



DISCUSSION PAPER

PAYMENT CARDS CENTER

An Examination of Mobile Banking and Mobile Payments: Building Adoption as Experience Goods?

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***Summary:** This paper examines consumer adoption of mobile banking and mobile payments using the experience goods and learning by doing constructs as a framework to better understand adoption patterns in the United States and how these may differ in other world markets. Consumer experience and familiarity with mobile devices is considered along with three relatively new communication technologies – SMS text messaging, wireless Internet access, and near field communication (NFC) – that are making important contributions to mobile financial services. Online banking and contactless payments — and consumers’ experience with them — are also studied as “building blocks” to mobile financial services. Furthermore, this analysis considers other factors that are affecting adoption patterns, including financial inclusion opportunities, data security problems, and coordination issues. Together, the building blocks and these other factors will influence how markets for mobile financial services develop.*

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I. Introduction

Both the popular and trade press have focused attention on mobile banking and mobile payments in the United States and around the world. In addition, financial institutions and nonbanks are considering how and to what extent to incorporate mobile financial services into their business models. The evolutionary path taken by mobile banking and mobile payments can be very different, depending on a variety of factors, including a market's level of banking sophistication, available technologies, and experience with antecedent products, services, or technologies. This "experience" provides a way to think about the trajectory that mobile banking and mobile payments may follow with regard to consumer adoption in the United States and how these adoption patterns may differ worldwide. The consumer-adoption story in the United States — against the backdrop of the broader experience in other world markets — involves other factors, such as financial inclusion opportunities, data security considerations, and coordination issues. These factors, acting in conjunction with consumer experience, will influence how markets for mobile financial services develop.

To construct a framework for adoption, I consider mobile banking and mobile payments to be experience goods. The economic term "experience goods" was introduced in the literature in 1970 by economist Phillip Nelson.¹ He built on work by George Akerlof, arguing that consumers are unable to evaluate the quality of an intended purchase if they haven't had experience using that good.² Nelson suggested that information about the quality of a product can be obtained in one of two ways: either by searching, which requires a consumer to inspect the good before purchasing it,³ or through experience, which means that the good is purchased and an evaluation about its quality is subsequently made based on using that good.

¹ Phillip Nelson, "Information and Consumer Behavior," *Journal of Political Economy*, 78 (1970), pp. 311-29.

² George Akerlof, "The Market for Lemons: Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* (1970), pp. 488-500.

³ In a search scenario, the consumer has decided to buy the good but will search for the variation of the product that has a set of attributes best meeting his needs.

Nelson coined the term “experience goods” to describe those goods that are best, or preferably, evaluated through experience rather than search. This term captures the notion that consumers are better able to objectively measure and then assign value to some products, services, brands, or technologies after some experience using them. In this case, the good is purchased before the consumer has a full appreciation of its utility; that is, the purchase, at this point, is a sunk cost. As familiarity increases, consumers tend to become more comfortable with products or technologies with which they have some experience that they deem favorable.

A companion economic concept, “learning by doing,” evolved from research on productivity functions: Increases in productivity are accorded not only to technological advances but also to increased knowledge about the activity itself.⁴ In essence, learning by doing conveys the sense that a consumer doesn’t get really good at doing something until he or she has done it many times. This concept is different from that of experience goods — where incomplete information makes a utility evaluation difficult — because, in this case, consumers gain increased efficiency with an experience good by virtue of the intensity with which the product, service, brand, or technology is used. This level of intensity is influenced not only by consumer behavior but also by supply or availability of the good as well as by the pricing of such a good. Ultimately, the degree to which consumers “learn by doing” will affect how quickly they gain the full benefit from using a particular good.⁵

As an example of the effect that consumers’ experience has on payments innovation, former Payment Cards Center Industry Specialist James C. McGrath introduced the concept of experience goods in a 2006 discussion paper to describe the influence that familiarity with and use of plastic payment cards have had on market acceptance of contactless payments.⁶ For

⁴ Ken Arrow, “The Economic Implications of Learning by Doing,” *Review of Economic Studies*, 29 (1962), pp. 155-73.

⁵ The market for contactless payments is an example of an area where limited opportunities for learning by doing are limiting potential growth in consumer adoption. For more discussion, see pages 14, 20-25.

⁶ James C. McGrath, “Micropayments: The Final Frontier for Electronic Consumer Payments,” Payment Cards Center, Federal Reserve Bank of Philadelphia, June 2006.

decades, consumers have used plastic magnetic stripe payment cards to pay for goods and services at merchant locations. This same form factor was modified to add the ability to “tap and go” at merchant point-of-sale terminals.⁷ McGrath argued that the history of experience with payment cards contributed to consumers’ willingness to experiment with contactless technology initiated via this same form factor. Interestingly, two years after McGrath made this argument, American Express announced that it intends to focus its contactless technology in payment cards rather than alternative form factors, such as key fobs.⁸ Again, consumers’ experience with the plastic payment card may be contributing to a preference for this form factor over others that are less familiar to consumers.

In this paper, I examine consumer adoption of mobile banking and mobile payments through the lenses of the experience goods and learning by doing constructs. In particular, I consider the introduction and subsequent use by consumers of three elements that, while not all-inclusive, are, I believe, significant “building blocks” necessary to the adoption of mobile banking and mobile payments. These building blocks include mobile devices (either a mobile cellular phone or personal digital assistant [PDA]), online banking, and contactless payments. Additionally, three relatively new communication technologies that are offered as part of some, but not all, mobile cellular phone service agreements are equally important. The most common of these is short message service (SMS) text messaging, followed by wireless Internet access and near field communication (NFC).⁹ Each of these technologies is making important contributions to mobile banking and mobile payment activities that, in turn, are making it possible for

⁷ “Tap and go” refers to the process by which a contactless card is tapped or waved in front of a merchant terminal that uses radio frequency identification (RFID) technology. By taking this action, the cardholder initiates the transfer of payment data wirelessly to the merchant terminal without requiring that the card be swiped through a card reader.

⁸ Robin Sidel, “American Express Drops High-Tech Payment Device,” *Wall Street Journal*, March 31, 2008.

⁹ Near field communication (NFC) is a form of RFID technology that allows for wireless data communication between two enabled devices. For a more detailed description, see pages 17-18.

consumers to access bank account information, perform typical banking functions, and execute payment transactions, all by using their mobile cellular phone.

Notably, consumers' experience in these areas is the result of using these technologies in contexts other than mobile financial services. For example, SMS text messaging became a popular way to relay short text-based messages to other mobile cellular phone users, not as a method for communicating banking or payment instructions. Yet, consumers' experience with SMS text messaging is contributing to the adoption of this technology for alternative purposes, such as those necessary for mobile banking or mobile payments. Ultimately, consumers' experience combined with, when applicable, their increasing use of mobile devices, online banking, and contactless payments, along with the enhanced communication technologies, will facilitate adoption of mobile financial services.

