The Manufacturing Sector of Ghana: Are There Any Macroeconomic Disturbances?

PATRICK ENU[1] AND EMMANUEL DODZI K HAVI[2]
[1]*penu@mucg.edu.gh*, [2]*ehavi@mucg.edu.gh*
Department of Economics, Methodist University College Ghana, Dansoman, Ghana

Abstract *- The study examined the macroeconomic factors that influence performance of the manufacturing sector of Ghana using multivariate time series approach. It was found out that manufacturing production and real gross domestic product per capita were inversely related. In the long-run, macroeconomic variables such as private sector credit, labour and real exchange rate were unfavourable factors that weigh down the manufacturing sector while in the short-run, the past years consumer price index and real exchange rate were unfavourable to the manufacturing production. Finally, it is recommended that private sector credit to the manufacturing sector should be improved, training of labour force should be skilled and technical oriented and policies to stabilise the real exchange rate should be put in place to halt the down trending in manufacturing production.*

Keywords: Macroeconomic Policies, Manufacturing Production and Vector Autoregressive

I. INTRODUCTION

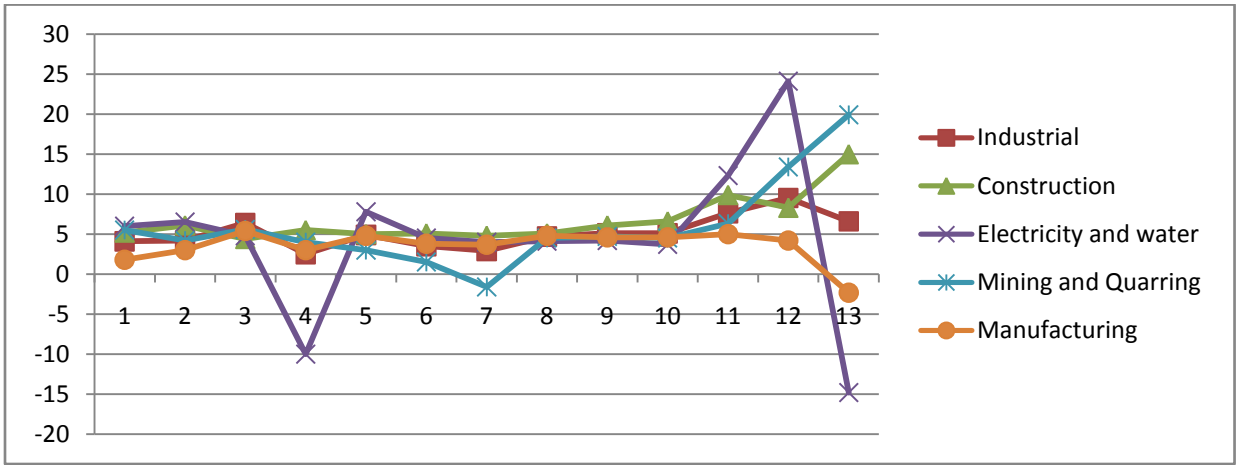
The aim of this paper is to determine which macroeconomic factors drive manufacturing output in the Ghanaian economy. Recent empirical works have confirmed the hypothesis that industrialization is an engine of growth in developing countries when the most dynamic industries are targeted and investment in skills are undertaken (Tregenna, 2007; Kuturia and Raj, 2009; Szirmai, 2009; Timmer and de Vries, 2009). The situation is, however, different in developed countries ((Fagerberg and Verspagen, 1999; Szirmai andVerspagen, 2011). So, is Ghana's industrial sector mostly referred to us as the manufacturing sector the engine of economic growth in Ghana? Since manufacturing has the largest multiplier of all sectors of an economy, this calls for a scientific investigation, hence, the need for this study.

The Ghanaian economy is made up of three main sectors; they are the agriculture, the industry and the services sectors. The services sector currently is the driving force of the Ghanaian economy based on its contribution to gross domestic product (GDP); it contributed about 49.5% of GDP in 2013. The question is, why not the manufacturing sector which has been proven to be an engine of growth (Kalirajan, 2004; Tkalec et al., 2009).

The performance of the industrial sector (comprising manufacturing, mining and quarrying, utility services and construction) in 2000 was unimpressive. Though, there were some government interventions such as the setting up of $100 million fund to assist firms particularly those in agro-food and fish processing; the agro-processing and export of textile and garment and industrial starch under the President's Special Initiative (PSI). The establishment of the Ghana Investment Fund (GIF), as a replacement of the Business Assistant Fund (BAF) to assist SMEs; the establishment of Export Development and Investment Fund with $30 million seed money to encourage exporters; introduction of Anti-dumping Bill to parliament, aimed at stopping the dumping of goods on the Ghanaian market and promoting growth of local industries; quickening of divesture process; the rationalization of tariff regime; the accelerated growth programme and the growth and poverty reduction strategy and many others but the sector grew at a slower rate. The manufacturing sector recorded a growth rate of 3.8% in 2000 compared with 4.8% in 1999 (see figure 1 below). Besides, the rate was 1.3 percentage points below the manufacturing sector's projected figure of 5.1% in the year 2000. According to the Association of Ghana Industries (AGI) statistics, only 9% of its 250 paid-up members were able to meet profitability in 2000, while 21% achieved production targets. This fact was corroborated by centre for Policy Analysis in its 2000 Mid-Year Economic Review.

From figure 1, the manufacturing sector dominates the industrial sector, accounting for over half of total industry contribution to GDP. Unfortunately, the encouraging momentum in the share of the manufacturing sector contribution to GDP slackened between 2005 and 2006.

