“Promoting full-fledged electronic money in South Asia: evidence from Bangladesh”

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PROMOTING FULL-FLEDGED ELECTRONIC MONEY IN SOUTH ASIA: EVIDENCE FROM BANGLADESH

Abstract

The study aims to develop several models for instigating full-fledged electronic money and to study prospects and challenges in the digitization process in the context of South Asian countries such as Bangladesh. Besides, the economic effect of full digitization of currency was analyzed considering its impact on vital economic indicators. Regression analysis, factor analysis and structural equation modeling were used to analyze data. The study suggests some models within the existing financial framework to support the process of instigating and implementing full-fledged electronic money in Bangladesh. The research defines a full-fledged e-money mechanism as a consumption-driven, production-oriented, creditworthy, cost-effective, prompt, technologically based inclusive payment system, as a prospect of full-fledged e-money. Besides, the requirement of an advanced technological infrastructure having secured and user-friendly software with high-speed internet services is identified as a major challenge to full-fledged e-money. The study also found out that a revolutionary change in GDP growth rate and inflation rate will occur through this mechanism.

Keywords money laundering, tax evasion, inflation, financial inclusion, transparency

JEL Classification E22, E62, M15

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INTRODUCTION

Electronic money (e-money) seems to be money that is intangible and invisible, but can satisfy the demand for money generated for transactions, precautions and speculation. Under the mechanism of full-fledged e-money, money is stored only in the bank account as electronic format, not a pocket, wallet, vanity bag, almirah, pillow, etc., where all savings and expenses are made through the banking system. If there is no hard cash/paper currency, all transactions will be conducted through electronic banking or any other mechanism that requires different electronic devices such as mobile, desktop, laptop, i-pad, plastic cards, etc. with the relevant common software and application for all to conduct a smooth transaction with electronic money from one account to another account within a bank channel. The Digital payment system accounts for 90 percent of cash transactions in Denmark as a leading country towards cashless society, which is 45 percent in the USA (Lipovsky, 2016). Money digitization is an urgent need because producing, processing and replacing physical currency is expensive. In India, total of ninety million dollars have been spent an print paper notes in 2018 as an increase in the value of managing physical currency where central bank digital currency can reduce this value (Zhao, 2018). Besides, currency digitization drops physical

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crime, tax evasion and physical bank location, but public education in this context should erase the confusion in currency digitization technology (Lipovsky, 2016).

The deposit interest rate may not be the only incentive of depositing money. People can choose a bank to deposit their fund, considering services, relationships, etc. (Al-Amin & Rahman, 2010). As digital currency will be issued by the central bank as fiat money, its nature will not change, but it will stimulate highly politicized credit allocation (Partz, 2018). Moving toward digital currency can be beneficial in case of cost and efficiency but threatening for privacy and freedom, since it will be easier for government to spy on each transaction which is tied to one's identity. Therefore, some digital cash will have to be retained that not be tied to financial intermediaries for confidential transactions (Brito, 2012).

The concept of full-fledged e-money is rarely studied in the context of South Asian countries such as Bangladesh. Uddin and Akhi (2014) illustrated the concept of the electronic payment system partially based on introducing e-wallet without any feasibility study and in-depth model development of full-fledged e-money. Besides, USAID (2013) developed some models of electronic payments, which are only limited to partners implementing their projects.

Hence, the aim of this paper is to develop unique full-fledged e-money models for Bangladesh, so as that can also be adopted by other South Asian countries. Besides, this paper investigates prospects and challenges of instigating full-fledged e-money in the context of Bangladesh. Finally, the impacts of the full currency digitization on vital economic indicators such as GDP and inflation rates are investigated.

This paper is structured as follows. First, there is an introduction. The next section gives the literature review, followed by a methodology. Then, several models of e-money mechanism, statistical results and findings consisting of prospects, challenges and economic benefits of the e-money mechanism based on econometrics analysis are presented. The last section concludes the paper and gives some recommendations.

1. LITERATURE REVIEW

A number of studies demonstrated various factors as prospects and challenges for the transition to full-fledged e-money. Existing literatures have been analyzed as the basis for selecting explanatory variables in the study.

1.1. Currency digitization in South Asia

E-banking mostly depends on information technology, where internet network is a prerequisite for comprehensive e-banking in Bangladesh (Al-Amin & Rahman, 2010). Sagar and Chowdhury (2014) found reasons for switching to the electronic fund transfer channel from the traditional fund transfer channel in Bangladesh based on the survey of 250 customers of five banks. Results of the survey show that percentages of switching to EFT are 14 percent due to less time requirement, 14 percent due to low cost, 12 percent due to saving more money, 16 percent due to more security, and 44 percent due to all above reasons. Uddin and Akhi (2014) concluded that since e-wallet is a web-based system that requires any device to access the system via internet, the system development will be possible if the government of Bangladesh has the necessary support for the initiative (Uddin & Akhi, 2014). Storti (2001) revealed that the central bank will lose its traditional instruments of monetary policy under the cashless economy concept.

Reserve Bank of India discourages banks from providing a service to crypto currencies holders, users and traders, since India does not support these currencies as a legal tender (Rodrigues, 2018). However, India supports electronic currency under regulation and supervision of the central bank. Digital illiteracy, cyber security, digital division, infrastructural problem etc. are challenges that can be addressed by properly planning and implementing a policy toward the transition to a cashless society (Ward, 2017).

All currencies in most of the South Asian countries are gradually becoming currency within the banking system, which is a precondition of transition to full-fledging e-money. Based on data for six (2012–2016) recent fiscal years and considering five South Asian countries, it has been found that an average of about 22.94 percent of currency of total broad money remain outside the bank in Pakistan. Nepal and India hold about 15 percent of currency as physical money (Martin, 2017). Bangladesh has about 12.79 percent of physical currency (Martin, 2017). The lowest share of physical currency remains in Bhutan with only 10.60 percent (Martin, 2017). In most of the South Asian countries, except Pakistan, more than 80 percent of currency is already in the banking system, which is a significant progress toward full currency digitization. Hence, on average, a significant share of currency was already in the banking system, which is used as an electronic currency in the form of demand deposits and time deposits in the commercial banks of South Asian countries, where deposits are collected and payments are made through electronic payment systems using bank accounts. However, instigation of full-fledged e-money will require 100 percent currency in the banking system.

