

Artificial Intelligence Adoption and Corporate Operating Activities of Deposit Money Banks

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ABSTRACT: *The deposits money banks (DMBs) in Nigeria that invested artificial intelligence (AI) were considered in this study with the objective to know the effect of AI on employee cost and other operating cost in the banking sector. The study adopted ex-post facto research design. Secondary data were gathered between 2012 and 2022 from the respective financial statements of the DMBs and analyzed using panel regression model. It was gathered that the adoption of AI has negative effects on employee cost while it has positive effects on operating expenses of DMBs in Nigeria. The study concluded that the adoption of AI by DMBs in Nigeria will improve their corporate operating activities which will translate to improve financial performance. Government should regulate the activities of DMBs to forestall any form of laying-off.*

KEYWORDS: artificial intelligence, employee cost, operating cost, financial system

INTRODUCTION

Shifting away from manual operations to adopting artificial intelligence (AI) by Deposit Money Banks (DMBs) is presumed to have relative effects on their operational performances. The adoption of AI has transformed the heavily-driven manual transactions of DMBs to engage in internet banking. With the increase in financial data and the processing power that is required to ensure real time response to the ever increasing needs of users of financial data, the adoption of

AI globally and especially in developing world by organizations became inevitable. This is expected to improve customer service, enhance productivity, reduce cost of operation and consequently lead to efficient profit for the organization (Bag et al, 2021).

Attention is now given globally to AI from the viewpoint of technological development and its computing power to manipulate and analyze big data in real-time using data analytic skills. Data analytics uses large amount of data with the aid of complex algorithm to predict timely and concisely the needed reports for business processes (Chen and Biswas 2021; Sestino and De Mauro, 2022). AI, therefore, is expected to improve the quality of decisions that firms make (Saenz, Revilla and Simon, 2020) and invariably enhance their financial returns (Blohm, et al, 2020) for the fact that it can apply different algorithms that can assist to determine key performance indicators of companies (Brynjolfsson & McAfee, 2017).

Duan et al. (2019) described AI as the ability of machines to efficiently collect information as fast as possible and processing it in such a way that it will meet with the needs of its users without the intervention of humans. AI tool, therefore, creates and develops tools that can be used to gather up-to-date reliable data and efficiently manipulating the data which can be used to take accurate decisions by those who the information.

AI is the combination of both automation and artificial intelligence (Yarlagadda, 2021) in order to technologically assist, monitor and control efficiently the production and delivery of services (Acemoglu & Restrepo, 2018) within an organization using devices such as computers and other computing devices which can simulate and give speedy accurate results than humans (Holzinger et al 2019). The soaring development in the world of technology, internet and the cravings for financial up-to-date information on transactions of companies by customers cannot be set aside without the adoption of the corresponding technology that could assist to achieve them. With internet banking in Nigeria, the introduction AI is a giant stride to encourage digitalization and transformation in the sector. The adoption of AI in organizations is, therefore, believed to trigger higher market value, induce financial performance and ensure control over the market (Vincent and Zakkariya, 2021).

Reliance on information systems and modern technologies to give up-to-date data from banking transactions which includes operations on accounts, assets management and investment banking triggers the need for the adoption of AI in some of their transactions. These transactions can only be real-time online to cater for the rate and speed at which customers require real-time information, the urgency of the needs and efficiency that should be attached. Hence, it should enhance effectiveness and efficiency.

The adoption of AI by deposit money banks (DMBs) in Nigeria is expected to enhance business opportunities, improve product quality, create market niche, improve customer's service, and also to reduce operating cost and improve operating profit (Angima & Aluoch, 2023). These opportunities are expected to improve the operating activities by a way of reducing operating cost

incurred by DMBs in Nigeria which invariably should enhance its operating profit. Some of the DMBs that have AI is Zenith Bank, Fidelity Bank, First City Monument Bank, Access Bank, Heritage Bank and Keystone Bank while some other banks invest in AI software to automate some of their transactions.

Nwosu (2018) in his study revealed that not all the DMBs in Nigeria appreciate the innovations that AI brought into the system, but Bag et al., (2021) explained that it improved customers' services when it was adopted while Akpanobong & Esseien, (2022) discussed that it ensured fraud detection and overtime improved financial performance. However, some studies reveal that the application of AI seems overhyped in relation to how it is effective, accurate, reliable and scale of its algorithm due to its complex nature.

