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The Effect of Financial Innovation on Cash Demand

Shahnaz A. Rauf[*]
Muhammad Saad Masud Khan[**]

Abstract

To assess the importance of payments system related innovations in Pakistan, this paper attempts to address two questions: First, has the modern technology diminished the importance of paper based financial transactions? Second, does the increased use of electronic financial infra structure and economic factors affect the transactions demand for cash payments.

Although data analysis clearly shows that the share of paper based transactions has declined during the period 2003-2012, retail payments in Pakistan happen to be largely paper based. Results of the cointegration test statistics based on quarterly data show that among the two most accepted electronic financial transactions, automated teller machines increase the demand for cash withdrawals while the online bank branches reduce it. It is also found that deposit rate and low financial inclusion influence the demand for cash payments negatively.

Key Words: Financial innovations, payments system,

1. Introduction

It is the payments mechanism of an economy that allows smooth functioning of its financial and real sectors. An efficient payments system is the one that offers real time settlement of financial transactions and facilitate the exchange of goods and services in a speedy, secure and reliable manner. In this respect, one important area that deserves to be studied is the growth of

[*] Shahnaz A. Rauf, Air University, Islamabad, Pakistan.
[**] Muhammad Saad Masud Khan is a student at Bahria University, Islamabad, Pakistan

payments system related financial innovations and their influence in determining the importance of money as a medium of exchange[1]. In the past few decades, these innovations have gained worldwide acceptance and taken the form of new financial instruments, services, processes, organizations and market segments etc. Out of these several innovations the effect of each innovation may be different depending upon its role in the financial system.

Keeping in view the global trend in payment systems a gradual shift from the paper based transactions to an electronic payments system was also initiated in Pakistan in 2000s. Although its payments system is largely cash based, the past one decade has witnessed increased use of electronic payments. Growth in the percentage share of total number of electronic transactions is recorded to have increased from 19.7 percent to 44.6 percent, while the share of paper based transactions has declined from 80 percent to 55 percent in between 2006-12. During the same period, percentage share of the value of electronic transactions also increased from 9 percent to 13 percent.

In this paper, it is the retail payments related innovations and their likely impact on the financial system and the importance of money for transactions and exchange purposes that is of interest to assess. This area of research is quite barren especially with reference to a developing country having adopted the modern payment system only recently. Therefore this study

[1] The modern electronic payments system involve less paper work and time that can directly improve the efficiency of financial institutions and the economy as a whole. The social cost of a check in U.S is estimated to be $2.80, which amounts to 2.6 percent of the GDP for clearing approximately sixty one billion checks annually (Well, 1996). Others estimate the traditional payments mechanism cost 2 to 3 percent of GDP in US and this expense can be lowered if the paper based payments system is replaced by an electronic payments system, the cost of which is one half of the conventional paper based payments. Humphery, Pulley & Vesala (1996) in a report prepared by the Centre for International Economics, "Exploration of future Electronic Payments Markets" (2006), suggest that an electronic payments system can save $2 billion annually in Australia. Apart from banks, consumers and businesses (large and small) are also likely to benefit from the new system in terms of reduced transaction costs and enhanced financial inclusion. For example the alternative, secure and speedy payment choices are expected to reduce the cost of cash management, business transactions and clearance etc. Similarly, though politically motivated, the innovative mobile payments system intends to expand financial innovation to the unbanked consumers and small businesses.

attempts to throw some light on this issue and two questions of direct interest can be raised. First, has the modern technology diminished the importance of paper based transactions? Second, how does the increased use of electronic banking infra structure and economic factors affect the transactions demand for cash and payments of the users?

Plan of the paper is to provide a review of literature in section 2. Theoretical background and measurement of variables is mentioned in section 3. An overview of the trend in financial transactions in Pakistan is given in section 4. Results and discussion of results are reported in section 5. Lastly section 6 is reserved for the main conclusions.

