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Trend Analysis of Consumer Price Index: Useful Lessons for Business Decision Making in Ghana?

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Abstract: Variations or irregular rise of consumer price index worldwide of which Ghana is no exception has affected many businesses in the country. However, the obvious indicator of an inflationary situation is rising prices of consumer goods. On the basis of the above, the researchers decided to do a trend analysis on consumer price indices obtained from the Ghana Statistical Service to serve as a guide to the business community in Ghana. The main objective of the analysis is to determine the overall pattern in the data and to subsequently fit an appropriate trend for forecasting future values. The main statistical technique used in this work is time series analysis. Based on the trend analysis carried out, the study revealed that, there was general upward trend in the CPIs in Ghana, collaborating an earlier research conducted by Ampofo. However, the shapes of graphs of the CPIs, showed a slight difference. Finally, forecast values or predictions for the CPIs were made for the year 2008.

Keywords: Consumer price index; Inflation; Market forces; Upward trend.

1. Background of the Study

In recent times there has been a variation or irregular rise of consumer price index worldwide of which Ghana is no exception. This development has affected many businesses in the country. However, the obvious indicator of an inflationary situation is rising prices of consumer goods. This does not imply that any price rise is inflationary because the natural result of the operation of market forces is that, prices should rise anytime demand exceeds supply. There are various inflation rates, but the most common inflation rates often used is: Inflation rate as an increase in average annual consumer price index (CPI). For example, average annual growth of prices as a change in last 12 –month average. This inflation rate is appropriate for making adjustment or considerations of average quantities. Inflation rate as an increase in CPI compared with the corresponding month of preceding year indicates percentage change in price level between the reference month of a given year of the preceding years. This inflation is appropriate in relation to state quantities which measure the change between the beginning and the end of the period without any reference to the trend of inflation rate as an increase in CPI compared with preceding month. For example, month-on-month growth comparing price level in the reference month with that preceding month. This is the figure which is referred to as rate of inflation. It refers to the price or speed at which general prices are rising from one month to the other. Adjusted for seasonal variations, the rate of increase should tally the year inflation rate, using the same reference points. Thus, the research seeks to analyse the consumer price index of long term detailed trends from 1997 to 2007 (time series in price level cost of living adjustments issues) with regard to consumer price index of food and non-food items.

2. Theoretical Issues

2.1. Consumer Price Index

Consumer price index is seen by many as the most important measure of inflation. The Consumer Price Index measures the price level of a fixed basket of goods. The Consumer Price Index (CPI) is a measure of the average change in prices over time of goods and services purchased by households. The U.S. Bureau of Labor Statistics (BLS) publishes CPIs for two population groups: (1) the CPI for Urban Wage Earners and Clerical Workers (CPI-W), which covers households of wage earners and clerical workers that comprise approximately 32 percent of the

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total population, and (2) the CPI for All Urban Consumers (CPI-U) and the Chained CPI for All Urban Consumers (C-CPIU), which cover approximately 87 percent of the total population and include in addition to wage earners and clerical worker households, groups such as professional, managerial, technical workers, the self-employed, short-term workers, the unemployed, retirees and others not in the labor force. The CPIs are based on prices of food, clothing, shelter, and fuels, transportation fares, charges for doctors' and dentists' services, drugs, and other goods and services that people buy for day-to-day living. Prices are collected in 87 urban areas across the country from about 50,000 housing units and approximately 23,000 retail establishments, department stores, supermarkets, hospitals, filling stations, and other types of stores and service establishments. All taxes directly associated with the purchase and uses of items are included in the index. Prices of fuel and a few other items are obtained every month in all 87 locations. Prices of most other commodities and services are collected every month in the three largest geographical areas and every other month in other areas. Prices of most goods and services are obtained by personal visits or telephone calls by the Bureau's trained representatives. In calculating the index, price changes for the various items in each location are averaged together with weights, which represent their importance in the spending of the appropriate population group. Local data are then combined to obtain a U.S. city average. The CPI-U and CPI-W separate indices are also published by size of city, by region of the country, for cross-classifications of regions and population-size classes, and for 27 local areas. Area indices do not measure differences in the level of prices among cities; they only measure the average change in prices for each area since the base period. The C-CPI-U data are issued only at the national level. It is important to note that the CPI-U and CPI-W are considered final when released, but the C-CPI-U is issued in preliminary form and subject to two annual revisions. The index measures price change from a designed reference date. For the CPI-U and the CPI-W the reference base is 1982-84 equals 100.0. The reference base for the C-CPI-U is December 1999 equals 100. An increase of 16.5 percent from the reference base, for example, is shown as 116.5. This change can also be expressed in dollars as follows: the price of a base period market basket of goods and services in the CPI has risen from $10 in 1982-84 to $11.65. The CPI is a statistical estimate that is subject to sampling error because it is based upon a sample of retail prices and not the complete universe of all prices. BLS calculates and publishes estimates of the **1**-month, 2-month, 6-month and 12-month percent change standard errors annually, for the CPI-U. These standards, error estimates can be used to construct confidence intervals for hypothesis testing. For example, the estimated standard error of the 1- month percent change is 0.04 percent for the United States All Items Consumer Price Index. This means that if we repeatedly sample from the universe of all retail prices using the same methodology, and estimate a percentage change for each sample, then 95% of these estimates would be within 0.08 percent of the 1- month percentage change based on all retail prices. For example, for a 1-month change of 0.2 percent in the All Items CPI for All Urban Consumers, we are 95 percent confident that the actual percent change based on all retail prices would fall between 0.12 and 0.28 percent. For the latest data, including information on how to use the estimates of standard error, see "Variance Estimates for Price Changes in the Consumer Price Index, January-December 2008".Movements of the indexes from one month to another are usually expressed as percent changes rather than changes in index points, because index point changes are affected by the level of the index in relation to its base period while percent changes are not (Jane *et al.*, 1988).

2.2. Consumer Price Index (CPI) as an Indicator of Inflation

The Consumer Price Index (CPI), first published by the U. S. Bureau of Labour Statistics (BLS) in 1919, is the country's principal measure of price changes. One major use of the CPI is as an indicator of inflation, through which the success or failure of government economic policies can be monitored. A second major use of the CPI is to escalate income payments. Millions of workers have escalator clauses in their collective bargaining contracts that call for increases in wage rates based on increases in the CPI. In addition, the incomes of Social Security beneficiaries and retired military and federal civil service employees are tied to the CPI. It has been estimated that a 1 % increase in the CPI can trigger an increase of over $1 billion in income payments. Since 1978, the BLS has published two national, all-items indexes: the new CPI-U and the traditional CPI-W. The CPI-U measures the price change of a constant market basket of goods and services that are representative of the purchases of all urban residents-approximately 80% of the U. S. population. The CPI- W measures the price change of a constant market basket of goods and services that are representative of the purchases of urban wage earners and clerical workers-approximately 50% of all urban residents. The base period for both indexes is 1967. The CPI-U is the index typically reported by the press and broadcast media. The CPI-W is the index used in the escalator clauses of most labour contracts and government benefit programs. In addition to these two national indexes, the BLS publishes CPI-U and CPI-W indexes for each of 27 metropolitan areas. The national indexes and the metropolitan indexes are reported monthly in the BLS's CPI Detailed Report. The market basket of goods priced by both the CPI-U and the CPI-W includes a homeownership component. Accounting for over 30% of the overall weight of the indexes, the homeownership component influences the indexes more than food, energy, or medical care. This component includes the costs associated with purchasing a home (the price of the home and mortgage interest), as well as the cost of property taxes, property insurance, and maintenance and repairs. During the 1970's and early 1980's, the use of these quantities to measure the cost of homeownership met with much criticism. The following two arguments were made by critics: Since the CPI is used to measure the change in purchasing power for the purpose of escalating income or determining the rate of inflation, it "should not include the impact of rising prices on the value of assets such as

houses. Just as the CPI excludes changes in the value of stocks and bonds, the change in the asset value of the house (appreciation or depreciation) and the cost of equity in holding that asset should be distinguished from the change in the cost of the shelter provided by the house. It is the cost of consuming the shelter provided by the house, not the investment aspects of home ownership, which should be reflected in an index used to keep real income constant" The CPI overstates the rate of inflation, because "it uses current house prices and current mortgage interest rates, the CPI should not measure the costs of purchasing the base period houses in today's prices and today's mortgage interest rates, but rather the CPI should measure what people are actually paying for housing". In response to these criticisms, the BLS developed and experimented with an entirely new approach to measuring the cost of housing. As a result, instead of explicitly including in the market basket the homeownership costs described above, the BLS now recommends that, a rental equivalency component be included. This approach assumes that, a household's cost of consuming the flow of services from the housing unit can be represented by the income that the household could receive by renting the home to someone else. This rental equivalency approach to measuring homeownership costs was implemented in an experimental version of the CPI-U called the CPI-U-XI Jane *et al.* (1988).