1.2. Currency digitization outside South Asia

Nakayama, Ginko, and Kenkyujo (1997) identified some requirements for cashless economy that include security (preventing invalid use and identifying malicious users), merits from cash (direct transferability between individuals, off-line capability, and portability) and unique convenience (divisibility and efficiently managing the issuing of electronic money). Some minimum requirements to be fulfilled in case of launching and using e-money in the areas of more lax regulatory framework and possible use of instruments for illegal purposes are relevant for issuers of e-money in third world countries (European Central Bank, 1998). Yaqub, Bello, Adenuga, and Ogundeji (2013) pointed out that challenges of cashless Nigeria issues can be categorized regulatory, security, social and infrastructural. The research findings of Ochei (2012) demonstrate that the challenge of adopting cashless society is the susceptibility to overspending.

The concept of full-fledged e-money for all people in a particular country has rarely been developed in any of the literature that has yet been found. Therefore, this paper seems to be a new contribution as it emphasizes an in-depth analysis of the concept of instigating full-fledged e-money in the context of the least developed South Asian countries such as Bangladesh.

2. RESEARCH METHODOLOGY

2.1. Data sources and the sample size

Based on the review of existing literatures and availability of data, the variables and timeframe of data were selected for the study. Two different surveys were conducted separately to generate primary data. During the first survey, a structured questionnaire was used to take opinion regarding prospects of instigating full-fledged electronic money; 250 bankers serving in commercial banks were chosen as respondents. Besides, another survey was conducted with the structured questionnaire regarding challenges of instigating full-fledged electronic money, taking into consideration 185 bankers. Secondary data on percentage of components of money supply in total money supply and GDP (constant) growth rate for forty-two fiscal years (1974–2017) were collected as sample size for the known population for 47 (1971–2018) years according to Krejcie and Morgan (1970) sampling table. Besides, data on deposit interest rates and the inflation rate were collected for 10 months (July, 31–May, 31) for a 12-month fiscal year (Krejcie & Morgan, 1970).

2.2. Variables covered

Based on secondary data, the regression model has been developed to evaluate the impact of e-money supply on GDP (constant price) growth rate. Besides, the impact of the deposit interest rate on the inflation rate was found from another regression model under the proposed e-money mechanism. Each regression model covers two variables. To analyze primary data, two separate regression models have been developed for prospects and challenges of proposed e-money respectively from factor analysis. The models covered multiple factors as independent variables against each dependent variable.

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2.3. Sampling method

To generate primary data, stratified sampling was adopted to cover bankers of total 57 commercial banks as population size according to the proportion of 14%, 70% and 16% from SCBs, PCBs and FCBs, respectively. The survey was conducted from January, 2016 to August, 2016.

2.4. Survey instrument and data analysis tools

One structured questionnaire was developed with 21 statements regarding prospects for instigating full-fledged electronic money in Bangladesh. Another structured questionnaire contained 22 statements regarding challenges in stimulating full-fledged electronic money in Bangladesh. In both questionnaires, the five-step Likert scale ranging from strongly disagree (1) to strongly agree (5) has been used. Statistical tools, such as regression coefficient, factor analysis and structural equation modeling, have been used.

3. MODEL DEVELOPMENT FOR THE PROPOSED FULL-FLEDGED ELECTRONIC MONEY MECHANISM

Several electronic money models have been developed regarding the operational procedure of full-fledged e-money, secured and user-friendly software and cyber security measures. All these models can comprehensively drive the instigation and implementation of full-fledged e-money bringing together all the concerned authorities in the context of Bangladesh

3.1. Proposed operational procedure for instigating and implementing full-fledged electronic money

Under the proposed e-money mechanism, each and every transaction will be conducted through the banking channel that will require mandatory bank account for each and everyone. At first, all the existing paper currencies outside the banking system will be deposited to the respective bank accounts of customers. Banks will deposit all the paper currency to the Department of Currency Management of Bangladesh Bank (Central Bank of Bangladesh) to convert the paper currency into electronic money. After conversation to equivalent electronic money abolishing paper currency, the deposit will be transferred to the respective accounts of the depositors as e-money.

There will be no interest rate on deposit since deposit will be mandatory to be converted into e-money due to abolishing paper currency and making transaction. Deposit in the electronic format will create loanable fund after meeting up reserve requirements of Bangladesh Bank. Reserve creation will be monitored and supervised by the Monetary Policy Department of Bangladesh Bank. Hence, Bangladesh Bank will have full power to control money supply using variable reserve ratio as a monetary policy tool. Loan will be disbursed in the deposit accounts of the borrowers and maximum lending interest rate will be five percent (existing interest rate spread). Therefore, investment and consumption will increase because depositors will not get alternative investment opportunity to make money through the interest and spend for consumption rather than holding e-money in the accounts due to having single digit interest rate on borrowing and no interest on deposit.

Under the e-money mechanism, all the transactions will be conducted through the account-to-account transfer where master card, debit card, credit card or any other e-banking service will be utilized. E-wallet concept has not been implemented in Bangladesh yet but other above mentioned e-banking services are available. Balancing will be confirmed for each and every transaction through e-money. The e-money sender will make payment using any of the e-banking services entering the following instruction:

A/C No. (Recipient of Tk.)
Amount: .....
PIN: .....

The sender will get the following message in response of the instruction:

You have transferred Tk....transaction ID is ....
and your current balance is Tk.....

Source: Developed by authors.

