

The Impact of Foreign Exchange rate Fluctuations in Inflation using the ARDL model

Applied study- Sudan during the period (1979 - 2017)

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Abstract: *The study aims to know the impact of the foreign exchange rate in inflation, which is reflected in the economic conditions, the high general level of prices, economic instability, high inflation rates, and price instability. The study adopted the econometrics historical statistical descriptive approach E- views 10, the method of least squares (O.L.S), co- integration, Granger's causal relationship and the use of ARDL. The study also found out the most important results: There is a direct relationship between the foreign exchange rate and inflation, so that the higher the foreign exchange rate, the higher the rates of inflation automatically and directly. The study proved that there is an impact of exchange rate fluctuations on the gross domestic product (GDP). The study also recommended the following: Continuing to adopted the policy of the managed flexible exchange rate to eliminate the parallel market, and to strengthen and support the official market. Attracting the savings of workers abroad, encouraging them and tempting them with remunerative prices. Attracting capital abroad and encouraging foreign direct and indirect investment by simplifying procedures, unifying the investment window, and facilitating transfer procedures. The authorities should find a mechanism to reduce inflation rates and adopt a flexible and balanced monetary policy. Maintain reserves of foreign exchange.*

Key words: *fluctuations, foreign exchange rate, inflation, ARDL model*

Introduction:

Since the end of the seventies, the foreign exchange rate in Sudan has witnessed instability that has a direct impact on inflation and the continuous rise in the general level of prices. The rise in prices of consumer goods, and consequently the hyperinflation occurred, where inflation has exploded in an unprecedented manner. The inflation rate has reached three correct figures. the economic situation has deteriorated. Also, there were fluctuations in foreign exchange rates, and this was reflected in consumer prices. Then the economic crisis, the horrifying rise in the prices of necessary consumer goods, and the worsening economic situation, have a clear impact on the standard of living and significant increase in the poverty rate in society, and threatened it. This is the life of the citizens which warns them of the early danger of hunger, extreme poverty, unemployment and destitution, which leads to bad morals, decadence and deterioration of society. This leads emergence of strange habits such as encroachment, looting and theft, insecurity, loss of security, deprivation, hunger and homelessness, an increase in emigration abroad in search of a situation better economics, and a decent and secure life.

First: Scientific and Practical Importance:

The scientific importance of this study stands out in adding information on the exchange rate from fluctuations and changes that had a clear impact on the overall economy in Sudan. Also the repercussions of the continuous rise in the prices of imported and local essential commodities. The practical importance lies in providing results and recommendations that help specialists and monetary policy makers.

The first axis: The methodological framework of the study

The problem of the study: The problem of this study is embodied in the impact of the changes and fluctuations of the foreign exchange rate on inflation and its repercussions on economic life. It is also aims to know the general level of prices in an unusual way that the Sudanese economy has not witnessed over time due to economic distress and deterioration in living conditions.

Study questions: What is the impact of foreign exchange rate fluctuations in inflation? What is the impact of foreign exchange in economic life and the general level of prices? What happens to inflation in GDP?

The importance of the study: The importance of the study highlights the fluctuations changes in exchange rate that had a clear impact on overall economy in Sudan. It also highlights the repercussions of the continuous rise in the prices of imported and local essential goods.

Objectives of the study: Knowing the causes of exchange rate fluctuations and their repercussions on the continuous rise in the general level of prices. And how to find a tool to address the factors that lead to high rates of inflation. Also it aims at seeking to follow an effective monetary policy that helps in stabilizing the economy with regard to the exchange rate and inflation.

Study Hypothesis: There is a direct, statistically significant relationship between the foreign exchange rate and inflation.

Study Methodology: The study adopts the descriptive historical-statistical approach using E- views 10, co-integration, Granger's causal relationship, least-quartiles method (O.L.S) and simple linear regression (ARDL).

Study boundaries: the spatial boundaries of Sudan, the continent of Africa. Time limits: the period (1979 - 2017).

Sources for collecting data: secondary sources, which are books, references, reports and periodicals

Second: Previous studies:

1 / Study (Abdul Baqi2021) ⁽¹³⁾ and others: Entitled ‘Analysis of the causal relationship between the exchange rate and the general level of prices using the ARDL model’ - a case study of Sudan during the period 1989-2018. The study aimed to analyze the causal relationship between the general level of prices and the actual real exchange rate in Sudan, using the Auto Regressive Distributed Lag Model (ARDL) to test the causal relationship long and short term. Through the results, the Long Run Form and Bounds test proved that there is a long-term equilibrium relationship between the study variables and the general level of prices (the exchange rate and the consumer price index) during the period. The study also found the existence of a three-stage Least Squares reciprocal relationship between the variables of the study. There is a causal relationship Granger Causality Tests, a trend in one direction from the general level of prices towards the consumer price index and vice

versa, and the results also showed that there is a causal relationship in one direction of the exchange rate and the actual real to the general level. For prices, the ARDL model proved that the general level of prices depended on a previous value and the previous values of the actual real exchange rate of the Sudanese pound against the US dollar. (Increasing production of cotton, groundnuts, sesame and Gum Arabic) and substituting imports to curb domestic demand in order to contain the growth of imports and alleviate inflationary pressures. And works to create an environment conducive to increasing flows of remittances from Sudanese working abroad and their suitability to the current economic situation.

2 / Study (Ibrahim 2021) ⁽¹⁴⁾ and others: Entitled ‘The Impact of the Sudanese Pound Exchange Rate Policies on Consumer Prices and Inflation Rates’ - An applied study of Sudan during the period (1980 - 2014). The study aimed to analyze the static and the direction of the short and long-term relationship between the actual real exchange rate, Consumer prices and inflation rates. The problem of the study was the continuous fluctuations of exchange rates affecting consumer prices and inflation rates. The study adopted the descriptive approach in view of the nature of the problem and the available information about it and discussed it within the framework of the study. For the purpose of analyzing time series, this requires unit roots test and co- integration test. The most important results are the existence of an integrative relationship between the study variables.

Also, there is an effect of exchange rate fluctuations on changes in consumer prices and inflation rates, as well as the continuous decline in the Sudanese pound exchange rate by the International Monetary Fund, which led to the weakness of the Sudanese pound against foreign currencies, and the weakening of purchasing power. The study recommended that the central bank should not interfere in the exchange rate to balance supply and demand for foreign currencies. Working to raise the value of the Sudanese pound against foreign currencies in the official market and to eliminate the parallel market, which greatly harmed the national economy. This can only be achieved by increasing production, creating a climate for foreign investments in the country, and attracting foreign currency remittances from residents abroad.

The second axis: The theoretical framework

The concept of the exchange rate, which is the fixed exchange rate that is determined based on the gold rule that allows the exchange of currency for gold, or according to

the rules of the International Monetary Fund, or through financial and monetary policies. As for the changing exchange rate, it means leaving the currency to the forces of supply and demand and it is called floating the currency or the intervention of the executive and monetary authorities according to the economic, political and social conditions)⁽¹⁾.

Types of transactions in the exchange rate ⁽²⁾:

1. Cash exchange rate: It is the process of exchanging one currency for another at the current rate, within 48 hours from the moment of concluding the contract.

There are two types of monetary exchange rate: the purchase rate is the number of units of the national currency that the bank pays to buy one unit of the foreign currency. The selling price is the number of units of the national currency that the bank requires to sell one unit of the foreign currency. The selling price is always greater than the purchase price. The difference between them represents the bank's margin, which is the selling price minus the purchase price⁽³⁾.

2. Derivative exchange rate (reciprocal cross): When exchanging currencies in a particular financial center, the price of two transactions against the exchange may be unavailable, and for the importance of the exchange, their price must be determined and this is done based on the relationship of the two currencies to a third currency, and the prices calculated in this way are called cross prices. The price of any currency can be calculated in terms of another currency.

