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Econometric Model for Estimating the Keynesian Consumption Function in Sudan during the period 1990-2019

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Abstract: ***This paper aimed to estimate the consumption function in the Sudan. The problem of the paper was formulatedon the following main question; what were the factors that affects inconsumption function in Sudan. The paperwas used the descriptive and analytical approach's. The most important hypotheses of the paper there was a positive relationship between income and consumption, and the existence of an inverse relationship between inflation and the exchange rate. Thepaper reached that wasa positive relationship between consumption and income, and therewasa negative relationship between inflation and exchange rate. The paper recommends using economic policies to raise awareness for lower-income consumers in order to improve their behavior to maximize consumption.***

Keywords: Consumption, Econometric Model, Income, Exchange Rate, Sudan

1. Introduction

The principal determinant of the Keynesian consumption function is income. However, there are at least three theories that modify Keynesian absolute income hypothesis. First, James S. Duesenberry says that consumption depends on relative income.People tend to consume more lo 'keep up with the Joneses'. This means that consumption spending is largely influenced by incomes earned by neighboring households. In other words, it is the relative income that determines consumption. This is called 'emulatory con-sumption'. Duesenberry's hypothesis is known as 'relative income hypothesis'. He demon-strates that in the long run MPC = APC, as opposed to Keynes' short run consumption function hypothesis; MPC < APC. Secondly, Milton Friedman argues that consumption depends on permanent income. Unexpected, transitory incomes have little effect on permanent consumption. Permanent consumption is always associated with permanent income. Friedman's hypothesis of permanent income also suggests that in the long run, MPC tends to equal APC, i.e., MPC=APC. Finally, Modigliani, F.A. Ando and R.E. Brumberg in their life cycle hypothesis, argue that people formulate their expenditure plans in accordance with their expected incomes over lifetime i.e., some perception of lifetime incomes. While making consumption decisions, individuals look at the total income to be earned over their lifetime. Modigliani, Andos' 'life cycle hypothesis' also says that in the long run MPC = APC. All these theories hold the same conclusion: APC tends to decline as income rises**.**

2. Previous Studies

Ali, Isaac (2014) estimated the private consumption function in Sudan during the period 1972-2011. The study used the descriptive analytical method. The main hypotheses of the study are a relationshipbetween consumption, disposable income, previous consumption, and inflation. Income is more explained by the private consumption model than other variables of the model. The study concluded that the most important factors affecting private consumption are income, previous consumption and inflation. The study recommended need to arrange consumer needs starting with necessities to luxuries and to reject the phenomenon of simulation in consumption.

Mullah (2016): build economic model for estimating the consumption function in Sudan during the period 1990-2015. The study used the descriptive analytical method. The study problem is formulated in the following main question: What were the main determinants of consumption in Sudan? The most important hypotheses of the study are that there is a direct relationship between consumption, income and the rate of increase in the population. There was an inverse relationship between consumption, inflation and interest rates. The study found that there was a direct relationship between consumption, income and the rate of increase in the population, and the inverse relationship between consumption and inflation and interest rate. The study recommended the adoption of an economic policy aimed to increase the volume of production and consumption in addition to supporting essential goods.

Khan etal (2015) Highlightsfor Estimate consumption function for China and G7 countries during the period 1985-2013. The bounds testing approach was used. Private consumption determines economic growth. The study aimed to estimate consumption function for China and G7countries. The study applied ARDL approach to estimate consumption function. The study reached indicates that Gross Domestic Product (GDP) and wealth are the most important determinants of aggregate consumption in both short and long run. However, real interest rate, negatively affect the aggregate private consumption both in the long and short run, apart from Canada, similarly, unemployment rate have negative effect of aggregate consumption in all cases. It could be recommended for open new directions for further research

The Concept of Consumption

It means this type of expenditure carried out by individuals, whether individually or collectively to the family of a body or association, or any other form, provided that the non-profit that is very consumption is to achieve satisfaction for the various needs of individuals rather than making profits depend for individuals consumer spending on a large group level The most important factors are income and the circumstances surrounding it [1], and personal conflicts and customs, In addition to the principles that govern the distribution of income among members of the community, Keynes is the first to refer to these factors and deal with them and study and analysis and concluded that the real income available to the labor ambitious labor overdrive[2].

