Effect of Automated Teller Machine (ATM) on Demand for Money in Isolo Local Government Area of Lagos State, Nigeria

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The study examined the effects of Automated Teller Machine (ATM) on demand for money. Primary data were analysed using difference of means and probit analyses. The study revealed that ATM has reduced queues in the banking hall significantly. The result showed that the frequency of demand for money to meet transactionary and precautionary motives is significant greater through ATM while average amount withdrawn is smaller compared to teller (p<0.05). Also the probability of a resident using ATM is 0.92. Investment in quality ATM and provision of alternative source of electricity are ways of improving the effectiveness of ATM.

INTRODUCTION

Automated Teller Machine (ATM) is a cash dispenser that enables bank customers to enjoy banking services without coming in-contact with bank tellers (cashier). ATM helps to perform the duties of the cashier in term of payment services. It is a computerised telecommunication device that provides the clients with access to financial transaction in a public place without the need for a cashier, human clerk or bank teller. ATM is also known as cash point or cash machine (Ogunsemore, 1992).

ATM was introduced into the Nigerian economy by Central Bank of Nigeria (CBN) in 1989. Now defunct Societe General Bank of Nigeria (SGBN) was the first commercial bank in Nigeria to introduce ATM in 1990. The trade name for SGBN's ATM was ''cash point 24''. This was followed by "First Cash" ATM introduced by First Bank Plc. in 1991. The aim of CBN on the introduction of ATM was to reduce the rate of cash withdrawal from the counter through the use of tellers as well as to prepare Nigerians for the incoming cashless economy.

However, as part of banking reforms that started in July 2004, the Central Bank of Nigeria (CBN) in its quest to improve bank services, achieve cashless economy and decongest the banking halls; mandated

commercial banks operating in Nigeria to install Automated Teller Machines (ATMs) in the their premises and other strategic locations to serve their customers. As fallout on this directive by apex bank, studies (Fanawopo, 2006; Olatokun and Igbinedoin, 2009) revealed that the Nigeria's debit card transactions rose by 93 percent between January 2005 and March 2006 over previous years owing to aggressive roll out initiatives by the Nigerian banks, powered by interswitch network. Specifically, the number of ATM transactions through the interswitch network also increased from 1, 065, 972 in 2004 to 14, 448, 615 between January 2005 and March 2006. This represents 92.6 per cent increase over the previous year. The number of ATMs has also grown from just over 500 ATMs in 2006 to over 8,000 ATMs in 2009. In Lagos State (the commercial nerve centre of Nigeria) alone under what is called 'operation cashless Lagos' there has been massive and aggressive deployment of ATMs in all the banks for customer's use. Eni (2011), Enyimaya (2011) and Okwe (2011) projected that banks would have deployed about 40,000 ATMs in various parts of Lagos, 75,000 ATMs by June 2012 and 150,000 ATMs per 100 persons by December 2012. Past studies (Ogunsemor, 1992; Hone *et al.* 1998; Fasan, 2007; Akrani, 2011) affirmed that ATM has made it possible for bank customers to access cash at any time irrespective of bank business hours. This includes cash demands to meet day-to-day transactions and emergency needs by households on weekends, public holidays and during national strikes. Despite the various benefits of ATM, there are still customers who prefer to transact with withdrawal slip within the banking hall which have not made the "queue system" to come to a halt in banks.

Since ATM came into use in its present form in 1974 in developed countries, the device has attracted widespread patronage offering wide range of services to the customers (Kolodinsky *et al.,* 2004; Agboola, 2006; Bellis, 2007). Conversely, challenges associated with its use have made the machine unattractive and no-go areas for some banks' customers (Adeloye, 2008; Obiano, 2009; Omonkhanlen, 2009). In Nigeria, the effect of ATM on demand for money has not been widely discussed in the literature. The study is aimed at highlighting this aspect and also to contribute to the existing literature on this topic. The purpose of this study is to determine the variations in the withdrawal frequency and cash demands (if any) that exist between the users and non-users of ATM. The novelty of the study is to determine the probability that a resident of the study area chosen at random uses ATM. The paper also tries to identify the factors influencing the probability of using ATM in the study area.

