Maximum Daily Cash Transaction Enforcement in Nigeria Cash-Lite Economy

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ABSTRACT

A cash-lite economy is an economy whereby there is a reduction in the high usage/volume of cash in circulation. It encourages the use of electronic payment channels and reduces the cost of cash production and transportation. This paper focuses on preventing daily over-limit cash transactions as a security measure, to enforce the Nigeria Apex Bank cash-lite policy, on daily raw cash transaction limits and the associated penalties.

This paper presents a remedy to stabilize and achieve the purpose of the new cash-lite policy in the Nigerian economy. At the point of every transaction, it checks for the existence of any previous transaction on that particular day, especially transaction(s) of the same type (that is withdrawals or deposits) and the similarity between the account owner's particulars using Bayes' theorem, to calculate the P(X).

If the P(X) >= 0.5 that is calculated result, it will conclude that those earlier transactions having the P(X)>=0.5 has been carried out by the same person who is about to transact at the transaction point. Then, it later calculates the total amount of transact(s) for that day. If the calculated total transaction is beyond the set daily limit, it will subtract the daily limit from the total transaction and calculates the excess charges on individual account using 2% for cash deposits, 3% for cash withdrawal and on corporate account using 3% for cash deposits and 5% for cash withdrawal.

(Keywords: multiple financial transactions, Bayes' theorem, Central Bank of Nigeria, CBN)

INTRODUCTION

There is a reduction in the usage/volume of cash in circulation in a cash-lite economy; it encourages the use of electronic payment channels and reduces the cost of cash production and transportation. According to Preeti and Manvi (2017) a cashless economy is one in which all the transactions are done through electronic channels such as debit/credit cards, Immediate Payment Service (IMPS), National Electronic Funds Transfer (NEFT). and Real Time Gross Settlement (RTGS). It is not the complete absence of cash, but rather it is an economy setting in which goods and services are bought and paid for through electronic media.

The introduction of a cash-lite economy policy by Nigeria Apex Bank was aimed at reducing the cost of cash management, increasing efficiency of the payments system, and driving financial inclusion according to Musa (2015). This policy was designed to provide mobile payment services, breakdown the traditional barriers hindering financial inclusion of millions of Nigerians, and bring in low-cost, secure, and convenient financial services to urban, semi-urban, and rural areas across the country (Emengini and Alio, 2014). It aimed at reducing the dominance of cash in the system, by promoting the use of alternative payment channels. As a result, the regulator has limited daily cash withdrawals/lodgment by bank customers in the country (*This Day*, 2013).

The pilot phase commenced in Lagos in January 2012. According to the Central Bank of Nigeria (CBN), the policy was later extended to some other states by the year 2013. The new policy on cash-based transactions (withdrawals and deposits) in banks, aim at reducing not eliminating the amount of physical cash (coins and notes) circulating in the economy and encouraging more electronic-based transactions for payment of goods, services, transfers, and so on (Central Bank of Nigeria, 2011).

Table 1: Individual Accounts.

TRANSACTION	DAILY CASH TRANSACTION LIMIT	FEES
CASH DEPOSITS	₦500,000.00(Five Hundred Thousand Naira)	2% of excess amount over the set limit
CASH WITHDRAWALS	₦500,000.00(Five Hundred Thousand Naira)	3% of excess amount over the set limit

Table 2: Corporate Accounts.

TRANSACTION	CASH TRANSACTION LIMITS	FEES
CASH DEPOSITS	₦3,000,000.00 (Three Million Naira)	3% of excess amount over the set limit
CASH WITHDRAWALS	₦3,000,000.00 (Three Million Naira)	5% of excess amount over the set limit

Tables 1 and 2 present the total daily cumulative cash and ATM deposits/withdrawals, across all accounts owned by an individual or a corporate entity in Nigeria (WEMA Bank, 2012).

Through the system, users can pay utility bills, school fees, hotel and airline bookings, and house rents, among other transactions or using a mobile phone device(s). One important thing about mobile money is the fact that it thrives on agency network, thereby taking traditional banking and its cumbersome processes in the cities to the streets in sub-urban areas where accredited mobile money agents also operate (*This Day*, 2012). A cash-lite economy enforces law, prevents corruption, promotes literacy, reduces crime committed with cash, promotes e-business, creates jobs, enhances banking ethics and so on.