To set the stage for a discussion of the influences on consumer adoption of mobile financial services, I will begin by briefly defining the terms mobile banking and mobile payments and how they are applied in this paper. Next, I will examine the development of the U.S. and other world market(s) for mobile devices and the technology enhancements identified earlier; then I will turn to online banking and contactless payments. I will consider how consumers' increasing familiarity with and use of these mobile "building blocks" have helped shape potentially very different environments for mobile banking and mobile payments around the world. Finally, beyond the theoretical framework of experience goods and learning by doing, I will examine several other factors likely to affect adoption trends for mobile financial services: financial inclusion opportunities, data security considerations, and coordination issues. These factors, in conjunction with the experience goods theory, provide insights into how mobile financial services may continue to develop around the world as well as suggest areas that may warrant continued attention by market participants and by policymakers in the United States.

II. Mobile Banking and Mobile Payments: Definitions

Mobile financial services is a term applied to a range of financial activities conducted using mobile devices, such as cellular phones or personal digital assistants.¹⁰ These activities fall into two broad categories: mobile banking and mobile payments. Mobile banking allows bank customers to check balances, monitor transactions, obtain other account information, transfer funds, locate branches or ATMs, and, sometimes, pay bills.¹¹ In the United States, depository institutions' mobile banking platforms rely on one or a combination of the following three strategies: SMS text messaging, browser-based programs, or downloadable mobile-banking applications.¹² The term mobile payments refers to payment transactions initiated or confirmed using a person's mobile cellular phone or personal digital assistant. These may be such things as making a purchase at the point of sale, sending money to a person or a business, or purchasing a product or service remotely. Mobile payments generally fall into two categories. Those made at the point of sale are called "proximity payments" and are typically initiated using NFC technology. Mobile "remote payments," on the other hand, are not transmitted by NFC but rather require payments to be initiated and settled through the mobile cellular phone network in combination with an associated payment network. These payments may involve person-to-person, person-to-business, or business-to-business payments and rely on SMS text messaging, wireless Internet technology, or a downloaded application in order to execute the payment.

¹⁰ Traditionally, a mobile cellular phone was used strictly as a way to orally communicate with a person on another landline phone or mobile cellular phone. Today, the definition of a mobile cellular phone is broader because a cell phone can be used not only to place voice-based phone calls but also to tap a wide range of nonvoice services, such as accessing the Internet, sending text messages, and conducting financial transactions.

¹¹ This paper uses a framework that separates mobile banking and mobile payments into two distinct activities because doing so helps to differentiate between and highlight the unique consumer adoption trends associated with each platform. At the same time, I recognize that since mobile banking enables such services as bill payment, the lines between mobile banking and mobile payments become blurred. This blurring may be more apparent in countries — other than the United States — where mobile banking has less potential as a stand-alone channel provided by traditional financial institutions.

¹² As examples, Bank of America offers mobile banking through a browser-based program; Wells Fargo offers mobile banking through either a browser-based program or SMS text messaging service; and Wachovia offers mobile banking either through a browser-based service or a downloadable mobile banking application.

Consumer experiences with more traditional banking and payment functions and with the tools and technology necessary to execute mobile banking and mobile payments are expected to influence consumer adoption patterns for mobile financial services. These adoption patterns might differ for users of mobile banking versus mobile payments. Therefore, in this analysis of consumer adoption, I retain a distinction between mobile banking and mobile payments that, in many markets, is clearly blurred in the broader application of mobile financial services. Keeping this distinction in mind allows for an analysis of how and why certain markets have developed differently from others as well as for a better understanding of the distinct adoption challenges that may emerge in specific national or regional markets.

III. The Building Blocks of Consumer Experience with Mobile Financial Services

While there may be many factors acting on consumer adoption of mobile financial services, I've chosen to focus on three "building blocks" that I believe are most directly affecting how mobile banking and mobile payments are evolving in the United States and other world markets. Again, these are consumer adoption of mobile devices, online banking, and contactless payments. Within the category of mobile devices, I also specifically consider three technologies being used to facilitate nonvoice communications and whose adoption is having a direct effect on the formation of markets for mobile financial services: SMS text messaging, wireless Internet access, and near field communication (NFC). I will begin by describing consumer adoption of mobile cellular phones and the technologies that are transforming these devices. Then, I turn to adoption trends associated with online banking and contactless payments.

a. Consumer Adoption of Mobile Cellular Phones and Associated Nonvoice Communication Technologies

Consumer adoption of mobile cellular phones has increased dramatically, representing, in many cases, the primary way by which people communicate across distances. Worldwide, in

2005, there were more than 2.1 billion mobile cellular phone subscribers,¹³ representing about 34 percent of the world's population.¹⁴ In comparison, in 2005, the number of personal computers in use (just over 900 million) and the number of Internet users (approximately 1 billion) were less than half the number of mobile cellular phone subscribers.¹⁵ The mobile cellular phone subscriber base is expected to have reached about 2.6 billion in 2006 and 3 billion in 2007.¹⁶ With population estimates of 6.5 billion in 2006 and 6.6 billion in 2007,¹⁷ the worldwide penetration rate for mobile cellular phones will have increased from 34 percent in 2005 to 40 percent in 2006, reaching 45 percent by 2007.¹⁸ Some industry reports have indicated that actual worldwide mobile penetration was even greater than 50 percent in 2007.¹⁹

Examining the U.S. mobile cellular phone market, CTIA-The Wireless Association²⁰ estimates that there were 255.4 million wireless subscribers as of December 2007, which equates to a penetration rate of 84 percent of the total U.S. population and an over seven-fold increase in subscriber base from December 1995.²¹ Interestingly, a survey by the National Center for Health Statistics found that the percentage of U.S. adults in wireless-only households grew from 2.9

¹³ The World Factbook 2007, Central Intelligence Agency (see www.cia.gov/library/publications/the-world-factbook/geos/xx.html#Comm).

¹⁴ The International Data Base (IDB), U.S. Census Bureau. (see www.census.gov/ipc/www/idb/worldpopinfo.html).

¹⁵ The Computer Industry Almanac, Inc. (see www.c-i-a.com/pr0506.htm and www.c-i-a.com/pr0106.htm).

¹⁶ IC Insights, "Cellular Phone Mania Sweeps the Globe," press release, September 18, 2006 (see www.icinsights.com/news/releases/press20060918.html).

¹⁷ The International Data Base (IDB), U.S. Census Bureau (see www.census.gov/ipc/www/idb/worldpopinfo.html).

¹⁸ In mature markets, cell phone penetration rates can be greater than 100 percent because it is estimated that a limited portion of the world population has more than one cell phone subscription per person. Therefore, these worldwide penetration rates may be slightly overstated as a percentage of world population.

¹⁹ For example, see "Global Cellphone Penetration Reaches 50 pct," Reuters, November 29, 2007 (investing.reuters.co.uk/news/articleinvesting.aspx?type=media&storyID=nL29172095).

²⁰ As described on its website, CTIA-The Wireless Association is "an international nonprofit membership organization founded in 1984, representing all sectors of wireless communications – cellular, personal communication services, and enhanced specialized mobile radio." For more information, visit www.ctia.org/.