3. The rise and fall of the value of a currency: The rate of increase or decrease in the value of a currency can be determined by calculating the percentage change in the exchange rate. By taking the difference between the new exchange rate and the old exchange rate and the ratio of this difference to the old rate, multiplying by 100 to get the percentage change. Usually, currency rates change with improvement or deterioration, and there is an improvement in the price of one currency against another if the price of this currency at the end of the period is greater than its price at the beginning of the period. And there is a deterioration in the price of the currency against the other currency if its price at the end of the period is lower than its price at the beginning of the period⁽⁴⁾.

4. Currency rates in financial centers: the price of one currency compared to another changes continuously on a daily basis at the level of financial centers. This change

leads to the emergence of different prices for the currency, and this difference prompts exchange agents to carry out arbitration operations between prices in various financial and exchange centers, buying in a low currency price, and reselling in a financial position for an increase in the currency price. If there is no change in prices, there is no sense in the arbitration process, and there is no need to sell or buy to benefit from the price difference ⁽⁴⁾.

5. Forward exchange rate: The term exchange rate is defined as the exchange of one currency for another during a specific time in the future to be agreed upon in advance at a specific price between the seller and the buyer, based on the exchange rate prevailing at the moment of concluding the contract. The exchange process is called term if the operation is carried out after 48 hours from the date of concluding the contract. The term exchange process is used by companies operating in foreign trade to avoid risks arising from possible fluctuations in currency exchange rates.

It is also used by speculators when they expect the price of the currency they are buying to rise ⁽⁵⁾.

6. Arbitration when exchanging currencies: There are three types of arbitration when exchanging currencies. They are direct arbitration, which is the operations that result from comparing the price of a particular currency in terms of another currency in two different financial centers. Indirect arbitrage, this type appears when there are three currencies and one of these currencies is not directly priced in terms of one of the last two currencies, but is priced in terms of the third currency. Arbitration on interest rates, this type of arbitration arises when there is a difference in interest rates on a particular currency in two different financial centers ⁽⁶⁾.

7. Exchange Rate Options: The exchange rate has two options: the purchase option: which gives its owner the right to buy a specific amount of foreign currency against the national currency at a specific price and for a pre-determined maturity. On this basis, the purchase option is not considered binding on the buyer, but rather enables him to implement the purchase decision or to waive it. And the put option: It is the one that gives the right to its owner the right to sell a certain amount of foreign currency against the national currency at a certain price and on a specific, predetermined maturity date. And the option to sell is not considered binding on its owner, but the seller can implement this option or waive it according to the developments of the exchange market ⁽⁶⁾.

8. The concept of the exchange market: The foreign exchange market is all transactions that require exchange other than some financial markets such as the stock exchange, the foreign exchange market is not located in a specific place, but the market spreads through financial centers all over the world subject to trade restrictions or government control ⁽⁷⁾.

The main components of the foreign exchange market:

1. Central banks intervene in the market for the purpose of buying and selling currencies to influence the exchange rate. On the other hand, the implementation of the orders of governments as state banks. As for currency transactions, this intervention is by the central bank in order to protect the position of the local currency or some other currencies because it is considered responsible for the exchange rate of the currency.
2. Commercial banks carry out transactions for companies and clients, and in some cases use foreign exchange brokers to match sellers and buyers of foreign currencies together. Most of the activities in the foreign exchange market ⁽⁸⁾.
3. Corporations from time to time need to convert receipts and payments from one currency to another.
4. Non-bank financial institutions, such as insurance companies ⁽¹²⁾.

The third axis: The literature of the Study

Inflation in Sudan , the period from 1979-2017:

Inflation is one of the main factors that lead to imbalance in the overall economy, and thus to economic instability, as inflation rates impact macroeconomic indicators. The rise in inflation rates is due to the increase in money supply at a rate that exceeds the increase in the supply of goods and services. Since the escalation of inflation rates means an increase in the prices of domestic goods and services, it negatively affects the competitiveness of exports and, consequently, the external account ⁽¹²⁾.

Over the past eras, the Sudanese economy witnessed continuous economic deterioration and low growth. In some cases, the Sudanese economy recorded negative growth rates, offset by higher growth rates in the population, which led to a continuous deterioration in the real incomes of individuals. It coincided with the low performance in economic growth and an acceleration in the rise in inflation rates.

This resulted in a continuous deterioration in local and national savings, and that period witnessed a shortage of food and the spread of famine, and this deterioration led to negative effects on the social fabric represented in displacement.

It is noted that inflation rates have been on the rise since 1970, and this period is considered the beginning of the imbalance in the structure of the Sudanese economy as a result of confiscations and nationalization of commercial, industrial and agricultural enterprises and the banking sector, which led to an imbalance in economic activity in both the public and private sectors, as well as regulatory policies in managing the economy, especially setting prices in the stages of production, import, export and distribution. Also, the outbreak of civil war in the south after it stopped for a decade. This period also witnessed many disasters such as desertification and drought, floods and torrential rains, in addition to political instability, as the country was exposed to the worst periods of drought during the years 83/84-84/85, which led to a decline in agricultural production, a decline in farmers' incomes, and a massive shortage in agricultural crops stocks. Famine spread on a large scale in the country, which led to an increase in the deterioration of the economic situation, which had already taken a deterioration as a result of the internal and external imbalance and the inflationary pressures that the national economy was exposed to. The size of the debt in the year 1988-1989 was double the size of the debt in the past years. The average budget deficit during the years 76-1989 reached 10% of the GDP, which confirms the imbalance in the financial policies. The financial performance deteriorated a lot after 1984 as a result of the sharp deterioration in public revenues, while public expenditures maintained their growth level of 22% of the output. Thus, the ratio of the deficit to (GDP) increased from an average of 10% in the period 76/84 to 13% in the period 85/89. Also, entering into short and medium-term external commitments to finance projects that are not economically feasible, in addition to the cash and commodity loans that were employed in the areas of consumption and current spending, these obligations were beyond the country's capacity, which the state was unable to pay, and debts accumulated until they reached more than 23 billion dollars in the year 2000 ⁽¹²⁾.

In 1991, the inflation rate reached 121%, which indicates the accelerated and continuous deterioration in the national economy. This escalation in inflation rates necessitated the continuous expansion of the public budget deficit and its financing from the banking system. In the first half of 1996, the Sudanese economy began

trotting at a rapid pace towards collapse, if the inflation rate developed in the period from January to June and reached 162%, and this is considered the fastest in the history of the Sudanese economy, and its details were as follows:

Table No. (3/2) the evolution of the inflation rate in Sudan for the year 1996:

Month	January	February	March	April	May	June
Inflation	83.9	95.8	102.7	115.6	119.4	162.5

Source: Central Bureau of Statistics

This rate was heading towards deepening the excessive inflation rate to levels that had not occurred before. In view of the economic situation prevailing in the period 1989 to 1996, it was expected that if the inflation rate proceeded at this speed, it would reach 300% by the end of the year 1996. Therefore, treatments must be taken to confront this deterioration.

In April 1996, the Ministry of Finance faced crises from all economic aspects, the most important of which were ⁽¹²⁾:

1. Low economic performance between (4%-5%) of the total macroeconomic indicators and the rise in inflation rates to unprecedented levels (162% in July 1996).
2. An unstable and unreal exchange system and a deterioration in the current account, as the deficit reached about (20-25%) and the level of maturity for external debt services reached about (180%) of the current receipts annually.

The economic policies that aimed to control the high rates of inflation in 1996 were represented in the following ⁽¹²⁾:

1. Stop all kinds of extra-budgetary spending.
2. Cancellation of ministries' authorization to dispose of their revenues without referring to the Ministry of Finance.
3. Reducing the amount of borrowing from the banking system.
- 4 . Controlling the cash flow pumped by commercial banks by raising reserves and tightening supervision over banks' performance to ensure that funding is limited to the specified ceiling.

