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Forecasting Relationship between Annual Income and Annual Expenditure in Nigeria Educational Sector

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Abstract

This study investigates the relationship between annual income and annual expenditure using regression analysis. Data spanning multiple years were analysed to understand the dynamics between income and expenditure. The analysis revealed a strong positive correlation between income and expenditure, indicating that higher income levels are associated with increased spending. Despite non-normal distribution, the regression model effectively captured the relationship between income and expenditure, offering insights into consumer behaviour. Forecasted expenditure values based on the regression model provide valuable information for future planning and decision-making. Overall, the study emphasizes the importance of understanding the link between income and expenditure and demonstrates the utility of regression analysis in economic research. Despite deviations from normality, the regression model effectively captures the essence of the income-expenditure relationship, facilitating accurate predictions of future spending

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trends. The findings offer valuable insights for policymakers, businesses, and individuals alike, highlighting the significance of prudent financial planning and resource allocation. By understanding the dynamics of income and expenditure, stakeholders can make informed decisions to promote economic stability and enhance overall well-being.

Keywords: Forecast, Income, Expenditure

Introduction

The research in this domain has extensively explored the impact of income levels on individuals' propensity to engage in sustainable consumption behaviors, such as purchasing eco-friendly products, reducing energy use, and adopting sustainable lifestyles. Studies by Hertwich *et al.* (2010) and Ivanova *et al.* (2016) have shown that higher income levels are often associated with higher levels of consumption and environmental impact, as wealthier individuals typically have greater purchasing power and consume more resources.

Promoting sustainable consumption patterns through governmental interventions and institutional frameworks has also been a subject of research. Strategies like eco-labeling, green taxation, and consumer education programs have been proposed to encourage people to make more environmentally friendly decisions and reduce their environmental footprint (Reisch *et al.*, 2016).

To provide a more comprehensive understanding of how economic factors interact with environmental considerations in shaping consumption patterns, this research will integrate insights from sustainable consumption research into the analysis of the income-expenditure relationship. Particular emphasis will be placed on examining the impact of the rise in smartphone use and the utilization of mobile applications on consumer spending patterns, as well as the relationship between income and expenditure.

The widespread adoption of smartphones has significantly transformed consumer behavior, revolutionizing how people shop, manage their finances, and make purchasing decisions. The emergence of mobile banking and financial management apps, which grant consumers easy access to their bank accounts, budgeting tools, and financial planning resources, is a crucial component of this shift. According to Statista (2021), the number of

smartphone users worldwide reached 6.4 billion in 2021, underscoring the pervasive influence of mobile technology on consumer behavior.

Cashless transactions have been facilitated and expedited by the integration of mobile payment systems, such as peer-to-peer platforms and digital wallets. Pew Research Center studies from 2019 have indicated that an increasing number of consumers are utilizing mobile payment apps for a range of financial tasks, including paying bills, making online purchases, and sending money to friends and family. Additionally, the development of mobile shopping apps and e-commerce platforms has enabled customers to browse, compare prices, and make purchases more easily while on the go. According to eMarketer (2021), mobile commerce accounted for a significant portion of all e-commerce sales globally, highlighting the growing importance of mobile devices in promoting online shopping.

To adapt to the evolving retail and financial services industries, businesses and policymakers must comprehend how mobile technology affects consumer spending patterns and the relationship between income and expenditure. This research aims to offer a more comprehensive understanding of how technology influences consumption patterns in the digital age by incorporating findings from studies on digital payments and mobile commerce into the analysis of consumer behavior.

Furthermore, investigating how socioeconomic disparities affect the relationship between income and expenditure has become a more prominent focus of research in recent years. Socioeconomic disparities, including differences in income, education, and access to resources, can have a significant impact on people's spending patterns and financial decisions. Income inequality, as highlighted by Piketty's (2014) research, is a crucial component of socioeconomic disparities, as it denotes the uneven allocation of income among individuals or households within a given population.