2.3. Cost of Living

The cost of living is a matter of vital concern to many families. Unfortunately, complete information is not available to show changes in the cost of living. All that is available is a comprehensive index of prices of goods and services typically bought by city families of wage earners and clerical workers. The data are obtained from 46 cities and cover about 300 items. Moreover, this index applies to a relatively unchanging bundle of goods and services. Actually, families change their pattern of consumption. This is particularly true when incomes rise or when prices show marked changes. During a period of high-level prosperity, there is a sizable volume of 'trading-up' as expanding incomes are used in part to buy better quality products. One illustration is the shift from bread and potatoes to dairy products and meats; another is the shift from hamburgers to roast beef and steak. Thus, although the consumer's price index shows what happens to the cost of most of the items consumed by moderate-income families, it does not reflect the effects of changes in consumption patterns. Price levels edged upwards in 1956. The consumer's price index of the Bureau of Labor Statistics, U.S. Department of Labor, rose from 114.6 in January to 117.1 in September. The major part of this advance took place in the summer and fall of the year. The comprehensive wholesale price index also moved upward several per cent. The rise in this index started in mid-1955. While there was considerable concern about a new inflationary spiral in 1956, the over-all changes in prices were modest. Business activity attained new high levels in 1956. Gross national product, which was at an annual rate of $397 billion in the third quarter of 1955, rose to an annual rate of $413 billion in the third quarter of 1956. The gain was accomplished despite a steel strike during the month of July, as well as a reduced rate of automobile production and residential housing. The increase in gross national product reflected price rises and, to a lesser extent, an expansion in physical output. The Federal Reserve Board's index of industrial production was generally well maintained at a very high level in 1956. The volume of unemployment was about two million, or lower than in the preceding year. Average hourly and weekly earnings in manufacturing industries rose steadily throughout the year as a result of substantial wage increases. The increase in incomes was greater than the rise in retail prices. Accordingly, real earnings, the amount of goods and services that could be bought, were at a new high in 1956 and the level of living improved for most families. There was a widespread adoption of three-year labour contracts in many industries, including steel, aluminum, railroads, electrical equipment, and automobiles. To protect workers against changes in the cost of living, these contracts included 'escalator' clauses which provide for automatic increases in wage rates if living costs should rise further. Wage increases granted in 1956 were followed by increases in wholesale and retail prices. For example, the list prices of most 1957 automobiles were higher than those of the previous year. After the end of World War II, the cost of living rose sharply. This rise was interrupted in 1949, when living costs declined about 4 per cent below the level which prevailed in the fall of 1948. The cost of living resumed its upward trend in 1950 and 1951, reaching new high levels. The rate of rise abated in 1952 and 1953. In 1954 and 1955 the index recorded little change. In 1956 the cost of living once again rose. There were quite substantial price rises in 1946, 1947, 1950, and 1951. In contrast, the years 1953, 1954, and 1955 were marked by only minor changes in consumers' prices. There was widespread concern over inflation in 1957. From mid-1955 to the fall of 1957, the comprehensive wholesale price index rose about seven per cent and the consumer price index (a sample of goods and services comprising 300 items typically bought by city families of wage earners and clerical workers in 46 representative cities) rose about six per cent. This rise reflected the business boom and a sharp increase in wages and other labor costs. As the business boom abated in 1957, the rate of rise in wholesale prices slowed up. In the first nine months of 1957 wholesale prices rose less than one per cent; the prices of industrial raw materials actually declined by more than five per cent. The consumer price index continued to rise each month in 1957 and by September had risen by 2.6 percent. Business activity leveled off at new high peaks in 1957. Gross national product, which was at an annual rate of almost $417,000,000,000 in the third quarter of 1956, rose to an annual rate of $439,000,000,000 in the third quarter of 1957. A substantial part of the advance was due to higher prices. The Federal Reserve Board's index of industrial production was generally maintained at close to its peak level. The volume of unemployment was almost 3,000,000 or moderately higher than in the preceding year. Average hourly and weekly earnings in manufacturing industries rose steadily throughout the year as a result of substantial wage increases. The increase in incomes was about equal to the rise in retail prices. Accordingly, real earnings (the amount of goods and services that could be bought with earnings) were at about the same level as in 1956. However, many

families who live on a fixed income found themselves deprived of some of the goods and services they formerly could afford. The rise in 1956-57 was moderate as compared with earlier postwar years. The pronounced rise in the cost of living which began in early 1956 definitely slowed down during 1958. Between January 1956 and January 1958 the index of consumer prices rose 6.7 per cent; by June 1958 it was only 1.1 per cent higher than in January, and in the following three months it did not rise at all. Perhaps the most puzzling aspect of the behavior of prices in 1958 was not that the preceding steady increase was arrested, but rather that the cost of living did not fall. The economic contraction which became evident in the fourth quarter of 1957, the most severe since World War II, stopped the upward movement of prices but did not bring them down. The experience demonstrated once more, as in 1949 and in 1954, that recession can stop rising prices but will not reverse past increases. In September 1958 the consumer price index was 23.7 per cent above the average for the period 1947 -1949. Slightly more than one third of this total increase occurred between 1950 and 1951, when the Korean War had its initial and greatest impact. The rise during 1956 and 1957 accounted for another third of the total increase. Significant bursts upward were thus concentrated in two brief periods, with little change occurring in 1948-1949, 1952 through 1955, or in 1958.

2.4. Consumer Price Index (CPI) For Food Prices

Retail food prices reached their postwar peak in August 1952. In the following months food prices declined and by December 1953 were 3.7 per cent below the peak level. In 1954, 1955, and 1956 retail food showed only small changes. In September 1956 they were 1.3 per cent higher than a year earlier. Retail food prices were much more above before World War II prices than any other major group of items. From September 1955 to September 1956 wholesale prices advanced more than 3 per cent. Farm product prices advanced about 1 per cent and industrial prices rose by 3.7 per cent. Prices of fruits and vegetables declined, prices of grain advanced, and livestock and live poultry prices recorded little change. By September 1956 farm prices were about one quarter below the 1951 peak. While farm prices showed little change, retail food prices rose because wage costs continued to advance, thus adding to distribution costs. Farm prices continued to fall relative to the cost of goods bought by the farmer and the parity price relationship fell to its lowest level in fifteen years. At the end of August 1956 the U.S. Department of Agriculture's investment in farm products acquired through price-support operations was more than $7.8 billion. This was about three quarters of a billion dollars above the level of a year earlier but was below the seasonal record of $8.9 billion that was reached in February 1956. From September 1956 to September 1957, retail food prices rose 3.4 per cent. This rise was particularly significant because output of food in 1956 and 1957 was close to the highest on record. During this period, the government held huge stocks of farm products in the Commodity Credit Corporation. In an effort to reduce the mountainous supplies of farm products, special programs were adopted to dispose of part of the surpluses abroad. In the crop year 1956-1957, some $2,000,000,000 in sales of agricultural products were financed under these special programs; about $250,000,000 worth of these products were donated to foreign countries. In September 1957, retail food prices were much more above before World War II prices than any other major group of items. Food prices continued a two-year upsurge until April 1958, but scarcely changed thereafter. In September 1958 they were 3 per cent above September 1957. Stability from April 1958 through July was followed by slight decreases in August and September. While the post-April pattern reflected favorable seasonal factors, it still provided a striking contrast with the two preceding years, in each of which food prices rose persistently through the spring and summer. The most spectacular increases in food prices were those for meat and for frozen fruits and vegetables. The index of meat prices rose 7 per cent in the year ending August 1958, and that for beef and veal rose 12 per cent. Frozen fruit and vegetables increased even faster (26 per cent), although fresh fruit and vegetables actually decreased 1 per cent. The prize for volatility should perhaps be awarded to frozen orange juice, which shot up 63 per cent after production was hard hit by an 'unusual' Florida winter. Coffee prices went the other way, falling 12 per cent. Prices of poultry decreased 7 per cent, fats and oils 1 per cent, and butter and cheese less than 1 per cent each (Bureau of Labour Statistics, U.S. Department of Labour).

2.5. Consumer Price Index (CPI) For Non-Food Items

During 1956 the rent component of the consumer's price index continued to move up. The rate of increase was slightly higher than in 1955 but was less than in the earlier postwar years. The rise in rents varied considerably by cities, depending upon the status of rent control. The smallest increase occurred in New York City where state rent control remained relatively tight. Few other cities still retain rent control. From 1939 to September 1956, rents rose only 54 per cent. During World War II and the early postwar years, rents changed little for those persons who remained in the same houses or apartments. However, much higher rentals were asked for new quarters, as there was a sharp rise in building costs. Even where rents were controlled, prospective tenants often had to pay large amounts 'under the table,' pay for their own decorating, or make related supplemental payments. From about 1948 there was a gradual relaxation of Federal rent control and finally all such Federal controls were terminated in 1954. Despite the continued rise in rents, the over-all advance lagged far behind the increase in other types of living costs. The impact of higher labor costs on the cost of living is most apparent in connection with the prices of services (excluding shelter costs; i.e. rent, mortgage interest, property taxes, insurance). For the eighth year in a row the number of new housing starts in 1956 was over 1,000,000. However, the total was about 20 per cent lower than in 1955. During the postwar period, a total of more than 11,000,000 housing units were started. As a result, the housing shortage was relieved, it became easier to obtain apartments, the number of families doubling up was reduced, and the vacancy ratio began to increase. Rents for new apartments were reduced in some instances, but rents for prewar housing

continued to advance moderately. In mid-1955, the Federal Housing Administration under its home mortgage insurance program announced a two per cent increase in down-payment requirements and a reduction in the maximum repayment period from 30 to 25 years. However, credit terms were eased again in the fall of 1956. The general shortage of credit contributed to the curtailment of new housing in 1956. Soon after the start of the Korean War, clothing prices rose markedly. They reached the postwar peak in September 1951. Since that time apparel prices have declined moderately. In 1956 little change was recorded in apparel prices. However, late in the year many price increases were announced following a new round of wage increases. The retail prices of house furnishings advanced steadily from the start of the Korean War until May 1951. From the peak level of early 1951, the prices of house furnishing items gradually declined. In 1956, house furnishing prices were more than 7 per cent below the peak level. There were many concessions from list prices in such lines as television sets, washing machines, and refrigerators. However, as a result of increases in the prices of important materials, such as steel, and higher wages, list prices were increased. Total sales of these products were stimulated by a continued increase in installment buying which rose to record levels in 1956. The prices of various services rose in 1956. Medical costs continued to rise slowly as higher charges were made effective for group hospitalization insurance, hospital care, and similar items. Transportation costs rose as there was an advance in railroad fares and used car prices and household repairs. Thus for personal care, medical care, automobile repairs, and appliance repairs the cost is primarily wages. For these services, productivity increases are not available out of which to absorb higher labor costs; they are transmitted directly to the consumer in higher prices. Since March 1955, the prices of services have risen more than the retail prices of goods. The disparity between increases in prices of goods and services is even wider if we go back to 1951. Since that year, goods prices have risen only 3.6 per cent while services have risen 23.1 percent. If the comparison is made from 1949 to overcome the greater impact of the Korean War on the prices of goods, the increases have been 13.6 per cent and 34.1 per cent respectively. Wage increases in 1957 were followed by increases in wholesale and retail prices. Clearly, the increases in administered wages have contributed significantly to price inflation. During 1957 the rent component of the consumer price index continued to rise, but the rate of increase was lower than in 1956. The rate of increase in rents varied considerably by cities, depending upon the status of rent control. The smallest increase occurred in New York City where state rent control remained relatively tight. Few other cities still retain rent control. For eight post-World War II years, the number of new housing starts was over a million annually. In 1957, the total was a little below a million. During the postwar period, a total of more than 12,000,000 housing units were started. As a result, the housing shortage was relieved, it became easier to obtain apartments, the number of families doubling up was reduced, and the vacancy ratio began to increase. Rents for new apartments were reduced in some instances, but rents for pre-war housing continued to advance moderately. In the summer of 1957, the Federal Housing Administration, under its home mortgage insurance programs, announced a reduction in down-payment requirements. The new minimums were three per cent on houses up to $10,000, 15 per cent on the next $6,000, and 30 per cent on the balance. The former requirement was seven per cent on the first $9,000 and 27 per cent on the remainder. It was hoped that this liberalization of credit terms would help stimulate new building which had declined by about one-third in the two years following the spring of 1955. Apparel prices reached a postwar peak in September 1951. Since then, they have declined moderately, recording small rises in 1956 and 1957. Late in 1957 many price increases were announced. The retail prices of house furnishings advanced steadily from the start of the Korean War until May 1951. From the peak level of early 1951, the prices of house furnishing items gradually declined. In 1956, house furnishing prices were more than 7 per cent below the peak level. In 1957, there were many concessions from list prices in such lines as television sets, washing machines and refrigerators. However, as a result of increases in the prices of important materials and higher wages, list prices were increased. The best behaved component of the consumer price index is that for commodities other than food. Taken together, these prices rose only 13 per cent in the last decade, and 0.7 per cent in the year ending August 1958. They actually decreased, although rather slightly, between January and August 1958. This behavior reflects the highly competitive character of the industries producing most non-durable consumer goods (notably clothing), and some durable goods *(e.g.,* furniture, radios). The growth of discount houses, undermining attempts at price maintenance through fair trade laws, has exerted downward pressure on retail prices for many durable goods which are important in consumer budgets. During 1958, apparel prices remained almost perfectly stable, at a level only 7 per cent above the 1947 -1949 average. Clothing other than footwear decreased slightly, but shoe prices continued to rise: in August 1958 they were 30 per cent above the 1947-1949 average, and 1 per cent higher than a year earlier. House furnishings have shown great price stability over the last decade, rising only 4 per cent since 1947-1949. In the year ending August 1958 they performed a neat U-turn, rising 1 per cent up to February 1958, then moving back down again to the same level as in August 1957. The term 'services' covers an extremely heterogeneous group of expenditures, including rent, gas and electricity, medical care, repair work, travel, and recreation. Collectively, expenditures on these 'non-goods' have been rising steadily in importance relative to spending on commodities: their prices have been rising relative to goods prices, and the volume of these purchases is not highly sensitive to the adverse price trend. This is notably the case for medical services, which have risen much faster in cost than the other main types of service expenditures. In September 1958 prices of medical services were 46 per cent higher than the 1947-1949 average, transportation costs were up 41 per cent, and rents 38 per cent. Price increases for gas and electric services, and for 'reading and recreation,' were each 17 per cent in the same period. In the year ending September 1958 the pattern was much the same, with medical and transportation costs continuing to rise much faster than the cost of living index as a whole. But one of the chief culprits of the past decade did slow up at last; average rents did not rise quite as much as the aggregate index. As has been true throughout the postwar period, the cost of