2. Literature Review

Research studies on financial innovations are mostly related to advanced countries and empirical evidence reported is found to be mixed. Theoretical models forming the basis of research studies in this area of research use the Baumol (1952) and Tobin (1956) models of transactions demand for cash money. These models express interest rate, transactions cost of getting cash and value of transactions as the main determinants of demand for cash money. It is convenient to incorporate different electronic payments infra structure in these models and assess their impact on cash demand.

To estimate the effect of financial innovations on cash money demand, empirical studies have estimated the money demand models using either time series or cross section data sets. In using the time series analysis, studies have either adopted the panel data approach for a set of countries or simply the pure time series data base for a single country analysis. Whereas the cross section studies either use questionnaire based data or test their model using house hold survey data. Model specification and methodology also differ from study to study depending upon the data availability and the research question analyzed.

Humphrey, Pulley and Vesala (1996) using panel data for fourteen developed countries examine a few questions like: Why are some payment

instruments used more than others? What determines the use of particular payment instruments? Whether the pattern of payments system varies overtime? What is the future pattern of payment system likely to be? To address all these questions the authors use a five equation model testing for five different types of payment instruments and the standard theoretical variables included were income, price of a payment instrument, institutional factors like crime rate and structure of the banking system etc. The regression estimates suggest that the influence of price or fee of a payment instrument has modest effect on the use of various payment instruments, whereas except for debit card all the other four payment instruments act as a substitute for cash. It means the impact of factors like changes in payments infra structure is significantly positively related to the use of non cash payment methods.

Stix (2004) attempts to estimate the effect of electronic cards, on cash money demand for Austrian individual's using micro level survey based data . Cash money demand is reported to be significantly affected by the use of debit cards. The frequent users of ATM cards reduce their cash holdings by 31 percent, whereas the users of debit cards use less cash approximately by 12 percent. This study confirms a negative association between card payment and demand for cash. Though, the use of card payments has reduced cash payments, yet the use of cash remains to be dominant. However, the effect of automatic teller machines (ATMs) on cash demand is reported to be inconclusive.

Besides the reduced demand for cash, credit card holders are found to have few demand deposits in their bank accounts (Duca and Whitesell, 1995) Testing for long and short term relationship between cash demand, point of sale (POS), ATMs and payment cards, a negative relation between cash demand, POS and ATMs is reported in the long term, whereas the use of ATMs influence currency demand positively in the short term *(*Rinaldi, 2001). In another study, Snellman, Jukka and Humphrey (2001) taking panel data for advanced countries of Europe report that payment cards have insignificant effect on demand for cash particularly in countries where card payment networks are not well developed. On the contrary the study finds ATMs and POS to have a significant negative effect on cash demand.

Drehmann, Charles and Kruger (2002) hypothesize that most crime related and illegal or underground activities involve cash payments however, except for some macro variables there is no significant impact of payments infra structure and the crime variable on demand for currencies of different denominations.

Amromin and Chakravorti (2009) by taking the case of 13 advanced countries, for the period 1988-2003, used pooled regression analysis to estimate money demand for the overall cash demand and also for three separate cash denominations i.e for low, medium and high cash currency denominations. The model relating overall demand for cash to the number of debit card terminals, number of ATMs, number of bank branches, short term interest rate and the proportion of self employed in total employment, show a negative link between currency demand and debit cards, ATMs and the short term interest rate. Whereas, increase in bank branches and self employed increase the demand for cash. In the denomination specific regressions they find that demand for small denominations of currency decrease with the use of debit cards, whereas the demand for high denominations of currency decline with increase in interest rate but remains unaffected by the use of debit cards. These findings are consistent with those of Alvarez and Francesco (2007) reporting low interest sensitivity of cash demand for specific denominations of currency. However, the authors are of the view that despite the growing importance of electronic payments the use of cash still remains to be high. This dependence on the use of cash suggests that electronic payment mechanisms have replaced cash transactions only partially.