Emphasis has been laid on the disruptive effect of AI performances of industries and some sectors of economy (Akpanobong and Essien, 2022). Some scholars, however, believe that AI is overhyped and that it may not have meaningful impact on the performances of the sectors that adopt it. The global impact of the pandemic that erupted in 2019/2020 brought significant changes in the operations of companies and industries especially the banking sector that embraces AI which they are optimistic will perform effectively and efficiently to reduce cost of operation and boost their financial performance.

The empirical results of AI's adoption have not been investigated as it relates to operating activities of DMBs in Nigeria. Also, with the upsurge in banking operations resulting from cashless policies that was introduced to the Nigerian economy in the year 2022, activities of DMBs have drastically increased thereby creating the need for more robust means to promptly attend to the needs of customers which invariably should translate to enhanced profit and perhaps a reduced operating cost due to the adoption of AI. This study, therefore, seeks to know the effect of AI on operating cost and employee costs of listed DMBs in Nigeria. To achieve these objectives, the study proxy investments in ICT and other computer related issues in the financial statements of the banks for AI while operating cost, employee costs and operating activities for banks' financial health.

LITERATURE/THEORETICAL UNDERPINNING

Artificial Intelligence

Understanding the theoretical AI will enable a deep insight into its empirical implications for DMBs. The advent of AI dates back to 1940 when cybernetics was introduced to map the human mind and model it as a "black box" with feedback mechanisms (Groumpos, 2023). Many scholars have given different definitions of AI as scientific applications that go beyond human reasoning (Decanio, 2016), while others describe it as machines in robotic form that mimic the intelligence of men (Niu, Tang, Xu, Zhou & Song, 2016). However, Alim, Asadullah & Shakawat (2020) described AI as software programs that are built to perform human tasks with little or no intervention. The views of Balfe et al. (2015) and Arntz et al. (2016) on AI were a bit digressed to the performance of financial tasks by machines or software programs installed in a machine. They

explained that AI enables a machine to perform financial tasks without human intervention in an efficient and effective way with precision on the output in the areas of decision-making, analyzing information and risk management. Therefore, AI is gradually changing a variety of models and operations in the banking sector and the general global financial services industry.

Artificial Intelligence and Financial System

Xie (2019) in his study on the adoption of AI in the financial system highlighted numerous applicable areas that the technology is essential. With the surge in amounts of data that are essential in the financial world for decision making, business model simulation, stock management and the increasing demand for financial updates on firms (Agrawal, Gans & Goldfarb, 2019), AI became expedient since it uses complex computing algorithm to analyze and predict financial information on timely basis with little or no help from humans. AI is, therefore, believed to prominently have effect on business productivity in the area of reducing operating cost (Agrawal et al., 2019), boost earnings (McKinsey, 2021) and improving business productivity (McKendrick, 2021).

Operating Expenses and Artificial Intelligence

Operating expenses are costs that relate to the primary operations of a company though based on the type of company. Operating costs include costs of goods sold and other operating expenses. These other operating expenses can be categorized into selling, general, and administrative expenses. Proper monitoring of operating expenses, otherwise called operating costs, is very essential to have maximum returns from the investments of companies (Muriithi, 2017). In his opinion, AI helps to reduce operational cost thereby increasing the overall profit of the company. He maintained that there are some elements of costs that their reductions can be traced to the adoption of AI, whereas some cannot be affected by it. Chaddad and Cook (2016) explained that operating cost should include the costs incurred in order to keep an organization running. Meanwhile, Sinta, Kembaren & Fadli (2021) maintained that operating costs include all the associated costs incurred to run the organization. However, while some of these costs can be reduced some are believed not to be influenced by AI. Ibrahim and Nwobilor (2020) buttressing this fact explained that with AI bank charges can never be altered whatever the level of its algorithm, although cost such as employee cost may experience reduction.