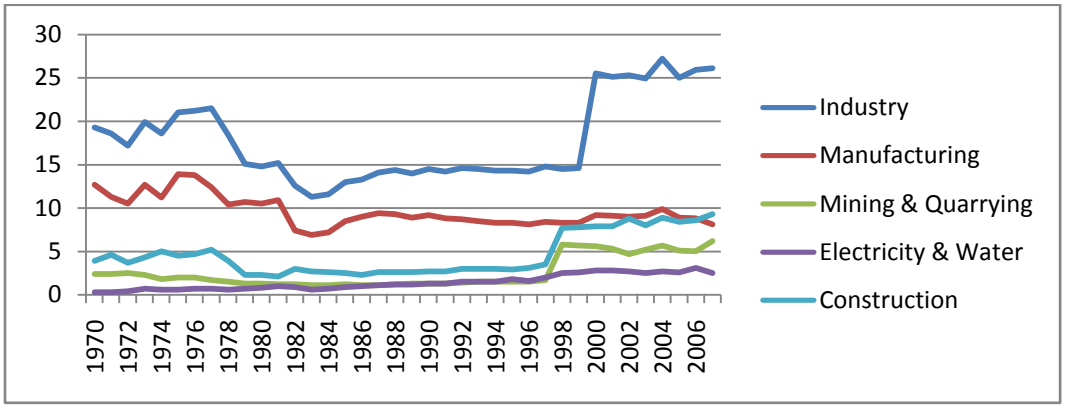
P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com



Source: The State of the Ghanaian Economy, various issues.

Figure 1: Growth Rates of Industry and Sub-sectors, 1995 – 2007

Its share in GDP has since been declining consistently. This implies that the value gained from this sector is falling or efforts have shifted from the manufacturing sector to other sectors of the Ghanaian economy. Why have efforts shifted from the manufacturing sector to other sectors of the Ghanaian economy or why is the value of the manufacturing sector declining for some time now? One way to address this issue is that policy makers need to understand how and to what extent macroeconomic policies affect manufacturing production in Ghana. The persistent declining performance of the manufacturing sub-sector could be attributed to some factors such as high inflation (40.5%), high lending rate (39 – 55%), high depreciation of the value of the cedi (49.7%), high utility charges, obsolete machinery and equipment (some installed 57 years ago) and high influx of cheap imported products in the name of liberalization and so on. However, all these factors mentioned above are based on hear say and not scientifically proven.

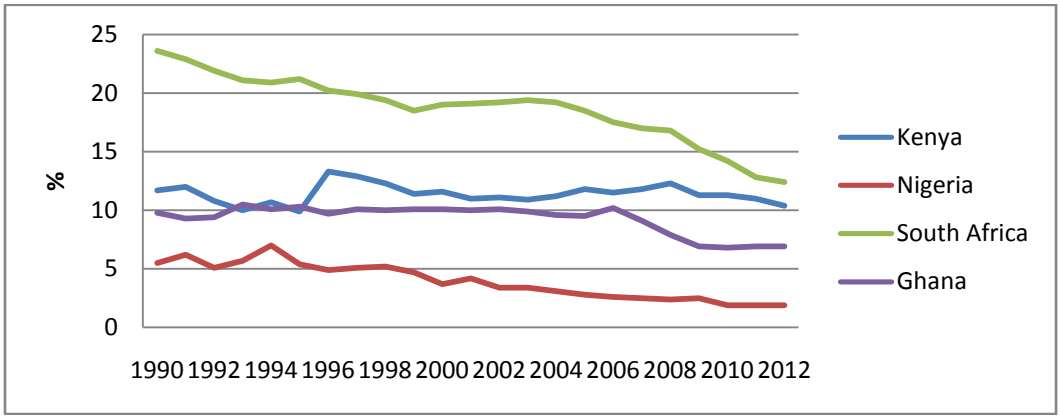


Source: National Accounts Section, GSS

Figure 2: Share (%) of Industrial Sub-sector in Gross Domestic Product, 2004 – 2007

In comparison to other developing countries in Africa, the manufacturing sector value added % of GDP for all these countries were falling, however, Ghana's manufacturing valued added as % of GD is lower. This is to say that comparing Ghana to other countries; Ghana's manufacturing sector produce is lesser though Nigeria is much lesser. What can policy makers do about this continuous decline in the manufacturing sector of Ghana, tackling it from the macroeconomic environment point of view?

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com



Source: World Development Indicators 2014
Figure 3: Manufacturing value added (% of GDP)

As a result, this study aims at analyzing the impact of macroeconomic policies on the manufacturing production in Ghana between the period 1980 and 2012. To be more specific, the study seeks to find answers to the following research questions. To what extent do macroeconomic variables such as private sector credit, consumer price index, infrastructure, labour force, real exchange rate and fixed capital formation influence the output of the manufacturing sector of Ghana?

II. LITERATURE REVIEW

The manufacturing sector being one of the traditional sectors that exist in a macroeconomic environment is most likely to be affected by changes in macroeconomic conditions. According to Solow (1956), Sundararajan (1987), Schatz (1964), Diaku (1972) and many other researchers, macroeconomic conditions can affect manufacturing production either positively or negatively and for that matter policy makers should pay particular attention to macroeconomic changes and how they affect manufacturing production.