5. Suspending all types of customs and tax exemptions that are not sanctioned by laws. As a result of these policies, inflation rates witnessed a noticeable decline (from three decimal places to one decimal place during the period from (1997-1998-1999), as shown in the Table: (3.2)

Inflation in Sudan during the period (1979-2017)

annual inflation:

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Inflation	32.9	26.1	22.5	27.7	31.1	32.4	49.3	29	49.1	74.1	67.4	122.5	119.0	110.2	115.9	69.0	130.4	47.2	17.0
Year	98	99	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Inflation	16.2	8.0	4.9	8.5	7.4	8.7	8.3	7.3	8.1	14.1	25.0	29.0	45.0	49.1	37.1	25.7	12.6	30.3	32.4

Source: Central Bank of Sudan reports.

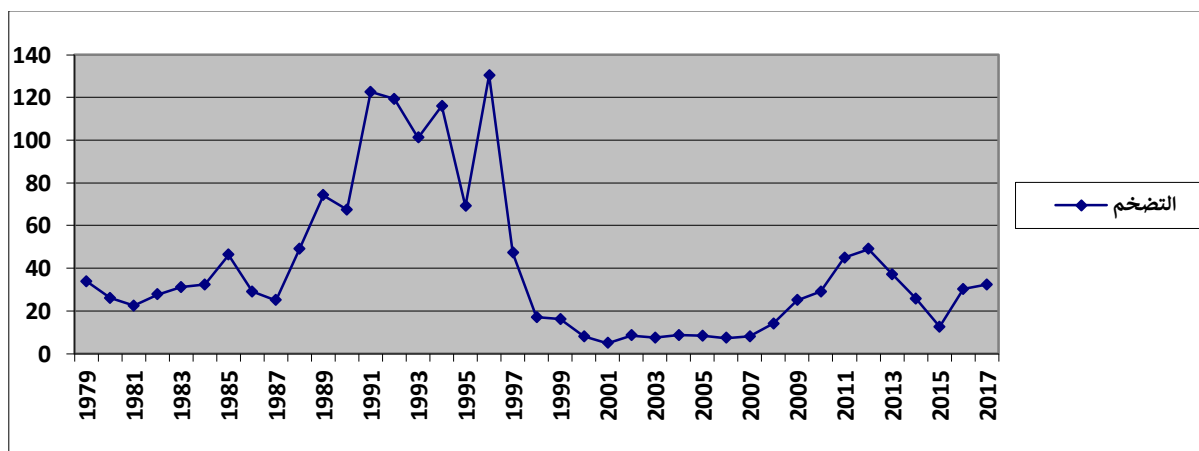
Table (3/2) shows the inflation in Sudan for the period from 1979-2017, as the highest inflation rate was in the year 1996 and the lowest inflation rate in the year 2001 was 4.9%. In general, the inflation rates increased in the first period of the time series and decreased in recent years due to income Petroleum in the economy. In addition to some reform and structural policies in the Sudanese economy, also entering into short and medium-term external commitments to finance projects that are not economically feasible, in addition to cash and commodity loans that were employed in the areas of consumption and current spending. These commitments were beyond the country's capacity, which made the state unable when it was paid, debts accumulated until they reached more than 23 billion dollars in the year 2000 ⁽¹³⁾.

Inflation rates began to decline until it reached 4.9 in the year 2001 and is considered the lowest level of the inflation rate. The reason is due to the production and export of oil, which affected the rates of the gross domestic product, the exchange rate and the balance of payments and in turn affected the inflation, and in the year 2002 the inflation rate rose to 8.5 and returned once Another decrease in the year 2003 was 7.4, then it rose again in the year 2004, and the inflation rate reached 8.7.

This period witnessed many political and economic events in Sudan. After the peace agreement in 2005, inflation rates began to decline, in the years (2006-2007), when inflation rates decreased to (7.3, 8.1), respectively.

As for the year 2008, the global financial crisis occurred, and Sudan, like other countries, was affected by it, which led to a rise in the inflation rate this year to (14.3). In 2009, the government took the necessary economic policies to control the money supply and reduce the inflation rate, which decreased to (11.2) in 2009. As for the period from 2010 to 2013, the inflation rates increased dramatically, reaching (13, 45.0, 49.0, 37.1%), respectively. The main reason for this rise in inflation rates was the secession of the south and the exit of oil as a main source of state revenues, as it represented 70% of state revenues (and more than 90%) the contribution of oil to Sudanese exports (12). It is noted that the inflation rates decreased in the years 2014 and 2015, respectively (25.7%, 12.6%), and the rate returned to rise in the years 2016 and 2017, respectively (30.3, 32.4 %).

Figure (3/2) Inflation in Sudan 1979-2017.

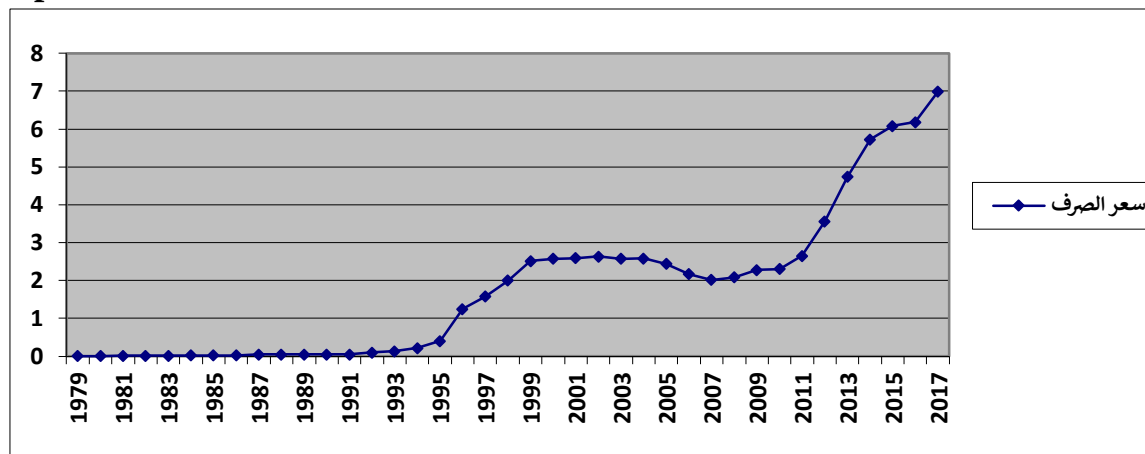


Source: Prepared by the researcher from table (3/2) data using Excel 2019

The relationship between the exchange rate and inflation in Sudan 1979-2017

Figure (3/3) The exchange rate in Sudan 1979-2017

pound/dollar



Source: Prepared by the researcher from the data in Table (1/3) using Excel 2019 program.

The exchange rate in Sudan 1979-2017 pound/dollar Figure (3/3) and Figure (3/4) show the relationship between the exchange rate and inflation in Sudan in the period from 79-2017, where it is noted that the highest inflation rate was in 1996 at a time when the exchange rate was low, and the reason for this is due to Many local, regional and international economic and political variables, the most important of which was the economic blockade that Sudan was subjected to during that period, and the suspension of all loans and financial and investment aid from international financial institutions and major companies, which led to thinking about developing an economic treatment for that period through economic structural policies For a period of three years applied by the Ministry of Finance.

Reasons of high inflation in Sudan:

1. Increasing investment expenditures: Since the beginning of the seventies, with the beginning of the May era, the regime was inclined in its directives to the socialist system, as the authority at that time increased government economic development projects in a large and unstudied way. The occurrence of these projects coincided with the occurrence of the so-called oil war between The oil-exporting countries and the major industrialized countries. Sudan, like other developing countries, is suffering

from importing high-priced petroleum products. Production inputs from high-priced industrial countries, all of which was directly reflected in the establishment of these projects and contributed to the failure of many of them. Inflation is considered when development projects are established as a natural economic phenomenon, but the failure of these projects due to these internal and global variables and the demand of all these sectors for full wages and high-priced raw materials. The inaccurate study of the establishment of these projects led to a widening of the gap between the amount of money in circulation and the goods and services produced, and accordingly increased Money supply without an increase in goods and services, which led to the emergence of inflation ⁽¹³⁾.

