merchants for these transactions. For example, "Visa signature-based debit card interchange fees ranged from \$0.43 to \$0.57 on a \$40 transaction in 2004. Meanwhile, PIN-based debit card fees ranged from \$0.11 to \$0.38 on a similar transaction".⁴⁰ These charges are proportional to the value of the transaction and not a fixed lump sum amount per transaction so that they rise with the value of the transaction. A more economical pricing mechanism for both consumers and merchants would be a fixed annual amount to have EPO account services plus a small fixed amount per transaction, which would represent the marginal cost across the EPO network of an extra electronic check being processed.⁴¹ We believe that the cost associated with PIN and

³⁹ See David Evans and Richard Schmalensee, *Playing with Plastic: The Digital Revolution in Buying and Borrowing*, MIT Press, 1999, Chapter 12.

⁴⁰ See Lubasi, Victor. (2005), "Debit card competition: Signature versus PIN", *Chicago Fed Letter*, Number 221, December http://www.chicagofed.org/publications/fedletter/cfldecember2005_221.pdf

⁴¹ There could also be quantity discount pricing arrangements in both the fixed and variable proportions of these fees.

signature-based debit transactions would be substantially higher than those of an EPO transaction.

Therefore, at least in the beginning, EPOs and debit cards would be different in their cost structure. As stated in section 4.2, we contend that as EPOs gain market share, the cost of processing them will be dramatically less than that of paper checks. At equilibrium, the marginal cost of processing and clearing an EPO will be a fraction of a penny. And, in addition to EPOs cost savings, another main difference between them and debit cards is based on the property of convenience and was briefly mentioned in section 3.0. These P2P transaction participants, who are looking for alternatives to cash and paper check, are currently using payment services that often run on top of the expensive card rails. As per our illustration, an EPO could be sent to anyone who has an email account and a mobile phone loaded with check processing software.

So why isn't this attractive alternative method – the EPO – a current payment option? The cost and uncertainties of setting up a new system may not be that small. Nor necessarily are the problems of getting households to switch to what will be to some degree regarded as uncharted territory for first adopters. But an additional obstacle at the present time that appears to be hindering the check from becoming completely electronic is the law.⁴²

5.0 Legal Considerations⁴³

The 2003 Check 21 legislation (“Check Clearing for the 21st Century Act”) freed financial institutions from some of the provisions of the Uniform Commercial Code (UCC) governing check transactions.⁴⁴ Historically, the existence of the UCC process for modifying check law has

⁴² Since legally a check is either a signed order or promise, it would initially appear that the EPO process might be sufficient to satisfy current Uniform Commercial Code (UCC). However, this appears not be the case; see Jane K. Winn and Benjamin Wright. *Law of Electronic Commerce*, Fourth Edition, Aspen Publishers 2008.

⁴³ Some of the discussion in this section is based on analysis provided by the Washington D.C. Law firm of Swartz & Ballen LLP, which serves as counsel to ECHHO on these matters.

⁴⁴ During the 2002 revisions to the UCC, it seems as though references to “writing” were nearly uniformly replaced with a more media-neutral term, “record”. The sole exception occurred when referring to a negotiable instrument such as a check. The idea of a check being initially created on paper appears to have been preserved; see Winn and Wright, p. 7-36. In 1998, various banks entered a pilot program with the Department of Defense to test an electronic equivalent of a paper check and the project was deemed a success. Thus during the UCC revisions, it

tended to retard technological advancements in check processing.⁴⁵ But the UCC has become increasingly irrelevant as a result of several developments including Check 21.⁴⁶ For balance, though, we should not overstate the case since most of the UCC and Reg. CC check provisions still apply to substitute checks. The one key UCC provision that was overridden by Check 21 legislation was the requirement to obtain agreement by all of the parties with an interest in the check in order to truncate the paper check.

The diminished importance of the UCC process has been counterbalanced by the increased significance of private rules, from bodies such as NACHA for ACH rules and ECCHO for image exchange rules, resulting in a faster rate of improvements. For example, after Check 21, new check innovations such as remote deposit capture were created and have gained fairly wide acceptance in a relatively short time period.⁴⁷ Initially, these were done using scanning devices loaned or leased almost exclusively to business users in part to control fraud. More recently, USAA Bank first permitted ordinary consumers to scan checks for deposit and later allowed account holders who were eligible for credit and had some type of insurance through USAA to use an iPhone application to make deposits remotely.