2.1. Financial Innovation and the Financial System in Pakistan

To understand the influence of retail payments related financial innovations, largely made by consumers and businesses for the purchase of goods and services of small value, financial transactions can be grouped into the modern electronic banking transactions and the conventional paper based payments system.

Table 1
Number of Transactions (000)

	2006	2007	2008	2009	2010	2011	2012
Electronic	20160	28006	33773	44494	53367	66266	74562
Paper	82131	84463	84338	85563	91606	89876	92431
Total	102291	112469	118111	130057	144973	156142	166993
% Share							
Electronic	19.7085	24.9011	28.59429	34.2112	36.81168	42.4396	44.6498
Paper	80.2915	75.0989	71.40571	65.7888	63.18832	57.5604	55.3502

Source: Statistical Bulletin (2003-2012) & Quarterly Reports on Payments System (2006-2012) www.sbp.org.pk

Statistics given in Table 1 show that the percentage share of electronic payments increased from 19.7 percent to 44.6 percent, while the share of paper based transactions declined from 80 percent to 55 percent in between the period 2006-12. However, despite rapid increase in the number of electronic transactions, its share in the value of payments increased gradually

Table 2
Value of Transactions (Rs Billion)

	2006	2007	2008	2009	2010	2011	2012
Electronic	2479	3073	4119	3886	4821	6229	6555
Paper	25036	31715	39875	33125	40536	40189	43675
Total	27515	34788	43994	37011	45357	46418	50230
% Share							
Electronic	9.009	8.833	9.362	10.499	10.629	13.419	13.05
Paper	90.990	91.16	90.637	89.500	89.370	86.580	86.95

Source: Statistical Bulletin (2003-2012) &Quarterly Reports on Payments System (2006-2012) www.sbp.org.pk

from 9 percent to 13 percent during the same period. This means retail payments in Pakistan are largely paper based i.e 86.95 percent, demand for which has not declined significantly despite the availability of convenient and fast modern electronic payments system. Slow growth in the value of electronic transactions, mostly of low value; confirm the resilience of cash money as a medium of exchange.

It is also noteworthy that among the main paper based payment

instruments, (cheques (cash cheques, transfer cheques, clearing cheques), pay orders, demand drafts, telegraphic transfers etc) cheques have a major share of 94 percent of the total volume of transactions and 90 percent of the total value of paper based transactions.

Table 3
Paper Based Instruments 2012
(Percentage share in Number of transactions)

Instrument	Percentage Share
Cash Cheques	46%
Transfer Cheques	31%
Clearing Cheques	17%
Pay Orders	2%
Demand Drafts	2%
Tele Transfers	0%
Others	2%

Table 4
Paper Based Instruments 2012
(Percentage share in Value of transactions)

Instrument	Percentage Share
Cash Cheques	47%
Transfer Cheques	26%
Clearing Cheques	16%
Pay Orders	4%
Demand Drafts	2%
Tele Transfers	2%
Others	3%

Whereas the five main sources of electronic payments infra structure include the ATMs, RTOB, POS, Internet banking, Mobile banking and Call centre. Of these, typically the number of ATM transactions of 61 percent is much higher than the value of 7 percent of all such transaction during the year 2012, largely because of the increase in ATMs installation from 552 to 5745 during the period 2003-2012 in the country (Table 6). Of the total number of ATM transactions almost 99 percent of the transactions involve cash withdrawals and are hardly used for other purposes like cash deposit, utility bill payments and transfer of funds from one account to another within the same bank. On average 90 to 100 transactions are made daily and the average size of a transaction is around Rs 10,000.