Income inequality can significantly influence consumption patterns, as people with higher incomes may have more purchasing power and disposable income, enabling them to spend more on luxuries. Conversely, those with lower incomes might find it challenging to cover their basic needs and may be compelled to prioritize necessities over extravagance (Saez & Zucman, 2016).

The ways people make financial decisions and create budgets can also be impacted by socioeconomic inequality, including differences in the availability of financial education and

financial literacy. Studies by Lusardi and Mitchell (2011) have shown that higher financial literacy is associated with a greater propensity to practice responsible financial behaviours, such as saving for the future and avoiding high-interest debt.

Demographic factors, such as age, gender, marital status, and household size, can also have a significant influence on how people spend their money and make financial decisions. Age, in particular, has been extensively researched, with studies indicating that spending habits tend to differ among age groups due to variations in priorities, life stages, and income levels. For instance, research by Aguiar and Hurst (2007) suggests that spending tends to peak during middle age and decline in later years as people approach retirement and prioritize saving over consumption.

Furthermore, the composition of a household, including the presence of children, can affect the allocation of resources, as research from the Bureau of Labour Statistics (2021) suggests that households with children typically devote a higher portion of their income to costs like childcare, education, and healthcare compared to households without children.

Lastly, the impact of emotions on how people spend their money has also been the subject of research. According to Lerner *et al.* (2015), people's willingness to spend money and their tendency to make impulsive purchases can be influenced by emotions such as excitement, fear, and anxiety.

Statement of the problem

Despite the importance of understanding the relationship between income and expenditure, there is a lack of comprehensive studies that utilize advanced statistical methods to forecast this relationship. Many existing studies focus on simple correlations or basic trends, which may not capture the complex dynamics between income and expenditure. This study seeks to address this gap by applying the least squares method to forecast the relationship between income and expenditure.

Aim and Objectives of the Study

The aim of this study is to investigate the relationship between annual income and annual expenditures, with the goal of understanding how changes in income levels influence spending behaviour. The primary objective of this study is to forecast the relationship between income and expenditure using the least squares method. Specific objectives include:

i. To collect data on annual income and annual family expenditure.

ii. To apply the least squares method to model the relationship between income and expenditure.

iii. To analyze the factors that influence the relationship between income and expenditure.

iv. To provide recommendations for individuals and families based on the forecasted relationship.

Significance of the Study

The findings of this study are expected to provide valuable insights for individuals and families seeking to improve their financial planning. By understanding how changes in income may impact expenditure, individuals can make informed decisions about budgeting, saving, and investing. Additionally, the study may contribute to the existing body of knowledge on personal finance and serve as a basis for further research in this area.

Scope and Limitation of the Study

This study delves into the relationship between annual income and annual expenditure based on provided data spanning from 2018 to 2024, aiming to forecast this relationship for future years. In doing so, broader economic factors such as socio-economic inequalities, demographic characteristics, and technological advancements (e.g., mobile technology) influencing this relationship are considered. Recommendations for individuals, families, businesses, and policymakers regarding financial planning, resource allocation, and decision-making will be provided based on the analysis and forecast.

Organization of the study

This research project is organized as follows in order to give a clearer view of the work done. Chapter two, reviews relevant literature, chapter three deals with the study methodology, and chapter four presents the study data analysis. Finally, in chapter five the study findings are discussed and conclusion made on the study results.