Imoughele (2014) examined the effectiveness of monetary policy on Nigeria's manufacturing sector output. The study covered the period 1986 to 2012. The econometric techniques used in the study include Granger Causality test, the Vector Autoregressive Model and Johansen Co-integration test procedure. The results indicated that growth in Nigeria's manufacturing sector is highly responsive to exchange rate, external reserve and inflation. A long-run relationship was also found to exist between manufacturing sector output and monetary policy variables. The study also found that the manufacturing sector contribute insignificantly to the Nigeria economy. The study recommended that monetary authorities should create and implement monetary policies that favoured efficient provider of favourable investment climate by facilitating the emergency of market based interest rate and exchange rate regimes that attract both domestic and foreign investment to the manufacturing industrial sector that are currently operating far below installed capacity.

Odior (2013) investigated the impact of macroeconomic factors on manufacturing productivity in Nigeria over the period 1975 to 2011. The study examined the stochastic characteristics of each of the time series variables by testing their stationarity using Augmented Dickey Fuller test and estimated the error correction mechanism model. The study found that credit to the manufacturing sector in the form of loans and advances and foreign direct investment have the capacity to sharply increase the level of manufacturing productivity in Nigeria, while broad money supply had less impact. The study recommended that government must create enabling environment for manufacturers in the area of infrastructure, financial, legal and property rights. In addition, the study advocated a cut margin between lending and deposit rates. Finally, the study suggested that efforts be made to achieve a more realistic and stable trade balance through liberalization that will gurantee output growth in both the short run and long run.

Eze, Onyekachi and Ogiji (2013) investigated the impact of fiscal policy on the manufacturing sector output in Nigeria. An error correction analysis was used. The study identified that government tax revenue had a significant negative impact on manufacturing sector output in Nigeria. Government expenditure appeared to have a significant and positive impact on manufacturing sector output in Nigeria. The results revealed again that there was long-run relationship between fiscal policy and manufacturing sector output. The study recommended that the expansionary fiscal policies should be encouraged as they play vital role for

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

the growth of the manufacturing sector output in Nigeria.

Charles (2012) investigated the performance of monetary policy on manufacturing sector in Nigeria, using econometrics test procedures. The result indicated that money supply positively affect manufacturing index performance while company lending rate, income tax rate, inflation rate and exchange rate negatively affect the performance of manufacturing sector output in Nigeria.

Loto (2012) examined the determinants of output expansion in the Nigerian manufacturing industries between 1980 and 2010. He used the OLS method and discovered that the rate of inflation is critical in explaining manufacturing output expansion in Nigeria as at the sample period. The research found a positive relationship between output expansion and real GDP and per capita real GDP, while gross domestic capital formation, inflation, capacity utilization had a negative influence on output expansion in the manufacturing industry.

Ahmed (2012) analyzed the drivers of total factor productivity growth in the Malaysian food industries using a parametric statistical method. The analysis found that output growth in Malaysian food industries are affected by individual contribution to capital, labour and materials, as well as the combined contribution of the quality of these inputs expresses as total factor productivity growth (TFPG). The results for the food-manufacturing sector depict characteristically low productivity levels. The contribution of TFP growth for 13 out of 27 food industries was negative during the full period of analysis (1971-2000) and the sub-period 1987-2000. Eleven industries were found to have contributed negatively to TFPG over 1971-1979 and 1980- 1986. He concluded that the low productivity resulted from low quality of inputs into these food industries, which are input-driven rather than TFPG-driven.

The rate of firm exit in the Nigerian manufacturing sector prompted Sangosanya (2011) to investigate firm growth dynamics in Nigeria's manufacturing industry. He employed panel regression which emanated from the neo-classical, managerial and optimum firm's size theories and the Gibrat's Law of Proportionate Effect. Forty-five manufacturing firms quoted under the Nigerian Stock Exchange (NSE) between 1989 and 2008 were surveyed using multi-stage sampling technique. The analysis concluded that manufacturing firms finance mix, utilization of assets to generate more sales, abundance of funds reserve and government intervention as indicated by Tobin's Q, operating efficiency, capital reserve and government policies are significant determinants of manufacturing firms' growth in Nigeria.

Sehgal and Sharma (2011) employed different categories of organized sector manufacturing industries pooled data for the periods of 1981-1982 and 2007-2008 to investigate the inter-temporal and inter-industry comparison of total factor productivity of the manufacturing Sector in the state of Haryana, India. They measured total factor productivity by Malmquist productivity index - an application of Data Environment Analysis (DEA) which calculates the indices of total factor productivity (TFP) and its components including technology and efficiency changes. The study revealed that technical efficiency change was the key driver of total factor productivity in the manufacturing sector of Haryana during pre reforms period, however, the picture turned around during the post reforms period. A positive impact of trade liberalization policy on technological advancement of the manufacturing sector of the state was experienced.

Tkalec and Vizek (2009) investigated the impact of macroeconomics policies on manufacturing production in Croatia. The study used multiple regression to assess how personal consumption, investment, interest rates, the real effective exchange rate, government consumption, fiscal deficit and foreign demand affected the output of 22 manufacturing sectors. The analysis was conducted on quarterly data from 1998:1Q to 2008:3Q. The results suggested changes in fiscal conditions, the real effective exchange rate and personal consumption mostly affect low technological intensity industries. The study found that production in high technological intensity industries is, in general, elastic to changes in investments, foreign demand and fiscal policy. It was again found that fiscal policy seems particularly important for manufacturing output, both in terms of the magnitude of fiscal elasticities and shorter time lags. The study also found that production in low technological intensity industries on average increases with the exchange rate depreciation, while in high and medium-high technological intensity industries it contracts as a result of depreciation.

