PAYMENT SYSTEMS IN THE US AND EUROPE: EFFICIENCY, SOUNDNESS AND CHALLENGES

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Abstract

This article surveys the recent changes in and outlook for wholesale and retail payments in Europe and the US. We document a convergence in payments institutions and patterns of use, although differences in retail usage remain.

An overarching theme of our survey is the importance of the differences in regulatory structure between the two areas. These differences are both a product of differing initial conditions and a catalyst for contrasting responses to current technological challenges. The Single Euro Payment Area (SEPA) is a major effort to unify the payment market and instruments in Europe, although substantial heterogeneity remains in some payments platforms. In the more unified US payment system, centralized programs for payment system improvement are much weaker and more preliminary.

We examine the consequences of this difference on the responses to the most recent payment innovations – the so-called fintech revolution. Here the key regulatory challenge is to balance the concerns of the traditional providers of payments services within the financial industry with the needs of the newcomers, in order to obtain the right tradeoff between innovation and safety.

1 Introduction

To those of us who have studied payments and payment systems for a long time, the recent popular interest in them is disorienting. Payment arrangements are part of the basic "plumbing" of the financial system and are critical to the efficient operation of the system; any malfunction can cause significant disruption and instability. Nonetheless, the procedures and structures that support payments are typically invisible to final users. Therefore we payments researchers are used to yawns in response when we describe our research.

Now, however, we get pummeled with questions: "What will happen with Bitcoin?"[1] of course, but also "Are these smart phone payment apps really safe?" "What do I do to protect myself from identity theft?" and the perennial "Why are banks charging so much for…?" Dramatic advances in technology, worries about safety and stability of the infrastructure, and public policy concerns about the competitiveness of the banking industry have converged to bring payments and payment systems into to the public's consciousness. Meanwhile, spurred by these same developments, researchers have made enormous progress in the study of payments and payment systems both at the theoretical and empirical levels.

The goal of this paper is to review and compare some of the recent changes in payments systems in Europe and the US in the light of this work. Our fundamental questions are these: how efficient and how stable are these systems at the wholesale and retail level, and what has been the effect of recent technological innovations and policy initiatives on their efficiency and soundness?

The article is structured in three sections following this introduction. Section 2 surveys the main theoretical advances regarding the structure of retail and wholesale payment systems

1 And regardless of this interest, we will for the most part not deal with Bitcoin or similar virtual currencies in this survey. Despite their increase over the last few years, and the interesting theoretical and technical questions they induce, virtual currencies still remain an economically relatively unimportant issue, and their use as a medium of payment – as opposed to a speculative investment – is still extremely limited.

as well as the recent institutional and regulatory developments in Europe and the US. A comparison of the structure of the EU and US payment systems is made in Section 3. Section 4 analyses some recent challenges, paying particular attention to the impact of fintech. Section 5 concludes.

2 The relevance of payments in the economy and the main developments in Europe and the US

The peculiarities of its national payment systems and their process of integration into a single market make the European case a particularly interesting object of study. Payment, clearing and settlement arrangements in Europe have been progressively converging into the so-called "single payment area," with different directives aimed at achieving common standards, promoting efficiency, monitoring innovations and protecting final users. A growing number of instruments and mechanisms have been developed under common standards. If these developments are not effectively managed, significant problems can arise from their credit, operational or legal risks.

The US has not had the difficulties of a transition to a unified arrangement. On the other hand, greater restrictions in the US on the powers of regulatory authorities to establish or enforce standardization or unified solutions has provided its own set of challenges, as regulators and government struggle to deal with the conflicting demands of heterogeneous, entrenched sectors of the economy.

For both the US and Europe, the latest challenge is innovation by non-financial institutions entering the payments arena, as a part of the so-called "fintech revolution." The ability of these two different regulatory structures to adapt their systems to this new opportunity will have a significant impact on their relative economic performance in the coming decades.

2.1 RELEVANCE OF PAYMENTS TO THE ECONOMY

The capacity to make payment is probably the most fundamental piece of infrastructure for any economy that has developed beyond the stage of pure barter. In an economy with multiple steps of production from raw material to finished product, the value of payment is many times the value of GDP; in the US the value of retail payment in 2014 was $203 trillion while in the Eurozone, it was €143 trillion or about 12 and 14 times respective GDPs.[2]

Because economies are so dependent on payment systems, and the amounts involved are so massive, the potential cost of their failure is high. Disruptions to the payments system have generally been associated with disruptions to commercial activity, as regularly observed in the nineteenth century US and, more recently in Cyprus and in Greece.[3] For this reason, safety and stability of the payment system is a fundamental concern for financial policy.

Also, because of the size of the payments system, there is a concern that inefficiency in the system can act as a drag on economic activity. A report by Schmiedel *et al.* (2012), suggests the costs to society of providing retail payment services can vary between 0.80% and 1.20% of GDP. Other studies estimated even larger costs, of around 3% of GDP [Humphrey *et al.* (2003)].[4] Clearly then reductions in cost can provide real gains to an economy. Moreover, the costs of payments services at the retail level are borne unequally: innovations in payments services can bring additional economic gains by reducing the burdens on the

2 Sources: Federal Reserve and European Central Bank.

3 On the other hand, there have been examples where disruptions to the payments systems have had surprisingly minimal effect on economic activity-notably in Ireland [see Norman and Zimmerman (2016)].

4 Other specific country-level studies, show, for example, that in the Netherlands, the total cost of all point-of-sale (POS) payments was estimated to be 0.65% of GDP in 2002 [Brits and Winder (2005)], while in Belgium was 0.74% of GDP in 2003 [Banque Nationale de Belgique (2005)].

poorest segments of the population, although the diffusion of new technologies among the most deprived obviously entails its own cost.

Innovation in payments brings its own set of concerns. Historically, policy makers worried about whether the payment system was robust enough to withstand macroeconomic shocks faced by the financial institutions that underpinned it. The entry to payments service provision by institutions based not in the financial sector, but in the tech and retail sectors, might lead to a system less affected by variations on the financial side of the economy. On the other hand, any instability could be exacerbated, both by limitations to the financial depth of these new players, and by weaknesses in the system at the interface between old and new payments systems. Thus the successful integration of the new technologies into the existing framework becomes a challenge for payments regulators.

The effect of introduction of new payments providers are mainly a concern for the retail portion of the payments landscape. Wholesale payments are undergoing technological and institutional changes as well, but on the whole are currently facing few challenges from new types of institutional entrants. The challenge there arises from the vast size of the system, the fact that the payments processed by any player on a daily basis can be many times the value of the player itself and the complexity of the interactions among the participants in the network. These issues only become more acute as systems become more internationally integrated and interdependent.

2.2 THEORY

In the abstract, all payments are the settlement of obligations through transfer of a mutually acceptable medium of exchange. A payments system "that set of arrangements for the discharge of the obligations assumed by economic agents whenever they acquire control over real or financial resources" [Borio *et al.* (1992)]. In any such system, the ultimate difficulty is in getting the payor to pay what he is supposed to pay. When the payor and payee are known to each other and interact repeatedly, very informal procedures can be effective – indeed if each of the pair is payor and payee about equally, the maintenance of a "running tab" between them may make payment itself unnecessary. However among strangers (or even among individuals well known to one another if the stakes become large enough) more formal arrangements are necessary. Payment systems are designed to facilitate these transfers.

Payments arrangements can be divided into store-of-value systems and account-based systems:

> *Store-of-value systems, such as commodity money, fiat money, and stored value cards, are founded on the transfer of some payments object (be it coins, notes, or electronic stored value) between payer and payee, and they depend critically on a payee's ability to verify the payments object. Account-based systems, such as charge accounts, checks, and credit cards, require the keeping of accounts in the name of the payer and payee. The success of account-based system hinges, most fundamentally, on the ability of its participants to verify the identities of account holders, to ascertain the link between transactors and histories*.[5]

Where a payment transaction in a store-of-value system can be arranged between just the payor and payee, the transaction in an account-based system involves (at least) *three* parties:

5 Kahn and Roberds (2009). The distinction between account based and store-of-value systems was initially observed by Green (2004).

payer, payee and account provider. In other words, since the process takes place on the books of the account provider, there has to be a protocol to communicate to the provider that the transaction is to take place and a process to confirm to the parties that the transaction *has* taken place.[6]

Thus store-of-value systems have traditionally been most useful for small immediate payments, relying on the instant recognisability of the medium. Account verification has required greater overhead and so has tended to be used more for larger and more delayed payments. With declining costs and increasing speed of communications, the account-based systems have over time moved into the realm once reserved for store-of-value.