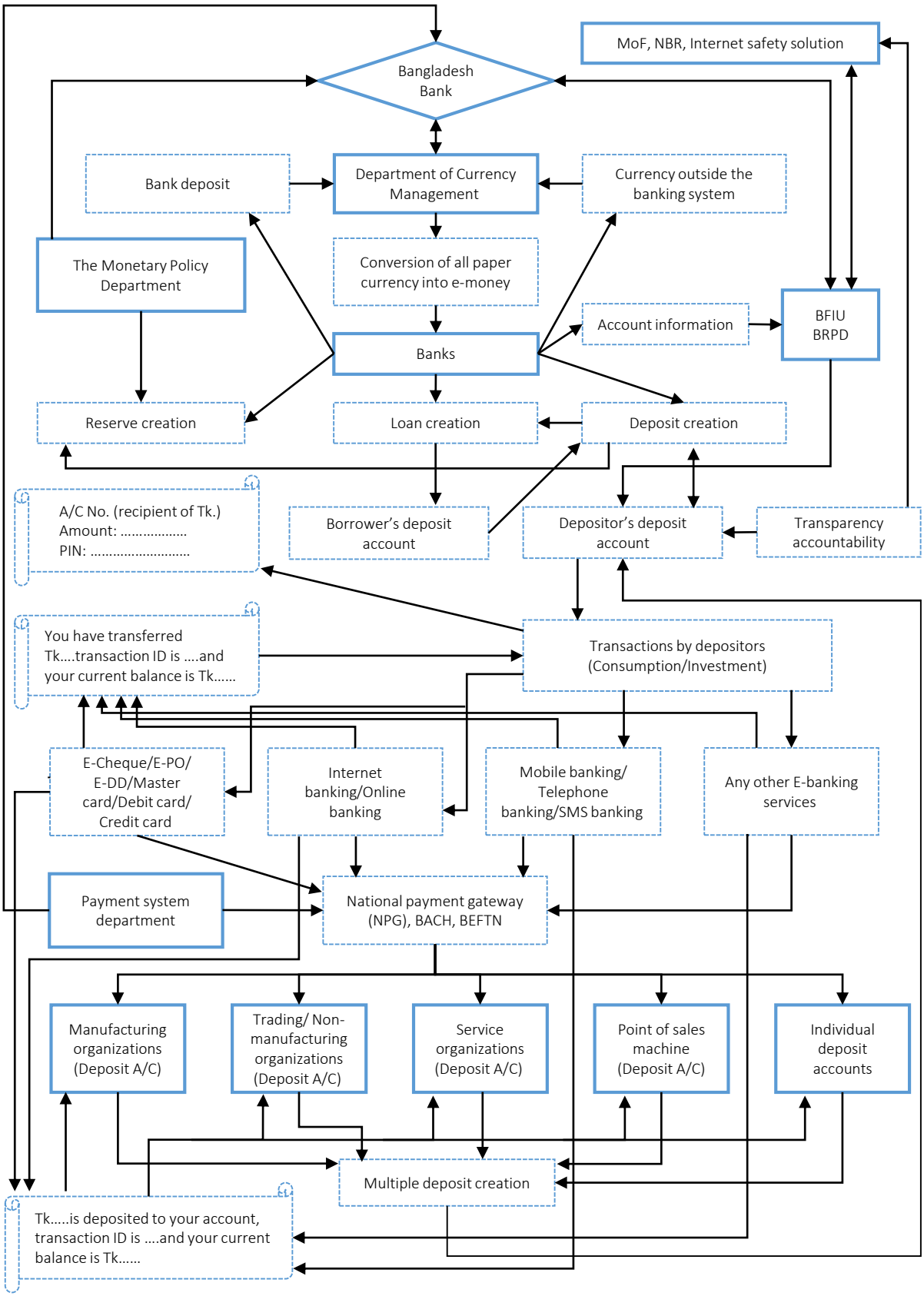

Figure 1. Operational procedure

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The recipient of the fund will get the following message after getting payment:

> Tk.....is deposited to your account, transaction ID is .....and your current balance is Tk.....

Each and every transaction will pass through one or more payment systems named National Payment Gateway (NPG), where the Payment System Department of Bangladesh Bank will monitor and supervise the payments. Under this mechanism, there will be a common platform for the banks, where all the banks will join NPG to settle transactions conducted using a debit card or a credit card in any point of sale (POS) machine. NPG will facilitate combating money laundering and ensuring low transaction costs, more flow of fund, easy access to funds, financial inclusion and increase of tax revenue through transparency and accountability of sources of income.

All the payments will be transferred to the deposit accounts of individuals, organizations and deposit accounts associated with POS machine. Therefore, deposit creation will again generate loanable fund in banks after meeting up the reserve requirement of Bangladesh Bank.

BFIU and BRPD of Bangladesh Bank will collect account information of depositors to monitor and supervise the deposit accounts for combating against money laundering, ensuring proper tax collection and regulating the banks. These departments will also provide account information to the Ministry of Finance, the National Board of Revenue and Internet Safety Solution, detectives etc. if necessary, collaborating with banks to ensure transparency and accountability of sources and the use of funds in deposit accounts.

3.2. Development of a proposed secured and user-friendly full-fledged electronic money software

Uniform software has to be developed for all the e-money users that will be operated by the bank clients with the help of the banks and supervised by the respective departments of Bangladesh Bank. At first, one needs to download the app or software in the electronic devices of the clients. Clients must log in into the e-money software through the suitable electronic device using a unique user ID number and a password.

Each account holder will have only one deposit account number, where the account number will contain a unique bank code and a branch code according to the last four digits. For example, account number: **05 22 33** for an individual client or organization. Each and every organization, including retail shop, will hang their account numbers at the prominent place of their territory so that it will be easy to make payment for any transaction through the deposit account. The My Documents menu of the particular client in the software will include a digital signature, an electronic deposit slip, a blanked electronic cheque and an issued electronic PO/DD. The digital signature will be same as the signature retained in account holder's bank for verification. In case of payment through the fund transfer option, all payments will be conducted from account to account fund transfer. A payer will send the instruction to his/her bank providing a payee's account number, amount of transaction and personal identification number (PIN). The instruction will be encrypted to the payer's bank. The payer's bank will decrypt the instruction and send it to the National Payment Gateway (NPG) for account to account transfer after further encryption. NPG will further decrypt the instruction and transfer the fund from payer's bank account to payee's bank account maintained in Bangladesh Bank. The payer's bank and the payee's bank will get confirmation from NPG after making payment. Respective payer's bank will send SMS to the electronic device of a payer for withdrawal of amount from his/her account and payee's bank will send SMS to the electronic device of a payee for depositing fund in his/her account.