Table 5
Sources of E Banking Transactions & Number (000)2012

Source	Number (000)
ATM	61%
RTOB	29%
POS	6%
Internet Banking	3%
Mobile Banking	1%
Call Center	0%

Table 6
Sources of E Banking Transactions & Value (Rs Billion) 2012

Source	Number (Rs Billion)
ATM	7%
RTOB	91%
POS	0%
Internet Banking	2%
Mobile Banking	0%
Call Center	0%

Source: Quarterly Reports on Payments System (2012) www.sbp.org.pk

Although RTOB accounts for 29 percent of the total number of electronic transactions (table 5), its share in the value of such transactions is as high as 91 percent (table 6). In 2012, of the total of 10017 bank branches in the country 9291 branches offered real time on line banking services. It means 93 percent of the bank branches are already providing electronic transfer of funds and growth in electronic banking is manly driven by the RTOB.

Data mentioned in Table 7 clearly show that increase in number of RTOB transactions is faster than the increase in value of these transactions. However, compared to the increase in value of ATM transactions increase in the value of RTOB is much higher.

Besides, ATM and RTOB, the percentage share of other electronic banking transactions i.e the POS and internet banking is 6 percent and 3 percent respectively. Whereas, the share of mobile banking and call centre in electronic transactions is negligible. The above data analysis suggests that though financial innovation has largely influenced the number of electronic

Table 6
ATM Transactions

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ATMs	552	786	1217	1948	2618	3523	4055	4465	5200	5745
Value	21019	37502	46675	77657	109490	152850	212000	250000	349000	438000
Number	4433710	7001390	7940000	12526000	16508000	21409000	27881000	31142000	39237000	45203000

ATM: Total number of ATMs.
Value: Total value of ATM transactions in (Rs Millions) Number: Total number of ATM Transactions in (000, s)
Source: Statistical Bulletin (2003-2012) &Quarterly Reports on Payments System (2006-2012) www.sbp.org.pk

Table 7
RTOB Transactions

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
OBB	1581	2475	3265	3947	4979	5857	6119	6727	7416	9291
Number	1581	2475	3265	3947	4979	5857	6119	6727	7416	9291
Value	1489	1697	1789	2165	3238	3448	3650	4517	5425	6324

OBB is number of online bank branches. Number of RTOB in (000s) and Value of RTOB in (Rs Millions)
Source: Statistical Bulletin (2003-2012) &Quarterly Reports on Payments System.(2006-2012) www.sbp.org.pk

transactions, the value of these transactions remain to be modest. It means the value of paper based transactions, including cash and checks etc, remain the preferred mode of payments.

3. Theoretical Model and Data

The objective of financial innovations is to improve the efficiency of a financial system in performing its payments function i.e the medium of exchange function. Therefore this section examines the influence of financial innovations on the transactions demand for cash with reference to a developing country.

3.1 Transactions Demand for Cash

To begin with, financial innovations related to the payments function of a financial system are most likely to affect the transactions demand for cash, therefore for estimation purpose this paper adopts Boumal's (1952) model of transactions demand for cash with modifications for financial innovation. According to these models rational individuals are expected to choose the most economical value of cash to settle payments for the transactions made. Modern financial innovations allow individuals to make such choices to settle their payments at minimum cost.

A model testing for the influence of financial innovations on the transactions demand for cash money is stated as below. All the variables of the model are taken in log form:

$$CC/D = \beta 0 + \beta 1\ ATM + \beta 2\ OBB + \beta 3FI + \beta 4\ DR + e \qquad (1)$$

Null Hypothesis: H0: $\beta 1, \beta 2, \beta 3$ and $\beta 4 = 0$

Alternative Hypothesis: H1: $\beta 1, \beta 2, \beta 3$ and $\beta 4 \neq 0$

Data source of this study is quarterly bulletins of the State Bank of Pakistan for the period 2003-2012.

3.2 Measurement of variables

Currency in Circulation to Deposits (CC/D): is the dependent variable of this study that represents the transactions demand for cash money. It generally includes all one rupee coins and above and five rupee notes and above, issued by the State Bank of Pakistan. A higher level of currency in circulation to deposits ratio indicates preference for cash transactions. Although the ratio of currency in circulation to deposits has declined from 47 in 1980s to 43 in 1990s and 30 during 2000s, it is still found to be the highest in South Asia.