Employee Costs and Artificial Intelligence

The extent to which an organization invests in human resources determines the level of its financial performance (Omodero, Alphaeus & Ihendinuhu, 2016). This implies that for improved financial performances there should be a better investment in human resources. The assertion of Agarwall, Das & Swain (2021) revealed that large chunk of a company's annual budget goes to employee cost. However, IBM (2021) is of the opinion that adopting AI can reduce the cost of employee and improve the productivity and efficiency of companies. Rozman, Oreski & Tominc (2023) in support of this notion explained that AI ensures the reduction of workloads of employees and meeting up with the required information by clients in a working environment that is characterized

by volatility, uncertainty, complexity and ambiguity. This, therefore, tends to improved efficiency and productivity of labour. Though, it has been adduced by many scholars (David, 2017; Felten et al, 2018; Guliyev, 2023) that AI will reduce number of employees thereby causing a drastic reduction in employee cost, some other authorities who believe that there is no software that can conveniently do every strategic thinking as human were of the opinion that it has little or no effect on employee cost (Acemoglu et al, 2022).

Return on Assets and Artificial Intelligence

The going concern of companies can be threatened if their assets are not yielding enough profits that can commensurate with the assets employed to produce it. Rodoni (2014) in Akbar (2020) maintained that companies are distressed when the return on assets dwindles thereby causing the company to experience negative returns on investments, insufficient cash flow to cater for obligations of the company, negative operating income and recurrent dismissal of its employee. While some studies investigated how the adoption of AI impacted business performance, some focused on how it reduced personnel cost (Acemoglu and Restrepo 2018), its ability to perform human task and ensure firm growth (Alekseeva et al. 2020).

Empirical Review

Some empirical studies were carried out to know the effect of the adoption of AI on financial performance of organizations. Some of them revealed positive impact while others were of contrary opinions. The research carried out by Elegunde and Osagie (2020) on artificial intelligence adoption and employee performance in the Nigerian banking industry with the objective to determine the complimentary effect of AI on the employees' performance with the aid of questionnaires that were administered on the 127 staff members of six selected banks purposively selected for the research and analyzed using regression analysis revealed that AI compliments the process of works and operations in the banking sector. The study recommended the need to embrace AI at every sector and most importantly the education sector for its inclusion in the school's curriculum.

Agarwall et al, (2021) studied to assess the influence of AI on operational performance of selected companies in India. They employed panel regression model to measure the effect of AI on firm's performance of the selected manufacturing, telecommunication, and IT industries between 2004 and 2018. The study revealed that AI has significant effect on the operating cost and the operating profits of the selected companies.

Hashem and Alqatamin (2021) empirically researched the role of artificial intelligence in enhancing efficiency of accounting information system and non-financial performance of the manufacturing companies with the objective to know how AI influences the efficiency of accounting information system and non-financial performance of Jordan. Primary data were gathered with the aid of questionnaires from 409 respondents which consisted of managers and accountants. The data analyzed with the aid of SPSS revealed that AI enhanced the efficiency of

accounting information system and helped to influence non-financial performance by ensuring the inflow of relevant information for managerial use into the system.

Chen et al (2022) researched the impact of AI on firm performance with the intention to know specifically how artificial intelligence capability, artificial intelligence management and artificial intelligence driven decision making affect firm performance. Primary data were gathered and analyzed with the aid of partial least squares structural equation modeling. It was revealed that AI impact positively on firm performance having considered some other mediating and moderating variables.

Mishra et al (2022) examined the linkage between AI and financial performance specifically focusing on gross and net operating efficiency of some US-listed firms. The study used simultaneous equations to empirically identify the relationship between AI focus and the variables of operating efficiency. It was discovered that the adoption of AI improves net profitability, net operating efficiency and return on marketing related investments.

Kim et al (2022) in their research on the impact of artificial intelligence on firm performance using difference-in-differences (DID) to analyze technology impact of AI on firm value, profit and cost structures of the 105 selected listed firms in US between 2008 and 2014 found empirically that there was a strong relationship between AI and firm value and firm's cost structure.

Drydakis (2022) also empirically examined the effect of AI on SMEs' business risk in London. He engaged 317 SMEs and analyzed the data gathered using regression analysis. The study revealed that the application of AI on online customers, cash flow forecasting and human resources of the SMEs reduced the business risk drastically. The study concluded that SMEs should leverage on technology to enhance their business operation which tends to reducing cost thereby boosting their financial performance.