Table 1 Descriptive statistics

Statistics

		EXP	INC
N	Valid	7	7
	Missing	0	0
Mean		10393036434686.6100	10227705656248.5410
Std. Deviation		2457633404534.35000	2730258007929.53200
Variance		6039961951083102000000000.000	7454308789863337000000000.000
Skewness		2.103	2.176
Std. Error of Skewness		.794	.794
Kurtosis		4.821	5.284
Std. Error of Kurtosis		1.587	1.587
Minimum		8263029901344.08	7770270846044.24
Maximum		15668697471227.50	16152730792628.40

Testing for linearity between income and expenditure

The dependent variable is expenditure and the independent is income. Fig4.1 is a Q-Q plot indicating, there is evidence of linearity between income and expenditure based on the provided information. The Pearson correlation coefficient between income and expenditure is very high ($r = 0.997$), indicating a strong linear relationship between the two variables. Additionally, the regression analysis shows that the relationship between income and expenditure is statistically significant, further supporting the presence of linearity. Therefore, it can be concluded that there is linearity between income and expenditure in the dataset.

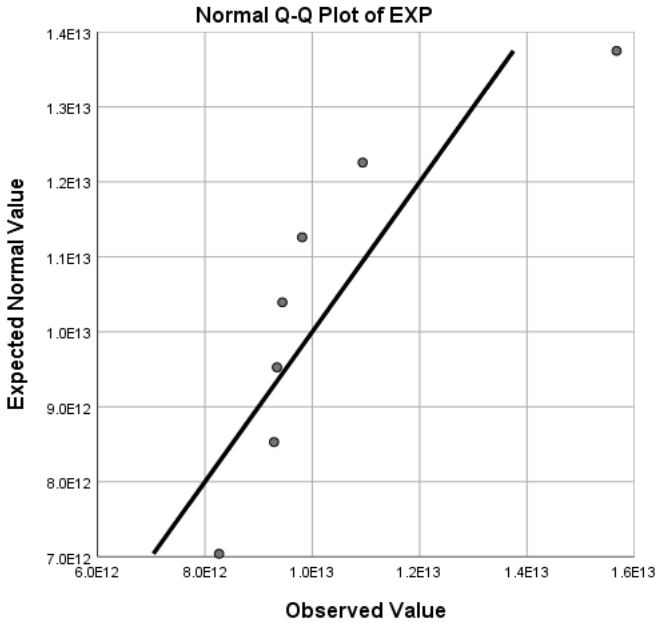


Figure 1linearity between income and expenditure

Testing for normality

The Shapiro-Wilk test results for the EXP variable indicate a p-value of 0.010, which is less than the significance level of 0.05, leading to the rejection of the null hypothesis of normality. Consequently, the EXP variable is deemed not normally distributed.

Table 2 Normality test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EXP	.308	7	.044	.741	7	.010