Consumption Function

Is the function that shows the amount spent by individuals to spend on consumer goods and services at each level of national income levels and to impose stability and other factors, we can easily to show that consumption expenditure was determined by the first two factors of income level and the second function of consumption of any income increase or decrease may change leads to an increase in Consumer spending is low and economists believe the consumption function to be And Y during the short period due to the stability of the specific factors and has not changed in normal circumstances[2,1]. That changes in income are the only responsible for changes in consumer spending factor while in the long-term period has statistical observations in developed countries showed a rise in the consumption function for the following reasons for the ever-growing needs due to the emergence of new products constantly, luxury needs turning to essential with the progress of civilization - the steady rise in the share of poor people in national income[3].

3. Consumption Theories

Absolute Incometheory: Assume that consumer spending in a given period depends on disposable income in the same period. Consumption increases as income increases, but less, and the average trend of consumption and marginal tendency decreases as income increases [4]. However, some economists have concluded that the relationship between current consumption and current income is weak, if not zero, and that household consumption depends on current income, a stream of income over a long time, and on family wealth. The average propensity to consume is higher than the marginal propensity to consume, whereas the average propensity to consume decreases with increasing income, and the average propensity to save is increasing [4].

Permanent income theory: Friedman argues that permanent income is the primary determinant of consumption expenditure and distinguishes Friedman in consumption and income between a permanent component and a transient component. Friedman determines permanent income by estimating consumer wealth. Consumption was relative to permanent income and was linked to long-term wealth. In the short term, however, the actual consumption of households is not relative to permanent income as much as transitory income disrupts the relative system of consumption and permanent income[5].

Lifecycle Consumption Theory: The theory, according to Modliani, assumes that consumption represents a fixed percentage of the family income throughout its life and divided the life into three stages: life of inactivity, life of activity, retirement. Consumption stability can be achieved during the life of an activity by obtaining current income in excess of consumption needs. Savings allow the accumulation of movable and immovable wealth, so that its own liquidity helps stabilize consumption. In retirement, the use of wealth covers non-savings resulting from low current income. During the inactivity phase [5,6]: Despite the absence of income, consumption is stable due to the wealth inherited from parents for each generation.

Relative income theory: The theory of relative income assumes that a large and permanent increase in income will lead to an increase in consumption at the same rate of income increase, and then move the individual on the long - term consumption function. This theory also assumes that low income will not lead to a decrease in consumption by the same percentage but to a lesser extent, in an attempt to maintain the level of consumer spending used to be before, and thus will not move the individual on the long - term consumption function, but on the short - term function [7].

Determinants of consumption

However, besides income, Keynes attached importance to other factors under the headings "objective" and "subjective" or "psychological" factors that determine aggregate consumption. Objective factors are also known as "economic factors" which are subject to change in the short run. Objective or economic factors are also quantifiable. On the other hand, subjective factors are psychological and, hence, are not subject to estimation. In addition, structural factors also influence aggregate consumption spending. Finally, Keynes paid attention to fiscal policy variable as another determinant of aggregate consumption. When we show consumption-income relationship, we assume all the above- mentioned determinants of consumption spending to remain constant. As income changes, consumption changes. This is called movement along the consumption function [1,2,3.5].

Similarly, one obtains movement along the saving function when saving changes following a change in income, holding all other determinants of saving constant. But, if one of the subjective, objective or other determinants change then consumption function and saving function would shift. Assuming a constant aggregate income, an increase in the volume of wealth would lead to an increase in consumption-thereby shifting the consumption function upwards and the saving function downwards [5].

4. Objective Factors

Objective or economic factors (which undergo change in the short run) that influences consumption function are considered here:

a) The Rate of Interest: Classicists assumed that consumption or saving depends on the rate of interest. They believed that an increase in interest rate encourages saving and, thus, consumption is discouraged. However, there is another way to explain consumption/saving and interest rate

relationship [18]. A rise in interest rate means a decline in the money value of bonds. This tends to discourage consumption propensities of bondholders. The money value of fixed interest bearing assets falls when its interest rate rises. This makes owners of these assets poorer and, will discourage consumption. Or at a high rate of interest, preference for bond tends to rise. This will induce people to consume less. Anyway, rate of interest may not be considered as a significant factor influencing consumption decisions as empirical evidence suggests a weak link between interest rate and consumption [2].