There are other literatures that empirically researched on the relationships that exist between AI and operating cost (OC) while some showed that there are positive relationships (Rožman et al, 2023; Agarwall et al, 2021) some scholars believed that its impact will pose negative results especially on employee cost and investments in activities related to AI (Ulrich and Frank, 2021). AI becomes the talk of the day due to the bloated technology stemming from the overwhelming needs for information on business by users and the rapid responses that are expected from managers.

THEORETICAL REVIEW

Innovation Diffusion Theory (IDT)

This study was hung on one of the two theories that are specifically related to adoption of innovations within system overtime. E.M. Rogers in 1962 developed the Innovation Diffusion Theory (IDT) to illustrate the acceptability of new ideas, products or behavior in a social setting.

The theory suggested that new ideas, especially in technology, are spread gradually rather than being spontaneous from its introduction to its total acceptability (Fichman, 1992). This theory is relevant to this study looking at the rate at which AI is gradually spreading in the banking sector in Nigeria. IDT is described as a good application to understand technology acceptability, its evaluation and eventual implementation.

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was developed by Fred Davis in 1986 with the blended idea of perceived usefulness of technology and the ease to use the technology (Davis et al., 1989). It refers to the acceptability of an information system, the willingness of its users to implement it and its further use it to a foreseeable future. Okoye et al. (2019) explained that the idea that the new application or program should enhance performance, enable the users' easy navigation and ensure it adds values which should result to customers' satisfaction. This study is pinned on TAM since it seems robust enough to consider the notions of Innovation Diffusion Theory in its objectives and captures the need for users' satisfactions.

METHODOLOGY

This study employed ex-post facto research design since it engaged ready-made data that were gathered from financial statements of DMBs. Ex-post facto research design was adopted in carrying out this study to examine the effect of independent variables on the dependent variables. Using the research design became justifiable to this study since it used already existing non-manipulated quantitative data as contained in their financial statements. The population of the study comprised of all IFRS compliant DMBs that embraced Information and Communication Technology (ICT) and AI in Nigeria.

The data gathered were run using E-View 13 while it employed the descriptive, correlation and regression analysis to analyze the data.

Dependent Variables

This study proxy employee cost (EC) and operating expenses (OE) as the dependent variables. These variables were chosen because they constitute part of the major focal items of the expenditure profiles of DMBs in the financial statement. These variables are believed to have influence the financial performance of DMBs.

Independent Variables

The independent variables include all the AI related expenditures such as investment in ICT and other expenses on ICT. These are directly related to the financial activities that are essential to acquire and maintain AI's operations in the DMBs.

Area of Study

The study covered the listed deposit money banks (DMBs) on the Nigerian Exchange between 2012 and 2022. The selected DMBs were assumed to be a good representation were purposively selected looking at the availability of required data for the relevant years under consideration. The selected DMBs comprised of Access Holdings Plc, Ecobank Transnational Incorporated, Zenith Bank, United Bank for Africa, FBN Holdings, Guaranty Trust Holding Company Plc, Fidelity Bank Plc, FCMB Group Plc, Union Bank, and Sterling Bank. It basically considered those DMBs that use AI and are IFRS compliant between 2012 and 2022. This period was chosen as the basis due to the fact that available data on ICT related issues and AI as reported in the financial statements of DMBs in Nigeria were more prominent from year 2012.

Model Specifications

The below panel regression models were considered to assess the relationship between the adoption of artificial intelligence and the corporate operating activities of DMBs in Nigeria:

$$EC_{it} = \beta_0 + \beta_1 AI_{it} + \dots + \varepsilon_{it} \quad (1)$$

$$OE_{it} = \beta_0 + \beta_1 AI_{it} + \dots + \varepsilon_{it} \quad (2)$$

where: (i = 1, 2, N) (t = 1, 2, t)

AI = Artificial Intelligence, EC = Employee Cost, OE = Operating Expenses, N = Number of companies or cross section, t = Number of time periods, β_0 = Intercept Coefficient, β_1 to β_2 = Parameters for estimation, ε = Error Term.

Description of Model Variables

From the above specified panel multiple regression equation, we proxy corporate operating activities with the followings:

Employee Cost (EC)

It is the portion that is attributable to employee in the financial statements of the DMBs selected for the study.