2- Government indebtedness from the banking sector: After inflation reached its highest level in the year 1996, the authorities worked to follow financial and monetary policies to curb the phenomenon of inflation. This was clearly reflected in the general trend of the inflation rate as it continued to decline. In the year 1999, the year of the beginning of production and export of Sudanese oil, which changed the structure of the Sudanese economy at the level of internal production and at the level of its foreign trade. Sudan turned into an oil-producing country after it was an importing country for oil needs, and with the entry of oil into budget revenues for the first time. A surplus was recorded in relation to total expenditures.

Thus, the export of oil provided foreign exchange for the economy, which strengthens the value of the national currency, which would reduce the rate of inflation due to the inverse relationship acquired between the value of the national currency and inflation in the economy. It is worth noting that the exit of Sudanese oil to international markets resulted in the provision of foreign currencies, which made inflation continue to decline, as it reached its lowest level in 2001 ⁽¹²⁾.

After the signing the Naivasha Peace Agreement in southern Sudan, Sudan witnessed stability that it had never seen before, which made foreign capitals flow into Sudan for investment, which led to a decrease in inflation rates. Sudan witnessed stability in various aspects of economic and political life until the year of the referendum, 2011, as an entitlement and complement to the Naivasha Agreement. The result was that the people of the south chose to secede and form a state of their own. This would cause Sudan to lose the oil resources extracted from the lands that lie within the borders of the new state. In order to face the repercussions of the separation, the government

developed the so-called three-year program for the fiscal years (2012-2014), one of its main objectives was to reduce the volume of government spending by 45% during the program period. But as usual, the opposite happened.

Only the budgets of those years increased the current government spending by 70% than it was when the south seceded in July 2011. While spending on development remained a foregone conclusion on the public spending agenda, one of the most prominent negative repercussions of this approach to spending was the rise in inflation rates, which doubled from 18% in 2011 to 36.4% in 2014. And the trade balance deficit grew, which rose from \$300 million in 2011 to \$3.3 billion in 2014, because the government is the largest importer, which increased pressure on the foreign exchange market, because the secession caused Sudan to lose \$6.6 billion in oil exports, according to government statistics.

We note that the inflation rate in Sudan is directly linked to the political events that occur in Sudan, with evidence that any change that occurred on the Sudanese political scene is offset by a change in the general trend of the inflation rate. There are also internal and external economic, political and social factors and variables that have an impact on the rise in inflation rates in Sudan during the period from 1979 - 2017 ⁽¹²⁾.

3 - Economic factors and variables, the public sector dominated the economic performance in the early nineties before switching to a free market system, which led to the widening and increasing of the public budget deficit, and consequently the state resorting to borrowing from the banking system and printing and pumping currencies that have no equivalent, which led to an increase in the monetary mass. Thus, the demand for goods and services increases in light of the decline and deterioration of supply represented in the deterioration and suspension of many agricultural and industrial projects due to the high cost of production.

It is also noted that the periods that witnessed a decrease in inflation levels are related to the period of entry of oil revenues, which led to a reduction in the government's debt from the banking system to fill the public budget deficit, in addition to the weakness and suspension of foreign loans due to the economic blockade imposed by the countries of the Western world on Sudan ⁽¹²⁾. The result was that the people of the south chose to secede and form a state of their own. This would cause Sudan to lose the oil resources extracted from the lands that lie within the borders of the new state. We note that the inflation rate in Sudan is directly linked to the political events that

occur in Sudan, with evidence that any change that occurred on the Sudanese political scene is offset by a change in the general trend of the inflation rate. There are also Political factors: The political and economic blockade of Sudan and the suspension of loans and foreign investments for political reasons and decisions.

As well as the political hostility between the regime and civil society organizations and political parties, which prompted the government to follow the policies of temptation and polarization for these parties by creating fictitious jobs that entail financial obligations that are not matched by real production or real contribution to the national output and income.

Fourth axis: Analytical framework

To perform the hypothesis analysis: There is a direct statistically significant relationship between the exchange rate and inflation using the following equations: internal and external economic, political and social factors and variables that have an impact on the rise in inflation rates in Sudan during the period from 1979 to 2017 ⁽¹²⁾.

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fictitious jobs that entail financial obligations that are not matched by real production or real contribution to the national output and income.

To perform the hypothesis analysis: There is a direct statistically significant relationship between the exchange rate and inflation using the following equation:

$$\widehat{INF}_i = 0.096719REER_i + 0.000122RGDP_i \dots\dots\dots (5)$$

$t_{c=}$ 2.179011, 0.295317

Prob. (0.0364) (0.7695)

$R^2 = 0.59$, $\bar{R}^2 = 0.56$, $d^* = 2.39$

Dependent Variable: INF

Method: ARMA Maximum Likelihood
(OPG - BHHH)

Date: 04/30/21 Time: 01:53

Sample: 1979 2017

Included observations: 38

Convergence achieved after 44 iterations

Coefficient covariance computed using outer product
of gradients

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0364	2.179011	0.044386	0.096719	REER
0.7695	0.295317	0.000413	0.000122	RGDP
0.0000	10.79823	0.076120	0.821958	AR(1)
0.0000	6.259154	79.33856	496.5922	SIGMASQ
39.53053	Mean dependent var		0.594659	R-squared
35.47160	S.D. dependent var		0.558894	Adjusted R-squared

9.299	Akaike	info	23.55	S.E.	of
383	criterion		875	regression	
9.471	Schwarz		1887	Sum squared	
761	criterion		0.50	resid	
			-		
9.360	Hannan-Quinn		172.6	Log	
714	criter.		883	likelihood	
			2.387	Durbin-	
			169	Watson stat	
				Inverted AR	
				Roots	
				.82	

Source: Prepared by the
researcher from the outputs of the
Views program

Economic Measure: The estimated coefficient α_1 0.096719 is positive, indicating that the relationship is direct between the exchange rate and inflation. And that the devaluation of the Sudanese currency against the dollar leads to an increase in inflation rates. A reduction of one pound leads to an increase in inflation by 0.0967

The estimated coefficient α_2 0.000122 with a positive sign indicates a positive relationship between the exchange rate and real GDP, but it is weak.

Statistical Measure:

individual moral: Individual morality was tested by .t .test

Morale α_1 :

$H_0 = \alpha_1 = 0$

$H_1 = \alpha_1 \neq 0$

The corresponding probability t-statistic for the estimated parameter α_1 is (0.0364) which is less than 5%. Which means that the parameter α_1 is significant. This indicates the importance of the exchange rate in influencing inflation.

Morale $[\hat{\alpha}]_2$:

$$H_0 = \alpha_2 = 0$$

$$H_1 = \alpha_2 \neq 0$$

There is no statistically significant relationship between the exchange rate and real (GDP) because the probability value corresponding to the t-statistic corresponding to the parameter that explains the effect of exchange rate fluctuations on real GDP is 0.7695

It is greater than 5%.

The coefficient of determination R^2 :

The coefficient of determination is 0.59, meaning that 59% of the changes that occur in inflation are attributable to the exchange rate and real GDP. While 41% of the changes that occur in inflation are due to other variables not included in the model.

Modified coefficient of determination R^{-2} :

The adjusted coefficient of determination is 0.56, meaning that 56% of the changes that occur in inflation are attributable to the exchange rate and real GDP. The modified determination rate excludes the inflation present in the coefficient of determination.

Econometrics Measure: There is no autocorrelation problem in the model because the statistical value of $DW = 2.387$ approaches the number 2.

Granger causality test: Granger (1969) proposed a criterion for determining the causal relationship that is based on the relationship between two time series Y_{2t} and Y_{1t} . The dynamics that exist between time series, where if Y_{1t} and the series t , express the development of two different economic phenomena over time, Y_{2t} contains the information through which it can be improved. Expectations for the series. In this case then we say about a causal variable if it contains information Y_{2t} causes Y_{1t} we say it helps to improve the expectation of another variable. Granger test is used to ascertain the extent to which there is a feedback or feedback relationship or a correlation between two variables, in If time series data exists.