b) Sales Effort: Advertising and various sales effort of producers of consumer goods are considered as a means for increasing consumption demand. It is quite likely that an increase or decrease in the amount of sales effort may lead to greater or lower demand for consumer goods. However/given the total income, an increase in sales effort may not lead to an increase in the demand for consumption goods. Further, there is no independent measure of the volume of effective selling effort. Hence, increase in demand following an increase in advertising outlay is difficult to estimate [1].

c) The Volume of Wealth: The total wealth position of consumers is considered as an important determinant of consumption. Wealth like shares, bonds, house property, etc., influence consumption decisions. Owners of these assets do not have enough preference for these assets. That is why their desire to save is less since they are already the owners of these assets. People who do not own assets intend to save more and consume less now in order to have assets in future [16]. In other words, property-owners have the greater desire to consume while desire to save is the greatest to the people who do not own assets. Such is known as Pigou effect, after the name of the classical economist A. C. Pigou. Pigou effect states that the more saving a man has, the less the strength of his desire to save more. If two men have identical tastes and incomes, but one has already acquired huge wealth, his incentive to increase current savings will be less than the other one who is yet to enjoy large property. According to Pigou, propensity to consume depends on the real value, and not on money value, of cash balances or liquid assets.The nominal value of cash balances or wealth rises or falls with the fall or rise in general price level. If these real cash balances are considered as net financial assets of the economy, changes in the price level will bring about a change in net wealth position of the economy. For instance, if price level declines, the real cash balances would rise, net wealth would rise and consumption spending would rise [17]. This is the essence of the Pigou effect or real balance effect [3].

d) Terms of Consumer Credit: The hire- purchase system of buying durable consumer goods has become popular in these days. However, such spending greatly depends on the terms and conditions of credit. If consumer credit is available on reasonable terms, some sort of spending spree will develop. However, it is agreed that the interest rate on instalment buying is of relatively less significance than the size of required down-payments, the length of the period over which the balances must be repaid.

e) Deferred Payment: Sometimes, particularly during war time, consumer spending declines due to restraint on spending. Once such restraints are removed, backlog of pent- up consumer demand might get exposure leading to a rise in spending [7].

Psychological Factors

Psychological or subjective factors that remain constant in the short run determine the form of the consumption function. Keynes attached importance to the psychological or subjective factors which consist of basic values, attitudes, states of mind, etc. These are not quantifiable or specific like economic factors. Motives behind consumption, according to Keynes, are enjoyment, short-sightedness, generosity, miscalculation, extravagance and ostentation. However, these elements do not change significantly in the short run. Despite this, these subjective and cultural factors are capable of changing the shape and the level of the function.Of all these subjective factors, expectations and attitudes of consumers do play an important role [15]. Rational behaviour suggests that a consumer who expects a rise in income or in the price level may consume more than who expects no such change in near future. Again, among similar individuals (same age) with the same level of incomes, it may be found that some individuals consume more than others because of the differences in their attitudes towards thrift. Further, in a status-symbol society, consumption spending is greatly influenced by the consumption pattern of the society in which the individual lives. “To keep up with the Joneses”, individuals imitate consumption patterns of their neighbors and workmates so that their status is not impaired. Duesenberry calls such imitating consumption pattern “demonstration effect”.

Finally, one point is to be remembered here. Keynes argued that expectations and attitudes, demonstration effect, etc., do have some influencing effect on individual’s consumption. But, aggregate consumption virtually remains unchanged in an economy since attitudes and expectations vary from person to person and different expectations and attitudes, therefore, cancel each other [6,7].

Structural Factors

Structural factors like income distribution, demographic factors, etc., do have some bearing on the aggregate consumption spending in the long run. The first important structural factor is the income distribution [14]. It is said that the marginal propensity to consume (MPC) is high of low-income families and low for high-income families. Thus, if there is a redistribution of income in favour of the poor-income families, aggregate consumption would rise since the MPC of these people is high. Secondly, demographic factors are responsible for differences in consumption spending with identical incomes. Demographic factors include size of family, stage in the family life cycle, place of residence, occupation, race, etc. It is true that large families or families with more children and aged persons consume more than small families. However, in the short run analysis, these demographic factors can be ignored [5].