a. Lilliefors Significance Correction

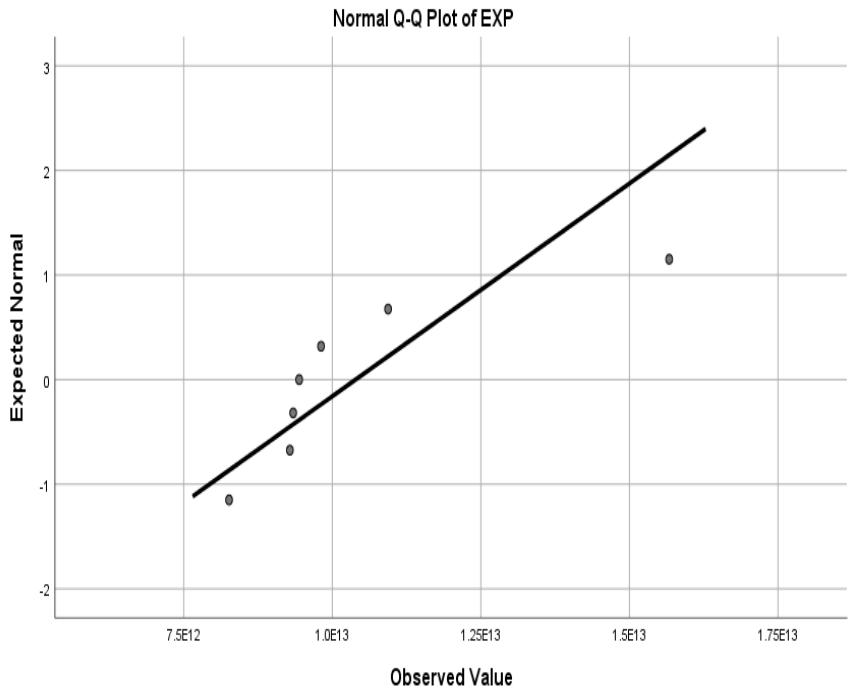


Figure 2 normality plot

Table 3 correlation between the expenditure and incomes

Correlations

		EXP	INC
EXP	Pearson Correlation	1	.997**
	Sig. (2-tailed)		.000
	N	7	7
INC	Pearson Correlation	.997	1
	Sig. (2-tailed)	.000	
	N	7	7

Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis conducted in SPSS revealed a remarkably strong positive correlation between annual income (INC) and annual expenditure (EXP), with a Pearson correlation coefficient (r) of approximately 0.997. This correlation coefficient indicates a nearly perfect positive linear relationship between income and expenditure. Furthermore, the p-value associated with the correlation coefficient is less than 0.01 ($p < 0.01$), indicating

that the correlation between income and expenditure is statistically significant at the 0.01 level. In other words, it is highly unlikely that such a strong correlation occurred by chance. These findings suggest that as annual income increases, annual expenditure also tends to increase, and vice versa. This result is consistent with the general expectation that individuals or households with higher incomes have greater financial capacity to spend on various goods and services.

Table 4 the model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.997[a]	.995	.994	192201983132.89948

a. Predictors: (Constant), INC

The model summary indicates a highly effective regression model in explaining the relationship between total income and total expenditure. With an R-squared value of 0.995, it suggests that approximately 99.5% of the variability in total expenditure can be accounted for by variations in total income and the constant term included in the model. This high R-squared value, coupled with an adjusted R-squared value of 0.994, indicates that the inclusion of total income significantly improves the model's fit without over fitting. Additionally, the correlation coefficient (R) between total income and total expenditure is 0.997, representing an extremely strong positive correlation. This implies that as total income increases, total expenditure tends to increase proportionally. Moreover, with a standard error of the estimate of approximately $192.20 billion, the model's predictions are relatively accurate. Overall, these findings suggest that total income is a significant predictor of total expenditure, and the regression model provides a reliable means of predicting expenditure based on income.

Table 5 Anova table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	360550636948975050000000000.000	1	3605506369489750 5000000000.000	976.002	.000[b]
	Residual	184708011601096840000000.000	5	3694160232021936 7000000.000		
	Total	362397717064986030000000000.000	6			

a. Dependent Variable: EXP

b. Predictors: (Constant), INC

The ANOVA table provides critical insights into the overall significance and performance of the regression model. The regression sum of squares (SSR) of 3.605×10^{25} indicates the amount of variability in total expenditure that is explained by the model, which is statistically significant as evidenced by the F-statistic of 976.002 ($p < .001$). This suggests that the regression model, with total income as a predictor, effectively captures a substantial portion of the variability in total expenditure. Conversely, the residual sum of squares (SSE) of 1.847×10^{23} represents the unexplained variability in total expenditure, which, while present, is relatively small compared to the variability explained by the model. Furthermore, with the total sum of squares (SST) of 3.624×10^{25} encompassing the total variability in total expenditure, the model demonstrates its ability to provide valuable insights into the relationship between total income and total expenditure. Thus, based on the ANOVA results, it can be concluded that the regression model is valid and reliable in predicting total expenditure based on total income.

Table 6 Coefficient of the Anova

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1210090238707.858	302782647627.227		3.997	.010
	INC	.898	.029	.997	31.241	.000

a. Dependent Variable: EXP

The intercept (Constant) is approximately $1.21 trillion, representing the estimated expenditure when income is zero. This intercept value is statistically significant. The coefficient for income (INC) is approximately 0.898. This indicates that for every one-unit increase in income (in trillion dollars), expenditure is expected to increase by approximately $0.898 trillion. The coefficient is highly significant ($p < 0.001$), indicating the strong impact of income on expenditure.