In case of payment through the electronic cheque, a duly filled up leaf of cheque including digital signature has to be uploaded in the e-mail tagged with the software and sent to the payee's e-mail address. The payee will send the cheque to the payee's bank for collection of amount in his/her bank account. The payee's bank will send the cheque to the Bangladesh Automated Clearing House of Bangladesh Bank for account to account transfer. After the settlement of account to account transaction, NPG will send a

Source: Developed by authors.

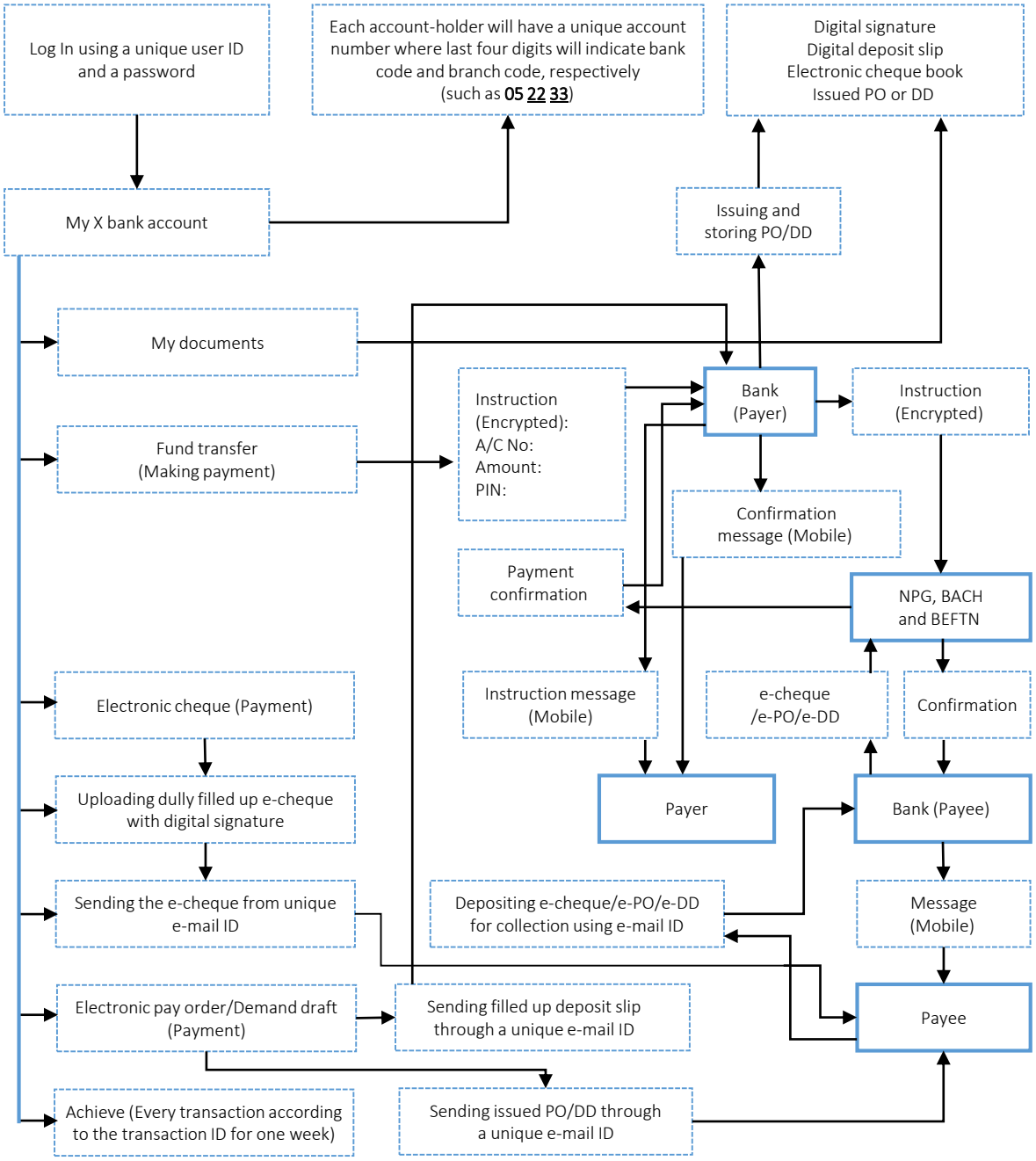

Figure 2. Secured and user-friendly software

message to the payer's bank and to the payee's bank for payment confirmation. After getting messages, the payer's bank will send a message to the payer for withdrawal of fund and the payee's bank will send a message to the payee for deposit fund in the bank account. In case of payment through Pay Order (PO) or Demand Draft (DD), the account holder will give an instruction to issue pay order to his/her bank with duly filled up soft copy of deposit slip, where payment to the bank for issuing PO or DD will be made from bank account. After getting instruction, the bank will issue PO or DD and store it in the My Documents menu. The payer will upload the issued PO or DD and send this to the payee through e-mail. The payee will send the electronic PO or DD to his/her bank for collection. Finally, the funds will be collected through the settlement by the Bangladesh Automated Clearing House (BACH) and a message will be sent to respective parties as a collection of fund through e-cheque.

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3.3. Proposed cyber-security model of full-fledged electronic money

Hackers may be involved in cyber-attack any time that will require taking cyber-security measures. In case of account to account fund transfer, hacker may send encrypted instructions to the victim's bank from illegal access in the software of victim. The hacker will require stealing a user ID number and a password to access to software and PIN for

Source: Developed by authors.