²¹ Wireless Quick Facts, CTIA-The Wireless Association (December 2007) (see www.ctia.org/advocacy/research/index.cfm/AID/10323).

percent in the period January to June 2003 to 9.6 percent in the period January to June 2006.²²

CTIA estimates that by December 2007, 15.8 percent of U.S. households were wireless-only households.²³

A preference for mobile cellular phones over traditional fixed landline connections is even more pronounced in developing countries that have limited or deficient landline infrastructures. In many of these countries or regions, the number of mobile phone subscribers is greater than the number of landline consumers. For example, in India, there were 44.9 million cell phone users in 2004 but only 43.9 million landlines.²⁴ At the end of 2005, China had 393.4 million cell phone subscribers but only 350.4 million landline users.²⁵ In Africa, in 2007, there was more than five times the number of people using mobile phones compared with those who used landlines.²⁶ Moreover, each of these markets has experienced significant growth in mobile cellular phone subscribers from 2005 to 2006 – India (96 percent)²⁷, China (17 percent)²⁸ and Africa (30 percent).²⁹ Collectively, in 2006, the emerging markets of India, China, and Africa accounted for approximately 59 percent of the global subscriber base of mobile cellular phones.³⁰

Not only is more of the world's population using mobile cellular phones to make traditional phone calls, people around the world are also increasingly using these devices for a

²² Stephen J. Blumberg and Julian V. Luke, "Wireless Substitution: Preliminary Data from the January-June 2006 National Health Interview Survey," Division of Health Interview Statistics.

²³ Wireless Quick Facts, CTIA-The Wireless Association, December 2007. (see www.ctia.org/advocacy/research/index.cfm/AID/10323).

²⁴ "Mobile Phones Take Over in India," BBC News, November 9, 2004. (see news.bbc.co.uk/2/hi/business/3994761.stm).

²⁵ Dan Nystedt, "Chinese Prefer Mobile Over Landlines," *InfoWorld*, March 27, 2006 (see www.infoworld.com/archives/emailPrint.jsp?R=printThis&A=/article/06/03/27/76822_HNchineseprefermobile_1.html; <http://www.guardian.co.uk/media/2004/may/05/citynews.newmedia>).

²⁶ "Connecting Africa: How ICT Is Transforming a Continent," The World Bank, October 29, 2007 (see web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21526131~pagePK:64257043~piPK:437376~theSitePK:4607,00.html).

²⁷ "The Indian Telecom Services Performance Indicators October – December 2006," The Telecom Regulatory Authority of India (April 17, 2007), p. 6 (see www.trai.gov.in/traif/upload/Reports/35/Report1.pdf).

²⁸ The World Factbook 2007, Central Intelligence Agency (www.cia.gov/library/publications/the-world-factbook/geos/ch.html#Comm).

²⁹ Mobile Factbook 2007, Portio Research, July 2007, p. 17.

³⁰ Cassell Bryan-Low, "News in Depth: Mobile Operators Make New Calls to Connect with Emerging Markets – Companies Cut Prices to Tap Remote Regions; Indian Firm Outsources," *Wall Street Journal-Asia*, February 15, 2007.

range of nonvoice services, which may include sending text messages, accessing the Internet, or, to a more limited degree, obtaining bank account information and making payments. These various nonvoice applications depend in large part on relatively new technical functionality associated with mobile cellular phones: SMS text messaging, wireless Internet access, and near field communication (NFC). In addition to the growing pervasiveness of and experience with mobile devices, consumers are becoming increasingly familiar with using these technologies for nonfinancial purposes, such as sending nonverbal communications to personal contacts either through text messaging or e-mail or accessing websites in order to obtain various types of information, such as search results, maps, sports scores, and so forth. The experience goods theory would suggest that consumers' increasing range of experience using their mobile devices in these nonfinancial situations could also translate into a natural extension to mobile banking and mobile payments.

SMS technology allows mobile cellular phone users to communicate with friends, family, and others by sending nonverbal text messages, of up to 160 characters, from handset to handset, the Internet to a handset, or a PDA – for example, a BlackBerry – to a handset. In 2006, 1.2 trillion text messages were sent worldwide, more than double the number sent in 2004. Of these, approximately one-third were sent across country borders. On average, each mobile subscriber sent 560 text messages during 2006,³¹ the vast majority of which were nonfinancial messages. Analysts expect the number of text messages to increase to 1.8 trillion by 2010. Importantly, SMS text messaging is providing a mechanism by which mobile cellular phone subscribers can communicate banking and payment instructions to providers of mobile financial services.³²

³¹ These estimates were obtained from Mobile SMS Marketing.com, a website owned and operated by Liquidnet, LTD and Netcom Consulting, Inc. (see www.mobilesmsmarketing.com/sms_history_facts_data.php).

³² SMS text messaging also provides an element of security for such financial transactions when combined with a secure code sent by a separate text to confirm banking or payment instructions. Of course, such security is contingent on the security of the networks over which the information is transmitted.

In addition to SMS, current generations of mobile cellular phones allow users to access and browse the Internet using a form of wireless access that may include wireless application protocol, or WAP. WAP is an open international standard that enables digital devices with smaller screens, such as cell phones and PDAs, to access web pages written with wireless markup language. Essentially, wireless markup language helps with information transfer, page navigation, and page presentation by reformatting pages intended for viewing on large screens (personal computers) so that they can be more easily viewed and navigated on the much smaller screens of mobile devices. For example, mobile cell phone users can visit WAP-enabled websites to, among other things, obtain sports scores, find maps, or conduct a search, all while the subscriber is on the go. This same technology is also a critical factor for many mobile financial services applications where the clear and convenient transfer of information is vital.

Another important component to this story is that there is considerable global variation in experience with wireless Internet access via mobile cellular phones. According to estimates, there are over 1.1 billion web-enabled handsets worldwide – about half of all handsets – and a quarter of these have been used to browse the Internet.³³ Web-enabled phones are much more common in developed than in developing countries, where more advanced mobile cellular phone models and associated data services (Internet access) are still too costly for most consumers. In a survey conducted in December 2006, 71 percent of mobile cellular phone subscribers in the United States had web-enabled cell phones, and 41 percent used this functionality. The United Kingdom, France, Italy, Germany, and Spain had a combined penetration rate of 77 percent, and 31 percent used the web functionality.³⁴ In comparison, the market for web-enabled mobile cellular phones in Africa is still nascent, with challenges to adoption stemming from the costs of both service and

³³ Karen O'Brien, "A Model for Wireless Application Protocol in Pedagogic Environment" (thesis, Trinity College, Dublin, Ireland, 2006), p. 26.