Conceptual Framework and Literature Review
The study's conceptual and theoretical framework is based on Keynes Liquidity Preference Theory which identified three primary reasons for holding on to cash; these are:
1. **Transactions Motive:**
   Money is a medium of exchange, and people hold money to buy goods. Money is demanded in order to fulfil day-to-day needs. As income rises, people have more transactions and people will hold more money.
2. **Precautionary Motive:**
   People hold money for emergencies (ill health, savings for unexpected job loss, labour strikes among others). Since this also depends on the amount of transactions people expect to make, money demand is again expected to rise with income.
3. **Speculative Motive:**
   Money is also a way for people to store wealth. Keynes assumed that people stored wealth with either money or bonds. When interest rates are high, rate would then be expected to fall and bond prices would be expected to rise. Bonds are more attractive than money when interest rates are high. When interest rates are low, they then would be expected to rise in the future and thus bond prices would be expected to fall. However, money is more attractive than bonds when interest rates are low.

The inventory theoretic model of demand for cash proposed by Baumol (1952) and Tobin (1956) opined that when deciding how frequently and, equivalently, how much to withdraw, consumers take two factors into account: the cost incurred per withdrawal (possibly including the opportunity cost of the time

required per withdrawal) and forgone interest. Baumol and Tobin showed that the optimal withdrawal amount is proportional to the square root of the total value of transactions and indirectly proportional to the square root of interest rates. Stix (2003) revealed that the effect of ATM on cash demand depends on the user groups. On the one hand, if the proportion of people using ATMs frequently is high, ATMs have a negative effect on cash demand. On the other hand, if the proportion of active ATM users is low, ATMs do not affect cash demand. According to Attanasio *et al.* (2002), ATM transactions and cashless payments do not only affect optimal cash holdings but also are likely to reduce the time-cost per withdrawal. They reasoned that with ATM, customers withdraw cash more frequently and so hold smaller amounts of cash on average. The small cash demands by most ATM users are enough to address the transactionary and speculative motives of demand for money. Goodhart and Krueger (2001) found that the demand for small bank notes is positively related to the number of ATMs. People may visit ATMs more often and withdraw small amounts of cash, which would increase the demand for small bank notes.

Despite the increase in the acceptance of ATM in Nigeria, Echekoba and Ezu (2012) observed that 68.2% of the respondent still complained about long queues in the bank, 28.9% complained of bad attitude of teller officers (cashiers) while 2.89% complained of long distance of bank locations to their home or work places. Generally, most studies (Hancock and Humphrey, 1998; Boeschoten, 1998; Goodhart and Krueger, 2001; Drehmann *et al.*, 2002) showed that the effects of ATM on cash demand are not highly significant.

METHODOLOGY

The study was carried out in Isolo Local Government Area (LGA). Isolo LGA is one of the local government areas in Lagos state (Lagos state is the business nerve centre of Nigeria and former Federal Capital Territory). It is located between Amuwo-Odofin and Oshodi local government areas. Isolo Local Government Area is made up of the following towns, namely: Ilasamaja, Aswani, Ire-akari Estate, Okota, Isolo, Ajao Estate and Industrial Estate Isolo. The choice of Isolo local government area is based on its vibrant economic activities, the diverse population and location of many branches of commercial banks. The study adopted a two-stage sampling technique which comprises of purposive sampling and stratified random sampling. Using purposive sampling, only the residents of the seven towns that made up Isolo local government area operating commercial bank account(s) are considered. The study area was stratified based on the seven major towns and samples were selected randomly. A sample of 30 respondents which comprises of users and non-users of ATM were selected from each stratum. The study utilised primary data collected using structured questionnaire. A total of 210 questionnaires (the questions captured socioeconomic characteristics of respondents, the average amount collected through teller or ATM, frequency of collections, average time spent while collecting money among others) were administered. Out of these, 180 were returned to time by respondents.