living in the United States advanced less than in most other countries during the year ending July 1958. As against increases of 17 per cent in France, 6 per cent in Mexico, or 4 per cent in West Germany and India, the 2 percent increase here appears moderate. On the other hand, industry continued to expand more rapidly in almost all other advanced countries than in the United States. For the world as a whole, the early postwar period of sharply rising production and strong inflationary pressure has altered toward greater stability. In comparison with other countries, the rate of industrial expansion in the United States has become particularly weak, and price increases have been relatively well restrained.

2.6. Consumer Price Index in Ghana

According to Nsowah-Nuamah (2007) the Consumer Price Index (CPI), which measures the annual rate of changes in the prices of goods and services in the country, for the month of October this year, dropped marginally by 0.1 per cent to 10.1 per cent from the September figure of 10.2. Announcing the figures at a press conference in Accra, the Deputy Government Statistician, Prof Nicholas N.N Nsowah-Nuamah, said the food and beverages group contributed to the change in the national index, accounting for negative 0.78 points, while the non-food groups contributed 0.41 points. He said the food and beverages group vegetables, including potatoes and other tuber vegetable groups contributed a negative 0.81 points to the change in the national index. Prof Nsowah-Nuamah stated that within the non-food group, transport contributed the highest of 0.15 points, followed by housing, water, electricity and gas. The year started with inflation rate of 10.9 per cent in January 2007 and for the two months ahead, February and March 2007, the rate fell to 10.4 and 10.2 per cent respectively. However, the rate rose in April and May 2007 to 10.5 per cent and 11 per cent respectively. Inflation started declining in June, which stood at 10.7 per cent in June 2007 and 10.1 per cent in July. Due to the upward adjustments in the price of petroleum in August, the CPI gained 0.3 basis points to close at 10.4 per cent. The Bank of Ghana in its recent Monetary Policy Committee meeting announced that it was targeting a five per cent inflation rate. The Ghana Statistical Service has re-based the CPI year to 2002 from the old base year of 1997, starting from January this year. The new base year featured a number of changes as compared to the old base, which included the updates of the various weights of the consumption basket from the 1991/1992 Ghana Living 1989/1999 GLSS expenditure levels. Additionally, the presentation of the CPI had been expanded to include indices on the 10 regions of the country. The CPI is computed from a basket of 242 goods and services collected monthly from 40 markets throughout the country. The Consumer Price Index which measures the rate of price increases over time has for the first time this year shown a marginal sign of decline. The rate fell by 0.1 percentage points from 18.41 in June to 18.31 percent for the July figure. Announcing the figures for this month. Prof Nicholas N.N. Nsowah-Nuamah, attributed the marginal decline in the inflation rate to the low prices of food. The rate of inflation which had been rising since January this year had seen the figures increased from 12.8 per cent in January to 13.2 percent in February and 13.8 percent in March. In the month of April the rate went up to 15.3 per cent while in May the rate stood at 16.88 per cent. The figures for June dosed at 18.41 percent. Prof Nsowah-Nuamah said the rate continued to be higher for the non-food group, than for the food group. He said the non-food group which was 14.40 per cent in January this year increased to 18.97 per cent in July and contributed 2.59 percentage points higher than that of the food group. The Deputy Government Statistician did not rule out the government's policy intervention announced in May as a result of soaring food prices as a factor in the lower prices of the food component of the index. He said the monthly changes in the CPI from the previous month to the present recorded a rate of 1.08 per cent in July this year, which is the lowest monthly rate since January. Prof. Nsowah-Nuamah added that the change in the monthly inflation rate increased from 1.17 per cent to 3.20 percent between January and May, and declined in June at a rate of 2.06 percent. On the regional inflation figures he said Ashanti Region recorded the lowest inflation rate of 12.96 percent, while the Central Region recorded the highest rate of 27.95 percent with six regions recording inflation rates above the 18.31 percent national rate. "The inflation rate in the rural areas is significantly higher at 23.77 percent than the urban areas which record an inflation rate of 13.68 percent. This however, does not mean that prices of goods in rural areas are higher than in urban areas he said.

2.7. Factors Affecting Consumer Price Index (CPI) as an Indicator of Inflation

The fact that inflation can be stopped with a change in the political situation suggests that condoning and making inflation in the first place are largely political problems. Homer (2008) states that, it is the responsibility of politicians to control inflation. It is not the responsibility of every individual citizen behave in a non-inflationary way, and ask them to do so is an abnegation of political responsibility. Inflation has two faces: domestic or local and foreign or imported. Robert and Richard (2008) in his article, "Inflation must be, stopped", writes, "Understanding the cause of a disorder is likely to be helpful in its treatment". Some persons would have us believe "that inflation is a kind of plague or invasion striking from outside and that the role of government is to fight it". (Robert and Richard, 2008) further adds that there are many causes of inflation. Some arise from within the country, as when demands for goods' and services exceed the available supply, or when workers press for increases in wages that exceed improvements in productivity, or when businessmen seek to enlarge their profit margins through higher prices. International factors play a role, when oil exporting countries raise the price of oil. It is nevertheless the duty of our governments under existing laws to serve as the balance wheel of the economy and that involves an obligation to restrain or to offset upward pressures on the general price level that arise in the private economy. Well said Arthur Burns, politicians and policy makers in developing countries take the advice of late Chairman of the Federal Reserve

Bank of America and Harry Johnson and fight inflation because after all, it results in better lives for the citizenry and fosters economic growth and development. Although a mild inflation rising out of the creation of money by deficit financing is good for the economy because it may stimulate investment by raising profit expectations and extracting forced savings; an extreme case of runaway inflation is highly detrimental to economic growth and development. In developing economies like ours, structural changes take place during the process of economic growth; some of these changes in relative prices do occur that generally put upward pressure on prices. Therefore, some changes in price level, or in other words, a certain rate of inflation is inevitable in a developing economy. Thus, price stability in our economy means reasonable rate of inflation. It is up to academicians, policy makers, think-tanks, key stakeholders, etc to start debating on the issue of reasonable inflation rate for Ghana. Is the medium-to-long term of five per cent as announced by Bank of Ghana a reasonable rate for the Ghanaian economy? Prices of various items all increase at different rates so some people benefit while others suffer. Those on fixed incomes suffer the most because the cost of things they are buying increases but their income stays the same. Even if incomes/wages are adjusted, they are adjusted after the fact so that households have already been paying the higher prices for a period of time before the adjustments take place. The price system becomes less efficient in responding to consumers' taste, preferences, and objective circumstances and in coordinating economic activity. Inflation takes its toll on the "pocket books" and the lives of the ordinary citizens and the economy. It raises the cost of living of the citizenry and reduces their standard of living, sending many people below the poverty line, thus hurting the poor most. Because of its negative effect on the lives of the citizenry, inflation has been described as enemy number 1 of the poor. In extreme inflations, when financial assets have ceased to serve as stores of wealth, the citizenry resort to commodities, foreign exchange, gold and real estate instead as inflationary hedges, lowering the rate of saving on which investment and economic growth depend (Harrod Domar Growth Model). Thus extreme inflation serves as disincentive to save. Real estate as an investment in good because the country needs adequate housing. However, as an inflationary hedge, It is one of the most non-productive investment areas. First, the local content in a house forms a small part of the total cost of a house, most of the resources that go into the house construction are of foreign origin, resulting in export of foreign exchange. That is why the economy is not experiencing any appreciable improvement from the real estate boom of the last seven years. GREDA for example must try to improvise and use a lot of local materials in housing construction in the country, so as to retain in the country the hard earned foreign exchange, which will go for the import of appropriate technologies that will enhance our development efforts. Secondly, most of real estate projects undertaken by the citizenry are financed from personal savings. The time lag from project conception to completion is about seven years. These monies that are tied up in an unproductive investment could easily have been channeled through the financial sector into more productive investments with higher rate of returns. By the way, the rate of return during the construction phase for many of these housing projects are basically zero when this same capital invested elsewhere could bring returns to the investor within the shortest possible time. Just imagine how vibrant the financial sector will be, if all the amounts spent so far on all the uncompleted houses (majority of these houses are over five years old) in the country were invested directly in the stock market and or into fixed deposits. Stable economy, reasonable inflation rate and financial deepening should provide a possible solution to allow investors have alternative investment products. Apart from the direct adverse impact of inflation on the citizenry, it sabotages the transmission of information by prices. Specifically, each price conveys information to the prospective buyer of a product about how much sacrifice of other products its purchase would entail, as well as, information about how attractive an offer each prospective seller is making in comparison with his competitors' offers. Inflation renders such information obsolete or unreliable more quickly. Prices, including interest rates are also distorted by particular ways or channels in which inflationary amounts of new money are injected into the economy. For some institutional reasons, some prices are less flexible than others, so that inflation further distorts relative price, resulting in inefficient allocation of resources. Inflation's impact on the economy is quite profound. First, it makes exports more expensive and discourages them, impacting negatively on the balance of payment (BOP). Higher prices at home make foreign goods cheaper vis-à-vis domestic goods, inducing more imports. When one studies the country's BOP accounts, it is quite evident that the country is experiencing chronic and perpetual BOP deficits. This problem must be tackled by prudent economic policies if our economic growth and development is to be sustained. The country cannot develop using only foreign savings. Research has shown that for a country to develop, it takes both domestic and foreign capital to accomplish this objective with domestic capital leading the way. A point worth mentioning at this time is the recent massive oil price increase, which would spell a mechanical increase of several per cent in the country's price level; and in order not to let this increase erode the purchasing power of the total money supply and exert a contractionary effect on production and employment, the authorities must take steps to expand the money supply. In other words, this will be monetary ratification of a cost push, with the push coming from abroad rather than from labour unions. There are various inflation rates, but the most common inflation rates often used are: Inflation rate as an increase in average annual Consumer Price Index (CPI). For example, average annual growth of prices as a change in last 12month average over preceding 12-month average. This inflation rate is appropriate for making adjustments or considerations of average quantities. It is taken into account particularly when real wages and pensions are calculated. Inflation rate as an increase in CPI compared with the corresponding month of preceding year indicates percentage change in price level between the reference month of a given year and the corresponding month of the preceding year. This inflation rate is appropriate in relation to state quantities which measure the change between the beginning and the end of the period without any reference to the trend. Inflation rate as an increase in CPI compared with preceding month. For example, month-on-month growth comparing price level in the reference month with that in preceding month. This is the figure which is referred to as rate of inflation. It refers to