At the retail level, security of the system means ensuring that these processes cannot be corrupted: that it is difficult for one party to fraudulently initiate or terminate a transaction, that once initiated there is a high likelihood that the transaction will proceed to completion, and that confirmation of completion is swift and certain.

At the wholesale level, stability of the system also means ensuring that the transaction proceeds smoothly, but the focus shifts to systemic considerations. Although individual transactions are large, and the (electronic) safeguards for their integrity are important, repeated interactions, sophistication of participants, and ability to standardize procedures, make verification of legitimacy of individual transactions less of a problem.[7] The greater costs from failures of individual transactions arise from the potential for systemic instability. In typical large value payments systems, the ability of a financial institution to make its obligated payments during the day depends on its ability to receive obligations from other institutions as well. Thus a system will be unstable if its design tends to cause individual failures to propagate in cascading fashion, and so a major concern for designers of payments systems is to ensure that individual payments failures remain isolated.

Dealing with financial stability issues in payment systems has become more complex nowadays with the concurrence of different important market changes. As suggested by the governor of the Bank of France, Villeroy de Galhau (2016) these transformations include a growing appetite for digital solutions, which has drastically altered consumption approaches; the public's clear mistrust of the banking world in the wake of the financial crisis; and the regulatory changes aimed at promoting increased standardization and transparency in financial transactions, which have also encouraged more electronic trading.

2.3 RECENT INITIATIVES IN THE EU AND THE US

European regulation

In Europe different legislative initiatives have progressively converged to a more general aim: the creation of the so-called Single Euro Payment Area (SEPA), whose goal is a Europe where all transactions (domestic and cross-border) offer the same conditions of ease, efficiency and security. SEPA covers all EU member states, as well as Iceland, Norway and Switzerland. SEPA deals with several aspects of efficiency in payments systems, including common instruments, standards, procedures and infrastructures. It has focused mainly on

6 One of the most interesting possibilities for the block chain technology that underlies Bitcoin is its adaptation to development of account-based systems which eliminate the need for the role of the third-party communication. Note that, unlike Bitcoin these applications of block chain technology need not be outside the standard regulatory systems; indeed payment systems using them could still operate in and be backed by central bank money.

7 This is not to say that individual transaction failures cannot impose costs on participants in wholesale systems; indeed concerns about such costs are a major policy issue in Europe. The recent hack of the Bangladesh Bank's account with the Federal Reserve Bank of New York, resulting in a loss of $101 million, show that even central banks can be vulnerable to major fraudulent transactions.

three payment instruments: credit transfers, direct debits and payment cards. SEPA took its first operative steps in January 2008, when SEPA Credit Transfers were put in place, enabling credit transfers under homogenous standards within the EU. SEPA Direct Debit followed in 2009.

The European Commission has collaborated with the European Central Bank and all central banks in SEPA countries to achieve the goals of SEPA. Coordinated oversight of payments systems is fundamental to the common treatment of payments; the legal basis for this oversight is set out in the Treaty establishing the European Community and the Statute of the European System of Central Banks (ESCB) and the European Central Bank (ECB). The Statute mentions that "the basic tasks to be carried out through the ESCB shall be [...] to promote the smooth operation of payment systems […] The ECB and the national central banks may provide facilities, and the ECB may make regulations, to ensure efficient and sound clearing and payment systems within the Community and with other countries".

The main regulatory initiatives connected with SEPA have been the following:

— The Payment Services Directive (PSD), on the standardized set of rules applicable to all payment services provided in the European Union.

— Regulation EC 924/2009 (amended by Regulation 260/2012) that establishes equality in the fees charged for domestic and equivalent cross-border payments in euro, except for checks.

— Regulation EC 260/2012, which establishes deadlines for migration to the SEPA instruments by setting a series of technical and business requirements for credit transfers and direct debits in euro.

Converging to electronic payment standards and creating a single market for payments is expected to generate significant cost savings for all market participants. An impact study conducted by PricewaterhouseCoopers (PwC) for the European Commission[8] summarized these estimated benefits after the full completion of SEPA:

— Potential savings for all stakeholders (corporations, public sector, banks, and clearing and settlement mechanisms) of €21.9 billion on a recurring annual basis, resulting from price convergence and process efficiency. Part of the improvements come from a reduction of up to 9 million bank accounts estimated, resulting from more efficient corporate euro cash-management infrastructures.

— €227 billion estimated to be unlocked in credit lines and liquidity. These benefits are realized from cash pooling and efficient improvements in clearing.

Large companies and small cap companies are expected to enjoy more cost savings from SEPA improvements, although the benefits seem to extend also to other firms. Whether these benefits will be finally realized or not will depend on the efficiency of the SEPA structure and also on the oversight of the system.

8 http://ec.europa.eu/internal_market/payments/docs/sepa/140116_study_en.pdf, report dated January 16th, 2014.

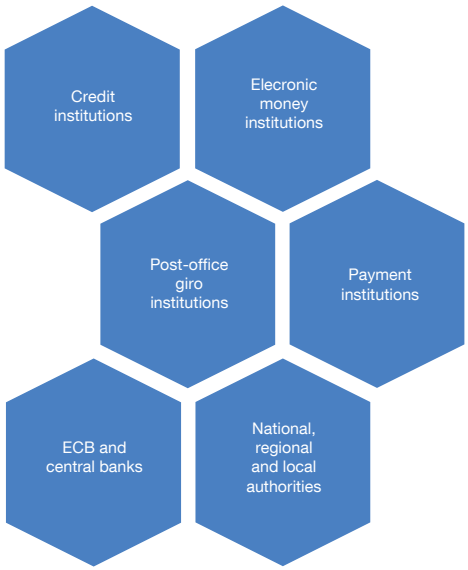
The new channels for retail payment instruments, and in particular the complexities of introduction of non-bank players into the payments arena, have stimulated the development of legislative and regulatory responses in the EU. As a result, a revised "Payment Services Directive" is currently being implemented, dealing specifically with electronic payments in Europe and the need to make them more secure and more convenient for European shoppers.

The PSD2 (technically specified as Directive 2015/2366 of 25 November 2015 on payment services in the internal market) was published in the *Official Journal of the EU,* on 23 December 2015 and entered into force on 12 January 2016. Member States will have two years to introduce the necessary changes in their national laws.

The new rules include strict security requirements for the initiation and processing of electronic payments and the protection of consumers' financial data. PSD2 also envisages opening the EU payment market for companies offering consumer or business-oriented payment services based on the access to the customer's payment account – the so called "payment initiation services providers" and "account information services providers." This will also make necessary to enhance consumers' rights in numerous areas, including reducing the liability for non-authorised payments, introducing an unconditional ("no questions asked") refund right for direct debits in euro. Another noteworthy novelty of PSD2 is the prohibition of surcharging (additional charges for the right to pay *e.g.* with a card) for the use of payment instrument for which interchange fees are already regulated.

Importantly, PSD2 incorporates a list of "categories of payment service providers," as shown in Figure 1. Along with credit institutions, two categories deserve specific definition. One is "electronic money institutions" which are those that issue electronic money that can be used to fund payment transactions and which should continue to be subject to the prudential requirements laid down in Directive 2009/110/EC. The other one is "payment institutions," which are those legal persons that are granted authorisation to provide and execute payment services throughout the European Union. Obviously, the same institution *(e.g.* a bank) may also exercise these functions but this definition embraces a large and growing number of non-bank providers. As also noted in the preface of PSD2, "while this

PAYMENT SERVICES PROVIDED IN THE EUROPEAN UNION AFTER THE APPROVAL OF PSD2 FIGURE 1



SOURCE: Authors' elaboration from PSD2 main text.

Directive recognises the relevance of payment institutions, credit institutions remain the principal gateway for consumers to obtain payment instruments." This is the case because European regulators assume that most payments at the point of sale today are card based, even if "the current degree of innovation in the field of payments might lead to the rapid emergence of new payment channels in the forthcoming years." PSD2 specifically opens the prudential regime – the single license for all providers of payment services which are not connected to taking deposits or issuing electronic money – up to the payment initation services providers and the account information services providers.

US Regulation

The regulatory experience in the US contrasts sharply with that in the EU. In particular, there has not been an overarching, systematic program focused on regulation of the payment system. This conclusion might be surprising in light of the Dodd Frank Wall Street Reform and Consumer Protection Act of 2010. Passed in the wake of the financial crisis, and the resulting review of US financial infrastructure and its performance, the bill is the most comprehensive (and compendious) piece of financial legislation ever enacted in the US. Among its many provisions are those setting up new financial authorities – in particular a systemic risk regulator (the "Financial Stability Oversight Council") and a consumer protection structure devoted to financial products (the "Bureau of Consumer Financial Protection"), and providing additional powers and responsibilities to existing authorities – notably the extensions of the powers of the Federal Deposit Insurance Corporation as an authority for resolving failed institutions. Provisions were made for changing the regulatory environment for deposit insurance, for over-the-counter derivatives, for hedge funds, for credit-rating agencies, for insurance companies and for executive compensation in financial institutions.