Pairwise Granger Causality Tests

Date: 04/30/21 Time: 02:19

Sample: 1979 2017

Lags: 2

Pro	F- Stati	Ob	Null Hypothesis:
b.	stic	s	
0.2	1.65		INF does not Granger Cause
084	628	34	REER
0.0	4.54		
192	387		REER does not Granger Cause INF

Source: researcher program outputs

From Granger's result above for causation testing, we note that exchange rate changes cause changes in inflation rates during the study period because the corresponding probabilistic value of the F statistic (0.0192) is less than 5%.

There is a direct relationship between the foreign exchange rate and inflation, so that the higher the foreign exchange rate, the higher the rates of inflation automatically and directly. The study proved that there is an effect of exchange rate fluctuations on the gross domestic product (GDP). The paper also recommended the following: Continuing to follow the policy of the managed flexible exchange rate to eliminate the parallel market, and to strengthen and support the official market.

Attracting the savings of workers abroad, encouraging them and tempting them with remunerative prices. Attracting capital abroad and encouraging foreign direct and indirect investment by simplifying procedures, unifying the investment window and facilitating transfer procedures. The authorities should find a mechanism to reduce inflation rates and adopt a flexible and balanced monetary policy. Maintain reserves of foreign exchange and a base of gold to maintain.

Conclusion

The study aimed to know the impact of foreign exchange rate fluctuations on inflation using standard quantitative analysis. Price stability, economic stability, and maintaining the real value of the local currency against foreign currencies. So, the results of the study were as follows: To follow the policy of a flexible managed exchange rate to eliminate the parallel market, and to strengthen and support the official market. Attracting the savings of workers abroad, encouraging them and tempting them with remunerative prices. Attracting capital abroad, encouraging foreign investment on the external account ⁽¹²⁾.

The paper also found out the most important results: by using the factors that deal with the exchange rate by finding a mechanism to unify the price in the manner of the managed flexible exchange rate to eliminate the parallel market, and to strengthen and support the official market. Attracting the savings of workers abroad, encouraging them and tempting them with remunerative prices. Attracting capital abroad and encouraging foreign direct and indirect investment by simplifying procedures, unifying the investment window, and facilitating transfer procedures. It is recommended by the study that to continue to follow the policy of the flexible managed exchange rate. The authorities should find a mechanism to reduce inflation rates. Adopt a flexible and balanced monetary policy. Maintain reserves of foreign exchange and a base of gold to maintain the required balance.

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The impact of neuromarketing tools on traditional marketing inputs in order to complete understanding of consumer behavior online

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Abstract

In this research we will show a new method of marketing called neuromarketing, a combination of neuroscience results collected and used in marketing, the research question focuses on whether neuromarketing was an entry point for explaining and defining human behavior, or is a sophisticated case of traditional marketing to understand consumer behavior in order to discover the desired purchase button in consumers' brains. The purpose of this research is to assess the impact of neuromarketing tools on traditional marketing inputs, although no neuromarketing study is available with a detailed overview of the impact of neuromarketing on traditional marketing inputs, taking into account technical and ethical problems as well. The increasing use of neuromarketing techniques to assess customer preferences and decision-making processes is an advantage for customers and marketers simultaneously. Functional MRI is among the most appropriate techniques in neuroscience mentioned in neuromarketing. However, critics emphasize restricting the free will of the consumer and its low ability to make individual decisions in purchasing behavior due to the implementation of neuromarketing. After evaluating external reactions, input models, outputs, and internal reactions to analyze brain activities, the research assesses the impact of neuromarketing on different related marketing inputs, consistent with consideration of its ethical defense. Eighteen donor participants were used for screening and are students who graduated from primary school in business administration. The results indicate that neuromarketing has a significant impact on consumer purchasing behavior, advertising, pricing, product distribution, trademarks, and decision-making as marketing inputs. Neuromarketing can therefore be counted as a great extension in the search for human behavior and the brain as a black box that can positively contribute to its practical viability.

Keywords: functional MRI, physiological processes, human resources, functional MRI.

Introduction

Neuromarketing has been entering the business world and marketers for nearly a decade and the term neuromarketing was first used by atlanta's advertising company, Brighta, in June 2002 when they announced the creation of a business department using functional MRI. Although very recent, neuromarketing has been a combination of neuroscience and marketing practices in order to understand, predict and control human behavior. The problem with neural marketing lies in the fact that it is not clear if it is just an academic area of research or a business practice recently used by companies. On the one hand, many neuromarketing companies claim to be able to light up the Black Box of Consumer Behavior and on the other hand there are very few academic or scientific entries to validate such allegations. Therefore, my research question is, whether neuromarketing is another attempt to understand human behavior up close; if the answer is yes, how and with what results, if not, is it another practice of deceiving the business world?

As is known, business is profit-oriented, but one must also think about consumers. Are these practices beyond manipulation or not? Are these sales forecasting and preference claims solely related to corporate profits? Or is it just about how science and technology cooperate and go too far that can even explain what the brain thinks? It's almost scary to believe that marketers know exactly what one thinks, what one loves, what one will feel tempted by the product or not, and what the process is before one buys something. It's also pretty amazing, in terms of the advancement of science and technology if possible. In this research, I will answer all the above questions by thoroughly researching previous articles, research, books and other sources in order to provide insight into the controversial world of neuromarketing. There is some evidence to suggest that the brain itself is the main mediator of human behavior, expressed emotions and decision-making processes.

In addition, some evidence shows that in most cases, people cannot express the reasons for their behaviour or the reasons for their preference for a particular product, consciously or unconsciously. With this in mind, the researchers' argument is that the nervous economy takes a neurological note and physiological processes seem to be the basis for interpreting consumer behavior. Although neural marketing will not compensate for traditional methods, there is strong evidence that emerging tools such as functional magnetic resonance imaging (fMRI) will improve the productivity of

marketing strategies. Since brands and advertising are supposed to have an appropriate impact on consumer preferences for products, neural marketing is likely to contribute to and influence these consumer preferences by applying neural marketing techniques in a positive way.

Problem

At present, with markets crowded with many similar and slightly different products, it has become a major discipline to constantly innovate and distinguish products, which meet the needs of customers in the best possible way. Given the increasing importance of meeting customers' needs, and the fact that in the past it was not possible to analyse the basic mental processes that occur when making decisions, this objective perspective provided by neuromarketing and neuroscience research seems very promising. In addition, nearly 80% of all new products fail during their first three years in the economic market, indicating that more harmonizations must be made between newly innovative products and actual user requirements. Therefore, non-invasive brain imaging techniques have been used for neuromarketing such as psychophysiological instruments (e.g., eye tracking) and brain imaging tools (MRI). With increasing interest, it has made it possible to actively perform brain observations during the execution of certain tasks, providing marketers with additional internal information about consumers. This research therefore covered all the procedures in which neuroscience and marketing work through online sales and we will answer the following questions:

1. Whether neural marketing is another attempt to understand human behavior up close; if yes, how and with what results, if not, is it another practice of deceiving the business world? As is known, business is profit-oriented, but one must also think about consumers .
2. Are these practices beyond manipulation or not?
3. Are these sales forecasting and preference claims only related to corporate profits?
4. Is there actually neurological marketing or not?
5. Why is neural marketing important?

The importance

Since the emergence of neuromarketing in 2002, it has been increasingly important and popular with companies, marketers and advertisers. Although the topic is gaining

increasing interest in the medical and psychology industry, this research focuses on clarifying human behavior through the use of neural marketing and its benefits and disadvantages in the economic sector. There is some evidence to suggest that the brain itself is the main mediator of human behavior, expressed emotions and decision-making processes. Some evidence shows that in the majority of cases, persons are unable to express the reasons for their behaviour or reasons for their preference for certain objects, consciously or unconsciously, and physiological processes as a basis for interpreting consumer behaviour appear to be justified. Although neural marketing will not compensate for traditional methods, there are Strong evidence that emerging tools such as functional magnetic resonance imaging (fMRI) will improve the productivity of marketing strategies. Since brands and advertising are supposed to have an appropriate impact on consumer preferences for products, neural marketing is likely to contribute to and influence these consumer preferences by applying neural marketing techniques in a positive way.