Data were analysed using descriptive, difference of means and probit analyses. Specifically, the difference of means was used to determine the variations in frequency of withdrawal; time spent withdrawing money and average amount withdrawn between the users and non-users of ATM. Since the sample size (number of respondents) used for the study is greater than 30, large sample formula was applied. The Z-calculated is obtained using the formulae below:

$$Z = \frac{\mu_{US} - \mu_{NUS}}{\sigma_{\mu_{US} - \mu_{NUS}}} \tag{1}$$

$$\sigma_{\mu_{US}-\mu_{NUS}} = \sqrt{\frac{\sigma_{US}^2}{N_{US}} + \frac{\sigma_{NUS}^2}{N_{NUS}}} \tag{2}$$

Where:
Z = N > 30 (large sample)
N = numbers of respondents

μ_{US} = Average parameter (amount withdrawn and time spent) for ATM card users

μ_{NUS} = Average parameter (amount withdrawn and time spent) for non-user of ATM card.

σ_{US} = standard deviation of the parameter for the ATM card users and non-users.

σ_{NUS} = standard deviation of the parameter for the non-users
US = users of ATM card
NUS = non-users of ATM card.

The probability and the determinants that a resident in the study area uses ATM were estimated using probit analysis. The independent variables in the model are age (year), marital status, frequency of withdrawing money per week and average time spent during transaction (either through ATM or through teller). According to Spermann (2008) probit is based on a latent model:

$$
\begin{aligned}
P(y_i = 1 \mid x) &= P(y_i^* > 0 \mid x) \\
&= P(x_i'\beta + \varepsilon_i > 0 \mid x) \\
&= P(\varepsilon_i > -x_i'\beta \mid x) \\
&= 1 - F(-x_i'\beta)
\end{aligned}
\tag{3}
$$

Where:
y = 1 represents ATM users
y = 0 represents non-users of ATM
x_i represents the independent variables
X_1 represents age (year),
X_2 represents the marital status
X_3 represents frequency of cash withdrawal per week,
X_4 represents average time spent during transaction.

RESULTS AND DISCUSSION

The age distribution of the respondents shows that majority of the ATM users falls within the age bracket of 26 – 30 years. On the other hand, majority of the non-users of ATM card falls within the age bracket of 21 – 25years. These age brackets constitutes 33.3% and 45.5% of ATM users' and non-users' respondents respectively. The average age of the users of ATM (29.7years) is greater than the average age of non-users of ATM (27.8years). Among the ATM users, 59.2% are male while 40.8% are female while

54.5% and 45.5% of non-users of ATM are male and female respectively. The study revealed that 62.41% of commercial bank customers in the study area use ATM. The bank officials posited that the congestion of customers in the banking hall has reduced significantly.

Moreover, 42% of the ATM users possess Higher National Diploma (HND)/BSc certificates while 36.4% of the non-users of ATM are General Certificate of Education (GCE)/OND holders. Only 6.1% of ATM users possess postgraduate certificates (MSc/MBA/MA). Comparatively, majority of ATM users have better educational qualifications. Well educated respondents find it easy to use ATM unlike the less educated respondents. Also, 59.2% of the respondents who are users of ATM are married while 66.7% of non-users of ATM are married. This result indicates that there are more of single ATM users than the non-user of ATM.

The study showed that 33.3% of ATM users are self-employed, 19.7% and 12.9% are civil servants and the unemployed respectively. Among the non-users of ATM, 45.5% are self-employed, 3.0% and 15.2% are civil servants and the unemployed respectively. The various problems encountered by the ATM users and the percentages of respondents that encountered each identified problem are shown in figure 1.0. The figure shows that 45.5% of the respondents ATM users had problem of no service displayed while 12.2% complained of ATM card seizure.
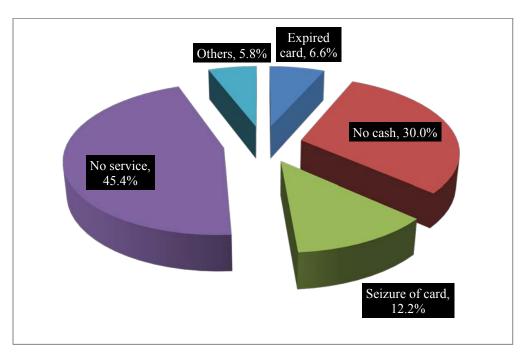
FIGURE 1
DISTRIBUTION OF PROBLEMS ENCOUNTERED BY ATM USERS