Despite all of this, the attention paid in the act to the payments system was relatively mild. Within the Dodd-Frank legislation, the "Durbin Amendment" requires the Federal Reserve to set "reasonable and proportionate" limits on the fees charged to retailers for debit card processing. Small issuers of cards (those with less than $10 billion in assets) are exempt from the legislation. The amendment also allows merchants to offer differential discounts for different payments methods or different cards (but not for different issuing banks for the same card). On the wholesale side, the act resulted in the designation of two of the backbone wholesale systems CHIPS and CLS as systemically important payments systems, with the Board of Governors of the Federal Reserve System as lead regulator in each case.

On the consumer side, an equally significant source of changes in the regulatory landscape came from the slightly earlier "CARD Act" of May, 2009, which put additional consumer protections on the activities of payment card providers. Among the provisions are restrictions on arbitrary rate increases, on manipulations of due dates, and on over-the-limit fees and procedures. The act requires roll back of penalty rates due to late payment after six months of good behavior. The results have not been entirely successful: there is evidence that in response issuers have tightened other terms, including introducing annual fees and reducing promotions, as well as dropping unprofitable card holders.

If we want to find recent significant regulatory input into the development of the payment system in the US, we need instead to strategic initiatives undertaken by the Federal Reserve. This process started in 2012 under the initial direction of the Financial Policy Committee (FSPC), a committee composed of three Reserve Bank presidents and two Reserve Bank first vice presidents, "responsible for the overall direction of financial services and related support functions for the Federal Reserve Banks, as well as for providing Federal Reserve

Bank leadership to foster the integrity, efficiency and accessibility of the evolving US payment system." The current status of the project is outlined in the paper "Strategies for Improving the US Payment System" describing among other things, a series of task forces consisting of representatives of industry and public interests, intended to advise on the directions for improving payments services:

> *The primary strategies call for (1) sustaining our recently enhanced engagement with payment system stakeholders; (2) working with payment stakeholders to identify effective approach(es) to implementing a US payments infrastructure to support a safe, ubiquitous, faster payments capability that promotes efficient commerce, facilitates innovation, reduces fraud and improves public confidence; and (3) collaborating with stakeholders to reduce fraud risk and advance the safety, security and resiliency of the payment system*.[9]

In particular, the 331-member Faster Payments Task Force was established in 2015 to identify methods to implement improvements to speed, safety and efficiency of Payments in the US, including the evaluation of proposed solutions based on 36 effectiveness criteria. The four design options to be studied are: 1) an enhancement of the debit card networks, 2) extension from an internet protocol, 3) development of a new real time infrastructure while retaining legacy infrastructure for settlement, and 4) development of a new real time infrastructure which will also replace existing ACH and check platforms. Proposals will be evaluated by the consulting group McKinsey & Company and the plans and evaluations will be made available to the task force this year, with the final report anticipated for 2017.

In all of this, the Federal Reserve is described as a "leader, catalyst for change and provider of payment services" (report, p. 1). For new non-bank payment systems the regulatory role is minimal: such systems are likely to be regulated under separate state-level regulations as "licensed money transmitters" and to deal at the federal level primarily in terms of anti-money laundering and anti-terrorist financing legislation, neither of which is the preserve of the Federal Reserve. Even in its role as a provider of payment services, the Federal Reserve is sharply circumscribed by the principles outlined in the 1990 policy statement ("the Federal Reserve in the Payments System")[10] and which is still regarded as determinative: In order to introduce a new service or enhancement on its own, the Federal Reserve must meet several criteria, including anticipation of full cost recovery, and of inability of other providers to meet the need.

In the case of the faster payments the policy statement says that the Federal Reserve is currently examining "policy issues associated with a possible multi-party environment, such as the framework for establishing rules." This preliminary position contrasts somewhat with SEPA; the difference probably reflects both the differing speeds of adoption of new payments technologies in the two areas, and the difference in relative political power of the regulators and the industry.

3 Payment systems in Europe and the US: comparative structure

3.1 WHOLESALE SYSTEMS

Europe's wholesale systems have been part of the worldwide transition from "Deferred-Time Net Settlement" (DTNS) systems to "Real-Time Gross Settlement" (RTGS) systems.[11] In a DTNS system a net position of each participating bank is calculated as the sum of the value of all the transfers a participant has received up to a particular point in time

9 Federal Reserve, "Strategies for Improving…" (2015), p. 2.
10 http://www.federalreserve.gov/paymentsystems/pfs_policies.htm.
11 Bech and Hobijn (2007).

minus the value of all transfers it has sent. In a DTNS settlement takes place once a day. In the RTGS the settlement is made on a gross basis – payment instructions are processed on a one-by-one basis – and the settlement is made on a real-time basis. Therefore, RTGS offers advantages compared to DTNS in terms of credit, liquidity and systemic risk.

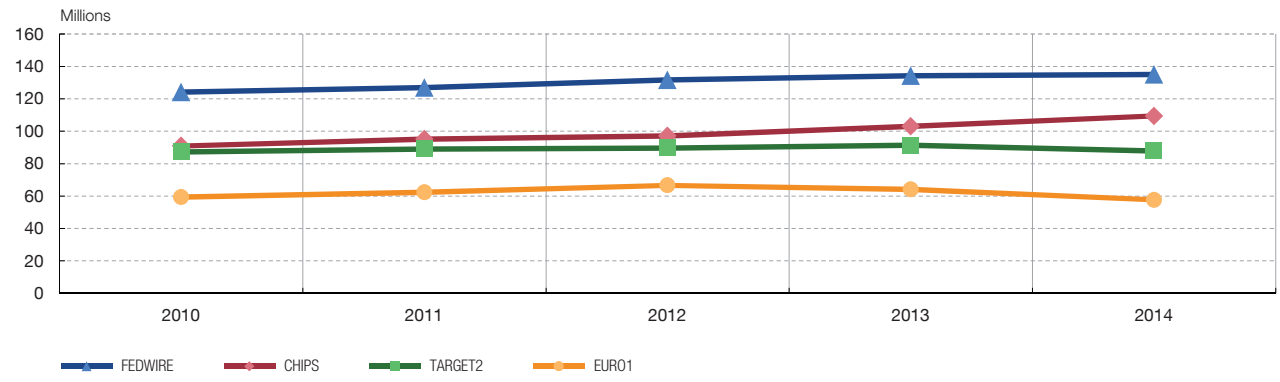
In the US, the backbone of the wholesale payments system is provided by Fedwire, run by the Federal Reserve. While the Fedwire system has been operating as a RTGS since 1985, several European countries adopted RTGS systems more recently. As the project for a single payments evolved during the 1990s, the EU adopted TARGET, a system that was created to settle transfer with the creation of the Euro as a single currency. Only national RTGS systems were allowed to link to the TARGET system. Not surprisingly, adopting an RTGS system became a prerequisite for joining the Economic and Monetary Union (EMU). All central banks that planned to introduce the Euro adopted RTGS systems before 1997.

Several technical developments followed in the Eurozone, most notably TARGET2, which involved moving from a decentralized structure to a centralized structure with a Single Shared Platform (SSP). As of 2014, Fedwire had 7866 participants, and TARGET2 had 2364 participants, of whom 1599 were classified as direct participants. The latest data for Fedwire, from the fourth quarter of 2015,[12] shows average daily volume of 581,339 payments, with average value of $3.3 trillion. As of February 2016 (latest data available) TARGET2 processed a daily average of 354,263 payments, representing a daily average value of €1.9 trillion. In other words every five days each system handles payments corresponding approximately to its annual GDP. TARGET2's share in total large-value payment system traffic in euro is 91% in value terms and 61% in volume terms, while the remaining is processed by EURO1. As a proportion of large value payment in the US, Fedwire is correspondingly less, because of the importance of CHIPS, the interbank payments system privately owned by the Clearing House. Fedwire represents 69% of US large-value payments traffic in value terms and 55% in volume terms. Charts 1 to 3 provide recent comparison of these four large value systems in terms of both value and volume. While the demand for the services of large value systems is affected by the demand for goods and services in the economy, it is more directly affected by the extent of financial transactions in the economy.