Why is neural marketing important? The issue of the effects of corporate and community neuromarketing is important because it is assumed that there is a possibility of discovering the implicit processes and mechanism that determine the decision-making process, and that it will reveal confidential information about consumer behavior that could not have been obtained through traditional marketing methods. Although there are crucial arguments against the interference of neural labels in customer privacy, it is expected that using this method, a more effective division of customers can be made, which in turn improves product marketing by considering individual and brand product preferences as well as consumer behavior in general.

Activities

One of the objectives of the research is to introduce the reader to the broad subject of neuromarketing and its use of the company as well as the consumer. However, the primary objective is to assess the impact of neuromarketing on many marketing inputs, such as consumer purchasing behavior, advertising, pricing, new product development, communication, product distribution, brands, and decision-making. The goal is to find out which of these marketing inputs is affected by neural marketing and what this might mean for the future. This new technology and objective brain

analysis are expected to produce more feasible strategies to attract consumers. In addition, because there are very different views on the subject of neuromarketing and its impact, research is necessary to provide the reader with a comprehensive and objective assessment of different scientific literature. In general, through the additional implementation of neuromarketing techniques, It is desirable to disclose unavailable information about customer behavior and preferences, funds will be saved and marketing processes facilitated, and analysis of the results of neuromarketing research will help divide humans in a way that can identify individual differences in decision-making processes. The main focus is on collecting and evaluating all relevant literature on the impact of neuromarketing on the main marketing inputs mentioned above. The main focus is on the correlation between key marketing inputs and the impact of neuromarketing as a new tool on these factors, along with the market and consumer feedback. There is no literature that integrates all these factors mentioned above, an in-depth explanation of their techniques as well as ethical issues in a single research, although these are the main issues related to neuro-marketing.

Neuromarketing

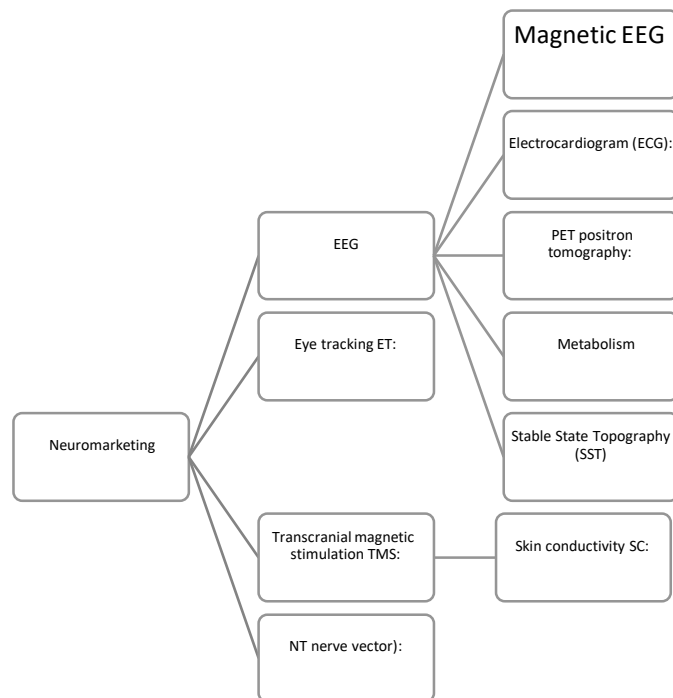
Marketing research is essentially about discovering, understanding and predicting individual behavior in the market. By evaluating final consumer decisions (buy or not) it is useless to identify all the basic paths of consumer decision-making. Humans are therefore increasingly seen as a black box that preserves all the secrets of emotions and decision-making processes, both of which are difficult to understand and correct. (Mansor, 2018) And so, against the background of traditional marketing research that does not lead to sufficient satisfactory results for both researchers and business representatives, neuromarketing has emerged. The purpose of neuromarketing is to combine neuroscience methods with marketing theories in order to discover the true impact of marketing on consumer behavior (Al Jabouri, 2022) beyond what is visible. . More precisely, the application of neuroscience techniques in marketing research curricula can lead to a clearer understanding of the impact of marketing techniques on consumers. In the end, the goal of neuromarketing is to gain insights that cannot be discovered through other marketing approaches, in addition to counting them relatively more objectively with traditional behavioral research methods. More specifically, a neuromarketing perspective reveals emotional engagement as a source of future purchasing decisions, memory retention, awareness,

and attention as the basis for future purchasing intentions. Keeping in mind that approximately 95% of mental processes are unconscious even for the subject, neural marketing opens up the possibility of approaching the invisible part of neural communication. (Rosca et al, 2019) Thus, access to the human black box goes beyond simply asking customers about their beliefs, feelings, ideas, memories or decision-making strategies, as neuromarketing involves studying neurological processes, focusing on hidden psychological and biological processes. (Silva, 2019) Moreover, the use of neuromarketing methods is justified by a fair balance between production and costs, but also by the ability to use it in the early stages of product and brand development with confidence that neural marketing results will not be affected by biases. The first steps towards the occurrence and development of neuromarketing were taken in 1999 when Gerry Zaltman of Harvard University conducted the first functional MRI research as a marketing tool. The concept of neuromarketing was first created and defined by Professor Ale Smidts in 2002, Al Jabouri defines neuromarketing as a practice area that is part of neuroethology, which is defined as a convergence in psychology, economics and neuroscience. The neuroscientist methods used in neuromarketing are as follows according to (Lim,2018)

1. Electromagnetic: Electro-Brain Planning (EEG): Detect brainwave changes using a bar or helmet of electrodes when people are exposed to marketing stimuli .
2. Electromagnetic: Magnetic Brain Planning (MEG): It identifies changes in magnetic fields resulting from electrical brain activity when people are exposed to marketing stimuli .
3. Electromagnetic: Stable State Topography (SST): Detects mission-related changes in sedentary brain activities triggered by visual ability (SSVEP)
4. Metabolism: Functional Magnetic Resonance Imaging (fMRI): Examines blood oxygenation in the brain resulting from basic neural activity. (PRÁCE,2014)
5. Metabolism: Positron emission tomography (PET): Tracks the radiation pulse to detect very accurately the metabolism of glucose within the brain.
6. Electrocardiogram (ECG): Measures the electrical activity of the heart using external electrodes of the skin .
7. Eye Tracking (ET): Measures eye movement and position using custom eye tracking devices .
8. Facial Muscle Electrogram (fEMG): Records facial muscles and physiological properties when amplifying small electrical impulses.

9. Skin Conductivity (SC): Assesses minor changes in skin conductivity responses when activating the automatic nervous system, and testing excess sweat resulting from marketing stimuli .
10. Transcranial Magnetic Stimulation (TMS): It temporarily disrupts certain brain activities in order to monitor the effects of marketing stimuli on behavior through methods other than evaluating brain activity .
11. Neurotransmitter (NT): Includes the use of various chemicals that enable the transmission of nerve signals between neurons.

Neuromarketing is closely linked to neuroeconomics that emerged before neuromarketing developed into what it is today. Neuroeconomics indicates that economists are able to take into account different aspects when making an economic decision. Neuromarketing is a combination of neuroscience and marketing practices. It means using the technique (PET positron tomography, MEG brain magnetic imaging, fMRI functional MRI, EEG, GSR skin response) as mentioned above, Al Jabouri) to measure emotions and record human brain reactions to different alarms such as sound, smell, images, touch, taste, etc. In this way, marketers claim to be able to predict whether the product will succeed through experiments that use imaging technology on customers, recording and activating brain signals. (Boluda,2020) This method is supposed to provide accurate predictions as well as direct results from the consumer brain, unlike other methods that require conscious participation from consumers. According to supporters of these methods, neuromarketing can be the only safe way in which companies can reduce losses and increase profits. Opponents of neuromarketing insist that it is a practice that goes far beyond acceptable marketing and advertising practices because it operates at a subconscious level that consumers cannot control or criticize; they raise the issue of free will and manipulation of marketing techniques. They add that consumers are not aware of these practices even because there is little transparency when it comes to companies. (Kyriaki,2012).