Since EPOs are not covered by existing law or regulation, we think that their legal standing must be based on private agreements. Although UCC provisions have been interpreted as requiring payment instruments (drafts/checks/orders) to be in writing with ink signatures, current check law does not specifically address electronic checks or EPOs. Together, UCC, the Federal Reserve Expedited Funds Availability Act (EFAA) and Regulation CC do provide legal authority for banks to exchange images of paper checks, but the policy details for image exchange are left to private agreements or clearing house rules. In addition, Check 21 does not provide legal coverage of EPOs, and neither does the Electronic Signatures in Global and National Commerce Act (ESIGN), nor the Uniform Electronic Transactions Act (UETA). However,

was suggested that this “e-check” was unlikely to have significant market penetration unless the code was revised to recognize completely electronic checks. The suggestion was apparently rejected by the Fed because of the concern that such quick innovation in the payments system could undermine the safety and soundness of the U.S. banking system; see Winn and Wright, 7-38.

⁴⁵ New York State, for example, has not yet adopted the UCC check provisions originally formulated nearly two decades ago.

⁴⁶ This is the theme of Stephanie Heller’s paper, Heller, *op cit*.

⁴⁷ It appears that they came to market in 2005, less than a year after Check 21 came into existence.

there is nothing in these laws that prohibit parties to a payment transaction from agreeing among themselves to apply check law principles to EPOs.

Considering the previously mentioned benefits of EPOs, it is plausible that parties to EPO payment transactions will choose to apply check law principles to EPOs. Thus, an EPO would have legal sanction through such an agreement-based approach. These agreements might affirm that the payee and payer of an EPO, and all bank participants in the collection of an EPO, will agree that the principles of the UCC 3 and UCC 4 as well as EFAA/Reg. CC will govern the rights of the parties with respect to EPO processing and payment. Depending on applicable technology, it may also be possible to obtain the same agreement of any intermediary endorsers. In addition, these agreements could possibly establish that the EPO will be treated as a “check” and an “item” for purposes of these laws; the customer’s electronic signature on the EPO could be equivalent to a customer’s written signature.⁴⁸

An agreement-based approach for acceptance and processing of EPOs is consistent with the legal structure for other retail payments today. Credit/Debit Card, ACH, and Internet payment services are not based on a statutory structure but rather are primarily agreement based. Interestingly, if the EPO structure were based on agreements, check users could have additional security from consumer protection laws that overlay the agreement provisions.

In addition, if the Federal Reserve System were to support the EPO concept at the legislative level, much like it did for the Check 21 legislation, the enhanced support would likely accelerate this electronification process, and expedite EPOs’ market penetration leading to a more socially efficient payment system. Such actions, while they might be advantageous, are not necessary. Ultimately an agreement-based approach for EPOs could be just as successful.

While the universality of the Check 21 legislation and the actions of ECCHO and the Federal Reserve jumpstarted check imaging, we believe that, it would be a smaller step to implement EPOs given where the industry now is with image implementation. By contrast, getting new legislation through Congress can take a considerable period of time. The passage

⁴⁸ But the signature could have added security; see SOFTPRO Group White Paper, 2006 and footnote 25.

of Check 21 was achieved in short order because there was no opposition. This provision could quite conceivably meet with more opposition from those having a vested interest in other payment options and if Congress were to include some provisions that banks regarded as counterproductive, there could be broad opposition. Moreover, image exchange has progressed at record speeds through agreements and not Federal law.⁴⁹

6.0 Scalability

We contend that once these legal obstacles are overcome, financial institutions will realize that providing such digital EPO services just might represent a completely different competitive growth path. Rather than continuing to invest in “brick and mortar” branches, which are used primarily to attract new customers, they could put their resources into software and hardware developments that would attract depositors over the internet medium rather than through the front door of a bank branch. Physical branches generally are limited to only serving customers in proximity to the branch while, on the internet, everyone is next door. That is, new depositors could be reached on the internet electronically – a process that at first glance appears to be much more conducive to a scaling-up growth strategy.⁵⁰ A proliferation of this technology could quickly spread throughout the financial industry, creating a more socially efficient payment system.