12 https://www.federalreserve.gov/paymentsystems/fedfunds_qtr.htm.

LARGE VALUE PAYMENT SYSTEMS, ANNUAL NUMBER OF TRANSACTIONS

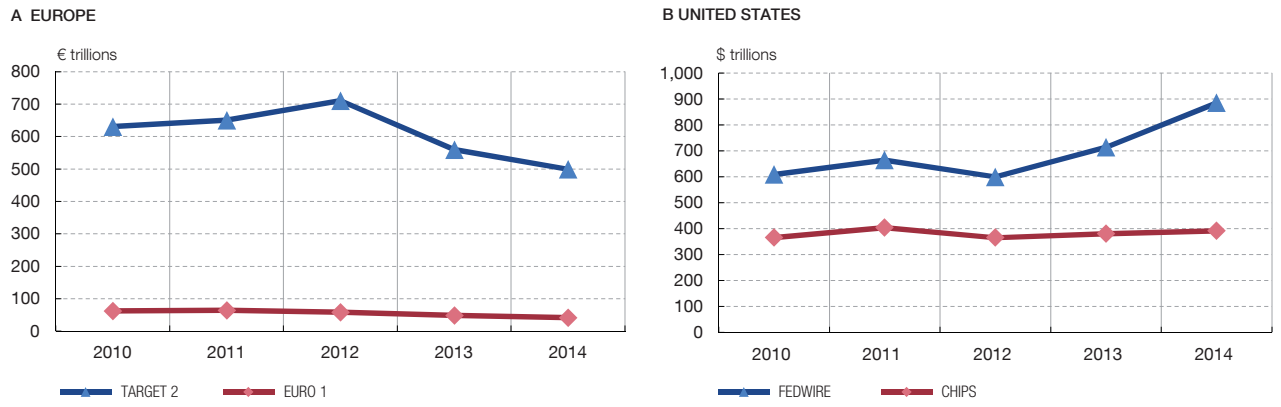
CHART 1



SOURCE: BIS (2015).

LARGE VALUE SYSTEMS, ANNUAL VALUE OF TRANSACTIONS

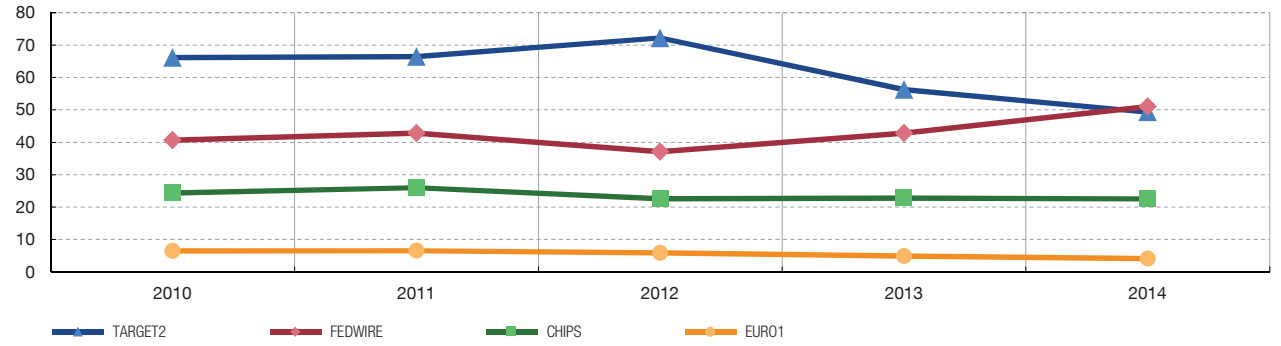
CHART 2



SOURCE: BIS (2015).

LARGE VALUE SYSTEMS AS A MULTIPLE OF GDP

CHART 3



SOURCE: BIS (2015).

In an RTGS system, funds must be in place before a payment can be effected. In the US an institution that satisfies the conditions required is permitted to have daylight overdrafts in order to make its payments; these funds are normally paid back by the end of the day. With the extraordinarily high availability of liquidity to the banks in recent years, this intraday borrowing by participants has declined dramatically, from a peak of more than $70 billion on average in the second quarter of 2008, to less than $1.5 billion in recent quarters. (https://www.federalreserve.gov/paymentsystems/psr_dlodavgqtr.htm) This corresponds in turn to the large holdings of balances by all banks at the Federal Reserve, which in aggregate were on the order of $2.5 trillion in recent quarters – the same order of magnitude as daily value moved through Fedwire (see Chart 2).

In the TARGET2 system, intraday borrowing must be collateralized. The importance of intraday borrowing is greater than in Fedwire (however the actual numbers are not comparable because of differences in the method of estimating them); and overnight deposits have dropped from their unprecedented levels in the wake of the financial crisis (see Table 1).

In other words, in the relaxed monetary environment currently prevailing, there is little incentive for the participants in TARGET2 or Fedwire to attempt any economizing on the use of central bank deposits to effect payment. This is in sharp contrast to, for example, the extreme level of economizing that occurs in the CLS system, the international system for settling large value bilateral foreign exchange transactions.[13]

13 For a discussion of this, see Garratt *et al.* (2014).

SETTLEMENT MEDIA USED BY CREDIT INSTITUTIONS IN THE EUROZONE TABLE 1

€m

	Intra-day loans (assets)	Loans other than intraday	Overnight deposits, Euro
2014	454,249	573,878	286,328
2013	498,843	721,668	307,313
2012	499,310	1,118,579	727,388
2011	475,904	806,662	611,605
2010	488,742	520,468	278,682
2009	485,193	709,369	358,213
2008	526,859	835,655	458,167
2007	272,831	524,806	201,217
2006	224,250	442,406	176,447
2005	217,084	406,322	154,130
2004	95,401	348,284	139,214
2003	51,848	277,941	133,727
2002	51,596	221,807	131,833
2001	47,913	182,567	130,925
2000	45,460	250,881	118,907

SOURCE: ECB.

While credit institutions are the most important users of the settlement services of TARGET2, access is also given to "non-monetary financial institutions" (non-MFIs). As of 2014 this included 52 clearing and settlement organizations. Direct access to Fedwire is restricted for the most part to depository institutions, although a handful of "financial market utilities" are also allowed accounts.

3.2 NON-CASH RETAIL TRANSACTIONS

Patterns of retail payment vary greatly across the Eurozone, reflecting the different national histories of financial institutions and economic development. Nonetheless, some overall patterns can be recognized as contrasting with the behavior of retail payment in the US.

Historically, checks had for many decades been the dominant means of retail payment in the US. On the other hand, the fragmented nature of the US banking system and the high degree of mobility within the country led to early and widespread adoption of the credit card. Meanwhile the expense and inefficiency of the paper check system (entailing as it notably did, the costs of transportation, including air transport, for physical presentment) led first to the efficiencies of the Check21 program (allowing for check truncation) and to other encouragements formal and informal to wean the population from the use of checks. The decline in check usage in recent years has been dramatic.