Ukoha (2000) examined the determinants of capacity utilization in the Nigerian manufacturing industry between 1970 and 1998. The study found that exchange rate, federal government capital expenditure on manufacturing and per capita real income had positive effects on manufacturing capacity utilization. However, inflation and loans and advances to manufacturing were found to have negative effect and concluded that improving capacity utilization in the

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

Nigerian manufacturing sector will enhance growth of the sector which will subsequently result in industrial development in Nigeria.

Tahma Siew Yean (1997) showed that while productivity growth in the Malaysian manufacturing sector was influenced positively by the rate of growth in output, exports and foreign direct investment, manufacturing sector productivity was negatively influenced by capital intensity.

Ray (1997) measured Malmquist productivity index for manufacturing sector in the different states in India for the period 1969-84 using a non parametric method of Data Environment Analysis (DEA). The measured Malmquist productivity index is decomposed to separate the contribution of technical change, change in technical efficiency and change in scale efficiency. The analysis depicted that in most of the states productivity decline is due to technical regress. The regression results further suggested that it was the greater urbanization and higher capital-labour ratio that could promote productivity in India. As against this higher incidence of industrial disputes and preponderance of non production workers can hinder the productivity growth.

In ascertaining the determinants of manufacturing output in Ghana for the period 1974-2006, Anaman and Osei-Amponsah (2009), using cointegration and error correction mechanism established a long-run relationship between manufacturing output and the level of per capita real gross domestic product (GDP), the export-import ratio and political stability. In the short-run, their study revealed that the level of output of manufacturing was driven by export-import ratio and political stability and thus stressed the importance of the growth of export-based manufacturing firms in stimulating manufacturing output in the country. The literature gap is that this study only considered total exports to total imports, per capita gross domestic product, real oil price and political stability as macroeconomic variables that affect manufacturing production in Ghana, but there is more macroeconomic variables to talk about or look at.

From the above empirical studies, not much research work has been done on the extent to which macroeconomic variables affect manufacturing production in Ghana. The only research work done on Ghana "Determinants of Output of the Manufacturing Industry in Ghana from 1974 to 2006" by Anaman and Osei-Amponsah (2009) did not consider other macroeconomic variables such as private sector credit, consumer price index, infrastructure, labour force, real exchange rate and fixed capital formation as part of their explanatory variables. To fill this literature gap, this study seeks to examine the extent to which private sector credit, consumer price index, infrastructure, labour force, real exchange rate and fixed capital formation influence manufacturing production in Ghana.

MATERIALS AND METHODS

A multivariate time series approach, vector autoreggresive (VAR), is used to determine whether private sector credit, consumer price index, telephone represent infrastructure, labour force, real gross domestic product per capita, real exchange rate and fixed capital formation in the macroeconomics environment affect the manufacturing value added output as percentage of GDP. The VAR model is specified as

$$mq_t = \alpha_1 + \sum_{i=1}^{p} \beta_1 mq_{t-i} + \sum_{i=1}^{p} \beta_2 lpscr_{t-i} + \sum_{i=1}^{p} \beta_3 lcpi_{t-i} + \sum_{i=1}^{p} \beta_4 ltel_{t-i} + \sum_{i=1}^{p} \beta_5 llab_{t-i} + \sum_{i=1}^{p} \beta_6 \lg dppc_{t-i} + \sum_{i=1}^{p} \beta_7 lrer_{t-i} + \sum_{i=1}^{p} \beta_8 \lg fcf_{t-i} + \varepsilon_{2t} \quad (1)$$

If the variables are found to be cointegrated then the dynamics can be represented in a vector error correction model (VECM) of the form:

$$\Delta mq_t = \alpha_1 + \sum_{i=1}^{p} \beta_1 mq_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta lpscr_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta lcpi_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta ltel_{t-i} + \sum_{i=1}^{p} \beta_5 \Delta llab_{t-i} + \sum_{i=1}^{p} \beta_6 \Delta \lg dppc_{t-i} + \sum_{i=1}^{p} \beta_7 \Delta lrer_{t-i} + \sum_{i=1}^{p} \beta_8 \Delta \lg fcf_{t-i} + \lambda ECM_{t-i} + \varepsilon_{2t} \quad (2)$$

where

Δ is the difference operator; β_i is the short-run coefficients; λ is the speed of the adjustment parameter; *mq* is manufacturing value added as percentage of gross domestic product (GDP); *lpscr* is log private sector credit (+); *lcpi* is log consumer price index (-); *ltel* is log telephone (+); *llab* is log labour (+); *lrgdppc* is log real gross domestic product per capita (+); *lrer* is log real exchange rate (-) and *lgfcf* is log fixed capital formation (+).

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

First, the study explore the relationship between the real gross domestic product per capita and manufacturing value added output as a percentage of GDP using scatter plot with the line of best fit, Pearson Correlation Coefficient and covariance matrix. The descriptive statistics and stationarity properties of all the variables (manufacturing value added as percentage of GDP, private sector credit, consumer price index, telephone, labour, real gross domestic product per capita, real exchange rate and fixed capital formation) of interest in the macroeconomics environment was established using the Augment Dicky Fuller (ADF) Test. If these variables are stationary and integrated of the same order then the Johansen's cointegration approach will be used to determine if the variables are cointegrated or not. If the variables are not cointegrated, then the VAR model will be estimated, however, if the variables are cointegrated then the VECM will be used to explore the dynamics among the variables. The data used in this study was sourced from World Development Indicators for Ghana from 1980 to 2012.