³⁴ "Going Mobile: An International Study of Content Use and Advertising on the Mobile Web," Online Publishers Association, March 2007.

handsets as well as a general lack of familiarity with Internet use. In 2007, only 4.7 percent of the population in Africa had access to the Internet, fixed or otherwise.³⁵

The final enabling technology considered here is near field communication, or NFC. This technology is different from SMS text messaging and wireless Internet access in that, in its basic form, it was developed to facilitate proximity or contactless payments, initially with a plastic payment card. Therefore, consumer experience with NFC technology has not graduated from a nonfinancial environment to one that can be considered a mobile financial service. Unlike SMS and wireless Internet access, NFC – or, rather, its precursor, RFID technology for payment cards – is a technology that the financial industry was very involved in designing and developing, in particular, security requirements for contactless transactions. Therefore, the financial industry is in a better position to control payment innovation in this area because of its role in technology design, payment network security, and market development.

The inclusion of NFC chips in handsets is giving users an opportunity to conduct contactless “proximity” payments not only with their payment cards but also with their mobile cellular phones. At this time, several hurdles limit broad adoption of the mobile cellular phone for contactless payments, not the least of which has been the limited number of mobile cellular phones that include NFC chips. In a March 2007 report, the consulting firm Frost & Sullivan estimated that only one-third of all handsets will be equipped with an NFC chip in the next three to five years.³⁶ A slightly more pessimistic outlook is presented by Ovum, which expects only 23 percent of total handsets shipped in 2010 will have NFC chips. As a result, consumers have limited opportunities to gain experience with mobile NFC payment capabilities or to build on this experience through learning by doing. In addition, the financial services industry is finding

³⁵ In Africa, for example, monthly Internet subscription fees may cost as much as 70 percent of the average monthly per capita income. “Mobile Broadband Could Be the Dominant Internet Access Route for Africa,” *Cellular-News* (May 5, 2008) (see www.cellular-news.com/story/30948.php).

³⁶ “Advances in Near Field Communications — Contactless Identification and Interconnection Technologies (Technical Insights),” Frost & Sullivan Research Service, March 31, 2007 (see frost.com/prod/servlet/report-brochure.pag?id=D0A7-01-00-00-00).

limited opportunities to increase card-based transactions through adoption of mobile proximity payments. This last challenge is complicated by the special circumstance in that unlike the payment card, the access device used to initiate mobile proximity payments is not one whose design, construction, or distribution is controlled by the financial industry. As a result, efforts to increase card-based mobile proximity payments are complicated by questions related to customer ownership and cost and revenue allocations among such entities as handset makers, telecommunication firms, and financial institutions, all entities that must participate in the functioning of such mobile platforms.

Consumer experience in each of these areas — mobile cellular phones and enhanced communication technologies — has in some way contributed to the story of consumer adoption of mobile banking and mobile payments. Mobile cellular phones are clearly becoming a common method of communication around the world, both in developed and, maybe more so, in developing economies. The technologies associated with mobile cellular phones are also increasingly accessible to mobile cellular phone subscribers, although SMS text messaging appears to be available more broadly around the world than either wireless Internet access or near field communication.

b. Consumer Adoption of Online Banking

By using online banking, existing bank customers can manage accounts, track transactions and account balances, and transfer funds without visiting a bank branch or ATM location. The convenience of the online experience has led to its increasing use by consumers in countries that have a high rate of Internet access and a large population with established banking relationships. Additionally, as Internet access has moved from slower dial-up connections to faster broadband technology, such activities have become easier and faster to complete. To better understand the evolutionary trends of online banking and to make inferences as to how it has

helped and is likely to continue to contribute to consumer adoption of mobile banking, I will examine the development of online banking in various global markets.³⁷

Of particular relevance to this analysis are the penetration rates for Internet access and banking relationships in particular geographic markets. Globally, the number of Internet users has increased by about one-third in the past few years, from just over 1 billion in 2005 to more than 1.3 billion in December 2007, equaling about 20 percent of the worldwide population.³⁸ About a quarter of all Internet users, or 4.6 percent of the world population, now have faster broadband connections, which make online financial and payment activities a more convenient experience.³⁹

The breakdown on a country or regional basis varies considerably. Internet access through either a home or work personal computer is far more prevalent in developed economies, such as the United States, the European Union, and Japan, than in developing economies, such as India, and Africa. Similarly, in developed markets, broadband connections are becoming a more significant portion of all Internet users. The Pew Internet and American Life Project estimated that, in the United States, 147 million adults, or about 73 percent of adults, were Internet users in 2006, and 42 percent had broadband access at home.⁴⁰ In 2007, Internet user penetration across the 27 member states of the European Union⁴¹ averaged 55.7 percent of the population, and 33 percent of Internet users had broadband access.⁴² Japan's penetration rate was 68.7 percent, with 32 percent of Internet users having broadband access.⁴³ In comparison, in 2007, Internet user penetration in India was 5.3 percent, but 4 percent of these were broadband subscribers; in Africa, the penetration rate was 4.7 percent, with 2 percent being broadband subscribers.⁴⁴ These

³⁷ For additional research examining the consumer's decision to adopt Internet banking, see Keldon Bauer and Scott E. Hein, "The Effect of Heterogeneous Risk on the Early Adoption of Internet Banking Technologies," *Journal of Banking and Finance*, 30:6 (June 2006), pp. 1713-25.

³⁸ Internet World Stats website (see www.internetworldstats.com/stats.htm).

³⁹ Internet World Stats website (see www.internetworldstats.com/dsl.htm).

⁴⁰ Mary Madden, "Internet Penetration and Impact," The Pew Internet and American Life Project (April 26, 2006) (see www.pewinternet.org/PPF/r/182/report_display.asp).

⁴¹ Internet World Stats website (see www.internetworldstats.com/stats9.htm).

⁴² Internet World Stats website (see <http://www.internetworldstats.com/europa.htm#at>).

⁴³ Internet World Stats website (see www.internetworldstats.com/asia.htm#jp).

⁴⁴ Internet World Stats website (see <http://www.internetworldstats.com/stats1.htm>).

numbers illustrate the dramatic difference in these populations' access to the Internet, particularly the overall portion of the population that has been able to take advantage of efficiency gains attained through broadband technology.

Not surprisingly, many of the same countries or regions with greater penetration of Internet access and correspondingly high overall broadband penetration rates also have high percentages of their populations with traditional banking relationships — the second condition required for online banking adoption. As a result, consumers in these markets have had an opportunity to gain practical experience with the functionality offered through online banking. The notion of experience goods and the impact of learning by doing would suggest that these consumers will find it relatively easier to adopt mobile alternatives to computer-based online banking services. This seems to be the case in countries such as the United States, where 63 million people, or 43 percent of American adults, banked online in 2006.⁴⁵ In fact, by the end of 2007, six of the 10 largest U.S. depository institutions offered mobile banking to their customers. Analysts projected that mobile banking subscribers in the United States would reach over 1.6 million users in 2007⁴⁶ and one financial institution, Bank of America, reported having 500,000 active users of its mobile banking service by year's end.⁴⁷ Mobile banking users are projected to reach almost 35 million by 2010, which equates to almost half of 2006 online banking users.⁴⁸ Interestingly, in most mobile banking programs, the financial institution retains control over the customer relationship, unlike, for example, in the earlier discussion on mobile proximity payments, where participation of the telecommunications and mobile industries is required to execute the business model and ownership of the customer relationship becomes more complicated.