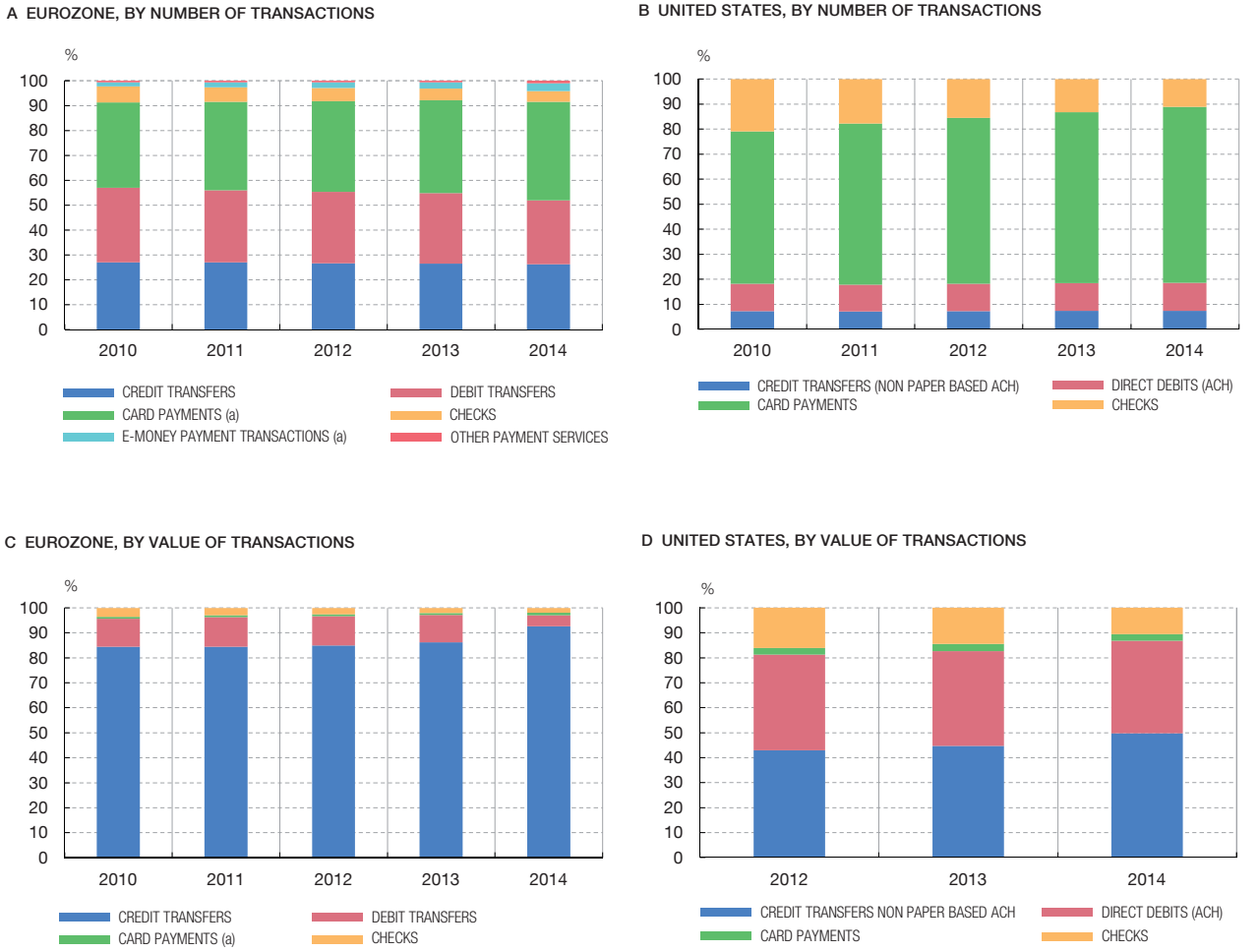
In many countries in Europe on the other hand, the bank giro has played the analogous role to checking in the US. The relatively consolidated nature of the banking system meant that credit and debit transfers were of greater importance earlier – and also made the transition to electronic banking much more seamless.

Chart 4 (A to D) shows the relative importance of various kinds of retail payments arrangements in the US and the Eurozone, measured both by number of transactions and by value of transactions. (Because of a change in the methodology of calculating ACH transaction value in the US, it is not possible to the extend Chart 4.D back before 2012). In both cases the use of checks continues to decline steadily, although from a higher base in the US. In both places card payment is growing, although in the Eurozone it is partly eating into the use of debit transfers. Note the overwhelming importance of card payments in the US by number of transactions, and the overwhelming importance of credit transfers in the Eurozone as

measured by value. Cards are predominantly used for small value payments as is clear from the comparison with the tables based on value. When we measure by volume, the dramatic decline in the use of checks in the US mirrors the increase in the use of cards (in particular, as we shall see, the use of debit cards) as a replacement for small value purchases. However in the measures based on total value, of purchase, the decline in checks is mirrored by the increased use of credit transfers, whose growth in the US has been steady for use in payroll and other business payment.

SHARE OF RETAIL PAYMENTS TRANSACTIONS

CHART 4



SOURCES: ECB, BIS and authors' elaboration.

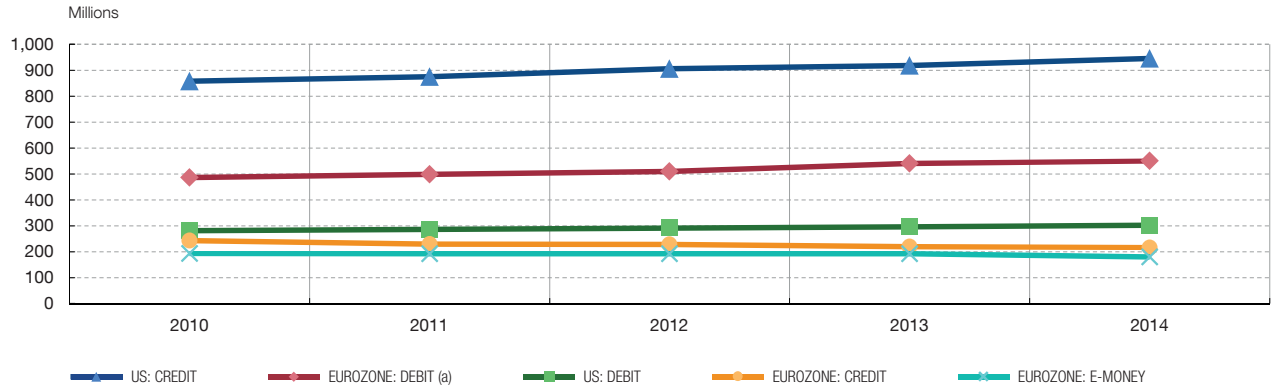
a Resident payment system providers only.

Cards penetrate much more deeply in the US than in the Eurozone and the credit function of cards is of much greater importance in the US. Chart 8 compares number of cards in Europe and the US, and Chart 9 shows the relative importance of the value of transactions with credit and debit cards as a percentage of GDP. The total number of payment cards in the Eurozone grew from 311 million in 2000 to 551 million in 2014. In the Eurozone the number of credit cards outstanding has shrunk in recent years, but the number of debit cards has grown quickly, to the point where there is approximately one debit card per person and 0.4 credit cards per person.[14] In the US the number of debit cards increased

14 These calculations are based on the data from the ECB.

TOTAL NUMBER OF PAYMENTS CARDS

CHART 8

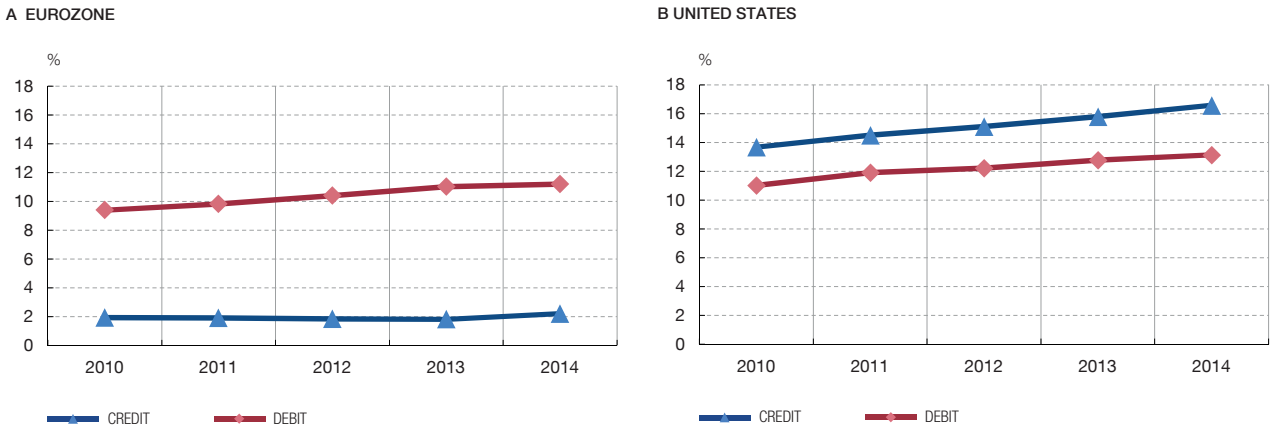


SOURCES: BIS and authors' elaboration.

a Eurozone Debit consists of all payments cards less those with a credit function.

VALUE OF CARD PAYMENT AS PERCENTAGE OF GDP

CHART 9



SOURCE: Federal Reserve, ECB, BIS and authors' elaboration.

by 10% from 2010 to 2014, and the number of credit cards increased by 7%; there is now approximately 1 debit card and nearly 3 credit cards per person. The relative importance is also reflected in the use of the two kinds of cards; although in both cases credit cards are used for higher value transactions than non-credit cards.

Security is also an important concern with card payments in both the US and the Eurozone. Losses related to card fraud are substantial. In Europe, the total value of fraudulent transactions conducted using cards issued within SEPA and acquired worldwide amounted to €1.44 billion in 2013, which represented an increase of 8% from 2012 [European Central Bank (2015)]. In the US in 2012, the estimate of losses on general purpose cards from unauthorized transactions ("third-party fraud") was $4.1 billion. On the one hand, these figures, while large, represent less than one-tenth of one percent of transactions. On the other hand, the rate of unauthorized transactions for cards in the US is much higher than for ACH or for checks [Federal Reserve System (2014)].