Fiscal Policy

Tax-expenditure programmes of the government can influence consumption spending. If rich people are asked to

pay more taxes and if these revenues are given as subsidies to poor people, aggregate consumption would rise [13]. High taxes curtail consumption by reducing disposable income. Now, if subsidies like flood relief, old- age pension, distribution of food grains at a subsidised rate, etc. are given definitely consumption spending of the recipient of these subsidies would rise. These are the people whose MPC is high. Thus, tax-expenditure programme shifts the consumption function through redistribution of income [3].

Inflation Rate

Inflation was a continuous and tangible rise in the general price level, a continuous decline in the real value of the currency [8]. Inflation was characterized by its different types and varies according to the criterion used to distinguish among them, but they all share the same characteristic: the inability of money to perform its functions. The most important types of inflation: apparent inflation, which is characterized by high levels of prices on a continuous basis without the State to take any measures to reduce it, pent-up inflation refers to the continuous and unclear rise in prices; commodity inflation means an increase in commodity production expenditures. Capital inflation is the increase in the value of investment commodities over its production expenditures. Profit inflation is the result of increased investment over savings, and inflation, such as high savings and inflation [7].

Income

It is what a person gets from his work or money, usually estimated in money and called cash income, but income is not wealth in itself, and can be achieved in the form of calculated income such as housing and free living or food produced in the house. It is known that the consumption of one person creates income for another person, and when a consumer buys a certain amount of goods and services, the seller gets what the buyer paid as income, and the seller in turn uses that money for his purchases and thus creates income for another person [12]. Income and types of sections, the most important of which is personal income, which is the total income earned by the state during a certain period of time, except the income of companies or institutions. The national income is the sum of income received by a state during a given period. GNP is the sum of the value of goods and services produced by a state over a given period of time. Economists sometimes measure income by comparing national income with net income and cash income with real income. Gross income is pre-tax income or other expenses. Net income is what remains after deducting those expenses. Monetary income is the value of income measured in the currency of a country [4].The net income is what remains after deducting those expenses. Monetary income is the value of income measured in the currency of a country. Real income measures purchasing power, that is, the amount of goods and services that can be purchased with a particular cash income. Wages are usually paid on the basis of hours worked or the amount of work produced, while salaries remain constant for certain periods of time, such as the year. Sources of Unearned Income: Includes interest, profits and rent. Unearned income comes from the use of non-labor resources [3].

Exchange Rate

The number of monetary units in which one unit is exchanged from one local currency to another. It is an important means of influencing the allocation of resources between economic sectors, the profitability of export industries and the cost of imported resources.It is a link between commodity prices in the local economy and prices in the world market and the domestic price of a commodity linked through the exchange rate [10,11]. One of the types of exchange rate is the nominal exchange rate, which is the measure of the currency of one country that can be exchanged for the value of the currency of another country.The parallel exchange rate, which is the rate applied in parallel markets, means that there is a possibility of having more than one nominal exchange rate at the same time for the same currency in the same country. Measures competitiveness. It benefits economic dealers in making their decisions, for example, the rise in export earnings in conjunction with the rising costs of production of exported materials at the same rate does not ponder the increase in exports because this rise in revenues did not lead to any change in the profits of exporters, although their nominal income increased by a high, the actual exchange rate The effective exchange rate is an indicator that measures the average change in the exchange rate of a currency for several other currencies in a period of time and therefore the effective exchange rate index is equal to the average of several bilateral exchange rates and indicates how well a country's currency has improved or evolved for a range of currencies. Other [1,2,3].

Methodology and Data

The paper attempted to identify the economic and econometric relations between consumption and factors affecting consumption through annual data. These data were taken and collected for the period (1990 - 2019).

The Model

The paper used annual data on consumption, inflation, income, and exchange rate during the period 1990-2019 obtained from Ministry of Finance and National Economy, Central Bureau of Statistics, and Sudan Central Bank.The paper was used the E GARCH model Eviews-7 package to estimate the model.

$$Con_t = \alpha_0 - \alpha_1 INF_t + \alpha_2 Y_t - \alpha_3 EX_t + Ut$$

Where:

C_t : Consumption

INF_t : Inflation Rate

Y_t : Income

EX_t : Exchange Rate

α_0 : Constant

$\alpha_1, \alpha_2, ..., \alpha_3$: Parameters

t : Time Period

Model EstimationOut Put

$$Con_t = -451447.0 INF_t + 5665.226 Y_t - 16165.97 EX_t$$

(0.000) (0.000) (0.000) F = 328.97R^2 = 0.90 DW = 1.97

5. Results and Discussion

5.1 Economic Criteria

Economic criteria It is concerned with size and indication of parameters estimated since the value of α_1 was negative and less than zero, value of α_2 was positive and greater than zeroand α_3 value wasless than zero and a negative this is consistent with economic theory.