A cash-less or mixed economy reduces risk level in lending transactions. This allows the lender to place more priority on the viability of the transaction; furthermore, the domiciliation clause in lending transactions will have better security value. This is because it will be easier for the lender to know when the business proceeds are not being routed through the transaction account. It is an obvious improvement on the *status quo*, as at today a significant percentage of the bad loans in our banks are fallouts of borrowers default on domiciliation clauses in contracts, the policy will enhance the efficacy of monetary policy operations and economic stabilization measures and balance genuine currency transaction demands and speculative market behaviors, as at March 2011, currencies in circulation stood at ₦1.42 trillion, while those outside banks' vaults, stood at ₦ 1.025 trillion as at February, 2011. Cashless banking is the route to financial inclusiveness and inclusive development (*Business Day*, 2012).

The policy is commendable given the fact that transactions in goods and services in the Nigerian economy are heavily cash-based. This imposes enormous costs on the banking system and customers in form of high rates and other charges. According to the CBN, the direct cost of cash management to the banking industry in 2009 was ₦ 114.5 billion, with an estimated cost of ₦ 192 billion by 2012. The spiraling cash management cost, most of which are passed to customers in the form of bank charges and lending rates, is as a result of the country's cash dominant economy (*Business Day*, 2012).

In Nigeria, almost everything is paid for in cash. In super markets, cheques are hardly accepted, and when applied, delivery of goods and services is only completed when the beneficiary gets value from the bank. Therefore, Nigeria has remained a cash-based economy, despite the growth in the country's banking sector, the billions of Naira invested in electronic banking over the years, and the cost of handling cash which is eating into banks' profits and liquidity on which banks will be spending ₦ 192 billion on cash handling by this year, noting that this would be passed on to customers in terms of fees and interest charges. The Nigeria Apex Bank then adopted the measure of cash-lite economy to curb dominance of cash in the economy, with its attendant implication for cost, security and money laundering, among others.

According to *This Day* (2012), "it is estimated that over 70 per cent of cash in circulation in the Nigerian economy exists outside the formal banking system". This means government spends a lot of money replacing cash with new ones; this has cost implications for the economy. Moreover, physical cash has life span; it gets destroyed easily. If cash is not in the formal

system it cannot be used for lending, but if you know an aggregate, that is, how much money is available to kick-start the economy, it makes lending and production easier (*Business Day*, 2012). And, the disadvantages of transacting businesses with cash, outweighs its advantages, noting that in 2009, the total cost spent on cash-in-transit was ₦ 27.3 billion, while cash processing stood at ₦ 69 billion. The high cost of processing cash, revenue leakages, and inefficient treasury management, among others, are some of the negative side of a cash-based economic system (Michael, 2011).

High usage of cash results in a number of challenges across the whole banking system. Some of them include robberies and cash-related crimes; high cost of processing borne by every entity across the value chain (that is, from Apex Bank, to banks, to the operating entities as well example, staff required to process cash transactions that manually operate the process); revenue leakage arising from significant handling of cash; inefficient treasury management due to the nature of cash processing; limitations of monetary policy due to high volumes of cash outside the formal economy, and this encourages money-laundering, terrorist funding, among other related acts. To address these challenges, the cash policy was introduced to encourage cash-lite payments and to encourage electronics transaction.

Factors Militating against the Development of the Cashless Policy

There are factors militating against the development of the cashless policy, among the issues are instituted from infrastructural and technology instability according to (Guardian, 2012). Multiple opening a bank account to boycott over limit daily cash transaction policy penalty and the security issue, specific needs of the consumers is that they want low-risk, maximum security payments services that preserve the confidentiality of any private information (Nick, 2008).