Figure 2 shows that 36.1% and 1.4% of ATM users withdraw cash four and six times per week respectively while majority of the non-users (54.5%) withdraws cash twice per week.
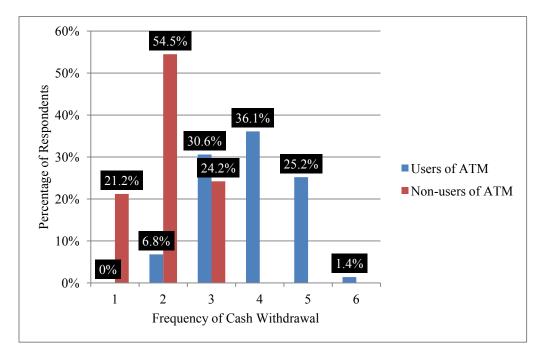
FIGURE 2
FREQUENCIES OF CASH WITHDRAWAL PER WEEK
BY USERS AND NON-USERS OF ATM

The result of the inferential analysis showed that the average amount of cash withdrawn by ATM users is significant less than the average amount withdrawn by the non-users ($p < 0.05$). This means that on average, small amount of money is withdrawn by the ATM users. Also, the average frequency of cash withdrawal per week by ATM users is significantly greater compared to the frequency of cash withdrawal by non-users of ATM ($p < 0.01$). The results are in agreement with Attanasio *et al.* (2002) that with ATM, consumers withdraw cash more frequently and so hold smaller amounts of cash on average. Specifically, the average amount withdrawn by users and non-users of ATM are ₦10, 700.68 and ₦72, 106.06 respectively. The study revealed that ATM has made it possible for customers to demand for cash beyond normal banking hours, weekends, public holidays and during national strikes. Bearing in mind the small amount of money withdrawn at a time, ATM has enables customers to fulfil their immediate cash needs (transactionary motive) and unexpected expenses (precautionary motive) which are in agreement with Keynesian theory of demand for money. The security implications of withdrawing substantial amount of money and the pegging of the maximum amount that can be withdrawn through ATM CBN and unrestricted access to ATM anytime by respondents may be adduced for small cash demand by ATM users.

Moreover, the result also revealed that the average time spent (minutes) to withdraw cash by ATM users is significantly less than the time spent by non-users of ATM ($p < 0.01$). Specifically, the ATM users spent on average 7.91minutes compared to 16.95minutes spent by non-users of ATM in the banking hall. The implication of this result is that the use of the ATM saves customers from wasting precious time that can be put into productive use. The study showed that customers prefer using ATM in order to reduce time wasting which has helped to reduce traffic volume of customers in the banking hall and by extension it has helped to reduce insecurity in banks.

The probit analysis result showed that the coefficients of three out of the five variables considered were significant at different levels of significance. The significant variables are the age ($p < 0.05$), frequency of withdrawing money per week ($p < 0.05$) and average time spent withdrawing money

(p<0.10). From the foregoing, the age (year), frequency of withdrawing money per week and average time spent withdrawing money are the factors influencing the probability of using ATM in the study area (see table 1).