Operating Expenses (OE)

It is the portion that relates to the primary operations of a company though based on the type of company. Operating costs include costs of goods sold and other operating expenses.

Artificial Intelligence (AI)

This relates to expenditures that were incurred on ICT investments and ICT expenses in the financial statements of the DMBs.

Analytical Techniques

The panel data gathered were analyzed using the Multiple Ordinary Least Square (MOLS) regression techniques with the aid of STATA software to test the hypotheses and to establish the effect of artificial intelligence on corporate operating activities of listed DMBs in Nigeria. The descriptive statistical technique was used while statistical tests such as F- statistic and Hausman test were employed to test the overall significance of the regression equation. Hansen test and Jarque-Bera normality test were used for the validity and normality of instruments used. Diagnostic tests such as normality test and homogeneity tests were performed to ascertain the nature of the relationship that exists between the dependent and independent variables.

RESULTS/FINDINGS

Table 1:

	AI	Employee_Cost	Operating_Expenses
AI	1.000000	-0.055429	0.190052
Employee_Cost	-0.055429	1.000000	-0.712415
Operating_Expenses	0.190052	-0.712415	1.000000

**Source: Researcher’s Computation, 2023
Correlation Matrix**

The result of the correlation between the artificial intelligence (proxy by ICT investments and ICT expenses) and employee cost and operating expenses from Table 1 reveals low correlation values between the independent variables and the dependent variables. This suggests that there is an existence of low degree of relationship between the independent variable and the dependent variables posing the absence of multicollinearity among them. The result shows that employee cost has negative correlation with artificial intelligence ($r = -0.055429$). The table also revealed that there is positive relationship between operating expenses and artificial intelligence ($r = 0.190052$). This implies that any observable increase in operating expenses (OE) and the decrease in employee cost (EC) are as a result of the adoption of artificial intelligence (AI) by the DMBs.

Table 2:

Dependent Variable:				
EC1				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.43E+08	10246302	13.99883	0.0000
AI1	-20871487	1451747.	-14.37681	0.0000
R-squared	0.124762			
Adjusted R-squared	0.124159			
F-statistic	206.6926			
Prob (F-statistic)	0.000000			
Durbin-Watson stat	2.271044			

Source: Authors' Computation, 2023

Regression Result between Employee Cost and Artificial Intelligence

The results from table 2 as revealed by the panel least square results indicate that the coefficient of determination (R^2) is 0.124762. This shows the extent to which the explanatory variable has impact on the dependent variable. The explanatory variable can only explain 12.48 percent of the observable variations in the dependent variable, that is, 12.48% of the variations in employee cost (EC) are influenced by artificial intelligence (AI). Invariably, 87.52% of the variation noticed in the dependent variable is caused by some essential factors that are not captured by the model.

F-statistics was employed to know the effect of the explanatory variables on the dependent variable. The result showed that the F-statistics' value was 206.6926 with a probability value of 0.000000 and statistically significant at 5 percent while the Durbin Watson statistics of 2.271044 revealed the absence of multicorrelation between the variables. This indicated the adequacy of the model and the influence of the explanatory variable (operating expenses) on the dependent variable. The t-statistics and its corresponding probability values were -14.37681 and 0.0000 respectively at 0.05 (Sig. Level). This shows that AI has significant effect on EC. An increase in AI reduces EC of DMBs in Nigeria.

Table 3:

Dependent Variable:				
OE1				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.04E+09	55917676	-18.54686	0.0000
AI1	1.49E+08	7922694.	18.74706	0.0000
R-squared	0.195094			
Adjusted R-squared	0.194539			
F-statistic	351.4524			
Prob (F-statistic)	0.000000			
Durbin-Watson stat	1.602084			

Source: Authors' Computation, 2023

Regression Result between Operating Expenses and Artificial Intelligence

The panel least square results from table 3 reveals the coefficient of determination (R^2) as 0.195094. This shows the level at which the explanatory variable explains the variation that occurs in the dependent variable. This reveals that the explanatory variable only explains 19.51 percent of the recognizable variations in the dependent variable, that is, 19.51% of the variations in operating expenses (OE) are influenced by artificial intelligence (AI). This impliedly revealed that 80.49% of the variation that is seen in the dependent variable is caused by some other variables that are not captured by the model.