Cashless Policy

Over the course of history, there have been many different forms of payment systems. Originally, barter was quite common. Eventually, various forms of money were introduced. In the mid-twentieth century, charge cards debuted. Ever since then, pundits have been predicting the demise of paper instruments and the emergence of a "cashless society." Today, we still pay with cash and cheques, but several other payment instruments, such as credit and debit cards, are widely used. The use of paper money is declining, but at a slow pace. As more payment systems have been introduced, researchers have begun to critically examine their costs from both private and social perspective. From a private perspective, researchers have examined the incentives payers have for choosing a given type of payment instrument, the incentives retailers may have for accepting such instruments, and why various payment methods are used in different settings. From a social perspective, researchers have examined whether economic welfare would increase if certain payment instruments displaced others such as, if electronic instruments displaced paper-based instruments (Daniel et al., 2004).

According to the research conducted by Business Day (2012), for the lower segment, 61.2% said they have ATM cards and use them. Only 10% said they don't have and do not want. It was discovered also that it is more likely for the top/middle segment individuals to have more than one account (70% of those in this segment has at least three accounts) than for a low segment individual. The top/middle segment refers to highly educated individuals who have a minimum of HND (Higher National Diploma) education. In most cases these individuals are acquainted with and use the Internet. The lower class is made up of those with lower educational qualifications.

Individuals and corporate organizations spread their Bank daily transaction across virtually all the Banks as an alternative to circumvent the cash-lite economy daily cash transaction limit and associated penalty. For the policy to be effective there should be preventive measures to debar the account users from circumventing the policy limit and associated penalty. This research shall be limited to the Nigeria cash-lite economy and to daily cash transactions limit enforcement.

Modes of Cashless Transactions

There are several modes of promoting cashless transactions; according to Kokila and Ushadevi

(2017) following are some of the various modes of digital payments system available:

1. Banking Cards (debit, credit, cash, travel, and others)

2. Unstructured Supplementary Service Data (USSD)

3. Aadhaar Enabled Payment System (AEPS)

5. Unified Payments Interface (UPI)

6. Mobile Wallets (Paytm, Freecharge, Mobikwik, Oxigen, Mruppee, Airtel money, Jio money, Sbi buddy, Itz cash, Citrus pay, Vodafone M-pesa, Axis bank lime, ICICI pockets, Speedpay, etc.)

7. Bank Pre-paid Cards

8. A Point of Sale (POS) is the place where sales are made

9. Internet Banking also known as Online Banking, E-banking or Virtual Banking

10. Mobile Banking is a service provided by a bank or other financial institution

11. Micro ATM meant to be a device that is used by a million business correspondents (BC)

This research aims at developing a system to enforce cash-lite economy policy using a Bayes' Theorem for developing nations such as Nigeria. The objectives are as follow: identification of individual account daily transaction; fraud prevention (internal and external), proper implementation of cash-lite policy and limit and associated penalty enforcement.

MATERIALS AND METHODS

The statistical Bayes' theorem is used to calculate the value "P(X)" which in turn will be used in determining the daily cash transaction of individual customers as shown:

$$p(a,b,c...z)=\frac{a*b*c*.....*z}{a*b*c*.....*z+[(1-a)*(1-b)*(1-c)*.....*(1-z)]}$$

Where:

a *= is the first item/particular/data supplied by the customer at the account opening desk and found existing already in the database e.g. first name.*

b *= is the second item/particular/data supplied by the customer at the account opening desk and found existing already in the database e.g. middle name.*

c *= is the third item/particular/data supplied by the customer at the account opening desk and found existing already in the database e.g. last name.*

z *= which is the last item/particular/data supplied by the customer at the account opening desk and found existing already in the database e.g. address.*

The above theorem can be broken into x_1 or Equation 1, x_2 or Equation 2, later form up P(X) as shown below:

x_1 = a*b*c*……*z ..... **(1)**

x_2 = (1-a) * (1-b) * (1-c) *……* (1-z)..... **(2)**

Then form up the P(X) shown below from both x_1 and x_2 or Equation (1) and Equation (2) above.

P(x) = (X_1 / (X_1 + X_2)) or **P(x)** = (eqn1/ (eqn1+ eqn 2))

Table 3 was used to calculate the chance value based on the suggested possible combination of six particular set of account users' outcome. Possible combination of items in a particular occurrence is shown in Table 3.