IV. RESULTS AND DISCUSSIONS

This table 1 shows summary statistics of all variables used in this study. From the table, the average manufacturing value added as percentage of gross domestic product (GDP) is 8.98 with standard deviation of 1.85. The skewness is a measure of departure from symmetry. From table, manufacturing value added as percentage of gross domestic product (GDP), private sector credit, consumer price index and fixed capital formation are positively skewed while telephone, labour, real gross domestic product per capita and real exchange rate are negatively skewed. The kurtosis is the measure of peakness or flatness of the data relative to the normal distribution. From table, the coefficients of the kurtosis of the variables show real exchange rate has peakness or lapto kurtic while private sector credit, consumer price index, telephone and labour have flat or plato-kurtic except manufacturing value added as percentage of gross domestic product (GDP), real gross domestic product per capita and fixed capital formation are most normally distributed.

Table 1. Descriptive Statistics of Variable under Consideration

	MQ	LPSCR	LCPI	LTEL	LLAB	LGDPPC	LRER	LGFCF
Mean	8.9818	0.8158	1.0872	-0.2343	1.737414	2.686540	2.254038	1.182093
Median	9.7300	0.7789	1.2856	-0.3497	1.737193	2.605305	2.100371	1.274158
Maximum	12.4000	1.2068	2.3502	0.2201	1.762679	3.204120	3.553883	1.462398
Minimum	3.7300	0.1875	-0.9431	-0.5391	1.713491	2.423246	1.938520	0.547775
Std. Dev.	1.8512	0.3320	0.9581	0.2964	0.015259	0.225426	0.422981	0.257227
Skewness	-0.9846	-0.3585	-0.4114	0.2855	0.036407	1.293347	1.845339	-1.106074
Kurtosis	3.5845	1.7739	2.0264	1.3328	1.734830	3.203396	5.366921	3.256748
Jarque-Bera	5.8012	2.7738	2.2343	4.2701	2.208190	9.256983	26.43219	6.819332
Probability	0.0550	0.2498	0.3272	0.1182	0.331511	0.009769	0.000002	0.033052
Sum	296.40	26.9203	35.878	-7.7333	57.33468	88.65582	74.38324	39.00908
Sum Sq. Dev.	109.67	3.5274	29.3741	2.8121	0.007451	1.626144	5.725208	2.117307
Observations	33	33	33	33	33	33	33	33

Source: Authors computation, 2014

The figure 4 below showed the scatter diagram with line of fit of real gross domestic product per capita and manufacturing value added as percentage of GDP for the period under consideration. From the figure, there is negative relationship between real gross domestic product per capita and manufacturing value added as percentage of GDP; as result increase in manufacturing value added as percentage of GDP leads to decrease in real gross domestic product per capita. This is confirmed by the negative Pearson correlation coefficient, $r = -0.3410$. Testing for the significance of the correlation coefficient, *r*, at 5 percent level of significant;

The null hypothesis, H_0: $\rho = 0$ (the population correlation coefficient is zero) against

The alternative one, H_1: $\rho > 0$. (the population correlation coefficient is greater than zero)

Rejected H_0 if the absolute value of t-calculated, t_{cal} is greater than t-critical $\left(t_{0.05,31} = 1.70 \right)$, otherwise accept H_0.

The t-calculated, $\left(t_{cal} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{-0.3410\sqrt{33-2}}{\sqrt{1-(-0.3410)^2}} = -2.020 \right)$.

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

Since the absolute value of the t-calculated (2.02) is greater than t-critical (1.7) at 5 percent level of significance, the null hypothesis which state that the population correlation coefficient is zero is rejected. Therefore, it conclude that the correlation between real gross domestic product per capita and manufacturing value added as percentage of GDP is statistically greater than zero. As a result, the inverse relationship between real gross domestic product per capita and manufacturing value added as percentage of GDP is statistically significant.

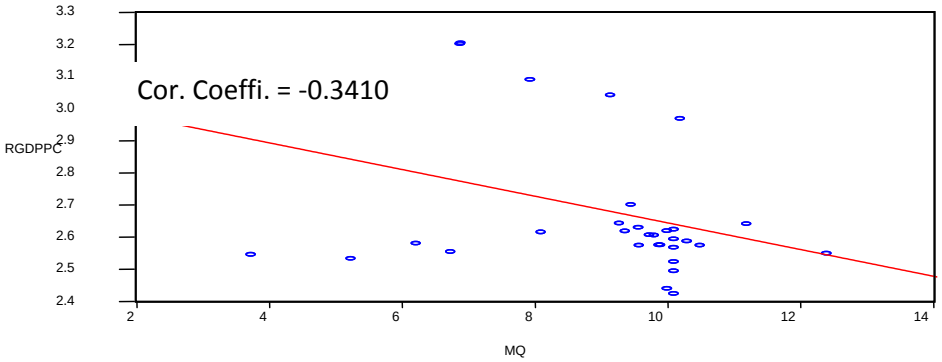


Fig 4: Scatter diagram for real gross domestic product per capita and manufacturing value added as % of GDP

Following the Pearson correlation coefficient the causal relationship between real gross domestic product per capita and manufacturing value added as percentage of GDP is explored using covariance matrix and the result is shown in table 2 below. From the covariance matrix result, the real gross domestic product per capita and manufacturing value added as percentage of GDP are negatively related. From the table, as real gross domestic product per capita increases by one unit, the manufacturing value added as percentage of GDP decreases by 0.015 unit and vice versa. Therefore, the study will investigate the macroeconomic factors that weigh the manufacturing value added as a percentage of GDP down.