Form (1) neuroscientist methods used in neuromarketing

Source: Researchers

Neuromarketing tools

The great advantage of neuromarketing is to measure the effect of a particular product or marketing technique in the brain using any device. This ability to measure neuromarketing is what makes it different from other traditional marketing businesses. From this point of view, measurements are a variety of equipment from high to low sensitivity in capturing measured response, and each team varies if the measurement is electrically manifested in brain waves, or measurement of radiation images of the brain. Therefore, it measures neural marketing alarms, temperature, flavors, colors, touch and sound; these feelings are translated into electric waves. The order of equipment and measurement techniques moves from neural marketing to high-quality information created by measurement, and there are some measurement tools: (Valencia,2017).

1-Functional Magnetic Resonance Imaging (fMRI):

The use of this technique in neuromarketing measurements is among the most expensive and high-quality information from the study to be conducted. When using

this technique to study a product, it should be analyzed by people who know they are sent to marketing and measured using functional MRI. This technique can be used to measure in ad videos, visual evaluation of trademark posters, in the brain's interpretation of the smells brand, in creating sound tones, and in comparing whether a product can generate the most to remember about another product, in assessing whether the product is like: more than anything else (bottle shape, poster color, photos, advertising poster, billboard, TV ad), (Rosca et al, 2019) etc. The principle of functional MRI measurement technology is to inject a dye into a person's vein while viewing the image to be evaluated, or the image can be placed in front of him to be classified as an advertisement.

The reason for this work is that the brain sends glucose to areas where it focuses on the main function of the brain while exposed to the product, and the amount of glucose that reaches the brain area is recorded as a denser color area. So functional MRI was used to evaluate commercials on TV, to evaluate political speeches, and to evaluate ads. What has been proven is that the brain regions created in psychology are called (precedence effect) (a powerful incentive for a video that allows it to remember something in seconds) and similarly, when there is a greater density of functional MRI images in the left frontal lobe area, it means that the commercial product is presented as the best. Allows a person to find the product (Lin et al.2010). A more commercial product is displayed in memory, not only is there a need to activate the left frontal lobe cortex, but also the front belt area and belt engine. However, if WHO wishes to assess the motive behind its product, the left frontal belt cortex, orbital anterior cortex and the bilateral frontal cortex are required to be activated. But the product should not only have the motive to sell; (Mohd Isa,2020)

2. Event-related capabilities (ERP):

Technology that has raised the potential for certain events has been commonly used in forensic psychiatry, in language training. The use of this technique is associated with demonstrating electrical activity for the surprise that occurs in the brain when a person is exposed to a commercial product. That surprise may be positive or negative and therefore this technique differentiates between the motivation sent. The indiscriminate use of this technique without accuracy in different results allows researchers to produce benchmarks and indicative measurement in order to talk about the same issues at the conclusion of the results. (Astolfi et al,2011).

3-EEG:

This is one of the most practical techniques but requires training and knowledge of the interpretation of EEG waves. The important thing is to pair the measured electrical activity in the cerebral cortex with the motivation resulting from presenting a marketing article, exposing the individual to smell, tasting something or analyzing a song for a brand. By far the most sophisticated studies are the interpretation of waves in the brain areas of the left frontal lobe area and the right area respectively. Science has shown that the use of a marketing incentive generates theta waves in the left frontal lobe cortex versus alpha waves in the right frontal lobe. Interpret brain electrical scheme waves in neural marketing. (Sah, 2019) and in the development of a new EEG product, allows brain mapping, in order to meet different waves of EEG in all areas of the cerebral cortex and thus get more valuable areas of cerebral cortex information. When more is obtained from the cerebral cortex using an electroencephalogram, it is more similar to functional MRI, without being comparable (Aitamir,2012)

4- Eye Path: Eye Path Technology

It is an adaptation of elements used by engineers in different disciplines and the association between brain and muscle functions that move the eyes. Thus, the path reaches the eye as a marketing tool to determine where the customer's appearance is directed. Eye path is an essential tool for neural marketing techniques, allowing the marketer to identify many variables involved in the decision to look at something. The eye path allows you to measure the following aspects when the outlook focuses on marketing a product:

- Installation element: Measures eye movements under a particular parameter.
- Duration setting: Determines how long the customer is late looking at the product. It should be remembered that sometimes the customer looks at a product and then passes the other and returns it to the initial product, which is the time of the aggregate exposure (Singh,2020)
- Important point for the seller: Identify points that give more interest to the customer.
- Product tracking: Adjust the sequence of events (products) in a particular visual domain.

In web marketing studies, the relationship between consumers and eye movement style is worked out, guiding web page designers to choose the most attractive point of sale as an online marketing tool. Eye use allows the study of theories (cognitive fluency) and "conceptual fluency" because they explain why the brand remembers and connects them to the product when contacted in supermarkets. That's why you create a print ad in the subconscious after being exposed to the brand text and product logo in the online ad. Some of the advantages of using the eye pathway in neuromarketing techniques can be summarized in: (Berns,2010)

- Increases brand width.
- Increases visual attention to ads .
- Promotes product promotions
- Highlight key elements of the declaration .
- Increase sales through optimal design .
- Improving product satisfaction and real use .
- Improving the adoption and use of new products. (Krajnovic,2012)
- Increase brand loyalty if used with EEG techniques or brain blood flow

Traditional marketing inputs to complete understanding of consumer behavior and dimensions

Consumer behavior includes purchasing and other consumption-related activities for people involved in the exchange. Consumer behaviour can be defined as the social actions, processes and relationships shown by individuals, groups and organizations in accessing, using and using other products, services and resources and the consequent experience with other products, services and resources. Consumer behaviour is motivated or purposeful (Al Jabouri,2020). Behavior is geared towards the goal of obtaining other products or resources.

It is a means of exchange in the present and the future. (Szentesi,2017) includes the three important aspects of this definition such as actions, processes and social relationships with various consumer activities. Some activities include experience of need, shopping through distribution windows, shopping by comparison, thinking about available information about the relative advantages and barriers of the product, or seeking friend's advice on a new product... etc. Consumer behavior also includes

experiences, which are the consequences of using products and services. If we analyze the definition above, we can identify the following three phenomena involving consumer behavior: activities such as actions, processes and social relationships. such as individuals, groups and organizations (Röndell,2012) and consumer behaviour as the actions of individuals directly in obtaining, using and disposing of economic goods and services, including decision-making processes that precede and identify such actions.

This definition includes some of the other definition features listed and discussed above. In addition,(Al Jabouri,2021) contains one of the most important aspects of the buyer's decision-making process. This aspect is dealt with in discussing the stages of the purchase process above. The definition of consumer behavior is the activities of people involved in the actual or potential use of market elements, whether they are products, services or retail environments. Understanding consumer behavior is a vital aspect of marketing. Consumer behaviour is to examine how individuals make decisions about what they buy, want, need or act on in relation to a product, service or company. (Al Jabouri,2022) is important to understand consumer behavior to see how potential customers respond to a new product or service. It also helps companies identify opportunities that are not currently met. (Isa,2020) Recent examples of a change in consumer behavior are consumer eating habits that have significantly increased demand for products.