It is proposed that the result shown in the Table 3 is the possible combination of supplied six sets of account users' particulars/items, which is within a set of six customers/combinations. It is possible to have 2 customers having the same first name, 2 customers having the same middle name, 2 customers having the same last name, 1 customer having unique date of birth, 5 customers having the same sex, 1 customer having unique next of kin, 4 customer having the same occupation, 1 customer having unique address, 6 customers having the same account type, 1 customer having unique international passport number, 1 customer having unique national identification number, 1 customer having unique passport photograph, 1 customer having unique biometric identification and 1 customer

having unique signature. Table 3 presents the following columns:

S/n: Means serial number.

Item/Particular: List of customers supplied information /particulars.

C_1: First account user's particulars, among the six (combination) users supplied data.

C_2: Second account user's particulars, among the six (combination) users supplied data.

C_3: Third account user's particulars, among the six (combination) users supplied data.

C_4: Forth account user's particulars, among the six (combination) users supplied data.

C_5: Fifth account user's particulars, among the six (combination) users supplied data.

C_6: The sixth account user's particulars, among the six (combination) users supplied data.

n: number of the given combination which is "6".

Frequency (F): Number(s) of possible outcome of each particular /item within the six combinations.

Mean (f/n): Possible outcome of each particular/item within the six combinations divided by total combinations).

Chance value: This is (1-(f/n)), The frequency divided by the number of the testing combination is subtracted from 1 to make the chance value, having discovered that the particulars/item having less frequency are given lower result than those that are having more frequency which are supposed to be in the reverse case because the particulars/items with lower frequency have the higher (increase) chances of such an account having reached the limited daily cash transaction.

Based on the chance value gotten from the Table 3, those results called Chance value are to be applied to calculate the probability of previous transaction of any (new) that is about to execute.

Table 3: Possible Combination of Data Items (Chance Value).

s/n	Item/ Particular	C_1	C_2	C_3	C_4	C_5	C_6	N	Frequency (f)	Mean= (f/n)	1-($f/_n$) (Chance value)
1	First name	✓		✓				6	2	0.3	0.7
2	Middle name	✓			✓			6	2	0.3	0.7
3	last name			✓			✓	6	2	0.3	0.7
4	date of birth		✓					6	1	0.17	0.83
5	sex	✓	✓	✓		✓	✓	6	5	0.83	0.18
6	next of kin					✓		6	1	0.17	0.83
7	occupation	✓	✓		✓		✓	6	4	0.67	0.33
8	address				✓			6	1	0.17	0.83
9	account type	✓	✓	✓	✓	✓	✓	6	5	0.83	0.18
10	international passport No			✓				6	1	0.17	0.83
11	national id no					✓		6	1	0.17	0.83
12	Passport photograph			✓				6	1	0.17	0.83
13	biometric				✓			6	1	0.17	0.83
14	signature					✓		6	1	0.17	0.83

Table 4: Result of the Probability (P(X)) of Early Twelve (12) Transactions for a Particular Day to be Executed by the Same Account User.

s/n	Item/ particular	Transactions											
		T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}
1	First name		✓		✓		✓	✓	✓	✓	✓	✓	✓
2	middle name	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
3	last name		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
4	date of birth					✓			✓		✓	✓	✓
5	sex		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
6	next of kin								✓	✓	✓	✓	✓
7	occupation		✓	✓		✓			✓	✓	✓	✓	✓
8	address						✓			✓	✓	✓	✓
9	account type	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	international passport No							✓			✓		✓
11	national id no										✓	✓	✓
12	Passport photograph							✓				✓	✓
13	Biometric												✓
14	Signature					✓				✓	✓	✓	✓
15	Frequency	2	4	4	5	5	6	7	8	9	10	11	12
16	**P(x)**	**0.33**	**0.36**	**0.36**	**0.05**	**0.36**	0.74	0.93	0.88	0.97	1.00	0.97	1.00

The result of the research is shown in Table 4 which consists of the following columns:

T_1, T_2, T_3, ……., T_{12}: These are list of twelve transactions made for that particular day, that is $Transaction_1$ to $Transaction_{12}$ with the data/particulars of the account owner's like first name, middle name, last name, date of birth, signature and so on, who had made some transaction on that particular day. These users' particulars are used to test for the possibility of numbers of transactions carried out earlier on a particular day by the same user/customer.