It is plausible to assume that such internet-based banks will be part of a system of banks that branch across states. Interstate bank branches have grown fourfold in the past decade or so, as shown in Table 1. Part of this growth simply reflects the opportunity to expand to satisfy latent demands when all the prohibitions on interstate branching were finally lifted in June 1997.

⁴⁹ Federal law did provide the inducement, though by eliminating the need to have hundreds of millions of agreements to truncate the original paper check so long as it was replaced with a paper substitute check.

⁵⁰ To be sure, we are talking about remotely created deposit accounts, which would need some extra layer of security when the account is being set up. The apparent need for a face-to-face meeting to know the DDA customer when the account is being set up may present problems for our narrative. For consumer accounts tied to smart hand held devices the telecoms could well end up being part of the equation. If so, the face-to-face location problem is solved since the telecoms have a number of offices to service accounts and sell equipment. Alternatively, the technology to handle security and transactions in non face-to-face settings is growing rapidly.

Table 1 : Number of Interstate Branches of FDIC-Insured Commercial Banks and Savings Institutions	
June 30 th	Number of branches
1997	8,876
2008	35,822
Source: FDIC	

The retail deposit rates banks offer households may be a relatively low-cost and stable funding source compared with wholesale deposits. But the buildings they build to attract such depositors are not particularly inexpensive. A recent estimate by Bancography, a Birmingham-based consulting firm, places the full cost of having a 3,500 square foot bank branch at between \$2.4 and \$2.9 million.⁵¹ Assume for simplicity that such an estimate applies to all the interstate branches in Table 1. Then the (annual) cost of replicating the current interstate bank branch structure would be between \$84.2 billion and \$104.9 billion. The simplest explanation for this outsized bank branch structure is the relatively low-cost of gathering retail deposits. Given the current economic situation involving considerable consolidation in the banking industry, "Banks are broadly reassessing their branches,"⁵² indicated Bob Meara, senior analyst at Celent. But Meara added, "Branches will be central to deposit gathering for some time."⁵³

We argue that a cheaper deposit-gathering strategy for a small number of technologically savvy banks would be to develop Internet products that don't necessitate having branches to attract depositors. A prototype of what we have in mind is USAA, a private FSB that caters to Military families. This bank "has enjoyed explosive deposit growth in recent years despite having a virtually non-existent retail branch network."⁵⁴ USAA's growth strategy has been to use technology rather than branches to expand its deposit base. From 1998 to 2008, its deposit base grew nearly sixtyfold at an annual rate of 22.7% (Figure 2). USAA FSB is

⁵¹ David Ellis, "Goodbye local bank branch: Lenders are culling locations as a result of the recession and industry consolidation. How deep will they go?" CNNMoney.com, August 12, 2009. Alternative estimates from a large bank that is supervised in the Seventh District range from \$1.6 to \$1.9 million, which would lower the overall replication costs discussed in the text from \$59 billion to \$69.5 billion.

⁵² Ellis, *op. cit.*

⁵³ Ellis, *op. cit.*

⁵⁴ Ellis, *op. cit.*

now able to serve over six million clients. A more recent entrant into internet banking ING FSB has experienced an even more spectacular rate of growth, 69.9% per annum, over a much shorter period (Figure 3).⁵⁵