the pace or speed at which general prices are rising from one month to the other. Adjusted for seasonal variations, the rate of increase should tally the year on-year inflation rate, using the same reference points. Inflation rate as an increase in CPI compared with base period indicates change in price level between the reference months of a given year against the base year. This inflation rate used for the analysis of long term detailed trends (time series in price level and cost of living adjustments issues). The basic CPIs to basic period provide the base for calculating all CPIs to give inflation rates in various periods of time. There is a principle for those calculations that inflation rates amount to aggregate CPI for households' totals. A lot of individuals get confused by the difference between inflation and the CPL It is therefore appropriate to provide an explanation at this juncture. The CPI is an index or a composite number used to measure a change. The CPI which is used to calculate various inflations are collated in Ghana by the Ghana Statistical Service (GSS). The weights of individual price representations in the consumer basket correspond to the share of a given kind of consumption which they represent in total household consumption. The consumer basket in Ghana comprises 242 items (food, beverages, etc), other goods (clothing, furniture, household, utensils, etc) and services (housing, household running, health and social care, transport, leisure, education, personal care, etc) collected from 40 marketing centers throughout the country every month. The base year for the index is 2002, which the GSS shifted from 1997. This shift allowed the GSS to update the various weights of the consumption basket from the 1991/1992 and 1989/1990 Ghana Living Standards Survey (GLSS) expenditure levels. In addition to the national inflation averages, the GSS also computes inflation rate for the 10 regions. These regional inflation rates are important and useful numbers to answer questions such as: which regional capital is more expensive to live in? Should a worker living in a region deemed more expensive be paid more than a colleague living in a less expensive region, even though they have the same responsibility? What kind of employment allowances do employers give their employees working in the various regions, knowing that the cost of living index in some regions are higher than others? For simplicity, let us assume that a basket is made of 10 items rather than the 242 items used by GSS and the cost in the base year is fixed at ¢100. Let us further assume that at current prices the same 10 items cost ¢185. All 10 items have equal weight (in actual sense weights for the survey depends on socio-economic behaviour of the consumers), the simple average rule, each would account for 10 percent of the total index. In this simple example, we assume the base year price to be Po and the current year price to be P_1. Applying the inflation formula, we get:

$$\left(\frac{P_1 - P_0}{P_0}\right)100 = \left(\frac{185 - 100}{100}\right)100 = 85\%$$

In our simplified example, prices have increased by 85 per cent from the base year to the current period. The increase in this simplified example could be over only year or several years. Once again, the time preference period is very essential when inflation rates are being discussed .When one just says inflation rate is 85%, it is correct at the same time misleading. The precondition is accurate, factual, and spatial and time definitions. This means that the period for which the inflation rate is indicated (reference period), and the base period which the reference period is compared with, should be clearly stated. For the mathematically gifted individuals, there is another way of calculating the inflation rate, which is $\log P_1 - \log P_0$ (using natural log), and stated in percentage. Using both formulae give the same results, except the noise in the log calculation is minimized. There are two general methods of calculating inflation rates-based period method and "chained" method. Chained method adjusts not only the prices, but also the contents of the market basket involved with each calculation. Whilst, for the base period method, the contents of the market basket remains fixed until otherwise recomposed by the collating agency. In Ghana, the base period is used in calculating the CPI. A point to note, inflation rates are basically historically concepts. Before these numbers are computed and released, consumers have felt and or feeling the impact/effect of it. What is essential is that the historical numbers allows consumers and market participants to form expectations about future direction of general prices, hence historically events leads consumers to form opinions about future events that is inflationary expectation. Inflationary expectation is a key ingredient in future decision making. What consumers, businesses, etc think about future direction of inflation determines the prices they place on factors of production, wages, rent, interest, profit. If market participants believe that inflation will be high in future, they factor that into their decision making by demanding higher prices and vice versa. In a nutshell, inflation rate answers the question of what has already happened to the economy (ex ante) and inflationary expectation (ex post) answers the question of what is about to happen to the economy. Therefore, there is a link between inflation rate and inflationary expectations; all depends on whether or not market participants think or perceive that future events will be like the past events. We cannot do without reasonable rate of inflation as a developing economy with structural and institutional rigidities. What this reasonable rate of inflation is subject to debate, even though BoG has announced a medium-to-long term rate of five per cent. Inflation as the literature points out is an effect rather than a cause; a result of government deficit spending which results in printing or creating of money for whatever reason. It is the government's responsibility to control inflation. Inflation rate answers questions on what has happened to the economy and inflationary expectation answers question on what is about to happen to the economy. After all, these two concepts are inflation rate and inflationary expectation raise our cost of living and reduce our standard of living; driving people below the poverty line, misinforming the consumers, and resulting in misallocation of resources.

3. Research Approach

3.1. Research Design

This section deals with the techniques and procedures used to obtain and analyse the data. The data were obtained from or collected from the statistical service of Ghana, Accra that is from 1997 to 2007. However, the data was analysed using statistical software (Minitab,). The main tool for the analysis was exploratory data analysis. This seeks to explain the variation in the data using time series with the help of statistical software mentioned above and also answer all the research objectives. The software (Minitab) was used in the preliminary analysis to draw the line graph for the trend of CPIs for food, non-food and the combined items respectably. Additionally, the software (Minitab) was used to draw the various lines of best fit for the CPIs of the items mentioned above in the form of quadratic model and at the same time to predict the trend beyond the period under consideration.

3.2. Methods

The basic theory and methods of time series are relevant to the analysis of this study. A time series is a set of observations of a variable measured at successive points in time or over successive periods of time. A time series may have a trend or no trend. If there is no trend, methods commonly used include moving average technique and the exponential smoothing techniques. On the other hand, if the data has a trend then a common method for describing the data is to fit a trend line. This trend line can be linear, quadratic cubic or indeed any other form of a line. Time series data are of particular interest in economics, business and commerce where the values of a variable are observed chronologically by days, weeks, months, quarters or years. Also, production, consumption, sales, profits, bank clearings during successive periods of time, and population, price, etc, at successive points of time are examples of time series. A study of time series data discloses that observed values of the variable are always fluctuating from time to time. The fluctuations are the result of the joint action of various forces, like changes in tastes and habits of people, increase in population, development of new techniques resulting in lower cost of production, changes in weather conditions, etc. The forces are ever changing and due to the interaction among them, values of the variable undergo change with the passage of time. The objectives of time series analysis are to isolate and measure the effects of various components. Such an analysis will help in the understanding the past behaviour, so that we may be able to predict the future tendency. To business executives who have to plan their production much ahead of sales, the analysis of time series will be of great assistance in planning for the living of personnel for peak periods, to accumulate the inventory for raw materials to ready equipment and finally in forecasting the future demand of their product, Fuller and Wiley (1976).

3.3. The Trend Analysis of a Time Series

In Economics, Business and commerce, it is important to estimate for the future. For example an economist is interested in knowing the likely population in the coming year for his future planning or a businessman likes to estimate (or predict) his likely sales in coming year to adjust his production accordingly. For making such estimates, one has to collect information from the past, i.e., one has to deal with statistical data collected and recorded at successive intervals of time (or points of time). Such statistical data relating to time are referred to as time series. Although Time Series usually refers to economical data, it also applies to data arising in natural and other social sciences. We shall discuss various methods for analyzing Time Series and procedures for resolving it into four important components. A Time Series is a set of observations taken at specified times, usually (but not always) at equal intervals. Thus a set of data depending on time (which may be year, quarter, month, week, days, etc) is called a Time Series.

Examples of Time Series are:

- The annual Production of Steel in over the last 10 years;
- The Monthly Sales of a Chemical Industry for the last 6 months;
- The daily closing price of a share in the Ghana Stock Exchange;
- Hourly temperature recorded by the Meteorological Office in a city in Ghana.
- Yearly Price or Quantity Index Numbers.

Mathematically, a Time Series is defined by the values Y_1, Y_2, -------, Y_n of a variable Y at times t_1, t_2 -------, t_n. Here Y is a function of time t and Y_t denotes the value of the variable Y at time t.

Analysis of Time Series is of special importance to Businessmen, Economists, Scientists, statisticians, Sociologists, Geologists, Research Workers in various disciplines etc. Analysis of Time Series helps us to understand the past behavior of time series data (i.e., one can understand the changes that took place in the past). With the knowledge of the past, it would be possible, within certain limits, to forecast for the probable future variations (movements) of such data. Thus it helps planning future operations. With the help of Time Series Analysis, we can compare the actual performance with the expected performance and analyse the cause of variation. Different time series can be compared and therefore important conclusions can be drawn. Analysis of Time Series shows that the observed values of the variable are always fluctuating from time to time. The fluctuations are due to various factors (or forces) like increase of population, changes in habits and tastes of people, weather conditions etc. On the action of these forces, the values of the variable are changing with time, Anderson (2000).