$Transaction_1$ (T_1): This contains the list/set of data/item retrieved from the customer's information stored in the database who had made transaction $_1$ (T_1) on that same day. The particulars/items 1 to 14 shown in the Table 4 above are the account users' particulars/items, retrieved from the database information of the account users. Having checked through the data supplied by account users, the algorithm makes use of the Bayes' theorem to calculate the possibility of the transaction carried out earlier that might have been carried out by the same account owners.

This is done by supplying the chance values on the Table 3 above to those transactions 1 to 12 on the Table 4's particulars/data like first name = 0.7, middle name= 0.7, sex=0.18, signature=0.83 and so on which were used to calculate the customers transaction possibility shown in Table 4. For example there are only two particulars/items ticked under the Transaction (T1) in Table 4 which shows that for that particular transaction that is about to take place, having search through the early transaction of the same type (like withdrawal or deposit) on that same day, there are only 2 ticked items that match with the first transaction (which are

account type and middle name). While for the second transaction (T2), on that same day, there are 4 particulars/items that match with that of the new transaction that is about to take place (first name, last name, sex and occupation). The algorithm then retrieves from the database the chance values of those matched particulars/items and uses them to calculate the probability (P(X)) of such transaction to have being carried out by same person on different accounts as follow:

Using the Bayes' Theorem to calculate the P(X) for Transaction$_1$ (T_1):

$$p(a,b,c...z)=\frac{a*b*c*.....*z}{a*b*c*.....*z+[(1-a)*(1-b)*(1-c)*.....*(1-z)]}$$

Therefore P(0.7, 0.18)=0.7*****0.18=0.126… eqn 1

(1-(0.7))*****(1-(0.18)) = 0.246…….. eqn 2

0.126 **+** 0.246 = 0.372 (Eqn 1 **+** eqn 2)…. eqn3

0.126**/**0.372 = 0.338 (eqn 1 **/** eqn 3) Answer.

The answer is 0.33 which is less than 0.5 (significant figure).

The algorithm will ignore such transactions that are less than the significant figure (0.5) since the P(0.7, 0.18) = 0.33.

If the (Probability of (a,b,c,…z)) or P(a,b,c,..z) < 0.5 the algorithm will ignore such a transaction result by not further making use of it to calculate the daily transaction. Those transactions are the P(X) in Table 4 in black ink while those transactions with results P(a,b,c,..z) or P(X) >= 0.5 shown in red ink in Table 4. P(X) above will be used to calculate the daily transaction.

Table 4 shows that the results (P(X)) obtained for the Transactions 1 to 12 (reflecting in black color) are less than 0.5, which shows that such transactions that is about to be performed has no relationship with those early transaction with P(X)>=0.5 while the results (P(X)) obtained for the Transactions 6 to 12 (reflecting in red color) are greater than 0.5 which shows that in the transaction that is about to take place chances of having relationship with earlier transactions 6 to 12 for that particular day is very high. Thereafter the algorithm will then calculate the day transaction amount if within the daily limit or not in order to calculate the penalty charge.

The algorithm will sum up the transaction amount (only transaction of same type, Withdrawal or Deposit) for that particular day where the P(X)>=0.5 and subtract the daily limit from the transacted sum to get the excess amount, then calculate the charges associated with the transaction type, if withdrawal 3% and if deposit 2%.

Table 5 shows the selected six transactions from Table 4, for a particular customer in a particular day.

RESULTS AND DISCUSSION

This section presents simulated results from analysis to determine the efficiency of the proposed algorithm for determining multiple transactions on an account that exceeds the threshold specified by the Central Bank of Nigeria.

From the Table 5 Customer Transactions with P(X) of 0.5 above written in red ink have the high chance of being carried out by the same person on different transaction type, account type, banks and locations.