Table 2: Covariance matrix for GDP per capita and manufacturing value added as a % of GDP

	LOG(GDPPC)	MQ
LOG(GDPPC)	0.040832	-0.01485
MQ	-0.014845	5.341671

Source: Authors computation, 2014

The time series characteristics of the macroeconomics variables whose impact are to be examined on the manufacturing value added as percentage of GDP are shown in the table 3 below. The Augmented Dickey-Fuller (ADF) test is used to examine the stationary of the variables under consideration. From the table, all the variables are stationary in their first differences at 5 percent level of significance. Therefore, all the variables; manufacturing value added as percentage of GDP, private sector credit, consumer price index, telephone, labour, real gross domestic product per capita, real exchange rate and fixed capital formation are integrated at first order, I(1). As a result, the Johansen's cointegration test can be used to examine whether long-run and short-run relationship exist among the variables.

Vector Autoregressive, VAR, is used to determine the optimal lag length for the Johansen cointegration test which is based on the AIC and SBC as shown in table 4 below. From the result, the optimal lag length based on both AIC and SBC is one. Using the selected optimal lag length of one, the likelihood ratio test which depends on the maximum Eigen values of the stochastic matrix of the Johansen (1991) procedure for exploring the number of cointegrating vectors is used.

Table 3. The Results of Augmented Dickey-Fuller Test (ADF) for Unit Root

	None			Constant			Constant and Trend		
Variable	Level t-obs	1st diff t-obs	Conc	Level t-obs	1st diff t-obs	Conc	Level t-obs	1st diff t-obs	Conc
mq	-0.5319	-4.9365	I(1)	-1.9939	-4.8492	I(1)	-1.9006	-4.1193	I(1)
p-value	0.4785	0		0.2879	0.0005		0.6309	0.0168	

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

Table 3 (cont). The Results of Augmented Dickey-Fuller Test (ADF) for Unit Root

	None			Constant			Constant and Trend		
Variable	Level t-obs	1st diff t-obs	Conc	Level t-obs	1st diff t-obs	Conc	Level t-obs	1st diff t-obs	Conc
lpscr	1.7551	-5.5977	I(1)	-1.436	-5.5978	I(1)	-2.6492	-5.7103	I(1)
p-value	0.9782	0		0.5515	0.0001		0.2628	0.0003	
lcpi	1.3636	-1.8623	I(1)	-3.262	-5.4183	I(1)	-1.3300	-3.9569	I(1)
p-value	0.9534	0.0606		0.0257	0.0001		0.8612	0.0227	
ltel	-1.2430	-6.6931	I(1)	-0.836	-6.8306	I(1)	-3.1341	-6.7125	I(1)
p-value	0.192	0		0.795	0		0.1189	0	
llab	19.9310	-0.3840		0.8550	-6.6049	I(1)	-2.9537	-6.5580	I(1)
p-value	1	0.5373		0.9935	0		0.1612	0	
lgdppc	1.4469	-4.1943	I(1)	0.5753	-4.3788	I(1)	-0.9031	-4.6805	I(1)
p-value	0.9602	0.0001		0.9867	0.0016		0.9434	0.0039	
lrer	-1.2089	-5.5922	I(1)	-1.5393	-5.8127	I(1)	-2.1708	-6.001	I(1)
p-value	0.2028	0		0.5012	0		0.4883	0.0001	
lgfcf	0.8246	-5.4220	I(1)	-1.4248	-5.6552	I(1)	-1.9495	-5.6645	I(1)
p-value	0.8848	0		0.5578	0.0001		0.6056	0.0003	

Source: Authors Computation, 2014

Table 4: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	305.0054	NA	1.20e-18	-18.56284	-18.19641	-18.44138
1	537.8535	334.7190*	3.54e-23*	-29.11584*	-25.81794*	-28.02268*

* indicates lag order selected by the criterion
LR:sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The result for cointegrating test is shown in table 5.

Table 5: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.977849	118.1064	52.36261	0.0000
At most 1 *	0.884091	66.80357	46.23142	0.0001
At most 2 *	0.843987	57.59232	40.07757	0.0002
At most 3	0.585766	27.32102	33.87687	0.2466
At most 4	0.463005	19.27474	27.58434	0.3936
At most 5	0.325525	12.20842	21.13162	0.5272
At most 6	0.166622	5.650317	14.26460	0.6584
At most 7	5.88E-05	0.001823	3.841466	0.9631

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

From the table, the Maximum Eigenvalue statistics show that there are three cointegrating vectors at 5 percent level of significance. The null hypothesis of zero cointegrating vectors is rejected against the alternative of one cointegrating vector. Similarly, the null hypothesis of at most one and at most two cointegrating vectors are also rejected against the alternative hypothesis. Therefore, it is concluded that there are three cointegrating vectors specified in the model.

The long-run relationships among the variables are shown in table 6 below. The result shows that in the long-run all the variables turn out to be significant except real gross domestic product per capita and fixed capital formation. From the result, in the long-run private sector credit impacted negatively on the manufacturing value added and this impact is inelastic, meaning that a greater change in private sector credit will lead to a smaller change in manufacturing output in Ghana. The result shows that as private sector credit increases by a percentage point, manufacturing value added as percentage of GDP will fall by 0.54 percentage point and it is statistically significant at the 5% significance level. This finding contradicts the finding of Odior (2013). This implies private sector credit weigh the manufacturing sector down. The reason could be due to the fact that access to private sector credit by the manufacturing sector does not go into productive investment like research and development (innovation and invention) that will bring further growth and development to the manufacturing sector of Ghana.