Most dramatic is the difference between the use of e-money transaction cards; the number and value of these cards in the US is negligible. In the Eurozone, Cards with an e-money functionality have risen from 110 in 2000 to 179 million in 2014.

Since SEPA integrates both credit institutions and other providers of payments services into a single system, it is easier in the Eurozone to begin to understand the relative importance of the various kinds of providers of payments services. In particular in 2014 there were 6,070 institutions in the Euroarea offering payments sevices, down from more than 7,000 in 2000, as a result of consolidation across the Eurozone. Most of these were credit institutions. However, the number of electronic money institutions increased from 13 in 2005 to 51 in 2014, and the number of payments institutions increased from 66 in 2000 to 323 in 2012, and the category of "other payment service providers" increased from 12 in 2010 to 512 in 2014 (these jumps are explained to a large extent by the change in the denomination of these institutions due to SEPA). And although by any measure the credit institutions activities dominate, the activities of institutions that are not credit institutions have grown rapidly. This illustrates the recent emergence of these institutions as well as the impact of the creation of a legal framework within SEPA.

3.3 CASH TRANSACTIONS

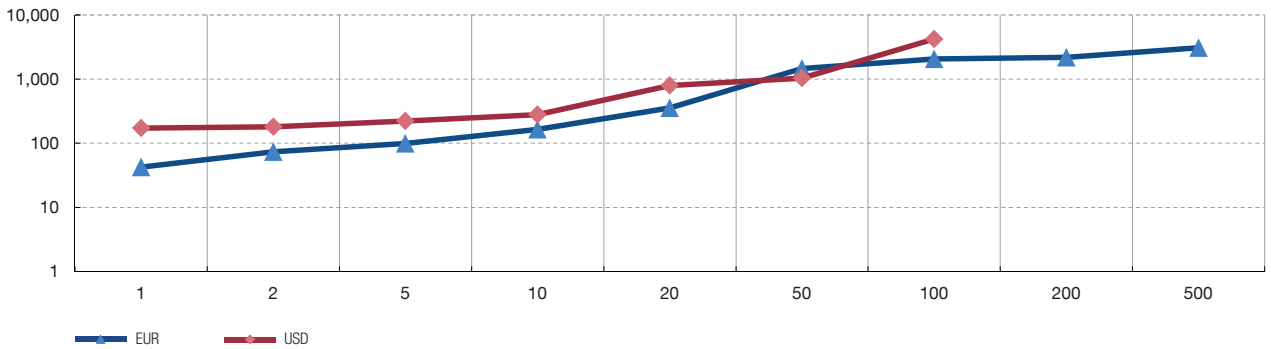
For obvious reasons, it is much more difficult to obtain information on the prevalence of cash transactions. A variety of recent studies have attempted to derive conclusions from the use of diary information, and some cross-country comparisons of payments behavior are beginning to be derived from them. In this section however we will confine ourselves to indirect comparisons based on aggregate data.

At the end of 2014, banknotes and coins issued and held outside of banks were about $3,900 per person in the US, and about €2,900 per person in the Eurozone (Chart 10). Clearly part of this circulated outside of the area in each case, and part was being held as savings rather than for transactions. Thus a clearer comparison might arise from examining per capita holdings at smaller denominations.

At almost all levels the per capita issue of banknotes and coins is greater for dollars than it is for Euros (the one exception comes from the prevalence of €50 notes relative to $50 bills) for example in denominations of €10 or less, the ECB has issued €165 worth of cash per capita, while in denominations of $10 or less the Federal Reserve has issued $280 (=€207 at an exchange rate of 1.35) worth of cash per capita. This consistent difference implies a somewhat higher demand for cash geared to small value transactions in the US than in the Eurozone.

This difference is also consistent with the difference in ATM availability in the two areas: In the Eurozone, ATMs have increased to 361,229 in 2014 from 198,994 in 2000 (an accumulated

PER CAPITA ISSUE OF BANKNOTES AND COIN, CUMULATIVE BY DENOMINATION, 2014 CHART 10



SOURCE: BIS and authors' elaboration.

81.5% growth, see Table 2). Detailed information on ATM numbers in the US is not readily available, but a consulting firm estimated 420,000 machines in the US in 2009[15] (corresponding figures for the Eurozone were approximately 320,000).

In the Eurozone, the number of withdrawals at ATMs has grown by 8.7% and the total value of withdrawals by 9.5% over the four years 2010-2014. The number of withdrawals amounts to around 24 per person per year, with the average withdrawal on the order of €125.

In the US, the number of ATM withdrawals declined between 2009 and 2012 by about 3%, with around 58 withdrawals per person made in 2012. The total value of withdrawals from ATMs over the four years rose by about 6% with the average size of a withdrawal in 2012 being about $118.

While this set of facts might be taken as indirect evidence of somewhat greater, but decreasing dependency on cash in the US than in the Eurozone, care must be taken in reaching such a conclusion. The Federal Reserve's 2013 payments study notes that while the number of withdrawals from ATM machines in the US was twice as great as the number of cash withdrawals over-the-counter at bank branches, over-the-counter withdrawals averaged $715 each.[16] Thus a complete comparison would require surveying consumer behavior within banks in the Eurozone as well

A final indirect source of evidence about the importance of cash in transactions comes from the data on the proportion of unbanked individuals in the two locations. According to the study by the World Bank, 6% of adults in the US did not possess a bank account in 2014[17];

15 http://www.cutimes.com/2014/07/28/3-million-atms-worldwide-by-2015-atm-association.

16 Federal Reserve System (2014).

17 Demirgüç-Kunt *et al.* (2015). A survey by the US Federal Deposit Insurance Corporation ("2013 FDIC National Survey of Unbanked and Underbanked Households") comes up with a similar figure, estimating that 7.7% of households in the United States were unbanked in 2013.

ATMs AND POS TERMINALS AND TRANSACTIONS IN THE EUROZONE TABLE 2

	Number of ATMs	Number of POS terminals
2014	361,229	7,045,510
2013	309,672	6,205,337
2012	316,620	6,528,817
2011	320,966	6,612,602
2010	318,881	6,437,320
2009	319,837	6,445,641
2008	311,626	6,145,461
2007	300,330	5,671,156
2006	262,783	5,304,921
2005	253,815	4,861,608
2004	245,776	4,638,126
2003	235,777	4,291,565
2002	227,329	4,101,030
2001	216,223	3,843,235
2000	198,994	3,349,750

SOURCES: ECB and authors' elaboration.

in the Eurozone countries, the range was from a high of 23% in Slovakia, and 13% in Italy and Portugal to 0% in Denmark and Finland; a weighted average by population yields an estimate of 5%. It is likely that a country by country detailed comparison would yield a correlation between prevalence of unbanked households and the prevalence of the use of cash.

4 Payment systems in Europe and the US: Consequences

In this section we examine three challenges faced by payments systems and the current performance of the system and or regulator to those challenges. First we look at the question of operational risk in the wholesale system. Then we examine two related changes in the retail system, the rise of fintech alternatives and the attempt to move away from cash payments.

4.1 FAILURES IN THE WHOLESALE SYSTEM

The performance of payments systems in the US and the Eurozone documents their extreme safety and resilience, even in periods of economic turmoil such as the recent financial crisis. Even so, it is worthwhile to consider the cases of system failure, if for no other reason than that the potential costs are so great.

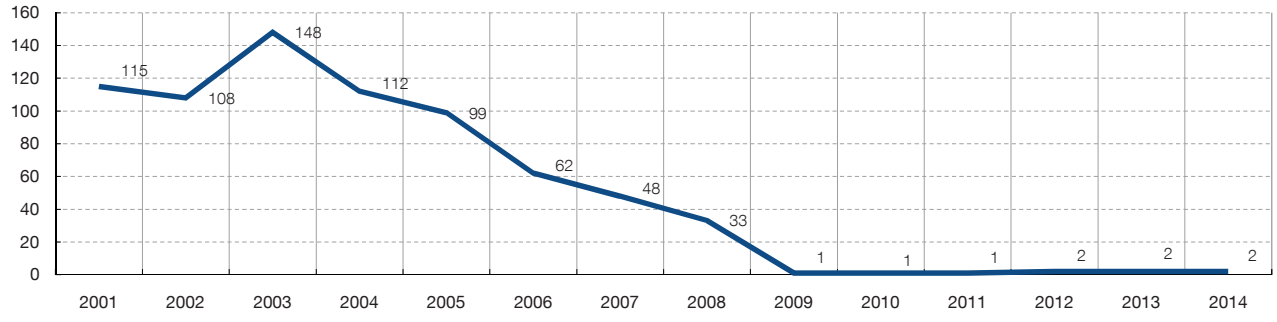
The Annual Reports of the TARGET system provide some information on the number and type of system failures. Chart 11 provides a summary, hand-collected from the reports since 2001. Prior to that date, earlier reports mentioned some particular incidents – for example, "a few serious incidents occurred in TARGET, mainly in 1999, when local TARGET components were not fully operational for several hours. In these rare cases, mainly in order to avoid end-of-day liquidity imbalances within TARGET, TARGET closing time was delayed accordingly." In the early 2000s, the number of failures was still high. At that time, the two main causes of incidents in TARGET were problems in the system's connection to the SWIFT network and software/hardware component failures.