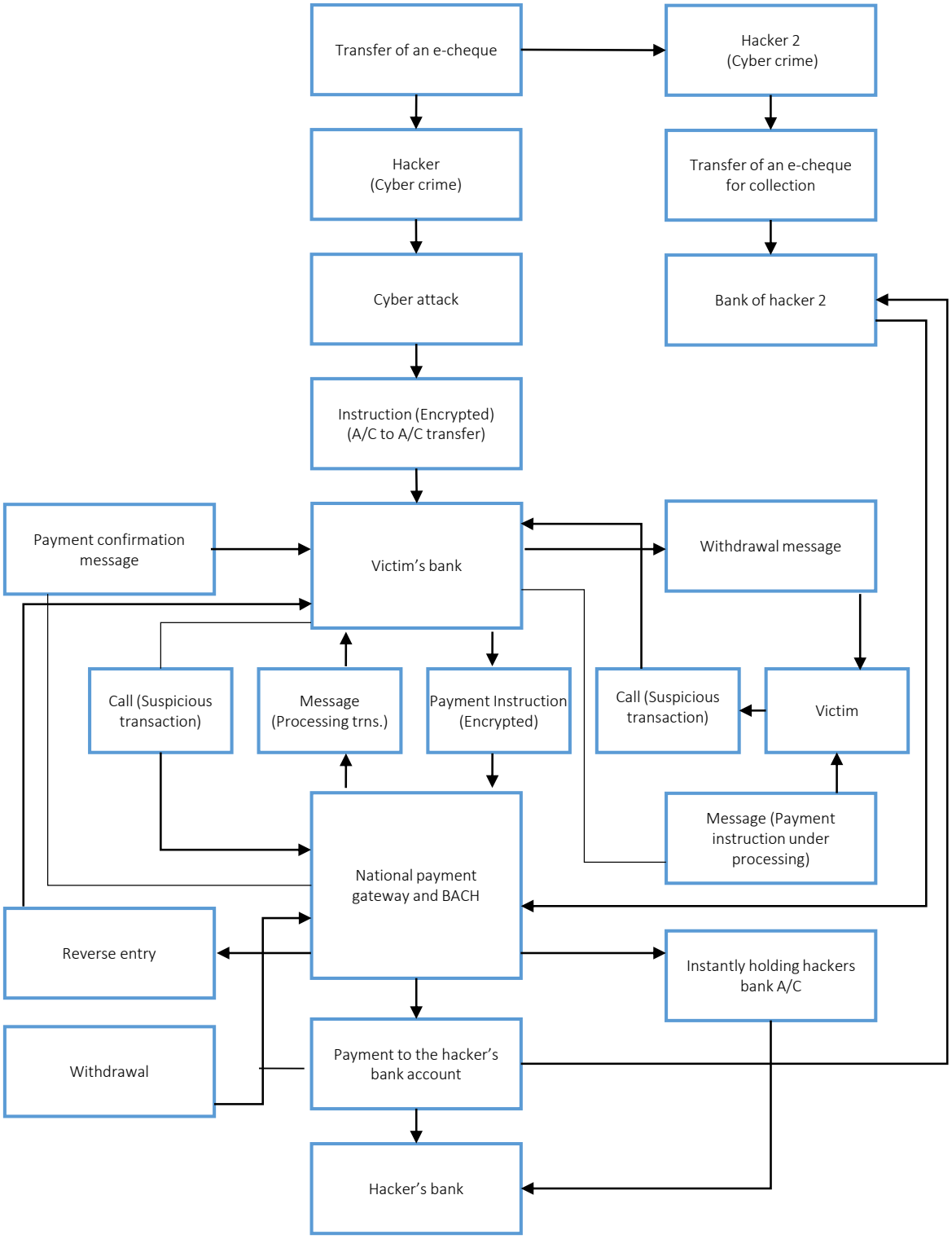

Figure 3. Cyber-security model

doing transaction after having access in the software in this regard. The victim's bank will decrypt the instruction and send the encrypted payment instruction to the National Payment Gateway. During the processing of transaction, a victim's bank and a victim will get a message (cheque No. will be mentioned in the cheque transaction). After the settlement of account to account fund transfer, respective banks and both the victim and the payee will get messages instantly.

If the transaction seems suspicious to the victim, he/she will call to his/her bank and the bank will call to the NPG after freezing the bank account of the victim immediately. NPG will inform the payee's bank and the payee's account will be freeze or hold instantly for the investigation. If the payer is proved as a hacker or criminal, NPG will give the reverse entry so that the victim can get the lost fund in his/her bank account again from the account of a payee or hacker since all the money will remain in the banking system. It should be noted that each person or organization will have only one bank account and every bank account will have some fund for making payment. Otherwise, the account holder will not be able to do any transaction. Therefore, if the nature of transaction of the hacker's account is investigated and account is kept freeze, the hacker or criminal will be financially weak and it will be easy for the concerned authority to identify the position and arrest the hacker or criminal. Personal property of the hacker or criminal can be considered for compensating the victim if account balance is not adequate.

In case of payment through the e-cheque, a hacker can send duly filled up cheque to his e-mail address or email address of any other criminal for collection. But, the hacker will require to steal a user ID number and a password to get access to the software and a password of e-mail ID of a victim to send a cheque after having access to software. If a hacker or any other criminal sends the dully filled up cheque for collection through his/her bank account, the respective victim will get a withdrawal message from his/her bank. Hence, he will have to inform his/her bank about the suspicious transaction so that the bank of a victim and a hacker can freeze the accounts of a victim and a payee immediately and the National Payment Gateway will take necessary steps through the reverse entry such as account to account fund transfer mechanism mentioned earlier.

In case of hacking through making payment issuing pay order or demand draft, a victim will be informed through the message of the victim's bank at the very beginning of issuing pay order since the amount of pay order will be withdrawn from the bank account of the victim. The victim will inform his/her bank instantly and the issuing pay order or demand draft will be stopped and account will be freezed instantly for the security purpose. If pay order or demand draft is already issued, a hacker will also require a password of the e-mail account to send it from the database system of software.

4. RESULTS AND DISCUSSION

The following subsections discuss the results of econometric analysis.

4.1. Factor analysis of the prospects for implementing full-fledged e-money in Bangladesh

The constructs of prospects for instigating full-fledged e-money have been accepted with factor loading more than 0.40. KMO value of the sampling adequacy measurement is 0.728, which is greater than 0.60 allowing collected data to proceed with factor analysis. The result shows that all these accepted factors have eigenvalues greater than 1 with cumulative percentage of variation ranging from 19.58% to 61.69%. The study determined five main factors out of 18 items as the prospects for instigating full-fledged e-money in Bangladesh excluding rest of the three items due to having factor loading less than 0.40 (Appendix A, Table A1). These factors are presented below.