The study employed F-statistics for it to test the effect of the explanatory variables on the dependent variable. The result showed that the F-statistics' value was 351.4524 with a probability value of 0.000000 which was statistically significant at 5 percent while the Durbin Watson statistics of 1.602084 revealed the absence of multicorrelation between the variables.. This indicated that the model was adequate and influence of the explanatory variable (operating expenses) on the dependent variable.

The t-statistics values and its corresponding probability value were 18.74706 and 0.0000 respectively at 0.05 (Sig. Level) which indicates that AI has significant effect on OE. An increase in AI increases OE of DMBs in Nigeria.

DISCUSSION OF FINDINGS

The null form of Hypothesis 1 which states that there is no significant relationship between AI and EC was tested using regression analytical tools. The result showed that the independent variable (Artificial Intelligence) when adopted brings reduction to employee cost (EC). The null hypothesis is, therefore, rejected on the ground that the study revealed that EC is adversely affected by AI with t-statistics values and probability value of -14.37681 and 0.0000 respectively at 0.05 (Sig. Level). The null hypothesis is therefore rejected. The study is in line with the study that was carried out by Malik et al (2022) which revealed that there exists a relationship between AI and EC.

Hypothesis 2 which also states that artificial intelligence has no significant effect on operating expenses was tested using regression analysis. It revealed that operating expenses are positively influenced by artificial intelligence with t-statistics values and probability value of 18.74706 and 0.0000 respectively at 0.05 (Sig. Level). This was in line with the study of Agarwall et al, (2021) that artificial intelligence positively influence operating expenses. Hence, the null hypothesis was rejected.

CONCLUSION AND RECOMMENDATIONS

The study was carried out to establish any relationship between artificial intelligence adoption and corporate operating activities of DMBs in Nigeria between 2012 and 2022. The study finds that artificial intelligence adoption by DMBs has negative effect on employee cost while it has positive effect on operating expenses. Hence, the adoption of AI by all the DMBs will reduce, to some extent, the whopping sum that banks incur on employee cost while it tends to increase their operating costs. The study recommends the adoption of AI to all DMBs so as to forestall poor performance by reducing their cost of operations which invariably will improve their financial performances. The government, through the Central Bank of Nigeria, should encourage the banking sector by providing the enabling environment and regulate any unforeseen abuse on employees of the sector so that it will not lead to crack down in their work force. This is expected to encourage long-term economic growth in the banking sector which can translate to improve national economy.

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APPENDICES

Dependent Variable: EC1

Method: Panel Least Squares

Date: 08/17/23 Time: 05:06

Sample: 2012 2022

Periods included: 11

Cross-sections included: 132

Total panel (balanced) observations: 1452

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.43E+08	10246302	13.99883	0.0000
AI1	2087148	1451747.	-14.37681	0.0000
		Mean dependent		367198
R-squared	0.124762	var		3.
Adjusted R-squared	0.124159	S.D. dependent		217800
		var		39
S.E. of regression	2038315	Akaike info		36.4996
		5 criterion		9
Sum squared resid	6.02E+17	Schwarz criterion		36.5069
		- Hannan-Quinn		7
Log likelihood	26496.78	crit.		36.5024
		Durbin-Watson		1
F-statistic	206.6926	stat		2.27104
Prob(F-statistic)	0.000000			4

Dependent Variable: OE1

Method: Panel Least Squares

Date: 08/17/23 Time: 05:11

Sample: 2012 2022

Periods included: 11

Cross-sections included: 132

Total panel (balanced) observations: 1452

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	-			
C	1.04E+0	9.55917676	-18.54686	0.0000
AI1	1.49E+0	8.7922694	18.74706	0.0000
R-squared	0.195094	Mean dependent var		976555
Adjusted R-squared	0.194539	S.D. dependent var		6.
S.E. of regression	1.11E+0	Akaike info criterion		1.24E+0
Sum squared resid	1.79E+1	Schwarz criterion		8
Log likelihood	28960.77	Hannan-Quinn criter.		39.8936
F-statistic	351.4524	Durbin-Watson stat		2
Prob(F-statistic)	0.000000			39.9008