3.4. Smoothing Methods

In this section we shall discuss about forecasting methods. Among some of the methods are moving averages, weighted moving averages, exponential smoothing and Holt-Winters forecasting model. The objective of each of these methods is to "smooth out" the random fluctuations caused by the irregular component of the time series. Therefore, they are referred to as smoothing methods. Smoothing methods are appropriate for a stable time series, that is, one that exhibits no significant trend, cyclical, or seasonal effects-because they adapt well to changes in the level of the time series. However, without modification, they do not work as well when a significant trend and / or seasonal variation are present. Smoothing methods are easy to use and generally provide a high level of accuracy for short-range forecasts such as a forecast for the next time period. One of the methods, exponential smoothing has minimal data requirements and thus is a good method to use when forecasts are required for large numbers of items, Brillinger (1998).

3.5. Moving Average Method

Moving average method is very commonly used for the isolation of trend and in smoothing out fluctuations in time series. In this method, a series of arithmetic means of successive observations, known as moving averages, are calculated from the given data, and these moving averages are used as trend values. Precisely, moving averages of period n are a series of arithmetic means of groups of successive n observations, shown against the mid-points of time intervals covered by the respective groups. If the period of moving average is odd, the trend values correspond to the given time. If the period of moving average is even, a two-point moving average of the moving averages so obtained has to be found out for 'centering' them. The logic behind the moving average method is that if the period of moving is exactly equal to the period of cycle (or its multiple) present in the series, then the method will completely eliminate cyclical fluctuations. The method is very simple and needs no complicated mathematical calculations. Moving averages can also adapt themselves to changing circumstances. The disadvantages of the method are that, some trend values at the beginning and at the end of the series cannot be obtained. Also, since moving averages assume no law of change, this method cannot be used for forecasting future trend. The period of moving average has to be chosen very carefully. There are no hard and fast rules for the purpose. Moving averages are useful only when the trend is linear or approximately so. If the actual trend is curvilinear, moving averages may deviate considerably from the trend. The moving averages methods use the average of the most recent n data values in the time series as the forecast for the next period. Mathematically,

$$\text{Moving average} = \frac{\sum(\text{most recent n data values})}{\text{n}} \qquad \text{---------- (1)}$$

3.6. Moving Averages with an Odd Number of Points

The easiest form of moving average uses an odd number of points, centred on each data point. For example, suppose we want to use a five-point moving average; then the average is calculated according to

$$\bar{x} = \frac{1}{5}\left(x_{t-2} + x_{t-1} + x_t + x_{t+1} + x_{t+2}\right)$$

The general equation for an *m*-point moving average, when *m* is an odd number, is

$$\bar{x}_t^{raw} = \frac{1}{m}\sum_{k=t-m/2}^{t+m/2-1} x_k$$

As soon as we attempt to implement such a moving average, however, we run into a problem that is first and last few points in the series do not have a sufficient number of neighbours to use the formula. Infact, all we can reasonably do is to calculate the moving average only for the range of time where sufficient points are available for the appropriate average. In other words, if we calculate a five-point moving average, we can only get estimates of the average trend for points ranging from the third in the series, to the third from the end of the series. This is a limitation of the moving average method, Chris Robertson (2002).

3.7. Moving Averages with an Even Number of Points

There is no problem in calculating a moving average with, say, 4 points, but we are left with values that do not correspond to any time point where there is an observation, as the 'centre' of the average lies midway between two time points. To get over this nuisance, we generally use the average of pairs of adjacent moving averages, and use this as the estimate of trend. We do this in two stages. First if *m* is the order of moving average we actually want, we obtain one 'raw' m-point moving average centred halfway between *t* and *t*-1 $\left(\bar{x}^{raw}\right)$, and then average successive pairs of these to get a trend estimate centred on *t.* For *m* = 4 these would be

$$\bar{x}^{raw} = \frac{1}{4}\left(x_{t-2} + x_{t-1} + x_t + x_{t-1}\right) \text{ with the general equation being}$$

$$\bar{x}_t^{raw} = \frac{1}{m}\sum_{k=t-m/2}^{t+m/2-1} x_k$$

Then we take the average of two successive estimates, to get a trend estimate centred halfway between them, that is, at time point *t:*

$$\overline{x}_t = \frac{1}{2}\left(\overline{x}_t^{ram} + \overline{x}_{t+1}^{ram}\right)$$

The term *moving* indicates that, as a new observation becomes available for the time series, it replaces the oldest observation in Equation (1), and a new average is computed. As a result, the average will change, or move, as new observations become available, Chris Robertson (2002). As a result of the drawbacks associated with moving averages mentioned above, this problem can be addressed by using exponential smoothing method.

3.8. Brown's Linear Exponential Smoothing

This method provides an additional correction similar to that of linear moving averages. In this method, the difference between single and double smoothed values is added to the single smoothed value and adjusted for the pattern in the data. The equations for these adjustments are:

$$S_{t+1} = \alpha X_{t-1} + (1-\alpha)S_t \text{ - First Smoothing Equation}$$

$$S_{t+1}^{I} = S_{t+1} + (1-\alpha)S_t - \text{Second Smooting Equation}$$

The overall forecast is given by

$$a_t = 2S_t - S_t^1$$

$$b_t = \frac{\alpha}{1-\alpha}\left(S_t - S_t^1\right)$$

Now forecasting for the future is given by

$$F_{t+m} = a_t + b_t m$$

Where m is the number of periods for forecast.

3.9. Exponential Smoothing

This section also talks about exponential smoothing method for forecasting rather than the moving averages because moving averages deal with stationary points and the graph is seemed to be horizontal. Exponential Smoothing uses a weighted average of past time series values as the forecast; it is a special case of the weighted moving averages method in which we select only one weight that is the weight for the most recent observation. The weights for the other data values are automatically computed and get smaller and smaller as the observation move farther into the past. The basic exponential smoothing model is:

$$F_{t+1} = \alpha Y_t + (1-\alpha)F_t \quad \text{----------} \quad (2)$$

Where

F_{t+1}=forecast of the time series for period $t+1$
Y_t = actual value of the time series in period t
F_t =forecast of the time series for period t
α =smoothing constant ($0 \le \alpha \le 1$)

Equation (2) shows that the forecast for period $t+1$ is weighted average of the actual value in period t and the forecast for period t. Note in particular that the weight given to the actual value in period t is α and that the weight given to the forecast in period t is $1-\alpha$. We can demonstrate that the exponential smoothing forecast for any period also is a weighted average of *all the previous actual values* for the time series with a time series consisting of three periods of data: Y_1, Y_2 and Y_3. To start the calculations, we let F_1 equal the actual value of the time series in period 1: that is, $F_1=Y_1$. Hence, the forecast for period 2

$$\begin{aligned} F_2 &= \alpha Y_1 + (1-\alpha)F_1 \\ &= \alpha Y_1 + (1-\alpha)Y_1 \\ &= Y_1 \end{aligned}$$

Thus, the exponential smoothing forecast for period 2 is equal to the actual value of the time series in period 1. The forecast for period 3 is

$$F_3 = \alpha Y_2 + (1-\alpha)F_2 = \alpha Y_2 + (1-\alpha)Y_1$$

Finally, substituting this expression for F_3 in the expression for F_4, we obtain

$$\begin{aligned} F_4 &= \alpha Y_3 + (1-\alpha)F_3 \\ &= \alpha Y_3 + (1-\alpha)[\alpha Y_2 + (1-\alpha)Y_1] \\ &= \alpha Y_3 + \alpha(1-\alpha)Y_2 + (1-\alpha)^2 Y_1 \end{aligned}$$

Hence, F_4 is a weighted average of the first three time series values. The sum of the co-efficient, or weights, for Y_1, Y_2, and Y_3 equals 1. A similar argument can be made to show that, in general, any forecast F_{t+1} is a weighted average of all the previous time series values.

Despite the fact that exponential smoothing provides a forecast that is a weighted average of all past observations, all the past data do not need to be saved in order to compute the forecast for the next period. Infact, once the smoothing constant α has been selected, only two pieces of information are required to compute the forecast. Equation (2)

shows that with a given α we can compute the forecast for period t +1 simply by knowing the actual and forecast time series values for period t that is, Y_t and F_t.

We begin by setting $F_1 = Y_1$.

The smoothing constant α is chosen on the basis of how much smoothing is required. A small value of α produces a great deal of smoothing. A large value of α results in very little smoothing, depicts a time series and two exponentially smoothed series with α = 0.1 and α =0.5.

3.9.1. Holt-Winters Forecasting Model

In this section, we present an extension of the exponential smoothing method of forecasting that explicitly recognizes the trend in a time series. The Holt-Winters forecasting model consists of both an exponentially smoothed component (E_t) and a trend component (T_t). The trend component is used in the calculation of the exponentially smoothed value. The following equations show that both E_t and T_t are weighted averages.

$E_t = \omega Y_t + (1 - \omega)(E_{t-1} + T_{t-1})$

$T_t = \nu (E_t - E_{t-1}) + (1 - \nu) T_{t-1}$

Note that the equations require two smoothing constants, ω and ν, each of which is between 0 and 1. As before, ω controls the smoothness of E_t; a choice near 0 places more emphasis on past values of the time series, while a value of ω near 1 gives more weight to current values of the series, and deemphasizes the past. The trend component of the series is estimated adoptively, using a weighted average of the most recent change in the level and the trend estimate from the previous period. A choice of the weight ν near 0 places more emphasis on the past estimates of trend (represented by T_{t-1}), while a choice of ν near 1 gives more weight to the current change in level [represented by $(E_t - E_{t-1})$]. The calculation of the Holt-Winters components, which proceeds much like the exponential smoothing calculations, is summarized below, Dubois and McGrow-Hill (1964).

3.9.2. Steps for Calculating Holt-Winters Model

This section has to do with the steps for computing Holt-Winters model. However, these days software (Minitab) can be used for the computation as well as the graph, but we would like to bring out the statistics behind the model.

- Select an exponential constant ω between 0 and 1. Small values ω give less weight to the current values of the time series, and more weight to the past. Larger choices assign more weight to the current value of the series.
- Select a trend smoothing constant ν between 0 and 1. Small values of give less weight to the current changes in the level of the series, and more weight to the past trend. Larger values assign more weight to the most recent trend of the series and less to past trends.
- Calculate the two components, E_t and T_t from the time series Y_t beginning at time t = 2 as follows:

  $E_2 = Y_2$

  $T_2 = Y_2 - Y_1$

  $E_3 = \omega Y_3 + (1 - \omega)(E_2 + T_2)$

  $T_3 = \nu (E_3 - E_2) + (1 - \nu) T_2$

  $E_t = \omega Y_t + (1 - \omega)(E_{t-1} + T_{t-1})$

  $T_t = \nu (E_t - E_{t-1}) + (1 - \nu) T_{t-1}$

3.9.3. The Winter's Exponential Smoothing Model

Winter's model is a three parameter linear and seasonal exponential smoothing model. It is an extension of Holt's model and uses an additional equation to estimate the seasonal component of the time series. Winter's model is the appropriate model to use when the data has both trend and seasonal components. The model uses four equations for forecasting.