Factor 1

Low default rate, cost effective transaction, much consumption and increased level of production, security of opening bank branches in remote areas, revolutionary change in online business and online banking, minimization of risk of losing cash of people and theft and robbery in banks, bringing transparency and accountability in tax collection,

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time saving and convenience, strengthening power of government, enhancing financial inclusion.

Factor 2

Generation of the employment opportunity, minimization of cost of production and stimulating investment, controlling money supply easily.

Factor 3

Rapid cross border transactions, usage of mobile devices, PC, POS machine, etc. instead of depending on ATM.

Factor 4

Minimization of corruption in public and private organizations, minimization of fund diversion.

Factor 5

Minimization of probability of crime and money laundering.

The prospects of e-money contained in Factor 1 are mainly related to the consumption-driven, production-oriented, cost effective and prompt technology-based creditworthy inclusive payment system. The prospects of Factor 2 are related to production and investment driven employment generating fully controlled money supply. Factor 3 consists of prospects related to rapid cross border transaction and electronic payment system abolishing the ATM usage. Factor 4 consists of minimization of corruption and money laundering. Factor 5 is related to easy detection of criminals through the bank account.

The above five factors can be named as the acceleration of economic development driven by transparency and accountability from monetary dealings through electronic money. The result suggests that these factors are prospects for instigating full-fledged electronic money in Bangladesh.

4.2. Structural equation modeling

The statistical result of multiple regression analysis shows that all values of VIF for the five independent variables are less than 10 and all values of tolerance are greater than 0.2 (Appendix A, Table A4). Therefore, the multi-collinearity problem in the following model is insignificant.

The fitted regression model is:

$$\textit{Prospects} = 4.58 + 1.086\ (\text{consumption driven, production-oriented, cost effective, and prompt technology-based creditworthy inclusive payment system}) + 1.080\ (\text{production and investment driven employment generating fully controlled money supply}) + 1.205\ (\text{rapid cross border transaction and electronic payment system abolishing usage of ATM}) + 1.006\ (\text{minimization of corruption and money laundering}) + 1.317\ (\text{easy detection of criminals through bank account}). \quad (1)$$

The value of r^2 is 0.975 or 97.5%, which indicates that 98% of variation in the dependent variable can be explained by the independent variables in the above model. Adjusted r^2 value of 0.975 or 97.5% depicts no need of adding additional independent variable (Kothari, 2004) in the model. All the above factors are statistically significant at the 5% significance level.

4.3. Factor analysis of the challenges of implementing full-fledged e-money

The constructs of challenges of instigating full-fledged e-money have been accepted with factor loading more than 0.40. KMO value of the sampling adequacy measurement is 0.698, which is greater than 0.60 allowing collected data to proceed with factor analysis. The result shows that all these accepted factors have eigenvalues greater than 1 with cumulative percentage of variation ranging from 17.56% to 52.81%. The study determined six main factors out of 18 items as the challenges of instigating full-fledged electronic money in Bangladesh excluding rest of the four items due to having factor loading less than 0.40 (Appendix A, Table A2). These factors are presented below

Factor 1

Requirement of sophisticated community of the software developers, requirement of secured and

user-friendly software for all, requirement of technical infrastructure, inflation stimulation, availability of electronic devices, internet services, internet applications, wireless application protocols for all, increased tendency of hacking at the beginning, safely storing PIN and electronic devices, domination of the central bank.

Factor 2

Lack of privacy, difficulties with preparation of the legal e-money framework, domination of foreign commercial banks.

Factor 3

Availability of reasonably priced mobile devices, training minors to work with bank accounts and transactions, lack of IT experience and management skills of bankers.

Factor 4

Requirement to keep and manage foreign currency only by the central bank.

Factor 5

Requirement to minimize the level of training for handling e-money transactions.

Factor 6

The economy may fall into crisis if production capacity cannot be increased, requiring a minimum level of transaction costs.

The challenges of Factor 1 are mainly related to the need for advanced technological infrastructure, secured and user-friendly software with high-speed internet services, supported by the sophisticated community of software and protocol developers under the authority of the central bank. Factor 2 relates to the lack of privacy and legal framework of e-money under the dominance of foreign commercial banks. Factor 3 includes the need for expertise and managerial skills of bankers to train minors, disables, illiterate people and disadvantaged people to handle transactions and availability of electronic devices for all as e-money challenges. Factor 4 relates to the need for prudential management of foreign currency transactions by the central bank. Factor 5 is related to the requirement of increased production capacity and minimum transaction costs. Factor 6 includes the requirement of ensuring minimum level of training for all to handle e-money transactions.

The above six factors can be termed a requirement of the sophisticated information technology oriented community that will have willingness and ability to take the advantages of IT under the required IT infrastructure provided by the government and the private sector. The result suggests that these factors are the main challenges of instigating full-fledged e-money in Bangladesh.

4.4. Structural equation modeling

The statistical result of multiple regression analysis shows that all the values of VIF for the six independent variables are less than 10 and all the values of tolerance are greater than 0.2 (Appendix A, Table A3). Therefore, the multi-collinearity problem in the following model is insignificant.

The fitted regression model is:

$$\textit{Challenges} = 4.62 + 1.251 \text{ (requirement of advanced technological infrastructure having secured and user-friendly software with high-speed internet services supported by sophisticated community of software and protocol developers under the dominance of the central bank)} + 1.262 \text{ (lack of privacy and legal framework of e-money under the dominance of foreign commercial banks)} + 0.691 \text{ (requirement of expertise and managerial skills of bankers to educate minors, disables, illiterate people and disadvantaged people to handle transactions, and availability of electronic devices for all)} + 1.159 \text{ (requirement of prudential management of foreign currency transactions by the central bank)} + 1.149 \text{ (requirement of increased production capacity and minimum transaction costs)} + 1.276 \text{ (requirement of minimum level of training for all to handle e-money transactions).} \quad (2)$$

The r^2 value of 0.954 or 95.4% shows that 95% of variation in the dependent variable can be ex-

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plained by the above model, where there is no need to add additional variable in the model since the value of adjusted r^2 is .953 or 95.3%. All the above factors are statistically significant at the 5% significance level (Gujrati, 2012).