Companies that have monitored the change in consumer eating patterns have created products to fill a market vacuum. Understanding consumer behavior allowed active companies to increase their market share by anticipating a shift in consumer desires. To understand how consumer behavior affects marketing altogether, it is necessary to understand the three dimensions that affect consumer behaviour: psychological, personal and social. (Kahn etal,2013)

Psychological factor

In everyday life, consumers are affected by many issues that are unique to their thinking process. Psychological factors can include understanding need or attitude, a person's ability to learn or understand information, and an individual's position. Everyone will respond to a marketing message based on their perceptions and attitudes. Therefore, marketers should take this dimension into account when creating

advertising campaigns, and make sure that their campaign will appeal to the target audience (Al Jabouri,2019)

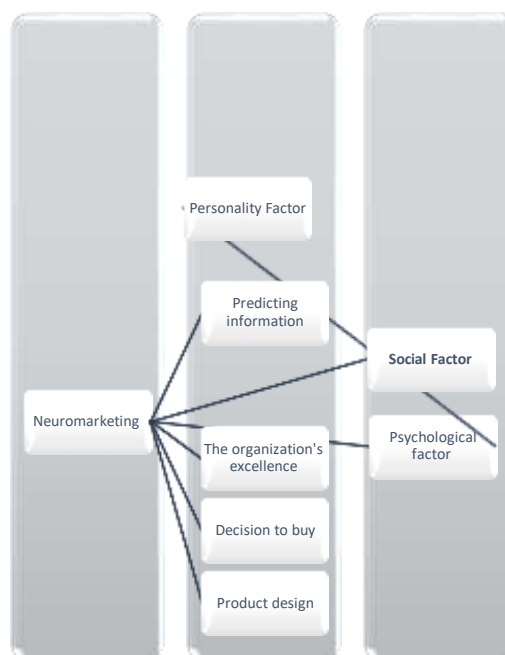
Personality Factor

Personal factors are characteristics of a person and may not relate to other people within the same group. These characteristics may include how a person decides, customs, unique interests, and opinions. When considering personal factors, decisions are also influenced by age, gender, culture and other personal issues. For example, an older person is likely to show different consumer behaviors than younger people, which means they will choose products differently and spend their money on items that may not matter to the younger generation. (Colombia,2017)

Social Factor

The third factor that has a significant impact on consumer behavior is social characteristics. Social influencers are quite diverse and can include a person's family, social interaction, work communities, school, or any group of people to whom the person belongs. It can also include the individual's social class, which includes income, living conditions and level of education. Social factors are very diverse and can be difficult to analyze when developing marketing plans. However, it is important to take into account social factors in consumer behaviour, as they significantly affect how people respond to marketing messages and make purchase decisions. Through research and monitoring, (Al Jabouri,2021) has developed several models that help explain why consumers make decisions, including black box, personal variables and complex models.

The black box model relies on an external stimulus response, which means that something drives consumers to make purchase decisions that are affected by many factors, including marketing messages, sampling, product availability, promotions and price. When the personal variable model is affected, consumers make their decisions based on internal factors. These internal factors may include personal opinions, belief systems, values, traditions, goals, or any other internal catalyst. The third model of consumer behavior is complex. The complex model takes into account internal and external variables. (Roth ,2013)



Form (2) traditional marketing inputs and complete understanding of consumer behavior for neuromarketing

Source: Researchers

Neuromarketing and its impact on consumer behavior

Starting with the effect of neuromarketing on consumer purchasing behavior through in-depth analysis, specifically through the use of neural marketing techniques, consumer purchasing behavior can be useful, because consumers are often unable to express their desires and needs when they ask for a particular product, which is why the brain itself is supposed to contain internal information, which may clarify their real desires and needs. If this knowledge is available, people's purchasing behavior is likely to be influenced and the question of cost aspects of neural marketing will outweigh the advantage of the internal information provided. Neuromarketing techniques are therefore an ideal opportunity to use the latest developments in brain scans to learn more about the mental processes behind customer purchase decisions. Which will in theory be able to determine consumers' purchasing behavior by activating the brain area responsible for final decision-making, since all neurological and cognitive processes are associated with multiple factors, or so-called multiple factors, and therefore cannot be reduced to a single area. Finally, one can say that neuromarketing methods in general, especially with regard to consumer purchasing

behavior, can measure important effects, and their results can be used as a model for future analysis or product development. (Rosca,2019).

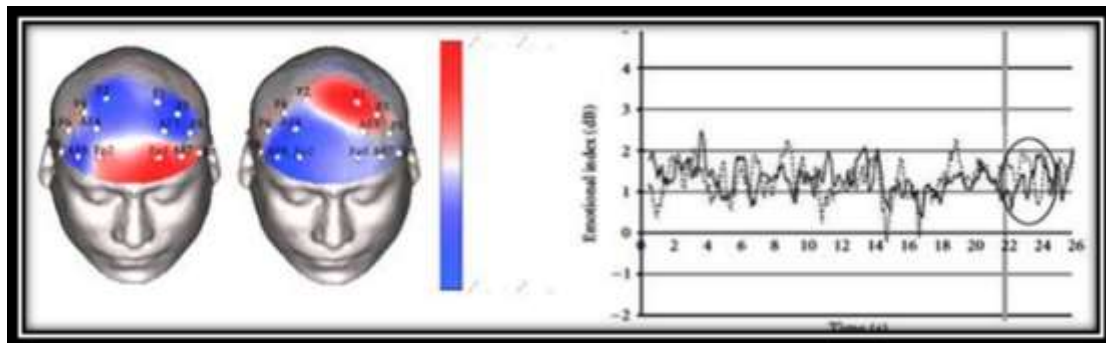
Methodology

The sample size was 18 participants after taking their consent. Four demographic questions were part of the tool. The research followed ethical guidelines such as legitimate incentives, prevention of hidden marketing, protection and participation of vulnerable groups, debriefing from participants, and accurate communication of the outcome (Hensel et al. 2016). A group of primary school students from the Business Administration, aged 21 to 30, have been hired by online consumers. The data was collected through eye tracking, with the help of Dr. Ahmed Muslim Zoghbi, an MRI specialist at The Sponsor General Hospital. The data collection and analysis tools used in the project are eye tracking, face tracking and emotion measurement. Classifying emotional state helps you understand how a customer feels and what they experience in a particular situation. Emotional status classification applies to different areas of our lives from neuromarketing to the retail industry (determining how emotions affect product choice and purchasing behavior). The best online retailers were selected from Iraq. According to previous research, small sample sizes are appropriate if the actual effects are really large enough to be reliably observed in such samples in the case of neuromarketing studies. Audio-visual stimuli were used. Participants were also asked before the survey whether they were taking medications or suffering from brain injuries in order not to bias data in our work.

Data analysis

Eye tracking devices measure and collect data about the perception of certain stimuli. Heat or attention maps show how many installations participants have made in a particular part of the image. Heat maps are indicators of participant concentration, with red-marked areas indicating a large number of stare points followed by red and blue. On the heat map, blue indicates the largest number of installations, while red indicates the lowest number, with varying levels between them. A shadowless area on the heat map shows that participants did not focus on that particular area of stimuli. Visualization can only be used to analyze data from neuro lab tests. The screens that are applied include the look chart, heat map, dimming image, areas of interest, and thermal map video. Analysis shows that the number of installers on product shelves is the highest in (88%). The second highest installation rate is from (72%). The third

highest number of installations is from other online retailers. The eye tracking tool contains hundreds of metrics; As in Figure 3



Form 3 eye tracking tool on hundreds of scales(Rosca,2019).

The feelings created in the face of customers while looking at product shelves are considered. Passion qualities stimulated the front time zones. When there was longer, there was also increased physical interaction with the product and a more wonderful display of mostly negative emotions. Customers show joy in emotion, but shelves gradually break up, so online retailers need to plan a more attractive process. The emotion rate when looking at product shelves is 27% in farah and 73% neutral. Pleasure gradually turned into melancholy.

The field called red indicates the highest stare points, followed by yellow and green. The thermal map of the product rack shows high, medium and vulnerable stare points for respondents on the product rack of online retailers. Displaying shelves for online retailers needs to attract and engage customers because the conversion depends on them. The central top position is more attractive, so the shelf screen should include the location of the basic items. That emotions showed 2% grief, 1% joy and 95% neutrality. This means that online retailers rack are not involved. Screen shots of customers' looks on the retailer's online product shelves. The central website displays the utmost attention, so retailers must put their attractive offers in the center. It also shows that all the look points of the respondents are at the top.