Chart 11 also shows a learning effect with a dramatic fall in the number of failures during the 2000s (The apparent increase from 2002 to 2003 is due to a change in reporting method). By the mid-2000s, the main identified cause of incidents was software component failures. The migration to TARGET2 was an important turning point in reducing technical failures. By 2009, failures were reduced to a minimum and were mainly due to isolated problems of network components. These incidents only partly affected the processing of transactions and did not cause any unavailability of TARGET2.

It is worth mentioning, however, a problem on 25 July 2011 that, according to that year TARGET report represented "the most serious TARGET2 incident in 2011 and, to a certain extent, since its launch in 2007 […] The payment module could not be updated to the right

INCIDENTS IN THE TARGET SYSTEM

CHART 11



SOURCES: ECB (TARGET annual reports) and authors' elaboration.
NOTE: Number of service interruptions exceding 20 minutes (2001-2002).
Number of service interruptions exceding 10 minutes (2003 onward).

status to start the day-trade phase. Technical investigations showed that the problem would still exist in case of a failover to another site or even region. As a consequence, for the first time in a real contingency situation – the contingency module was activated […]. This module allows the national service desks at each central bank to manually input, on behalf of their users, payments which are considered as very critical or critical."

As a more mature system, with a less complicated topology, Fedwire has worried less about operational difficulty.[18] However, the terrorist attacks of Tuesday, September 11, 2001, constituted an extraordinary operational challenge to the entire financial system in the US, but in particular to the large value payments systems. As documented in McAndrews and Potter (2002), settlements continued to occur on Fedwire and in CHIPS on September 11 and subsequent days, although volumes on Fedwire were down more than 40% from the previous day, and remained somewhat low for the succeeding two days. (Value of Fedwire payments on the other hand returned to normal on September 12, and remained elevated for the following days). While some individual banks suffered physical disruptions, the decision by the Federal Reserve to inject large amounts of liquidity into the system meant that the effects were minimized for the system as a whole. The large injections meant that turnover ratios (total payments divided by deposits) fell from more than 100 before September 11 to 18 on September 14 [McAndrews and Potter (2002), p. 64].

The experience also emphasizes the importance of the interrelation between participants in an RTGS system. Even at the extreme levels of liquidity observed currently, the typical amount of payment by a participant greatly exceeds the available overnight deposits. Thus the timing of payments by participants will depend not only on the availability of funds, but on the expectations that counterparties will recycle the liquidity by provide payments promptly. McAndrews and Potter provide evidence of the disruption of this "reaction function" during the aftermath of the attacks, explaining the decreased turnover ratio and necessitating the additional liquidity.

Although the backbone of Fedwire is thus extremely resilient, it contains a large number of participants of varying sizes. Thus there are noticeable effects on the system from operational outages at the participant level. Klee (2007) examines the effect of outages (measured by unexpected intraday gaps in participation in Fedwire by individual depository institutions) and shows that some individual outages may slightly increase the federal funds rate and its volatility, as well the amount of borrowing by participants at the discount window. In particular, outages later in the day or outages associated with extensions of the settlement time by Fedwire (which can be done if in Fedwire's estimation, there is a significant disruption in payments as a result of the problems of an individual bank), have small but significant effects on these variables.

4.2 THE CASE OF FINTECH AND FINANCIAL STABILITY

International financial supervision institutions are expressing their concerns about financial innovations – including payment instruments – related to new technologies, the so-called 'fintech.' Although the effects of fintech are still small at the moment, this will soon change. In the Eurozone, e-money and "other methods of payment" are a small but growing fraction of the number of transactions (see Chart 4.A); in the US the systems are growing rapidly as well, although they are still negligible in comparison to traditional payments methods.

18 Fedwire operating hours can be extended for one of two reasons: if there is a failure of Reserve Bank equipment, or if there is an operating problem at a third party yielding more than $1 billion worth of payments delay. [Federal Reserve Bank Operating Circular 6, effective August 1, 2004, p. 7, cited in Klee (2007) p. 7]. Almost all extensions are associated with third-party transfers.

According to the statistics portal Statista, the total value of investment in fintech globally reached approximately $6.8 billion in 2014.[19] Other sources point at an even larger investment. The Economist, for example, suggests fintech investment reached €12 billion in 2015, 9 billion corresponding to the US and 3 billion elsewhere.[20] Statista estimates that 28% of the fintech investment in the world in 2013 was devoted to payment instruments, with another 29% to banking and corporate finance.[21]

Of particular concern is the entry of non-financial firms into the payments arena. The growth of non-traditional electronic payments such as mobile or contactless highlights the linkage between payment system innovations and financial stability. Services such as those promoted by ApplePay, SamsungPay or other non-bank payments service providers may evolve rapidly, and the lack of a typical bank structure requires a special treatment.

The challenge is to ensure a level playing field between bank and non-bank providers, as well as an adequate level of control and supervision over them. In the G-20 meeting of February 29, 2016, the governor of the Bank of England and head of the Financial Stability Board (FSB), Mark Carney, described the challenge:

> *The regulatory framework must ensure that it is able to manage any systemic risks that may arise from technological change without stifling innovation. The FSB is evaluating the potential financial stability implications of emerging financial technology innovation for the financial system as a whole, working with standard setters that are monitoring developments in their respective sectors. We are also working to understand better the potential impacts on financial stability of operational disruption to core financial institutions or infrastructure*.[22]

Dermine (2016) notes there is a need to assess the threat posed by digital banking as seen in the context of a long series of innovations in the banking sector that includes telephone banking, payment cards, the development of capital markets, internet, smartphones, and cloud computing. In particular, it raises public policy issues: its impact on the profitability and solvency of banks, the protection of borrowers and investors, and the systemic importance of the new players, the fintechs starts-up specialized in financial services.

It is in their responses to the fintech revolution that the regulatory systems of the Eurozone and the US differ most notably. The US has not provided a roadmap; the Eurozone somehow has, through the PSD2. The principles in the Eurozone are clearly stated by PSD2: "equivalent operating conditions should be guaranteed, to existing and new players on the market, enabling new means of payment to reach a broader market, and ensuring a high level of consumer protection in the use of those payment services across the Union as a whole." What remains unclear, of course, is the meaning of "equivalent operating conditions" – in particular, 1) what constitutes "equivalent" regulatory requirements for old and new players and 2) what forms of access will old players be required to provide to new players?

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19 http://www.statista.com/statistics/376891/value-of-global-fintech-investment-areas/.

20 The Economist (May 9, 2015): http://www.economist.com/news/leaders/21650546-wave-startups-changing-financefor-better-fintech-revolution.

21 http://www.statista.com/statistics/376666/global-fintech-investment-areas/ . Other investments included (29%), data analysis (19%), capital markets (10%) and personal finance (14%).

22 See this piece in *Financial Times* (February 27, 2016) for reference: http://www.ft.com/intl/cms/s/0/d6813cba-dd55-11e5-b072-006d8d362ba3.html#axzz41TmIDFCq.

With regard to the first of these questions, the PSD2 opens the single standard for all providers of payments services which do not themselves take deposits or issue electronic money up to the payment initiation services providers and the account information services providers. The crucial question is how tight the standard should be. As noted by Verdier and Mariotto (2015), the trade-off between financial stability and competition is key to payment innovations. They suggest that creating new licenses for non-banks is not the only regulatory option to enhance competition in retail banking markets.[23] Among the innovations put forward by the UK's Financial Conduct Authority is the idea of a "regulatory sandbox," a "'safe space' in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question." [FCA (2015), p. 2]. By allowing the introduction of new payments arrangements on a small scale the regulatory structure enables both the business and the regulator the opportunity to begin to understand the risks and benefits from the innovation.