4.5. Monetary policy implementation under the proposed full-fledged e-money mechanism

As the full-fledged e-money mechanism can extensively increase money supply through money multiplier effect generated from the multiple deposit creation that will be controlled by the central bank (Bangladesh Bank), it is necessary to show the impact of electronic money supply on several vital economic indicators. Besides, it is required to determine the appropriate level of e-money supply to achieve a targeted level of growth in significant economic indicators. Besides, the impact of the deposit interest rate on the inflation rates needs to be addressed since the e-money mechanism will require no deposit interest rate to protect inflation and stimulate economic growth. Economic benefits of instigating full-fledged e-money to implement monetary policy are shown in following subsections based on the impact of the e-money mechanism on several economic indicators as a goal of monetary policy:

4.6. Estimation of deposit creation and loan creation under the proposed full-fledged e-money mechanism

Total money supply (*M*2) in economy has been found of about BDT 834501 crore in 2016 (Bangladesh Economic Review, 2016–2017). The current reserve requirement (statutory liquidity reserve and cash reserve ratio) is 19.5% of deposits (Bangladesh Economic Review, 2016–2017). Hence, if all the currencies outside the banking system and the deposit money in the banking system are converted into e-money and mandatorily deposited in banks, then maximum deposit creation in economy can be BDT 4279488 crore (BDT834501÷0.195) that can generate total loan of BDT 3444988 crore and total reserve of Tk. 834500 crore at a time after the conversion to e-money in the banking system. The process of deposit creation will be continuous as the given loan from the bank will be repaid that will create deposit again and again. If increased level of money supply cannot generate production through investment, then the economy may face inflationary pressure due to having more money to consume but less goods and services to consume.

4.7. Impact of physical currency (currency outside the banking system) on GDP

According to the last forty-two fiscal years (1974–2017) data collected from the Bangladesh Economic Review (2016–2017) on the percentage of currency outside the banking system in economy and GDP (constant price) growth rate, following statistical outcome has been generated.

There is a moderate degree of a negative correlation ($r = 0.502$) between percentage of currency outside the banking system as physical currency and GDP growth rate. The value of $r^2 = 0.252$ or 25.2% or 25% implies that 25% of the total variation of GDP growth rate can be explained by the variation of percentage of currency outside the banking system. Durbin-Watson value is 1.796 and p-value is 0.001. Significance level is 1%.

The simple linear regression model is developed by taking percentage of currency outside the banking system as the independent variable and GDP growth rate as the dependent variable.

The fitted regression model is:

$$\hat{GDP} = 8.975 - \\ - 0.502\,(\hat{Currency_Outside_Banking_System}), \quad (3)$$

where $\beta_0 = -0.502$ implies that if percentage of currency outside the banking system increases by 1 percent then GDP growth rate will decrease by 0.502 percent. If percentage of currency outside the banking system is zero, then GDP growth rate will be about 8.98 percent.

4.8. Impact of electronic currency (demand deposit and time deposit) on GDP

From the data of the last forty-two fiscal years (1974–2017) collected from the Bangladesh Economic

Review, 2016–2017, regarding the percentage of demand and time deposits in the banking system in economy and GDP (constant price) growth rate, the following statistical results have been found:

There is a moderately positive correlation (r = 0.501) between demand deposit and time deposit in the banking system and GDP growth rate. The value of r^2 = 0.251 or 25.10% or 25% implies that 25% of the total variation of GDP growth rate can be explained by the variation of demand deposit in the banking system.

The simple linear regression model is formulated by considering demand deposit and time deposit in the banking system as the independent variable and GDP growth rate as the dependent variable.

The fitted regression model is:

$$\hat{GDP} = -18.451 + \\ + 0.501(Currency_Within\hat{\ }_Banking_System) \quad (4)$$

where β_0 = 0.501 implies that if demand deposit and time deposit percentage in the banking system increases by 1 percent, then GDP growth rate will increase by 0.501 percent. If demand deposit and time deposit percentage in the banking system is zero, then GDP growth rate will be negative around 18.45 percent.

4.9. Impact of the deposit interest rate on the inflation rate under the proposed e-money mechanism

From the data for ten months (June, 2015–April, 2016) collected from the Bangladesh Economic Review 2016–2017, regarding the weighted average deposit interest rate and inflation rate, the following statistical results are obtained:

The results reveal a high degree of positive correlation (r = 0.901) between deposit interest rate and inflation. The value of r^2 = 0.812 or 81.20% or 81% implies that 81% of the total variation of inflation can be explained by the variation of deposit interest rate. The following simple linear regression model is formulated by taking into account deposit interest rate and inflation rate:

$$Inflation = 1.83 + 0.901\hat{DIR}, \quad (5)$$

where β_0 = 0.901 implies that if deposit interest rate increases by 1 percent, then inflation rate will increase by 0.901 percent. Finally, if deposit interest rate is zero under the proposed full-fledged e-money mechanism, then inflation will be only 1.83 percent.

CONCLUSION AND RECOMMENDATION

The results of the study revealed that the proposed full-fledged e-money model (Figure 1) involves several departments of the central bank (Bangladesh Bank) and requires only one mandatory deposit account for each person in the country, where each and every transaction will be conducted through the bank account. Customers will select banks based on only the service quality, not deposit interest rate, since the proposed e-money mechanism will not offer any interest rate on deposit where people will willingly deposit whole money in the bank accounts as e-money to perform regular transactions. A unique code/ID number for each and every electronic note can be introduced under the full-fledged electronic money mechanism. The proposed e-money software (Figure 2) will be password-protected that will take advantage of e-mail for doing transactions. It will ensure transactions through e-cheques, e-pay order and e-demand draft besides e-currency. Payment instructions will be encrypted and decrypted several times that will ensure more security. Bangladesh Bank has to be capable enough to handle the huge transactions with adequately skilled manpower. Cyber security model (Figure 3) of e-money will protect from hacking through reverse entry. Regularly upgrading the proposed full-fledged e-money software and cyber security model will be required so that hackers cannot find out any weakness to enter into the proposed system.