- Updating the exponential smoothed series.

$$S_t = \alpha \frac{X_t}{I_{t-L}} + (1-\alpha)(S_{t-1} + b_{t-1})$$

  Where α is the length of seasonality i.e. the number of quarters or months in a year.

- Update the seasonality estimate

$$I_t = \beta \frac{X_t}{S_t} + (1-\beta) I_{t-L}$$

  Where I is the seasonality adjustment factor.

- Update the trend estimate

$$b_t = \alpha(S_t - S_{t-1}) + (1-\alpha) b_{t-1}$$

- Forecasting m periods into the future

$$F_{t+m} = (S_t + b_{tm}) I_{t-L+m}$$

The difference between the exponentially smoothed series of Winter's and Holt's is that in Winter's, X_t is divided by I_{t-L} and this removes the effects of seasonality. The seasonal component is also smoothed exponentially. The update of the trend is the same as that of Holt's.

3.9.4. Fitting a Trend

In this section we are going to use mathematical equations to fit a trend in the form of the line of best fit. Method of fitting mathematical curves is perhaps the best and most objective method of determining trend. In this method, an appropriate type of mathematical equation is selected for trend, and the constants appearing in the trend equation are determined on the basis equation is facilitated by a graphical representation of the data.

- If the plotted data show approximately a straight line tendency on an ordinary graph paper, the equation used is:

$y = a + bx$……(1)

- If they show a straight line on a semi-logarithmic graph paper, the equation used is:

$\log y = a + bx$……(2)

- Sometimes a parabola or higher order polynomial may also be fitted

$y = a + bx + cx^2$……(3)

- Special types of curves are also used in certain cases.

$y = a + bc^x$ ……..(4)

The constants appearing in the equations referred to *(1)* to *(4)* above are obtained by applying the principle of least squares. This states that the values of constant should be such as to make the sum of the squares of vertical distances from the trend line as small as possible. The method of fitting mathematical curves can be used for forecasting the future trend. This method also involves considerable numerical calculations. Supposing a polynomial of degree *k* in *t* is chosen to represent the trend *T*, viz.

$T_1 = a_0 + a_1^t + a_2t^2 + ….. + a_kt^k$,…….(5)

The normal equations for determining the unknown constants a_0, a_1, a_2, ….a_k will be

$$\left.\begin{array}{lllllllll} \sum y & = & na_0 & + & a_1\sum t & + & a_2\sum t^2 & + \ldots\ldots & + \; a_k\sum t^k \\ \sum ty & = & a_0\sum t & + & a_1\sum t^2 & + & a_2\sum t^3 & + \ldots\ldots & + \; a_k\sum t^{k+1} \\ \sum t^2y & = & a_0\sum t^2 & + & a_1\sum t^3 & + & a_2\sum t^4 & + \ldots\ldots & + \; a_k\sum t^{k+2} \\ \ldots\ldots & & \ldots\ldots & & \ldots\ldots & & \ldots\ldots & \ldots\ldots & \ldots\ldots \\ \sum t^Ky & = & a_0\sum t^K & + & a_1\sum t^{K+1} & + & a_2\sum t^{K+2} & + \ldots\ldots & + \; a_K\sum t^{2K} \end{array}\right\} \ldots..(6)$$

Using the estimates obtained from equations (6), we can get the trend value for any given time *t* by substituting that value of *t* in (1).

Obviously, for linear trend,

$T_1 = a_0 + a_1t$,…….(7)

and there will be two normal equations, viz.

$\Sigma y = na_0 + a_1\Sigma t$

and $\Sigma ty = a_0\Sigma t + a_1\Sigma t^2$

For quadratic trend,

$T_1 = a_0 + a_1t + a_2t^2$,……..(8)

and the normal equations are

$\Sigma y = na_0 + a_1\Sigma t + a_2\Sigma t^2$

$\Sigma ty = a_0\Sigma t + a_1\Sigma t^2 + a_2\Sigma t^3$

and $\Sigma t^2y = a_0\Sigma t^2 + a_1\Sigma t^3 + a_2\Sigma t^4$

Based on Equations (7) and (8), having known the values of *t* you can predict for the value of T. The implication here is that when we can establish a quadratic model curve for the further analysis, let us say, $Y_t = a_0 + a_1t + a_2t^2$ for the equation from 1997 to 2007. We can therefore predict for 2008 and beyond which is seen in the further analysis. When the value of t for January 2008 is known, Y_t, i.e. the CPI at time t, can be determined.

3.9.5. Quadratic Exponential Smoothing

The quadratic Exponential Smoothing for trend analysis is given by the following equations.

First Smoothing Equation is given by

$S_t = \alpha X_t + (1 - \alpha) S_{t-1}$

Second smoothing equation is given by

$S_t^{11} = \alpha S_t^I + (1 - \alpha) S_{t-1}^{II}$

Overall forecast equation is given by

$a_t = 3S_t - 3S_t^I - S_{t-1}^{II}$

Linear Trend equation is given by.

$$b_t = \frac{\alpha}{2(1-\alpha)^2}\left[(6-5\alpha)-(10-8\alpha)S_t^1+(4-3\alpha)S_t^{II}\right]$$

Quadratic trend equation is given by.

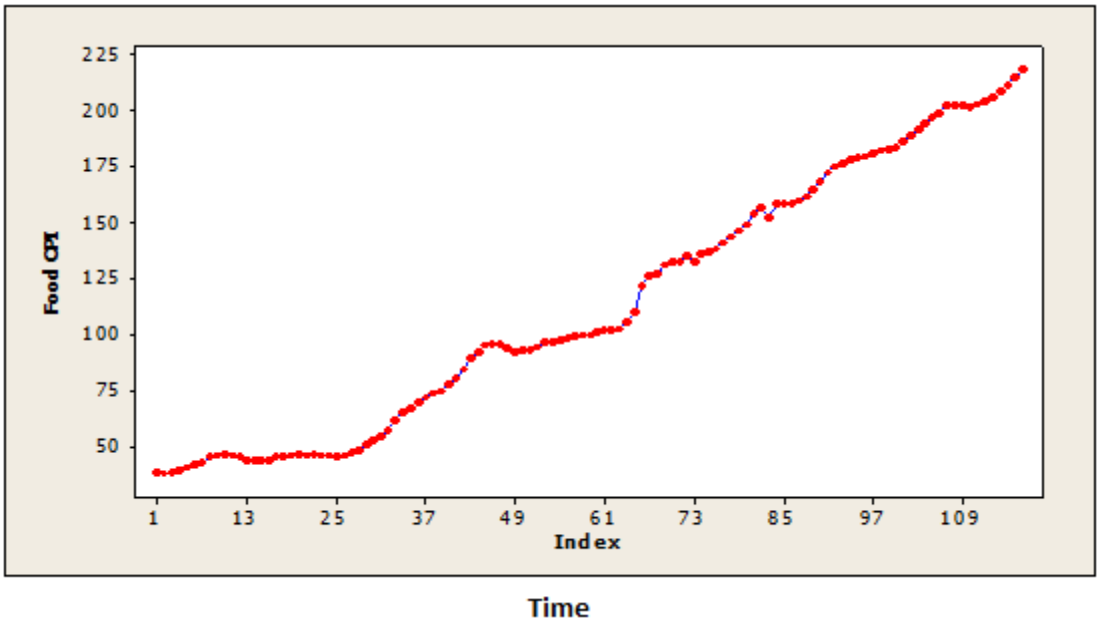
$C_t = (S_t - 2S_t^I + S_t^{II})$
Forecasting into the future is also given by.
$F_{t+m} = a_t + b_{tm} + 0.5\,(C_{tm})^2$

4. Results and Discussion

4.1. Consumer Price Index for Food Items

Fig. 1 represents the consumer price index for food items. The horizontal axis of the graph is scaled such that 1 represents January 1997, 13 represents January 1998, 25 stands for January 1999, etc.

Fig-1. Consumer price index for food items

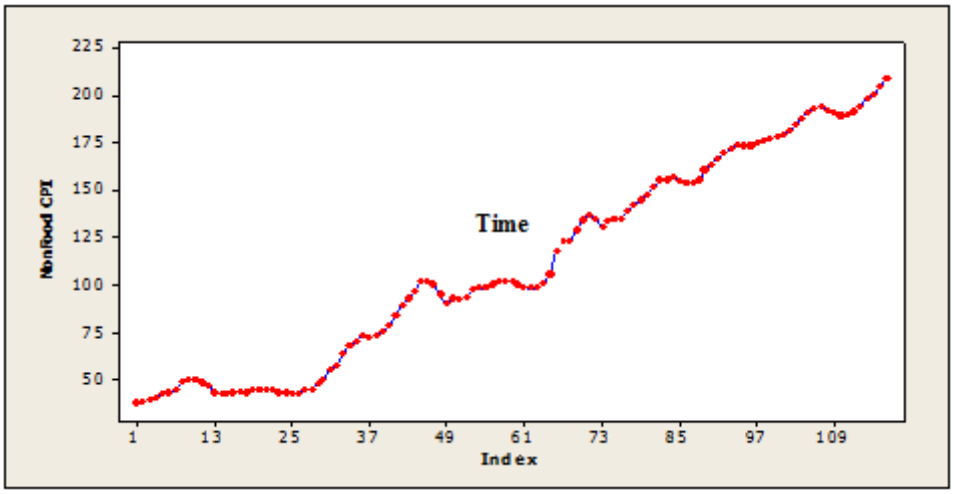


From the graph, it can be seen that there is on the whole, an upward trend in CPIs. When the CPIs increase it implies that, the inflation rate also tend to move upward since the consumer price index goes hand-in-hand with inflation. From 1997 to 1998, and from 1999 to 2001, however, no change in CPIs can be observed. Since there is no change in CPIs it meant that the rate of inflation remained unchanged. Also, between 1998 and 1999 there was a slight decrease in CPI and the trend therefore moved upward to 2001. Again from the graph, between 2001 and 2003, there was a decline in CPIs. As a result of this situation inflation would also fall. It can be observed that, the CPIs increase at a faster rate from 2003 to 2007 when compared with the rate of increase from 1997 to 2001. In the light of this, the inflation rate moved upward correspondingly. Even though from 2003 up to 2007, there was a faster rate of increase in the CPIs, there seemed to be a slight variation in the rise as we moved along. Thus, it meant that, the rate of inflation increased at a faster rate between 2003 and 2007 as against 1997 and 2001. Based on the analysis, it implied that, there was a rise in CPI rate between 2003 and 2007 and declined.