The consumer price index (general price level) impacted positively on the manufacturing value added as percentage of GDP and the impact is inelastic, meaning a greater change in the general price level will lead to a lesser change in manufacturing output in the long run. Hence, a percentage point rise in general price level will cause manufacturing value added as percentage of GDP to increase by 0.74 percentage point and it is statistically significant at the 5% level of significance. This finding is consistent with the findings of Ukoha (2000), Loto (2012) and Charles (2012). This finding supports that law of supply which states that, all other things being equal, the higher the price, the higher the quantity supplied because of the motive of profit maximization. This finding further implies that a moderate rate of inflation is good for the growth and the development of the manufacturing sector of Ghana in the long-run.

In addition, telephone (representing infrastructure development in the manufacturing sector) had a positive and significant impact on the manufacturing value added as percentage of GDP. This impact is inelastic, implying that a greater change in infrastructure development will lead to a less than proportionate change in manufacturing production in Ghana. As a result, a percentage point increases in telephone infrastructure will cause the manufacturing value added as percentage of GDP to increase by 0.29 percentage point. Therefore, infrastructure development is vital to the growth and the development of the manufacturing sector of Ghana. The labour force variable significantly impacted negatively on the manufacturing value added. This impact is elastic, meaning that a smaller change in the labour force will lead to a greater change in manufacturing production in Ghana. From the result, a percentage point increase in the labour force will cause the manufacturing value added as percentage of GDP to fall by 46.55 percentage point. This impact greatly weighs the manufacturing sector down.

The reason could be due to the fact that Ghana does not have the needed skilled labour force that will drive the growth process and the development of the manufacturing sector in Ghana. The real exchange rate also had significant and negative impact on the manufacturing value added as percentage of GDP in the long-run. The impact is inelastic. A percentage point increase in real exchange rate will cause 0.31 percentage point decline in manufacturing value added as percentage of GDP and it is statistically significant at the 5% significance level. This finding is consistent with the findings of Charles (2012), and contradicts the finding of Ukoha (2000). This finding means that higher levels of exchange rate between the local currency and the foreign currency will lead to an increase in the cost of production and hence, a lower level of output produced which will in totally affect manufacturing production adversely. Finally, the real gross domestic product per capita and fixed capital formation had positive and negative impact on the manufacturing value added as percentage of GDP, respectively. The finding of the former is consistent with the finding of Loto (2012). However, these impacts are not statistically significant at 5 percent level.

In sum, the macroeconomic variables such as private sector credit, labour force and real exchange rate significantly do not work in favour of the manufacturing sector in Ghana while consumer price index and infrastructure development significantly work in favour of the manufacturing sector in Ghana.

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

Table 6: Normalised Cointegrating Coefficients: 1 Cointegrating Equation(s)

	LPSCR	LCPI	LTEL	LLAB	LGDPPC	LRER	LGFCF
Coefficients	-4.8124	6.6786	2.6164	-418.108	-0.2897	-2.7675	0.3688
Stand. Error	0.8127	0.6078	0.5791	45.2835	0.6137	0.3916	0.7246
t-value	-5.9214	10.9882	4.5178	-9.2331	-0.4721	-7.067	0.509
Elasticity*	0.5358	0.7436	0.2913	46.55	0.0322	0.3081	0.0411

Source: Authors Computation, 2014

where $*\text{Elasticity} = \left(\frac{dY}{dX}.\frac{X}{Y}\right) = \beta_i\left(\frac{1}{Y}\right)$ *, (since the model is linear-log) Y is the mean of MQ=8.9818 and* β_i *is the respective coefficients.*

The short run dynamics among the variables are explored by vector error correction model (VECM). Error correction model allows the introduction of previous disequilibrium as independent variables in the dynamic behaviour of existing variables. Table 7 presents the short run dynamic relationship and the set of short run coefficients in the vector error correction model. VECM associates the changes in manufacturing value added as percentage of GDP to the change with the other lagged variables and the disturbance term of lagged periods. The coefficient of the speed of adjustment is negative and significant. This shows that there is about 96 percentage point adjustment taking place each year towards the long run periods. From the result, the past years manufacturing value added as percentage of GDP impacted positively and significantly on the current manufacturing value added as percentage of GDP. As a result, a percentage increase in the past years manufacturing value added caused the current manufacturing value added as percentage of GDP to increase by 0.31 percent. The past years private sector credit had a positive and significant impact on the current manufacturing value added as percentage of GDP and the impact is inelastic. Therefore, percentage point increase in the past years private sector credit caused manufacturing value added as percentage of GDP to increase by 0.33 percentage point. Therefore, private sector credit supported the manufacturing sector in Ghana in the short run.

In addition, the past years consumer price index had a negative and significant impact on the current manufacturing value added as percentage of GDP and the impact is inelastic. As a result, a percentage point increase in the past years consumer price index caused manufacturing value added as percentage of GDP to decrease by 0.31 percentage point. The past year telephone (representing infrastructure development) had a negative effect on the current manufacturing value added as percentage of GDP and the impact is inelastic but not significant. As a result, a percentage point increase in the past years telephone caused manufacturing value added as percentage of GDP to decrease by 0.12 percentage point. The past year labour force had a negative impact on the current manufacturing value added as percentage of GDP and the impact is elastic but not significant. Hence, a percentage point increase in the past years labour caused manufacturing value added as percentage of GDP to decrease by 4.03 percentage point.