With regard to the second of the questions, while PSD2 lays out general principles for equitable access (which will lastly be concreted by the European Banking Authority), the effective implementation of these will ultimately be the responsibility of national regulators. In the interim, there is a transition period when some suppliers of these services are not still fully regulated or treated on par with credit institutions. National Competent Authorities are expected to supervise new providers and, at the same time, guarantee fair competition in that market avoiding unjustifiable discrimination against any existing player. In order to make this monitoring as transparent as possible, the EBA is expected, inter alia, to ensure easy public access to the lists of the entities providing payment services and operate a central register for each category of payment service providers in which it publishes the names of the entities providing such services.

The importance of the question of access and the rules for it cannot be overstated. Rules for access will determine both the pace of innovation and the ultimate structure of the payments industry.[24] Boot (2016) suggests that online platforms could offer a supermarket type model facilitating access to various products and services of disparate providers along with record keeping. He refers to firm such as Google, Facebook, Amazon or Apple making use of payments solutions such as ApplePay as a platform to gain direct customer interface for related products and services. This implies that legacy financial institutions then might be relegated to serving as the back office to the platform. As Verdier and Mariotto (2015) note, when the regulator intends to set rules that aim at enhancing customer protection, they may impede entrants from accessing banks' existing infrastructure to offer innovative services.

4.3 MAIN REMAINING CHALLENGES IN THE TRANSITION FROM CASH TO ELECTRONIC SYSTEMS

Cash is expensive. One recent study [Chakravorti and Mazzotta (2013)] estimates that cash alone imposes total costs of $43 billion a year to US households, and $55 billion per year to US firms. The prime source of costs to households in this estimate is the time spent obtaining cash (trips to the bank or ATM); the prime source of costs to firms is the losses associated with retail theft. While fees associated with cash are a small part of customer costs, individuals without bank accounts were estimated to pay $3.66 per month more for cash than those with bank accounts.[25]

23 Some countries have even decided to reduce capital requirements for new competitors getting a bank license. This is the case of the Financial Service Authority (FSA) and the Prudential Regulation Authority (PRA) in the United Kingdom, which decided to reduce capital requirements at authorization in 2013.

24 For more detailed examination of these issues see Kahn (2016).

25 Using a different methodology, Denecker *et al.* (2013) estimate that cash cost the US 0.47% of GDP between 2007-2011, or $490 per household, and the European Union 0.45% of GDP or $350 per household.

Cash transactions provide greater privacy than is obtainable through other payments media.[26] Privacy can be legitimate benefit[27] and so cash can provide a socially useful function in the portfolio of payments options. Nonetheless, most studies focus on the costs from privacy associated with cash transactions, in the form of criminal activity and tax evasion. The Chakravorti and Mazzotta study puts these costs at $100 billion annually.

Because of these costs, many observers have advocated moving away from cash. The most strident recommendations have been for elimination of high denomination notes, on the grounds that these are overwhelmingly used for illegal activity [see, for example, Sands (2016)]. In the US, the last instance in which bills were eliminated was in 1969, when the $500 and higher bills were withdrawn from circulation. The ECB has just announced the phase out of the €500 note; current recommendations are for withdrawal of the $100 bill in the US. In addition, various countries within the Eurozone have made cash transactions above a certain level illegal (for example in Spain the limit is €2,500). In the US, large value cash transactions will come under banks' reporting requirements under anti money laundering regulation.

More generally, an attempt to move an economy away from cash requires both a "push" (discouraging cash transactions) and a "pull" (improving the alternatives to cash transactions). For small denomination retail transactions, the alternatives are either the established card-based technologies or new fintech solutions such as mobile platforms. As we have seen, the new technologies, while growing rapidly are still a minor part of the payments landscape in both the US and the Eurozone. Even if the PSD2 represents an explicit acknowledgement of the emergence and growing relevance of non-cash payments, the focus in Europe is still on cards, and so for the immediate future, the significant replacement for cash is likely to be card based.

As we have documented earlier on, while credit and debit transfers have been almost fully integrated in Europe, substantial efforts are still need to progress towards a single card payments area. Technical problems are some of the remaining issues in Europe that impede a greater payment card adoption. For example, some cards which are SEPA-compliant, are not accepted in some countries. Considering the advances in solving pricing problems related to interchange fees,[28] consumers and merchants should probably find some of these technical problems as significant constraints. Competition between local and foreign acquirers may have a say on these problems.

The ECB itself considers that "internationally active retailers face difficulties with different business practices and rules within SEPA, as well as different functional and security requirements for their payment terminals. Acquirers are sometimes bound by restrictive membership or licensing rules in the card schemes. At the level of the processing of card transactions, several restrictions still prevail. This shows that there is still much to do to achieve the objective of SEPA for cards." [European Central Bank (2014)].

In contrast, while the card systems are mature and stable in the US, the process of integrating alternative platforms seamlessly into the payments system is, as we have seen, much less advanced. Which of the two systems is better positioned for the replacement of cash might therefore depend on the extent to which non-traditional platforms begin to dominate the payments landscape. However it should be kept in mind

26 As some users have discovered, to their chagrin, in some circumstances even Bitcoin is not as private an instrument as cash.

27 See, for example, Kahn *et al.* (2005).

28 See Carbó-Valverde *et al.* (2016).

that included in the Fintech revolution are a host of technologies which, despite their innovative shells – whether mobile, contactless or virtual – still the payment card infrastructure underneath.

5 Conclusions

This paper has surveyed the main recent developments and prospects in payments systems in Europe and the US. The size and importance of these systems make their efficiency and stability of crucial concern to policymakers. We have compared patterns of usage and differences in regulatory landscape in the Eurozone and the US at retail and wholesale level. In particular we have compared the initial reactions to current innovations in financial technology and the challenge of non-financial institutions entering the payments arena.

A key theme has been the effect of the regulatory framework on changes in the payment system. In Europe, the quest for common schemes and continent wide standardization has defined the regulatory landscape for payments in the past decade. In the US on the other hand, where existing platforms already benefit from standardization, the challenge has come from limitations on the ability of regulators to enforce unified solutions on emerging technologies.

At the wholesale level, Fedwire and TARGET2 operate at comparable scales. In the relaxed monetary environment currently prevailing, in neither system have participants felt the need to economize on the use of central bank liquidity to effect payment. Instead, concerns about safety of wholesale system center on the potential for systemic instability. The move of Europe's system to Real-Time Gross Settlement was an important step in protecting the system from systemic risk, and further improvements have occurred as the centralized structure of TARGET2 has matured, with sharp decreases in the number of system failures. As a simpler system and more established system Fedwire has had fewer concerns about operational safety. However, since it contains a large number of participants of varying sizes, there are detectable effects on the system from failures at the participant level.

At the retail level the usage of different payments modes differed historically but appears to be converging. The dependence of the US on checks is largely disappearing; the use of payment cards in the Eurozone is increasing rapidly. Differences persist, as in the preference for credit cards in the US and debit cards on average in the Eurozone. The growth of card usage in the Eurozone is matched by growth in losses from card fraud. Similarly, the rate of unauthorized transactions for cards in the US is much higher than for ACH or for checks.

In Europe, converging to electronic payment standards and creating a single market for payments under SEPA is expected to generate significant cost savings for all market participants. Nonetheless, at present there remains substantial work to be done to make progress towards a single card area, although credit and debit transfers have been almost fully integrated. In the US on the other hand, with a single card area already in place, there has not been an overarching program for regulating the retail payments system; instead legislation has largely been confined to consumer protection against particular practices by payment card providers.

Probably the most effective way of decreasing the overall cost of a retail payments system is to reduce its reliance on cash. Use of cash is probably slightly greater in the US, although declining, and the attempts to limit its use are probably somewhat more aggressive in Europe. On the other hand, since cards are most likely to be the primary replacement for cash in the foreseeable future, the single card area in the US puts it at an advantage in the immediate transition.

In the longer run, however, the US may find itself not as well positioned. PSD2, which deals specifically with electronic payments and non-bank payments providers, provides a clear framework for the development in Europe of integrated fintech platforms for payment. The framework places it well ahead of the comparable initiatives in the US. The documented growth in users of e-moneys and providers of alternative payments services, illustrate the impact of the SEPA legal framework.

Questions remain as to whether the introduction of the new players will lead to new instabilities in the payments system. Maintaining the proper degrees of efficiency and safety is a difficult balancing act: should regulation of the new providers be comparable to that of bank or would a "lighter touch" (reduced capital requirements, regulatory sandboxes) be appropriate? Can the goal of guaranteeing fair competition between old and new providers can be met under the proposed standards? With the fundamental uncertainties about the ultimate organizational structure of the payment system after the fintech revolution, these questions will remain at the forefront.

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