⁴⁵ Jean Beier, "Online Banking 2006: Surfing to the Bank," Pew Internet and American Life Project (June 14, 2006 (see www.pewinternet.org/PPF/r/185/report_display.asp)).

⁴⁶ Nick Holland, Aite Group, "The Predictable Success of Mobile Banking," *Bank Systems & Technology*, (January 2008), p. 27.

⁴⁷ Nancy Feig, "Mobile Banking," *Bank Systems & Technology* (January 2008), p. 21.

⁴⁸ Nick Holland, Aite Group, "The Predictable Success of Mobile Banking," *Bank Systems & Technology* (January 2008), p. 27.

Unbanked consumers, by definition, will not share the same experience base as banked consumers. Worldwide, estimates show that as much as 70 percent of the population is unbanked.⁴⁹ In the United States, 10 million households, or 22 million individuals, equaling about 10 percent of the U.S. adult population, are unbanked.⁵⁰ In comparison, in 2006, 41 percent of India's population was unbanked.⁵¹ In 2003, Africa's unbanked population was estimated to be between 80 and 90 percent.⁵² More broadly, a 2004 study by Consultative Group to Assist the Poor (CGAP) estimated that only 500 million poor people living in developing countries on less than \$2 a day had bank accounts. Based on a total population estimate of 3 billion, this translates into an unbanked rate of approximately 83 percent.⁵³ In these countries or regions with less experience with traditional banking services, lower adoption of mobile banking is also expected, and, instead, mobile payment alternatives are more likely to be the path to adoption of mobile financial services.

c. Consumer Adoption of Contactless Payments

A relatively new innovation in electronic payments has been in the area of micro-payments, or small dollar transactions of generally less than \$5. Traditionally, these payments have been made primarily with cash or coin, but, in recent years, the payment card industry has seen a significant opportunity in finding ways to convert these small-dollar transactions to

⁴⁹ "The Virtuous Circle: Electronic Payments and Economic Growth," White Paper prepared by Visa International and Global Insight, Inc. (June 2003), p. 5 (see www.omg.org/docs/finance/04-03-06).

⁵⁰ Julia S. Cheney, "Payment Cards and the Unbanked: Prospects and Challenges," Payment Cards Center, July 13-14, 2005, p. 10.

⁵¹ "Financial Inclusion - The Indian Experience," speech given by Usha Thorat, Deputy Governor, The Reserve Bank of India at the HMT-DFID Financial Inclusion Conference 2007, July 16, 2007 (see www.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=8557).

⁵² Paul V. Applegarth, "Capital Market and Financial Sector Development in Sub-Saharan Africa," A Report of the Africa Policy Advisory Panel, Center for Strategic and International Studies (March 2004), p. 7.

⁵³ Brigit Helms, "Access for All: Building Inclusive Financial Systems," Consultative Group to Assist the Poor (CGAP), 2006, pp. 1-6 (see www.cgap.org/portal/binary/com.epicentric.contentmanagement.servlet.ContentDeliveryServlet/Document/Book_AccessforAll.pdf).

electronic payments. McGrath, in his paper, estimated that the U.S. market alone for point-of-sale micropayments could equal as much as \$160 billion.⁵⁴

A key strategy employed by card networks and issuers to convert small-dollar transactions to electronic payments has been the development of contactless payment cards based on radio-frequency identification (RFID) technology.⁵⁵ Near field communication extends the contactless payment model to mobile cellular phones.⁵⁶ As noted earlier, the extent to which consumers gain experience with contactless payment cards may influence the likelihood that they will adopt similar technology through their mobile cellular phone.

In the United States, the adoption of contactless card payments and, by extension, the opportunity to build experience with technology similar to that used for mobile proximity payments, is still relatively small. A report by the Aite Group estimated that, by the end of 2007, approximately 19 million contactless cards had been issued in the United States, representing less than 1 percent of credit cards and less than 3 percent of debit cards in this country.⁵⁷ Analysts estimate that, by 2010, the number of contactless payment cards will reach only 10 percent as a percentage of total payment cards in the United States. This same report estimated that

⁵⁴ James C. McGrath, "Micropayments: The Final Frontier for Electronic Consumer Payments," Payment Cards Center, Federal Reserve Bank of Philadelphia (June 2006), p. 5.

⁵⁵ A silicon chip and antenna (referred to as tags, tokens, or chips) are imbedded in traditional plastic payment cards. The chip is passive until it comes in short-range contact with an RFID-enabled reader (i.e., a modified payment terminal) that may be installed at merchant point-of-sale locations, in vending machines, in parking meters, or in taxi cabs. Then, magnetic inductive coupling acts to provide a power source to the passive transmitter — the RFID chip in the payment card — in order to initiate data transfer from the contactless payment card to the terminal.

⁵⁶ A primary technical difference between contactless payment cards and NFC-enabled mobile cellular phones resides in the RFID chip and whether it is passive or active. Contactless payment cards are primarily based on passive RFID technology, while NFC is an example of an active RFID technology. Active tags have their own power source, and both can send (or initiate) and receive data transfers. By being able to both send and receive data, the potential applications for NFC-enabled mobile cellular phones are more robust than applications such as contactless cards, which rely on passive RFID. For example, an NFC-enabled mobile cellular phone may be used in a similar way to a contactless payment card: It may be tapped in front of an RFID-enabled reader, or alternatively, it may be waved over a magazine or poster that has a passive RFID chip associated with an advertisement. In this case, the NFC chip in the mobile cellular phone would use its power source to initiate data transfer with the passive RFID chip in the poster or magazine

⁵⁷ Steve Bills, "Lack of Retail Incentives Hinders Contactless Pay," *American Banker*, January 31, 2008.

contactless card payments in the United States will account for only \$79 billion in payment volume, or 2 percent of total card payments, in the United States by 2010.⁵⁸

At the same time, there have been numerous trials, but not full-market rollouts, of mobile contactless or proximity technology in the United States. Many recently announced programs incorporate a transit payment element. One such example is a partnership among First Data, Sprint, the San Francisco Bay Area Rapid Transit District (BART), Jack in the Box, VivoTech, NXP semiconductors, and Cubic, among others, all of whom play key roles in building or managing the business model. This program combines NFC mobile technology with an electronic wallet that is tied to prepaid accounts associated with BART transit expenses or with Jack in the Box purchases. The BART prepaid account is automatically reloaded or “topped up” when the balance falls below \$10. Conversely, participants may top up their Jack in the Box prepaid accounts at participating Jack in the Box locations. The mobile phone may be tapped at NFC-enabled locations, including BART turnstiles and Jack in the Box restaurants, or through passive RFID chips in poster advertisements in BART stations. In this way, the mobile cellular phone is able to draw on the consumer’s prepaid accounts to facilitate a mobile payment for transit or food expenses or to act as a mechanism for conducting mobile payments to purchase other types of goods or services as advertised in the posters. Some industry observers suggest that it is in these smaller, closed environments where consumers may gain experience with NFC technologies that might lead to broader adoption of mobile proximity payments in the United States.⁵⁹

In addition to the lack of consumer experience with contactless payments, other factors are also hindering adoption of mobile proximity payments in the United States. Aside from the relatively small number of handsets enabled with NFC chips, as discussed in the earlier section on

⁵⁸ Edgar, Dunn & Company, “Outlook for Mobile Payments,” presentation made at the CardTech SecurTech conference, May 16, 2007.