4.2. Consumer Price Index for Non-Food Items

Fig. 2 illustrates the trend for the consumer price index (CPI) of the non-food items from 1997-2007. The values on the, horizontal axis 1, 13, 25, 37 etc. represent January 1997, January 1998, January 1999, January 2000, etc.

Fig-2. Consumer price index for non-food items

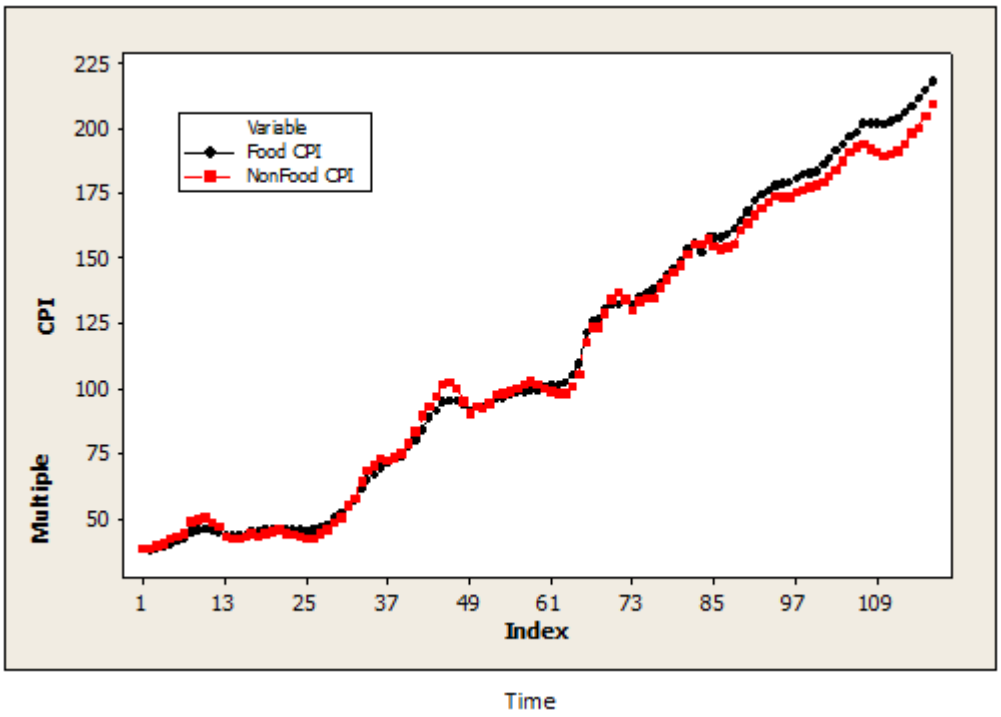


It can be seen that the CPIs for the non-food items showed an overall increasing trend from 1997 to 2007.However, the rate of increase in the CPIs were irregular which could be seen from the graph. Again, from the graph, there was a rise in the CPIs from 1997 up to 1998. The CPIs, however, declined slightly between 1998 and 1999 and suddenly rose up in 2001, also between 2001and 2002 there was a decrease in CPIs after this decline, the trend of the CPIs moved upwards from 2003 up to 2007 with some amount of irregular increase in the CPIs. It then however, changed and saw a slight decline between 1998 and 1999 and suddenly rose up in 2001. Again, between 2001 and 2002 witnessed a decline in the CPIs. After this decline, the trend of the rise in the CPIs moved upwards from 2003 up to 2007 with some amount of irregular increase in the CPIs. This meant that there was a corresponding rise and fall of the inflation rates. We can therefore say generally that, the trend of the CPIs right from 1997 up to 2007 increased randomly. This situation could also result in the irregular trend of the CPIs rates based on the period under consideration.

4.3. Comparing Consumer Price Indices for Food and Non-Food Items

Fig. 3 shows both the consumer price index (CPI) for both food and non-food items from 1997 to 2007.

Fig-3. Graphs for food and non-food CPI



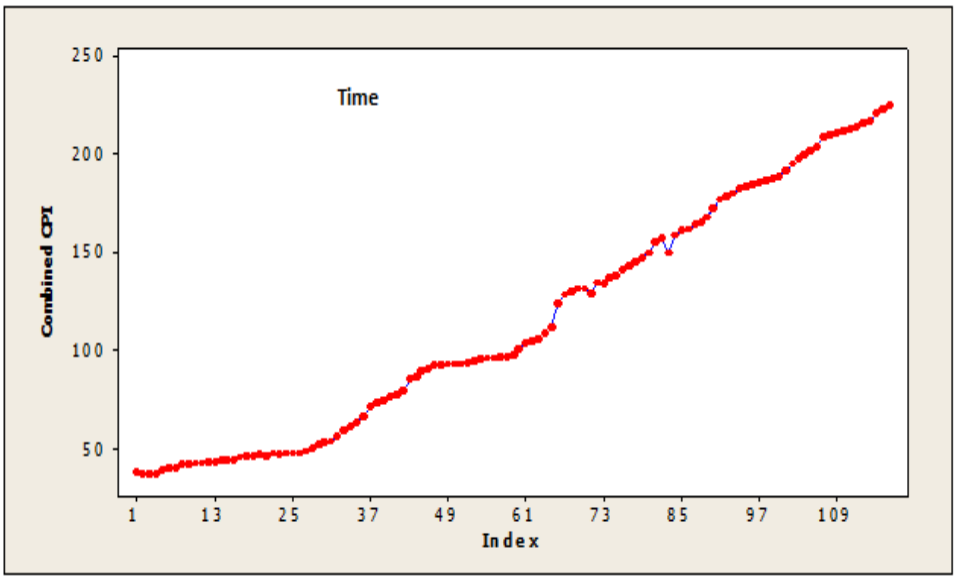
From the graph, it can be seen that there was an upward increase in the CPIs from 1997 to 2007. Thus, since there was general increase in CPIs, it meant that the CPIs also moved overall irregular upward. From the graph, between 1997 to 1999, there was no significant increase in CPIs. The implication here was that, the inflation rate had not increased in that direction. Also it could observed that, there was a rise in CPIs between 1997 and 2001,

however, the CPIs rose upward slightly. The situation there changed where the CPIs for both food and non-food items witnessed a faster rate in the increase with non-food rising a little above food items up to 2004. The analysis here is that, the rate of inflation increased with regard to non-food items as compared to the food items. Again, both items declined and went upward with this time round the food item rising a little bit above the non-food items, as a result, inflation rate shifted to the food items instead. Generally it appeared that, there was an irregular trend for the rise in the CPIs for both items right from 1997 to 2007, with one of the items superimposing one another as we moved along. Based on the analysis carried out, it therefore meant that the CPIs was not stable but rather the increase was irregular.

4.4. Consumer Price Index for Combined Items

Fig. 4: also talks about the trend of consumer price index (CPI) for the combined items from 1997 to 2007.

Fig-4. Combined CPI

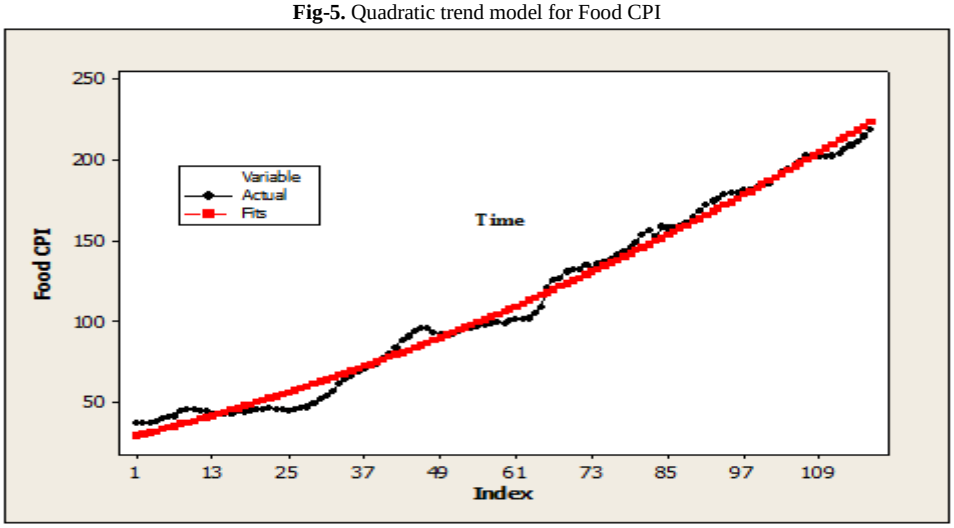


According to the graph, it can be observed that, there is general rise in the CPIs for the combined items from 1997 up to 2007. It means that there is a general rise in the inflation rate. From the graph, between 1997 and 2001, the CPIs rose steadily, we can therefore say that based on this period the inflation rate was on the increase. However, between 2001 and 2002, the CPIs fell slightly. It implied that there was a corresponding declined in the rate of inflation. The trend for the CPIs increased at a faster rate from 2003 up to 2007. As a result, there was higher rate of CPIs based on the period under consideration.

4.5. Consumer Price Index for Food Items

This graph is made up of the line of best fit and the actual. Also, the horizontal axis 1, 13, 25, 37 represents the years 1997, 1998, 1999, 2000 etc.

Fig-5. Quadratic trend model for Food CPI



A trend analysis of the CPIs for food shows that the best line of fit is a quadratic curve. This curve is superimposed on the actual and is shown in Fig. 5. It can be observed that the curve showed an upward trend in CPIs for the food items. Between 1997 and 2001, there was an increase in CPIs. It meant that there was a corresponding increase in inflation rate. However, between 2001 and 2003 there was a marginal decline in CPIs for the food items resulting in lower inflation rate. Again, from 2003 to 2007 the CPIs rose up rapidly at a faster rate. Based on the analysis, the rising trend in CPIs might also give way to faster rate of CPIs between the period mentioned above. Thus, the equation for this quadratic curve is found (in Minitab) as:

$$Y_t=29.06 + 0.9603t + 0.000597t$$

Where Y_t denotes the CPI at time t, for example t = 1 is January 1997 and t = 49 denotes December 2001. This equation can therefore be used to forecast CPI values for 2008 and beyond. Thus, the CPI for food items for 2008 is obtained as follows:

Y_t for January 2008, t = 121, substituting t = 121 into the trend equation we have $Y_{121} = 29.06 + 0.9603\ (121) + 0.00597\ (121)^2$.