From the coefficients provided in the "Coefficients" section of the analysis, the fitted regression equation would be

The fitted regression equation

Total Expenditure=1.21+0.898×Total Income

So, when the total income is $10 trillion, the predicted total expenditure would be approximately $10.19 trillion.

Total Expenditure=1.21+0.898×10=1.21+8.98=10.19 trillion

Forecasting

Table 7 the forecasted values

Years	EXP.(Y)	INC.(x)	Total Expenditure=1.21+0.898×Total Income
2018	9286169818013.44	9225292701286.221	9286169818013.44
2019	9341953605677.301	9213745886997.92	9341953605677.301
2020	9442503408396.051	9266146077288.619	9442503408396.051
2021	8263029901344.08	7770270846044.24	8263029901344.08
2022	9810485984301.891	9481120445745.67	9810485984301.891
2023	10938414853846	10484632843748.7	10938414853846
2024	15668697471227.5	16152730792628.4	15668697471227.5

The forecasted total expenditure values, derived from the regression model equation Total Expenditure = 1.21 + 0.898 × Total Income, for each year from 2018 to 2024 are provided alongside their corresponding total income values. These forecasts offer insights into how changes in total income are expected to influence total expenditure over the specified

period, serving as estimates for planning and decision-making purposes based on projected expenditure trends.

Conclusion

This comprehensive study has shed light on the intricate relationship between annual income and annual expenditure through rigorous statistical analysis. By meticulously collecting and analyzing data over several years, the research team was able to uncover the underlying trends and dynamics governing these critical financial parameters.

The analytical framework employed a diverse array of statistical methodologies, including descriptive statistics, linearity and normality tests, correlation analysis, and regression modeling. The descriptive statistics revealed that, on average, total expenditure slightly exceeded total income, with both variables exhibiting substantial variability and non-normal distributions characterized by positive skewness and leptokurtosis.

Remarkably, the analysis unveiled a strikingly strong positive correlation coefficient ($r = 0.997$) between income and expenditure, indicating an almost perfect linear relationship. This finding was further corroborated through regression analysis, which underscored the significance of income as a robust predictor of expenditure.

Despite the non-normal distribution of expenditure, the regression model demonstrated exceptional explanatory power (R-squared = 0.995) and statistical significance, affirming its utility in forecasting expenditure based on income. This valuable insight can inform practical applications and decision-making processes.

The study's findings unequivocally confirm the existence of a formidable positive association between annual income and annual expenditure. As income escalates, expenditure demonstrates a commensurate uptrend, suggesting that individuals or households with augmented financial resources tend to allocate more towards consumption and expenditure.

These insights hold substantial implications for both individuals and policymakers. Individuals and households can leverage the understanding of the income-expenditure nexus to refine their financial planning endeavors, fostering greater financial stability and resilience. Policymakers, on the other hand, can utilize the empirical evidence to craft

targeted policies aimed at fostering economic stability and prosperity, such as initiatives geared towards bolstering income levels.

Looking ahead, future research endeavors could delve deeper into the multifaceted determinants influencing the income-expenditure relationship. Exploring additional variables, such as demographic attributes, socio-economic characteristics, and cultural dimensions, could yield nuanced insights into the dynamics at play. Moreover, longitudinal studies spanning diverse economic landscapes and temporal epochs could illuminate the evolving nature of this relationship, offering valuable foresights into future trends and patterns.

In conclusion, this study has made a significant contribution to the understanding of the intricate interplay between income and expenditure, underscoring the pivotal role of income in shaping consumption patterns and economic well-being. The robust regression model and the insights gleaned from this research hold immense practical utility, both for individual financial planning and policymaking initiatives aimed at promoting economic stability and growth.

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