5.2 Statistic Criteria

a) T-Test indicates that the probability values for the estimated parameters were less than 5%. we accept alternative assumption, that means this parameters values were not equal to zero and the inflation, income, and exchange rate are very important in explanationtheconsumption function in Sudan.
b) F-Test indicates that (F) Calculatedgreaterthan (F)Tabularwe accept alternative assumption thatmeansthe model was economical acceptable.
c) R-Square Test indicate that 90% of the variables that explanationthe consumption were included in the model and that only 10% of the variables that explanation consumption was included in random term.

5.3 Econometric Criteria

The Durban Watson Test indicates that there was no auto-correlation in the model because Durban Watson value equal (1.97) it located in auto-correlation-free zone aria.

6. Results

1) The Consumption was directly positive related to income.
2) The Consumption was directly negative related to inflation.
3) The Consumption was directly negative related to exchange rate.

7. Recommendation

1) Increase consumer expenditure by increasing average per capita income and subsidizing essential goods.
2) Reducing inflation rate by using monetary and fiscal policy, due to its negative impact on consumption
3) Supporting the exchange rate with production, to increase in income and consumption in finally.

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Annex (1) Descriptive Statistic

C	EX	Y	INF	
30752058	1588.870	13584.57	47.68295	Mean
22304500	2053.500	12550.00	16.58500	Median
96890550	2637.000	22389.66	129.2000	Maximum
68789.00	4.500000	7904.540	4.800000	Minimum
31628393	1083.763	4620.962	47.06625	Std. Dev.
0.729156	-0.510501	0.507531	0.622524	Skewness
2.258394	1.502639	1.964789	1.737665	Kurtosis
2.230543	2.737112	1.751678	2.619696	Jarque-Bera
0.327826	0.254474	0.416513	0.269861	Probability
6.15E+08	31777.40	271691.4	953.6590	Sum
1.90E+16	22316303	4.06E+08	42089.40	Sum Sq. Dev.
30	30	30	30	Observations

Annex (2) Ordinary Least Square out put

independent Variable: Con Method: Least Squares Date: 04/02/20 Time: 04:23 Sample: 1990 2019 Included observations: 30				
Prob.	**t-Statistic**	**Std. Error**	**Coefficient**	**Variable**
0.0000	-8.1123	46900.78	-380472.9	INF
0.0000	9.629	525.8037	5063.155	Y
0.0037	-3.364	3508.027	-11800.11	EX
30752058	Mean dependent var		0.919004	R-squared
31628393	S.D. dependent var		0.909475	Adjusted R-squared
35.11236	Akaike info criterion		9516144.	S.E. of regression
35.26172	Schwarz criterion		1.54E+15	Sum squared resid
35.14152	Hannan-Quinn criter.		-348.1236	Log likelihood
Durbin-Watson stat 1.723623				

Annex (3) Garch model out put

Dependent Variable: C Method: ML - ARCH (Marquardt) - Normal distribution Date: 04/02/20 Time: 14:41 Sample: 1990 2019 , Included observations: 30 Failure to improve Likelihood after 37 iterations Presample variance: Backcast (parameter = 0.7) LOG(GARCH) = C(4) + C(5)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(6) *RESID(-1)/@SQRT(GARCH(-1)) + C(7)*LOG(GARCH(-1))				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
INF	-451447.0	16309.13	-27.68063	0.0000
Y	5665.226	205.8972	27.51482	0.0000
X	-16165.97	1075.156	-15.03594	0.0000
Variance Equation				
C(4)	13.23730	14.48239	0.914028	0.3607
C(5)	4.054168	2.204262	1.839241	0.0659
C(6)	-0.551412	1.123893	-0.490627	0.6237
C(7)	0.481689	0.438370	1.098818	0.2718
R-squared	0.905020	Mean dependent var		30752058
Adjusted R-squared	0.893846	S.D. dependent var		31628393
S.E. of regression	10304921	Akaike info criterion		34.81995
Sum squared resid	1.81E+15	Schwarz criterion		35.16845
Log likelihood	-341.1995	Hannan-Quinn criter.		34.88798
Durbin-Watson stat 1.970512				