Thus, $Y_{121} = 232.66307$

$Y_{121} = 232.7$(1 dec. place)

Thus, the consumer price January index (CPI) for 2008 is 232.7

Y_t for October 2008, t =130 it implies that:

$Y_{130} = 29.06 + 0.9603\ (130) + 0.00597\ (130)^2$

$Y_{130} = 254.792$

$Y_{130} = 254.8$ (1 dec. place)

Also Y_t for November 2008, t = 131

Thus,

$Y_{131} = 29.06 + 0.960\ (131) + 0.00597\ (131)^2$

$Y_{131} = 257.31041$

$Y_{131} = 257.3$ (1 dec. place)

Again, y_t for December, t = 132

$Y_{131} = 29.06 + 0.960\ (132) + 0.00597\ (132)^2$

$Y_{131} = 259.80128$

$Y_{131} = 259.8$ (1 dec. place)

Hence the CPIs for October, November and December for 2008 are 254.8, 257.3 and 259.8 respectively.

4.6. Consumer Price Index for Non-Food Items

Fig. 6 illustrates the quadratic trend model for the non-food items beginning from 1997 up to 2007

Fig-6. Quadratic trend model for Non-food CPI

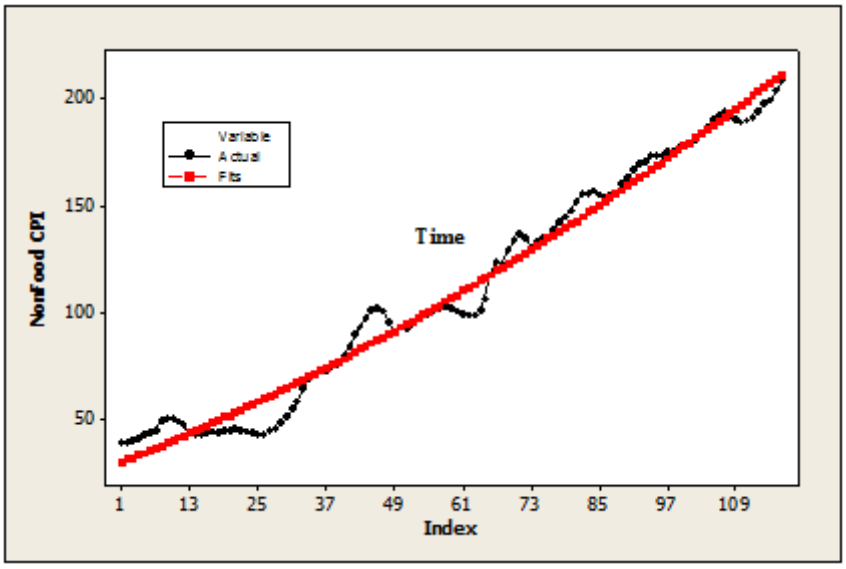


Fig. 6.above also represents a trend analysis of the CPIs for non-food items and that the best line of fit is quadratic curve. Once again, it can be seen from Fig. 6 that, the curve is being superimposed on the actual. However, the equation of this quadratic curve is found (in Minitab) as:

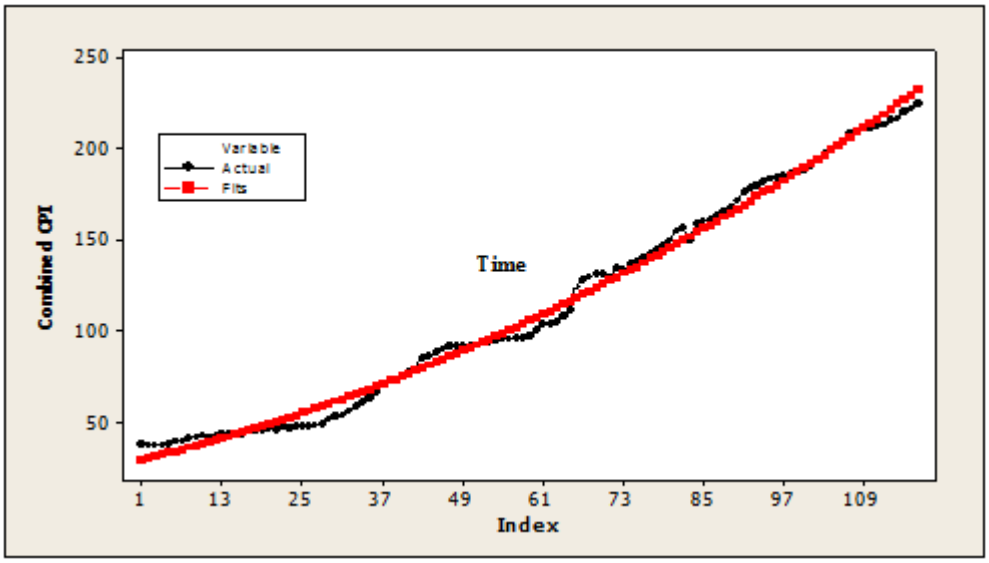
$$Y_1 = 28.59 + 1.077t + 0.00418t^2$$

Where Y_t stands for the CPI at time t. Thus, we can use this trend equation to forecast CPI values for 2008 and the rest. Hence, the CPI for the non-food items for 2008 is obtained as seen below: Y_t for January 2008, t = 121 yields 220.1 (The calculations can be found in Appendix 6).

4.7. Consumer Price Index for Combined Items

Fig. 7 shows the quadratic model for consumer price index (CPI) for the combined items from 1997 up to 2007. The graph is made up of the line of best fit and the actual.

Fig-7. Quadratic trend model for combined CPI



Once again, Fig. 7 illustrates a trend analysis of the CPIs for the combined items and its best line of fit is also a quadratic curve which is superimposed on the actual. From the graph, both the line of best fit and the actual showed an increasing trend for CPIs for the combined items with the line of best fit showing a change in shape whilst the actual showed a variation in shape. Even though the quadratic curve is superimposed on the actual, there seemed to be a variation in the CPIs with regard to the actual from 1997 to 2007. The equation for the quadratic curve is given by:

$$Y_t=29.44 + 0.8651t + 0.00743t^2.$$

Again, the equation can be used to forecast CPI values for 2008 and beyond. The computed CPIs for October, November and December are: For October, t=130, November t = 131, December t = 132, the calculation is seen in Appendix 7 and the results are display on the table.

Table-1. Forecast value of Consumer Price Index (CPI) for 2008

MONTH	FOOD	NON-FOOD	COMBINED
October	254.8	239.2	267.5
November	257.3	241.4	270.3
December	259.8	243.6	273.1

From the table, the summary of the trend analysis for the forecasting of CPIs is that, the food, non-food and the combined items are increasing from January through October up to December based on the further analysis carried out.

5. Conclusion

5.1. Findings of the Study

From the preliminary analysis, it was seen that, graphs for the food, non-food and the combined items showed an upward trend in the CPIs. It could be observed from Fig. 1 that, between 1997 and 2001, there was a rise in the trends of the CPIs. The CPIs, however, between 2001 and 2003 witnessed a slight increase. From 2003 up to 2007, the CPIs showed a faster increasing rate. Thus, we could therefore see that there was irregular trend of the CPIs. Also, from Fig. 2 the CPIs showed an upward trend from 1997 up to 2007. From the graph, between 1999 and 2005 witnessed a slight decrease in CPIs and then rose up again up to 2003. However, between 2003 to 2004, it was observed that, there was also a slight change in CPIs. Thereafter, there was a rapid increase in CPIs from 2004 up to 2007 with some amount of variation in the trend as we moved along. The CPI for food items during the preliminary analysis showed an upward trend with some few variations in the trajectory. The CPI for non-food items also showed an irregular increasing trend. Besides, the CPI for the food and non-food items showed an upward increasing trend with an irregular variation in the moment. Again, CPI for the combined items also followed the same upward trend. Based on the further analysis, the fitted model was quadratic model with the actual being superimposed

indicating a regular trend however there was irregular trend regard to the actual. Thus, with the help of the software used (Minitab) a quadratic equation was formed. Based on this equation, subsequent forecast values for 2008 were also computed as seen in table 1. In addition, another quadratic model was found for non-food items. This trend also showed an upward trend why the actual however, exhibited an irregular variation increasing trend. As a result another quadratic equation was formed such that forecast values also computed. The CPI for the combined items also appeared to have shown an increasing trend with the regard to the quadratic model whiles the actual or the observed one rather showed an irregular variation in the trend. Thus, quadratic was formed. Based on this, predicted values for the subsequent year, 2008 were found as displaced in table 1. The results of the forecast values of consumer price index for 2008 for food items, non-food and combine items clearly showed that from October to December there was a general equation trend. This clearly meant that, the CPIs also followed the same trend with slight irregular trends somewhere along the line, since consumer price index (CPI) is used to measure the change in the purchasing power for the purpose of escalating income or determining the rate of inflation. Thus, throughout the study based on the findings from both the literature and the analysis carried out it appeared that, there was on the whole irregular variation in the CPIs. Furthermore, when we considered the further analysis, the CPIs also moved upward and appropriate lines of best fit were drawn. Based on these findings, we established quadratic curves and its various equations through the use of Minitab. The equations were used to predict the CPIs for 2008. Thus, it was found out that the trends for the CPIs were increasing. The study revealed that the general upward trend in the CPIs collaborated the philosophy of Ampofo (2007) Edition of Daily Graphic. We therefore conclude that as the years go by there is an increase in the CPIs. Thus, the study has shown clearly from the literature and the findings that, the rate of inflation can be measured based on the consumer price index (CPI). The study has also shown that, the trend of the CPIs moved upward, as the years go by.

References

Ampofo, S. O. (2007). (Thursday, December, 20, 2007) Edition of the Daily Graphic.
Anderson, S. W. (2000). *Essentials of Statistics for Business and Economics.* 2nd edn.
Brillinger (1998). *Time Series Data Analysis and Theory.* 4th edn: Academic Press: London.
Chris Robertson (2002). *Business: and Multimedia Guide to Concepts And Applications.* 1st edn.
Dubois, E. N. and McGrow-Hill (1964). *Essential Methods in Business Statistics.* 3rd ednMcGrow-Hill.
Fuller, W. A. and Wiley, J. (1976). *Introduction to Statistical Time Series.* 4th edn.
Homer, H. J. (2008). Mental models and transformative learning: The key to leadership development? 19(1)85-89.
Jane, I., Maclove, P. and George, B. (1988). Statistics of Business and Economics of Daily Graphic.
Nsowah-Nuamah, N. N. N. (2007). Edition of the Daily Graphic.
Robert, B. B. and Richard, A. B. (2008). *Business research methods and statistics using SPSS.* 1st edn.