⁵⁹ Similar paths have been followed for contactless card payments in markets such as Hong Kong, where the Octopus e-purse began as a way to pay for transit purchases but later branched out so that these cards could be used at ATMs and merchant point-of-sale locations. For further information on Hong Kong’s Octopus program, see James C. McGrath, “Micropayments: The Final Frontier for Electronic Consumer Payments,” Payment Cards Center, Federal Reserve Bank of Philadelphia (June 2006), pp. 20-21.

mobile cellular phone adoption, growth in merchant acceptance is constrained by several factors, including terminal upgrade and other acceptance costs, on the one hand, and insufficient adoption incentives for merchants, on the other hand. For example, contactless payments rely on RFID technology; therefore, merchants must have an RFID reader incorporated into their payment terminal. To upgrade existing terminals with such capability increases merchants' acceptance costs. To date, payment networks have made only limited investments in helping some of the larger merchants, such as McDonald's, to offset terminal replacement costs, estimated to be \$100 per terminal.⁶⁰ As of 2006, industry estimates show that the number of merchant acceptance locations for contactless payments in the United States is about 45,000 outlets.⁶¹ This compares with a total of over 6 million acceptance locations for MasterCard and Visa credit and debit cards, or a penetration rate of less than 1 percent among merchants.⁶² A study by the Aite Group estimates that the penetration of contactless-enabled merchant locations in the United States will reach only 2.5 percent by 2014.⁶³

Recently in the United States, the card payment networks have also implemented programs that allow select categories of merchants to forgo obtaining a consumer's signature on credit card purchases under \$25, and more generally, federal regulation has allowed all merchants to eliminate receipts on debit card purchases under \$15.⁶⁴ These programs have enabled merchants to more quickly move customers through checkout lines. Speedy checkout has been one argument put forward by card networks and issuers as an incentive for merchants to invest in RFID-enabled terminals.⁶⁵ The elimination of a signature requirement on these small purchases, a

⁶⁰ Meghan Boyer, "Analysts, MasterCard Differ on Contactless Views," *ATM & Debit News*, 9:18 (March 20, 2008).

⁶¹ Dan Balaban, "Contactless in American: Some Banks Have Yet to Climb Aboard," *Card Technology* (May 25, 2007; see www.cardtechnology.com/article.html?id=200705257LZ7G9PX).

⁶² *The Nilson Report*, Issue 874, February 2007, p. 10.

⁶³ "Contactless Payments and NFC in the United States: Beyond Science Fiction," Aite Group, LLC, January 30, 2008 (see www.aitegroup.com/reports/200801301.php).

⁶⁴ *Federal Register*, 72:128 (Thursday, July 5, 2007), p. 36589, Board of Governors of the Federal Reserve System, Final Rule, 12 CFR Part 205 (see edocket.access.gpo.gov/2007/pdf/E7-12810.pdf).

⁶⁵ According to research by CVS, the average transaction time for a typical payment card is 26.7 seconds and for a cash transaction is 33.7 seconds. In comparison, contactless payments averaged only 12.5

move that is already reducing wait lines for customers, is also reducing the incentive for many of these merchants to replace their existing terminals.⁶⁶

Finally, to date, card networks have not provided a cost incentive in the form of reduced card acceptance costs or interchange fees for payments made with contactless cards. Several industry observers argue that in order to support increased adoption of this technology by merchants and, of course, for them to bear the cost to upgrade or replace existing terminals, some form of per transaction monetary incentive will be required until greater scale with regard to acceptance can be reached.

From a global perspective, Visa, MasterCard, American Express, and Discover have all launched versions of the contactless payment card. The Visa and MasterCard programs are available in numerous world markets, are offered in partnership with various bank card issuers, and may include either credit and debit cards, or both. Each network has branded its contactless technology with a unique name. For example, MasterCard's *PayPass* is now accepted at more than 80,000 merchants in 20 countries, and more than 20 million *PayPass* cards have been issued as of November 2007.⁶⁷ Visa supports the more than 7 million *payWave* cards⁶⁸ that have been issued by over 41 card-issuing banks across 11 countries.⁶⁹ Neither American Express nor Discover has released figures related to the number of *Express Pay* or *Zip* cards that have been issued to date. As a rough gauge, the number of general-purpose payment cards is projected to be

seconds. See Brye Steeves, "Wave Good-Bye to Swiping: Customers Can Pay Without a PIN, Signature, or Cash," TEN, Annual Report Issue, Federal Reserve Bank of Kansas City (Spring 2006), p. 7.

⁶⁶ For further information on the role played by wait times in consumer payment decisions, see Elizabeth Klee, "Paper or Plastic? The Effect of Time on Check and Debit Card Use at Grocery Stores," Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series, 2006-02 (February 16, 2006).

⁶⁷ "20 Million-Issued Milestone for MasterCard PayPass Demonstrating Global Shift to Contactless Payments," press release, MasterCard Worldwide, December 10, 2007 (see www.mastercard.com/us/company/en/newsroom/pr_PayPass_GlobalCash_release_12_10_07.html).

⁶⁸ Mary Catherine O'Connor, "RFID Platforms Gaining Momentum," *RFID Journal* (May 24, 2007) (see www.rfidjournal.com/article/articleview/3335/1/1/).

⁶⁹ "New Visa payWave Issuers and Merchants Sign Up for Faster, More Convenient Payments," press release, Visa, Inc., September 20, 2007 (see www.corporate.visa.com/md/nr/press735.jsp).

more than 3.3 billion⁷⁰ in 2009, which means that 27 million Visa and MasterCard contactless payment cards remain a very small part of the worldwide payment card market. These characteristics also present only a very limited opportunity for consumers to gain experience with contactless technology by virtue of using the contactless payment card.

Despite the small market for contactless payment cards worldwide, there are a variety of experiences around the world with mobile proximity payments, with countries such as Japan, for example, offering more opportunities for consumers to gain experience with these technologies. In Japan, the three major mobile operators have distributed over 40 million handsets — mobile cellular phones, not contactless payment cards — enabled with mobile proximity technology based on a chip jointly developed by NTT DoCoMo and Sony called the FeliCa IC chip. Given an assumption of only one handset per person, over one-third of the population has access to mobile proximity payments in Japan. The FeliCa IC network also includes over 210,000 acceptance locations, such as transit terminals and point-of-sale merchant locations. While the supply side seems advanced, on the demand side, consumer adoption is still evolving. As a case study, NTT DoCoMo, the leading mobile operator and the company in the forefront of development of mobile proximity payments in Japan, has distributed almost 25 million contactless handsets. Through partnerships, NTT DoCoMo handsets offer consumers broad functionality with both e-wallet capabilities and credit services. Despite consumers' access to broad-based functionality, estimates are that NTT DoCoMo has 3 million registered users of its contactless technology, and, of these, only 30 percent can be considered active users because they “tap and go” at least once a month.⁷¹

Estimates by Strategy Analytics seem to support demand-side constraints: Worldwide, contactless payments using mobile cellular phones are expected to account for over \$36 billion in

⁷⁰ *The Nilson Report*, Issue 886, August 2007. This estimate includes general-purpose payment cards issued by Visa, MasterCard, American Express, Discover, and JCB. It does not include PIN-based debit cards, including Maestro and Interlink, or private-label cards.