Financial Innovations: To estimate the influence of financial innovation on transactions demand for cash (CC/D), (ATMs) and online bank branches (OBB) represent the two main elements of financial innovation that form the retail payments infra structure in Pakistan. Also among the electronic modes of transactions, ATM and online banking are the two most accepted payment methods. This study examines the impact of both these components on the transactions demand for cash money.

Automatic Teller Machines (ATMs): The link between ATMs and the transactions demand for cash is suggested to be theoretically ambiguous. These machines allow the depositors full time access to their accounts for deposits as well as withdrawal of cash from any branch of a specific commercial bank within the country. Therefore, increase in the number of ATMs on the one hand may lower the demand for cash, and on the other hand easy access to ATMs may increase the number and value of ATM transactions and cash payments. However, in case of Pakistan most of the ATM transactions involve the withdrawal of cash (and very few deposits), it is quite likely that ATMs infra structure influence the use of cash and money demand positively.

Online Bank Branches (OBB): Just as ATMs are a source of access to cash similarly, bank branches are also a source of access to cash but also a source of cash deposit. A priori it is difficult to establish the direction of association

between transactions demand for cash and the number of online bank branches, but given an extensive bank branch network households, and businesses would most likely easily deposit excess cash with their banks and are also expected to reduce the demand for cash. As online banking facilitates the settlement and transfer of funds on real time basis from one account to another, increased use of this secure facility is also expected to reduce the demand for cash. Past experience shows that, the value of on line transactions is the highest among electronic banking transactions in Pakistan. This indicates the acceptance of electronic transactions and a reduction in the demand for cash.

Deposit rate (DR): the opportunity cost of holding cash is the deposit rate on deposits of at least one year and is theoretically expected to be negatively related to the demand for cash.

Financial Inclusion (FI): The number of total bank accounts in the economy is taken as a measure of financial inclusion. Cash transactions are expected to be high when the banking facility is concentrated in few big cities of the country and only a small percent of the population hold bank accounts[2]. The unbanked households, the self employed small/micro enterprises or retailers in the economy are all expected to have a high cash demand, therefore cash payments will continue to be a preferred mode of payment by the majority unbanked population of the country. Furthermore, cash money will remain a medium of exchange as the nature of retail transactions particularly of the self employed micro/small enterprises and retailers are mostly of low value[3].

[2] Financial inclusion remains to be low in Pakistan, of the total population almost 12 to 15 percent of the population hold bank accounts and 75 percent of the bank branches are located in big urban cities (BSR 2006 & 2008).

[3] Although some studies like, Arby, Malik and Hanif (2010) suggest that lack of education acts as a hurdle and keeps away the economic agents from a formal recordable way of economic transactions, therefore presence of a large informal sector for illegal transactions and tax avoidance are as high as almost 20 percent of the total economy and is most likely to increase the demand for cash transactions. However, it can be argued that, the popular use of modern technological innovations like mobile phones, mobile banking, micro finance etc; by small enterprises and the unbanked households indicate that low or no education does not always act as a barrier in the way of financial inclusion to justify the demand for cash transactions. Lack of data on informal transactions; do not permit us to assess the influence of

4. Results

4.1 The Unit Root Test

Given the data set, unit root ADF test was applied to determine the order of integration of the variables included in the model. The ADF test statistics reported in Table 6 indicate that the variables are integrated of order I(0) and I(1) . For two variables of the model, ATM and OBB, the test statistics at level are greater than the critical values at 1 percent significance level, it means for these two variables the null hypothesis of non stationarity is rejected. Therefore the two variables are integrated of order zero I(0). In case of the other three variables, CC/D, FI and DR, the ADF test statistics is less than the critical values and are considered as non stationary at level. In other words these variables are stationary at the first difference and are integrated of order I (1). Both CC/D and FI are stationary at 1 percent significance level while DR is stationary at 10 % significance level.