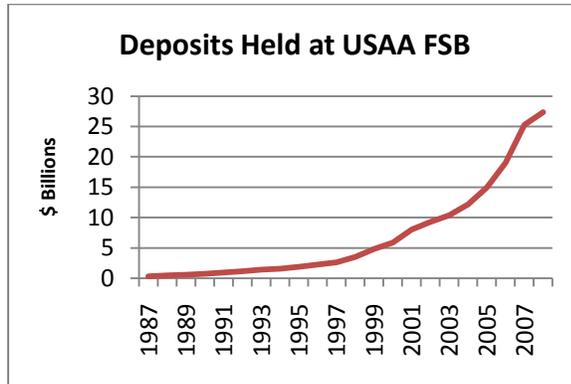


Figure 2: Deposits Held at USAA FSB

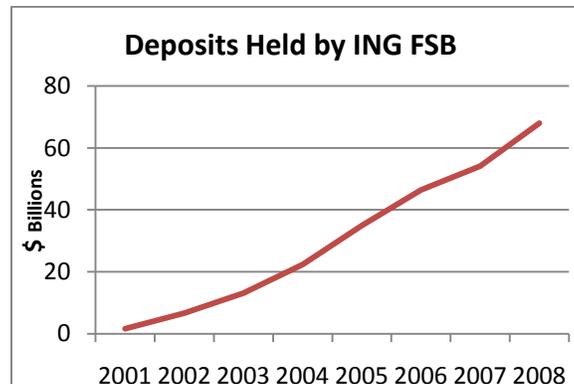


Figure 3: Deposits held at ING FSB

The point is that USAA represents an affinity group, current and former military personnel and their families.⁵⁶ These clients may not be located near each other but they form a virtual community on the internet. A high-tech service provider that would link with a banking organization could gather deposits on the internet provided it was viewed as safe,

⁵⁵ As a result of investments in Alt-A mortgages in the United States, ING has ended up in financial difficulties. This occurred despite the fact that its virtual banking internet operation sub, ING Direct, had been quite successful. See Egbert Kalse, "ING Direct was source of success and problems for Dutch bank," NRC Handelsblad, October 30, 2009.

⁵⁶ Such growth strategies have worked before, for example, MNBA became the largest independent credit card issuer in the 1990s, specializing in affinity groups such as graduates of a given university.

secure, and reliable.⁵⁷ The technological opportunity is there and if the banks don't take it, the telecom companies could.⁵⁸ While the revenue per transaction might be considerably smaller than the current interchange fee on credit and debit transactions, it is not that clear whether the interchange pricing model is that sustainable. Moreover, a large-scale provider could achieve high returns by scaling up its operations sufficiently. This vision does not seem to be such a ludicrous proposition in today's highly efficient and sophisticated computing and telecommunications environment. Just as a few titans dominate word processing and econometric software, one could imagine that a few providers would also come to dominate the check writing software on mobile phones.

7.0 Conclusion

The back-end of the check processing system (where checks clear and settle) has been completely modernized based on image technology together with enabling laws and regulations and private agreements. As a consequence, the lion's share of checks that are written by individual consumers and businesses are now converted to images early in the clearing process, resulting in substantial efficiency gains. Nonetheless, there remains potential for process and technology improvement, by extending the benefits of digital checks all the way to the check writer. A digital check would make additional benefits available to the check writer in the form of greater convenience (payment initiation and record keeping), time savings, and reduced physical handling expenses. Security could also be enhanced in comparison to traditional paper checks. The enabling technology and at least partial consumer acceptance of the enabling technology exist today.

Allowing check writers to initiate their payments as images, thereby extending the image processing infrastructure all the way to the individual check writer, would avoid paper

⁵⁷ Of course, this need not be tied to the EPO for it to work. The success of ING indicates that a savings deposit account could also be highly successful.

⁵⁸ At the Chicago Fed's 2009 payments conference, Richard Crone, Crone Consulting LLC, argued that an opportunity exists for financial institutions to get on board with mobile payments to reduce transaction costs and promote loyalty through mobile self-service, payments, and banking. If they failed to do so, the telecom companies were well positioned to offer payment services. See Katy Jacob, Carrie Jankowski, and Anna Lunn, "Payments Pricing: Who Bears the Cost?—A conference summary," *Chicago Fed Letter*, September 2009.

completely. The core idea is that the substantial existing investment in the image processing infrastructure can be leveraged at what is likely to be a moderate incremental cost by offering consumers and businesses EPO applications, particularly for individual consumers on their smart phones (although these applications could readily be provided on home computers through the on-line banking systems).⁵⁹ Longer term, it is plausible to think that the U.S. payments system might evolve in line with developing international standards for digital payments (for example, ISO 20022 XML). Until that distant day arrives, however, it may be in the best interest of the U.S. payment system to continue to leverage its historical commitment to and investment in “the check.”

⁵⁹ It is our contention that the smart hand held phone will provide a more user friendly environment than home banking. For one, there are more phones in the world than computers. Further, these phones now or soon will have more computing power than super computers of a generation ago. The size of this market will create more attractive and friendly environments than the home computers. Compare the much wider range of applications available on phones than on home computers since the advent of Apple’s iPhone.