⁷¹ Dan Balaban, “DoCoMo Seeks to Expand Use of Mobile-Credit Service,” *Card Technology* (November 20, 2007) (see www.cardtechnology.com/article.html?id=20071120COXT2RQ3).

consumer spending by 2011; in comparison, in 2006, total purchase volume on Visa and MasterCard bank cards alone had reached more than \$4 trillion.⁷² Therefore, in today's environment, global consumers have only limited opportunities to become familiar with mobile contactless technology, either by building on existing experience with contactless payment cards or through the use of contactless-enabled mobile cellular phones.

IV. Other Factors Influencing Consumer Adoption of Mobile Financial Services

Returning to the “building blocks” for mobile banking and mobile payments, there is clearly variation around the world among consumer experiences with mobile devices and nonvoice communication technologies, online banking, and contactless payments that are ultimately shaping adoption patterns for mobile financial services. At the same time, one common thread worldwide is the continued strong growth of mobile cellular phone adoption and its increasing use as a primary means of communication. As such adoption builds and the mobile cellular phone continues its transformation into a tool that can do much more than facilitate verbal exchanges, the potential is growing to leverage this device as a mechanism for building broader or more traditional financial relationships, particularly for underserved consumers around the world. The expanded use of these devices for mobile financial services is also presenting data security and coordination issues that are important influences on adoption and relevant for both those who use the business model and policymakers.

a. Financial Inclusion Opportunities

Part of the adoption story dealt with consumer experience with traditional financial institutions. The somewhat obvious conclusion is that the lack of banking experience will likely lead to less adoption of mobile banking. The corollary is that underserved populations in the United States, in developing countries, and around the world are likely to adopt various other mobile financial services models. The special case of the underserved also has some important policy considerations.

⁷² *The Nilson Report*, Issue 893, December 2007.

One insight gained by examining mobile financial services adoption using the experience goods and learning by doing framework was that differences in adoption patterns became most apparent when examining consumer experiences in developed versus developing economies. These differences were tied to a market's level of banking sophistication, access to nonvoice communication technologies through mobile devices, and consumers' experience with antecedent products, services, and technologies.

For example, in countries with more developed banking systems, mobile financial services may be seen as just another service channel complementing existing well-functioning alternatives. Comparatively, in developing nations, mobile banking and mobile payments may emerge as the only electronic payment option available to a large portion of the population that heretofore has operated outside mainstream banking systems. Ultimately, the mobile cellular phone may provide a way for these consumers to save and to make remote payments electronically, benefiting from increased convenience and cost savings obtained by moving from paper-based financial services to more efficient electronic alternatives.⁷³

To the extent that mobile technology reaches underserved consumers and provides access to more traditional bank-like products and services, the adoption of mobile financial services can be significant in terms of making financial services more inclusive and the associated benefits for less-developed nations. Such benefits may stem from the electronification of payments. For example, research by Humphrey, et al. estimated that generally a country could save 1 percent of its GDP annually by moving from a wholly paper-based payment system to an electronic one, once transaction costs are absorbed.⁷⁴

Additionally, a country may broadly benefit from the development of a more formal financial system. For example, Ross Levine found a strong positive link between the functioning

⁷³ For further information about the mobile financial services market for underserved consumers in the United States, see Katy Jacob, "Mobile Financial Services and the Underbanked: Opportunities and Challenges for Mbanking and Mpayments," Center for Financial Services Innovation, April 2007.

⁷⁴ David Humphrey, Magnus Willeson, Ted Lindblom, and Goran Bergendahl, "What Does It Cost to Make a Payment?," *Review of Network Economics* 2:2 (2003), pp. 159-74.

of the financial system and long-term economic growth, with both financial intermediaries and markets playing roles. He reached this conclusion after an extensive review of the existing theoretical and empirical work addressing this relationship.⁷⁵ In considering adoption of mobile financial services in developing countries, the opportunity to use the mobile cellular phone as a mechanism for conducting banking and payment functions or facilitating more formal savings — activities that, in the past, had been primarily relegated to informal channels⁷⁶ — may provide real economic benefits. To the extent that banking, payment, savings, and credit activities fall under more established operational and regulatory controls and enhance the functioning of the financial system, per Levine’s research, the adoption of mobile financial services may also positively affect a country’s long-term economic growth.

Another distinction observed between developed and developing economies dealt with adoption patterns for mobile banking specifically and the benefits accrued to such adoption due to consumer experience with online banking. Importantly, two pre-conditions for building online banking experience were the percentage of banked consumers and those with Internet access in a particular market, two attributes shown to be more prevalent in developed versus developing economies. In developed economies, mobile banking may be seen as no more than an extension of online banking programs offering similar functionality, albeit through a different access device — the mobile cellular phone rather than the personal computer. In these cases, consumer adoption seems to be driven by a demand for increased convenience and access to bank account information at any time, from any location.⁷⁷

Alternatively, in developing markets — or when targeted to underserved consumers in developed economies — where access to traditional banking products is less common, mobile

⁷⁵ Ross Levine, “Finance and Growth: Theory and Evidence,” *Handbook of Economic Growth*, Philippe Aghion and Steven Durlauf (eds.) (Elsevier Science, 2005), p. 85.

⁷⁶ Informal payment channels may include a person sending money to a relative by having it hand-carried from one location to another or, with regard to saving, storing excess cash in a house.

⁷⁷ Bruce Cundiff, “Mobile Banking: Using Data to Determine Strategy & Increase Adoption,” Javelin Strategy & Research, presentation, 2007.

banking may take a different form, becoming a way to communicate account-like information tied to alternative types of deposit or credit relationships held by nontraditional or nonbank financial services providers, such as payday lenders or prepaid or micro-finance facilities. Or — and there is some evidence to support this pattern — mobile payments may be more likely to develop that imitate alternative financial services, such as cashing checks and sending money orders or remittances. One example of such an evolution is the M-PESA program in Kenya, where a telecommunications company, a mobile operator, and sellers of air time manage and facilitate a payment network that allows people to load and withdraw cash or send money from their mobile cellular phone.⁷⁸ In this case, there is a separation from the banking system that has contributed to the success of this program because it does not require customers to have a bank account, in a country where only 20 percent of families are banked, nor does it rely on the sparse bank branch network. Instead, it leverages the increasing proliferation of mobile cellular phones in Kenya, which saw a six-fold increase in the number of mobile cell phones from 2001 to 2006.⁷⁹ As of March 2008, less than a year since it launched, this program has over 1.6 million customers registered as M-PESA account holders who collectively have used M-PESA to transfer \$145 million.⁸⁰ In cases where the mobile phone is used to provide credit or payment facilities outside traditional banking systems, those participating industries — for example, in the M-PESA case, the telecommunications and mobile industries — must also address lending and payment risks that may be different from those experienced in their primary businesses. Moreover, in the case of M-PESA, banking and telecommunications regulators have had to consider how to address issues

⁷⁸ “Dial M for Money,” *The Economist*, June 28, 2007. Also see the safaricom website at www.safaricom.co.ke/.