Table 8
Results of Unit Root ADF Test

Variables	ADF Test Statistics	
	Level	First Difference
CC/DD	----------	-6.160903*
ATM	-3.893512*	---------
FI	----------	-4.809566*
OBB	-4.586547*	----------
DR	----------	-2.758155**

* and ** indicates 1% and 10% significance level.

4.2 Testing for Co-integration

The co-integration test is applied to identify the number of co integrating vectors using the likelihood ratio test. From the test results reported in Table 9 the null hypothesis of no cointegrating relationship is rejected at 5 percent significance level. The likelihood ratio statistics identified all the five

all such transactions on cash money demand. Our variable indicating financial inclusion is expected to indirectly reflect partially if not fully the influence of all such transactions (legal and illegal) that are assumed to be not made through the banking channel.

cointegrating vectors at 5 percent significance level and confirm the presence of relationship among the variables specified in the model.

Table 9

Eigen Value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.570807	97.60624	68.52	76.07	None **
0.480450	65.46403	47.21	54.46	At most 1 **
0.387608	40.58194	29.68	35.65	At most 2 **
0.299955	21.94741	15.41	20.04	At most 3 **
0.198245	8.396185	3.76	6.65	At most 4 **

(**) denotes rejection of the hypothesis at (1%) significance level.
LR test indicates 5 co-integrating equation(s) at 5% significance level.

Table 10
Unnormalized Cointegrating Coefficients

CC/D	OBB	DR	FI	ATM
0.381109	-0.712354	-1.233694	-0.478562	0.495018
-4.703898	2.269414	-2.105808	0.418898	-0.848839
1.778472	-3.658139	-3.506283	0.129457	4.707427
-3.722645	-0.358568	0.218741	1.651003	-0.404920
-4.677842	-2.639380	-1.378813	-0.344438	2.351049

Table 11
Normalized Cointegrating Coefficients

CCD	OBB	ATM	DR	FI
1.000000	-1.869161	1.298890	-3.237118	-1.255711
	(5.54591)	(4.11124)	(9.89327)	(3.37295)
Log likelihood	421.4785			

Figures in ( ) are the t values

The normalized cointegrating coefficients reported in Table 11 show the estimated long run relationship among the variables. The relationship between currency to deposit ratio, number of online bank branches, deposit rate and number of account holders is found to be negative and significant. Whereas, automatic teller machines positively influence the currency deposit ratio.

Results of this study need careful interpretation. As predicted in the literature, these results do not imply that the increased use of electronic

technology is expected to reduce the importance of banks and their branch network. It is also not implied that adoption of financial innovation will lead to decline in the currency in circulation or the stock of money. During the period under study, besides an increase in electronic banking infra structure branch network of banks increased substantially and so did the currency in circulation and money stock. However, these results are consistent with the predictions of earlier studies to the extent that the adoption of financial innovation has led to increased competition among banks. Khan (2009) also reports that concentration ratios of banks have been declining since 2000 and competition among banks has increased.

5. Conclusion

This paper first examined the data by grouping financial transactions into paper based transactions and those made electronically. Data analysis clearly suggests that though paper based transactions are dominant the share of electronic transactions has somewhat increased over the years, Among the paper based transactions cheques play a predominant role , while ATMs and OBB represent the two main elements of financial innovation that form the retail payments infra structure in Pakistan. Also among the electronic modes of transactions ATM and OBB are the two most accepted payment methods.

This paper also examines the influence of financial innovations on the transactions demand for cash with reference to a developing country. Clearly test statistics show, the two main elements of financial innovation, ATMs and OBB, that form the retail payments infra structure in Pakistan, influence the demand for cash transactions. ATMs are found to increase the demand for cash withdrawals from bank accounts, while the OBB indicate reduction in the demand for cash. Low financial inclusion also affects the demand for cash transactions. The opportunity cost of holding cash is also found to influence the demand for cash negatively.

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