Withdrawal Transaction

Transactions T_1, T_6, T_8 and T_{10} are deposit transactions with P(X) values 0.33, **0.74, 0.88 and 1.00,** respectively. Transactions with P(X) =>0.5 having high chance value of being executed by the same person will be added up against that same person and subtracted from the daily transaction limit and then calculate its excess charge of 3% if beyond the daily transaction limit on individual account and 5% on corporate accounts as given below assuming it is an individual account:

T6 = ₦212,000.00,
T8 = ₦92,000.00,
T10 = ₦450,000.00

Where total withdrawal for that day is = T1+T2+T3+……..+Tn

Excess amount = (T1+T2+T3+……..+Tn) – daily Transaction limit)

Table 5: A Day Transaction Table for a Particular User.

SN	Trans-action (T)	Date	Transaction Type	Bank	Account Type	Transaction Location	Amount	P(x)
1	T1	08/12/2012	Withdrawal	WEMA Bank	Savings	Lagos	₦200,000.00	0.33
2	T3	08/01/2013	Deposit	Union Bank	Current	Abuja	₦220,000.00	0.36
3	T6	08/01/2013	Withdrawal	First Bank	Savings	Ilorin	₦212,000.00	0.74
4	T7	08/01/2013	Deposit	GTB	Savings	Sokoto	₦67,000.00	0.93
5	T8	08/01/2013	Withdrawal	Afri Bank	Current	Ikeja	₦92,000.00	**0.88**
6	T10	08/01/2013	Withdrawal	UBA	Current	Apapa	₦450,000.00	**1.00**

Excess amount charges = (T1+T2+T3+……..+Tn) – daily Transaction limit) * 3%

Given (((T1+T2+T3+……..+Tn) – daily Transaction limit)*3)/100

For the above example we have = (((₦212,000.00 + ₦92,000.00, + ₦450,000.00) - ₦5000,000.00)*3)/100
= (754,000 – 500,000) * 3)/100 = 7,620.00

The excess amount charges of ₦7,620.00 which is going to be displayed, and then ask at the point of transaction that you have carried out the total amount of withdrawal transaction of ₦754,000.00 for that particular day, that you will be charged for ₦7,620.00 if you still proceed with the transaction and then ask whether you still want to proceed with the transaction or not.

Deposit Transaction

Transactions T_3 and T_7 are withdrawal transactions with P(X) values 0.36 and **0.93** respectively. Transactions with P(X) =>0.5 having high chance value of being executed by the same person will be added up against that same person and subtracted from the daily transaction limit and then the calculation of its excess charge of 2% if beyond the daily transaction limit on individual account and 3% on corporate accounts as given below. Assuming one is dealing with individual account:

T1 = ₦220,000.00, T6 = ₦67,000.00

Where total withdrawal for that day is = T1+T2+T3+……..+Tn

Total Transaction for that particular day = (T1+T2+T3+……..+Tn)

For the above example we have = (₦220,000.00 + ₦67,000.00,) = 287,000.00 which is within the daily limit. Then the transaction can then be successfully carried out.

CONCLUSION

The algorithm helps to identify multiple daily deposit or withdrawal transactions by one individual or the same organization on different transaction type, account type, banks and locations by the account owner in order to circumvent the cash-lite economy policy over limit charges.

The withdrawal and deposit transaction explains how the algorithm will help to calculate the excess charges limit. Table 4 shows the results/outcome of twelve (12) sets of customers transaction in a day where seven (7) customers transactions have (P(X) >=0.5) and those 7 transactions are belonging to same person who has executed different transactions in a day.

Table 5 shows the deposit and withdrawal transactions that took place on that same day on different transaction type, account type, banks and locations by an account owner. The method can therefore be applied to control and prevent over limit cash transaction in Nigerian cash-lite economy.

This paper recommends embedding of Bayes' theorem in banking software for daily cash transaction limit and associated penalty calculation, which serves to control, checkmate

and prevent multiple cash transactions across the bank and enhance the policy of cash-lite economy in Nigeria.

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