⁷⁹ Isaac M. Mbiti, “The Impact of Cell Phones in Kenya,” Southern Methodist University, presentation made at the National Bureau of Economic Research (NBER) conference titled “Economic Research on African Development Successes,” February 22, 2008. (see www.nber.org/confer/2008/Africas08/Mbiti_presentation.ppt#22).

⁸⁰ George Obulutsa, “Kenya’s Safaricom andles \$145 mln Cash Transfers,” Reuters, March 18, 2008. (see <http://www.reuters.com/articlePrint?articleId=USL1880668820080318>).

of safety and soundness in a circumstance where banks are not directly involved in managing the payment network.

The adoption patterns associated with mobile financial services will also vary to a large degree depending on the types of nonvoice technologies accessible with mobile cellular phones in a particular market. Access to certain technologies may be cost-dependent or it may be determined by the existing supporting infrastructure in a country. In the former case, for example, wireless Internet access via mobile cellular phones is more common in developed than in developing countries, where the increased costs associated with such handsets and wireless programs are often too expensive for consumers. As a result, mobile payment platforms in developing nations rely more heavily on SMS text messaging for initiating and confirming mobile payments. Therefore, an individual in a less-developed economy may be able to send money and make payments using SMS instructions but not be able to browse the Internet and make a purchase at an online merchant using his mobile cellular phone. At the same time, the potential to provide less expensive Internet access through a mobile device — and one that is gaining broad consumer adoption — rather than a personal computer may help spur innovation in these markets.

b. Data Security Considerations

As the market for mobile financial services has developed in the United States, the protection of consumers' financial accounts from unauthorized access and potential identity theft has been a concern for the banking industry and other payment providers.⁸¹ Securing the mobile channel presents many of the same concerns that have been and continue to be addressed with online banking, including authenticating consumers' identification; keeping the data transfer

⁸¹ For further information, see Julia S. Cheney, "Identity Theft: Do Definitions Still Matter?," Payment Cards Center, Federal Reserve Bank of Philadelphia, August 2005. (see www.philadelphiafed.org/pcc/papers/2005/i-identity-theft-definitions.pdf).

process safe from viruses, malware, and phishing attacks;⁸² and educating consumers about each of these potential threats. Consumer education also extends to ensuring that consumers understand and are comfortable with the protections afforded under current regulation, network rules, and industry practices related to individual mobile banking and mobile payments programs.⁸³ A recent survey by Javelin Strategy & Research found that 33 percent of respondents described mobile banking as “too risky.” To the extent that consumers continue to be very concerned about the security of mobile devices, adoption of this channel as a means to manage bank accounts or to make payments will be affected.

c. Coordination Issues

Another aspect of the mobile financial services market that presents adoption challenges revolves around issues of coordination. Multiple industries may participate in mobile financial services programs, including financial services firms (both banks and nonbanks), telecommunications companies, technology providers, and handset makers. Such broad participation can make this market complex. For example, one coordination issue in the United States relates to how telecommunications companies and card issuers address the business model economics of such programs. On the one hand, telecommunications companies control the mechanism through which such mobile banking and payments are initiated: the mobile cellular phone. On the other hand, bank card issuers or their card networks are responsible for all aspects — authorization, processing, settlement, fraud risk, and customer service — of the banking or payment process once instructions have been transmitted from the mobile cellular phone to either the financial institution or the merchant terminal. The question arises as to how to share or

⁸² Mobile-based spam is becoming an increasing concern in many parts of the world. For example, the average mobile cellular phone subscriber in China receives six to 10 spam messages a day. See “Cloudmark: Mobile Operators Bracing for Global Surge in Mobile Messaging Abuse,” *Wireless News*, February 17, 2008.

⁸³ For further reference, see Mark Furletti and Stephen Smith, “The Laws, Regulations, and Industry Practices that Protect Consumers Who Use Electronic Payment Systems: Credit and Debit Cards,” Payment Cards Center, Federal Reserve Bank of Philadelphia, June 2005. (see www.philadelphiafed.org/pcc/papers/2005/ConsumerProtectionPaper_CreditandDebitCard.pdf).

appropriate revenues among telecommunications companies and others, such as third-party technology providers and handset makers, and bank card issuers and their networks. Given these challenges and in order to increase adoption of mobile banking and mobile payments, these two powerful industries must reach an agreement on how to share in the economics of mobile financial services.⁸⁴

Those who follow the business model must find ways to collaborate in order to resolve inherently different and, at times, conflicting approaches to structuring pricing and managing customer relationships. Their respective regulatory agencies will also need to consider how to coordinate in areas such as compliance issues, consumer protection policy, nonbank controls, and data security guidance. Ultimately, the objective is to develop a supportive regulatory structure that balances innovation in mobile financial services with the regulatory responsibilities imposed on them by Congress. Further, to the extent that mobile financial services, such as mobile-based money remittances, involve international transactions, coordination will also become necessary among international regulators to focus on areas such as money laundering and cross-border fraud perpetrated via mobile payment devices.

V. Conclusion

The theories of experience goods and learning by doing serve as a framework for building understanding of the trends associated with consumer adoption of mobile financial services — mobile banking and mobile payments — both in the United States and in other world markets. This view of the market highlights how consumer experiences with mobile devices and associated nonvoice communication technologies, online banking, and contactless payments, particularly in nonfinancial contexts, are contributing to the various evolutionary paths taken by

⁸⁴ This coordination challenge is particularly apparent in markets such as the United States, where there are many technology providers, financial institutions, and telecommunications firms that must participate in economic negotiations. Alternatively, in markets such as those in Europe with fewer banks and more standard mobile platforms, coordination may be easier.

mobile financial services around the world. These differences became particularly apparent when comparing experiences in developed economies, where adoption of mobile financial services may be driven more by convenience than by the need to provide an infrastructure for electronic access to financial products and services, as is more often the case in developing economies.

The emerging adoption patterns also raise policy and business model considerations related to financial inclusion, data security considerations, and coordination issues, presenting both opportunities and challenges to increasing the adoption of mobile payment devices for financial transactions. Ultimately, greater adoption will rest on the ability of diverse and often isolated market participants and their regulators to work together in order to cost-effectively design, build, market, price, secure, distribute, and regulate products and services that combine a telecommunications device and a payment process into an innovative way to connect consumers with merchants, billers, banks, and other financial providers. With success, the mobile channel may become the primary way through which consumers conduct their financial business, particularly in developing economies without comparable alternatives.