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In this study, acceleration of economic development and culture of creditworthiness, driven by the transparency and accountability of monetary transactions, looks like the prospect of the proposed full-fledged e-money mechanism. A full-fledged e-money model should be used to detect fund diversion and ensure use of fund in productive sectors to build a culture of creditworthiness in the banking sector. On the other hand, the requirement of a sophisticated IT-oriented community that will have the desire and ability to take advantages of IT under the required IT infrastructure, provided by the government and the private sector, has been identified as a challenge of the proposed full-fledged e-money mechanism. An advanced technological infrastructure having secured and user-friendly software with high-speed internet services maintained by sophisticated community of software and protocol developers has to be developed to overcome the challenges of instigating full-fledged e-money.

It can be demonstrated that without any currency outside the banking system or with the full currency digitization within the banking system, GDP growth rate will be sustainable at 8.98% if all other things remain constant. Usually, people keep currency outside the banking system for transaction purposes only specially for consumption, which is rarely invested directly for production and GDP growth. On the other hand, currency that remains in the banking system is systematically invested in the short and long term through lending by financial intermediaries. These bank deposits are invested in agriculture, industry and service sectors that directly contribute to GDP growth. So, if no currency remains in the banking system, it will result in negative GDP growth rate assuming all other things remain constant. Moreover, it seems that the more the currency in the banking system, the better the GDP growth rate. Inflation rate will be only 1.83% under the strict control of the central bank since the proposed full-fledged e-money mechanism will not offer any interest on the deposit. As the deposit will be mandatory for each citizen under only one bank account for each, he/she will decide to open and keep a bank account, based on only the service quality of a bank not a deposit interest rate. This mechanism will ensure a maximum 5% interest rate on a bank loan as the interest rates determined by the central bank extend. Therefore, the cost of production will be lower because of low cost of capital, resulting in lower price level of goods and services and a well-controlled inflation rate besides the sustainable GDP growth rate.

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APPENDIX A

Table A1. Prospects for instigating full-fledged e-money in Bangladesh

Source: Field Survey (2016, August).

Component Matrix						
	Component					
	1	2	3	4	5	6
Encourage innovation						.288
Mobile phone, PC, POS machine, etc. instead of ATM			.507			
Minimize corruption in public and private organizations				.545		
Minimize fund diversion				.497		
Strengthen the power of government	.464					
Enhance financial inclusion	.409					
Bring transparency and accountability in tax collection	.481					
Cost effectiveness	.579					
Security of opening branches in remote areas	.519					
Minimize cost of production and stimulate investment		.447				
Hacking of money will be minimized	.391					
Easy control of money supply		.447				
Probability of crime will be minimized					.447	
Generation of huge employment opportunity		.468				
Much consumption and increased level of production	.534					
Time saving and convenient	.472					
Revolutionary change in online business and online banking	.498					
Rapid cross border transaction			.547			
Green banking through automation and paper saving	.333					
Minimize the risk of cash loss by people, theft and robbery of bank	.482					
Default rate of borrowers will decrease	.595					
Eigenvalue	5.288	2.457	1.525	1.466	1.131	1.042
Percent of variation	19.584	9.098	5.648	5.430	4.189	3.860
Cumulative percent of variation	19.584	28.683	34.331	39.761	57.833	61.693

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; KMO = 0.728 and only factor loading ≥ 0.40 has been shown in the table.

Table A2. Challenges of instigating full-fledged e-money in Bangladesh

Component matrix						
	Component					
	1	2	3	4	5	6
Controlled and regulated only by the central bank	.423					
Stimulates inflation	.493					
Secured and user-friendly software for all	.544					
Software usable by disable and illiterate people						.309
Foreign currencies have to be kept and managed by the central bank only				.539		
Banks will remain main players in the financial service industry	.382					
Economy will be in crisis if production capacity cannot increase						.505
Tendency of hacking will increase at the beginning	.456					
Limited service charges have to be imposed	.332					
Foreign commercial banks may dominate		.540				
Minimum level of training for handling transactions					.578	
People are not aware of e-money	.352					
Transaction costs should be minimal						.503
Privacy may be hampered		.653				
Difficult to prepare a legal e-money framework		.547				

Table A2 (cont.). Challenges of instigating full-fledged e-money in Bangladesh

Component matrix						
	Component					
	1	2	3	4	5	6
Technical infrastructure will be required	.537					
Requirement of Internet applications, wireless application protocols for mobile phones, operating systems, etc.	.463					
Lack of expertise and management skills of bankers			.441			
The price of a mobile phone should be reasonable			.531			
Educate minors to operate bank accounts and make transactions			.478			
You need safely store and use your PIN and electronic devices	.448					
Sophisticated community of software and protocol developers	.549					
Eigenvalue	4.213	2.543	1.926	1.447	1.373	1.172
Percent of variation	17.555	10.596	8.023	6.031	5.719	4.883
Cumulative percent of variation	17.555	28.150	36.173	42.204	47.923	52.806

Note: Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; KMO = 0.698 and only factor loading ≥ 0.40 has been shown in the table.

Table A3. Statistical output for the prospects

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(Constant)	4.583	.830	–	5.520	.000	–	–
Factor 1	1.086	.020	.662	53.724	.000	.712	1.405
Factor 2	1.080	.044	.273	24.623	.000	.877	1.140
Factor 3	1.205	.069	.195	17.510	.000	.873	1.146
Factor 4	1.006	.069	.162	14.634	.000	.878	1.138
Factor 5	1.317	.098	.147	13.418	.000	.902	1.108

Table A4. Statistical output for the challenges

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(Constant)	4.623	1.372	–	3.370	.001	–	–
Factor 1	1.251	.043	.552	28.800	.000	.750	1.333
Factor 2	1.262	.065	.370	19.372	.000	.757	1.321
Factor 3	.691	.072	.185	9.628	.000	.750	1.334
Factor 4	1.159	.166	.123	6.986	.000	.896	1.116
Factor 5	1.149	.157	.132	7.328	.000	.857	1.167
Factor 6	1.276	.116	.196	11.013	.000	.876	1.142

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