TABLE 1
PROBIT ANALYSIS RESULT

Parameter	Coefficient	std. error	z	Slope
Constant	1.08319	1.32249	0.8191	
AGE	0.102412	0.0506119	2.023**	0.0174082
MARITAL STATUS	- 0.503227	0.459306	- 1.096 [ns]	- 0.0927277
GENDER	- 0.377554	0.0388678	- 0.9840 [ns]	- 0.0616770
FREQUENCY/WEEK	0.855367	0.367255	2.329**	0.187949
AVERAGE TIME	- 0.355465	0.202945	- 1.752 *	- 0.0604226

Source: Result of data analysed (2012)
Note: * means significant at 10%
       ** means significant at 5%
        [ns] means not significant

Specifically, the result showed that an infinitesimal increase in age (year) of respondent selected at random from the study area raises the probability of using ATM card by 1.74% (0.017). That is, as one ages, the probability of using ATM increases. The precautionary and transactionary motives for demanding for money are higher among the married adults; most especially married couple with children. Moreover, an infinitesimal increase in the frequency of withdrawing money by a resident selected at random from the study area raises the probability of using ATM by 18.79% (0.1879) (see table 1). The result also posited that an infinitesimal increase in the average time spent while withdrawing money by a respondent selected at random, the probability of using ATM reduces by 6.04% (0.060). Furthermore, the study revealed that the probability that a person chosen at random from the study area will use ATM is 0.9215. That is, taking hundred residents of the area, it is very likely that 92 of the residents will use ATM.

CONCLUSION AND RECOMMENDATION

The study examined the effect of automated teller machine on demand for money in Isolo local government area. The study showed that ATM has significantly increased the frequency of demand for money when compared with the non-users of ATM. However, the average volume of money withdrawn through ATM is significantly less than the amount withdrawn through teller or cheque. The study showed that the ability of customers to meet their emergency need for cash is improved through the use of ATM. This is because apart from the normal working hours, customers have access to the use of cash during weekends and during national strikes. The study found that the use of ATM did not only help to reduce significantly long queues in the banking hall but also reduced the average time spent while withdrawing cash. Out of the various problems encountered, majority of ATM users (45.5%) complained of 'no service' displayed by ATM due to technical fault or power outage. From the foregoing, it is recommended that stakeholder should ensure improved performance of their Automated Teller Machine by making sure

that they invest in quality ATM. While the stakeholder has a role to play in stable power supply not only for the machine but the environment also, the bulk of problem of stable power supply in the countries lies with the federal government.

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APPENDICES

APPENDIX 1
VARIATION IN AVERAGE AMOUNT OF MONEY (N) WITHDRAWN
BY ATM USER AND NON-USERS

Parameter	Amount Withdrawn	
	Non-User	*User*
Mean	72106.06061	10700.68027
Variance	29020043087	56194040.63
Observations	33	147
Hypothesized Mean Difference	0	
Df	178	
Z Stat	2.070236665	
P(T<=t) one-tail	0.023290226	
t Critical one-tail	1.693888703	
P(T<=t) two-tail	0.046580453	
t Critical two-tail	2.036933334	

Source: Result of data analysed (2012)

APPENDIX 2
VARIATION IN AVERAGE TIME SPENT BY ATM USERS AND NON-USERS

Parameter	Average time spent (min.)	
	Non-User	*User*
Mean	16.95454545	7.911564626
Variance	59.56818182	5.317468083
Observations	33	147
Hypothesized Mean Difference	0	
Df	178	
Z^{Stat}	6.664275007	
P(T<=t) one-tail	6.92321E-08	
t Critical one-tail	1.962360258	
P(T<=t) two-tail	1.38464E-07	
t Critical two-tail	2.034515287	

Source: Result of data analysed (2012)

APPENDIX 3
VARIATION IN FREQUENCY OF WITHDRAWAL PER WEEK
BY ATM USERS AND NON-USERS

Parameter	Frequency of withdrawal per week	
	Non-users	Users
Mean	2.03030303	3.836734694
Variance	0.46780303	0.863572826
Observations	33	147
Hypothesized Mean Difference	0	
Df	62	
Z^{Stat}	-12.7573066	
P(T<=t) one-tail	2.7041E-19	
t Critical one-tail	1.669804163	
P(T<=t) two-tail	5.4082E-19	
t Critical two-tail	1.998971517	