Also, the past year real gross domestic product per capita had a negative effect on the current manufacturing value added as percentage of GDP and the impact is inelastic but not significant. As a result, a percentage point increase in the past years real gross domestic product per capita caused manufacturing value added as percentage of GDP to decrease by 0.15 percentage point. The past year real exchange rate had a negative and significant effect on the current manufacturing value added as percentage of GDP and the impact is inelastic. As a result, a percentage point increase in the past years real exchange rate caused manufacturing value added as percentage of GDP to decrease by 0.38 percentage point. The past year fixed capital formation had a negative effect on the current manufacturing value added as percentage of GDP and the impact is inelastic but not significant. As a result, a percentage point increase in the past years fixed capital formation caused manufacturing value added as percentage of GDP to decrease by 0.22 percentage point.

In sum, consumer price index and real exchange rate in the short-run weigh down the manufacturing sector value added significantly while private sector credit significantly work in favour of the manufacturing sector value added.

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

Table 8: The Result of Error Correction Model for Short Run Dynamics

Error Correction: D(MQ)	Coefficients	Standard Error	t-statistics	Elasticity*
The speed of adjustment	-0.95903	0.08529	[-11.2438]	
D(MQ(-1))	0.309099	0.07463	[4.14187]	0.309099
D(LPSCR(-1))	2.956507	1.1148	[2.65205]	0.329166
D(LCPI(-1))	-2.75181	1.41249	[-1.94820]	0.30638
D(LTEL(-1))	-1.09015	0.83637	[-1.30343]	0.12137
D(LLAB(-1))	-36.1987	221.284	[-0.16358]	4.03022
D(LGDPPC(-1))	-1.4313	1.27995	[-1.11824]	0.15935
D(LRER(-1))	-3.43268	0.60913	[-5.63542]	0.38218
D(LGFCF(-1))	-1.94867	1.09896	[-1.77320]	0.21696
C	0.282349	0.42039	[0.67164]	
	0.924343	0.891919	28.50762	
R-squared: 0.9243 Adj. R-squared:0.8919 F-statistic: 28.5076				

Source: Authors Computation, 2014

where *Elasticity $\left(= \frac{\mathrm{dY}}{\mathrm{dX}}\frac{\mathrm{X}}{\mathrm{Y}} \right) = \beta_i \left(\frac{1}{Y} \right)$ *, (since the model is linear-log) Y is the mean of MQ=8.9818 and* β_i *is the respective coefficients.*

POLICY RECOMMENDATIONS

Access to private sector credit should be improved and spending must go into productive investment such as research and development which will unearth new ways of doing things and enhancing value addition in terms of manufacturing output. The moderate inflationary trends that Ghana has chopped since the 2000s should be continued as general price level is favourable to manufacturing sector in the long run. Infrastructural facilities that enhance the activities of the manufacturing sector should be continued to be provider by the government. Training of the Ghanaian labour force by our educational institutions should be more of skilled and technical oriented. The monetary authorities should stabilise the exchange rate problem in Ghana.

CONCLUSION

The study examined the effect of macroeconomic variables on manufacturing production in Ghana. The study employed scatter diagram, Pearson correlation coefficient and covariance matrix to establish the relationship between real GDP per capita and manufacturing value added % of GDP, multivariate time series approach was also used investigate the problem. It was found out that all the variables considered are integrated of order one and Johansen's cointegration test was carried out and the result indicated that there exists both short-run and long-run relationship among the variables of interest, therefore, VECM was estimated. Based on the scatter diagram, Pearson correlation coefficient and covariance matrix it was found out that manufacturing value added as percentage of GDP and real gross domestic product per capita were negatively correlated. In the long-run, macroeconomic variables such as private sector credit, labour force, GDP per capita and real exchange rates were unfavoured to the manufacturing sector's growth and development while consumer price index and telephone (representing infrastructure development) and gross fixed capital formation are favourable for the expansion and development of the manufacturing sector of Ghana. There was about 96 percent point adjustment taking place each year towards the long run equilibrium. In the short-run, the past years consumer price index and real exchange rate were unfavourable to the growth and the development process of the manufacturing sector in Ghana while private sector credit was favourable. Finally, it is recommended that private sector credit to the manufacturing sector should be improved, training of labour force should be skill oriented and policies to stabilise the real exchange rate should be put in place to halt the down trending in manufacturing sector value added as percentage of GDP.

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com

REFERENCES

Ahmed, Elsadig Musa (2012), Malaysia's Food Manufacturing Industries Productivity Determinants, *Modern Economy, 2012, 3, 444-453,* doi:10.4236/me.2012.34057

Anaman, Kwabena A. and Osei-Amponsah, Charity (2009), Determinants of the Output of the Manufacturing Industry in Ghana from 1974 to 2006, Ghana Policy Journal Vol. 3, The institute of Economic Affairs, Accra, Ghana.

Charles, A. N. B. (2012). Investigating the Performance of Monetary Policy on Manufacturing Sector in Nigeria. Arabian Journal of Business and Management Review, 2(1): 12 – 25.

Diaku, I. (1972). A Capital Surplus Illusion: The Nigeria Case Revisited. The Nigerian Economic Society, pp. 135 – 145.

Eze, Onyekachi Richard and Ogiji, Festus O. (2013), Impact of Fiscal Policy on the Manufacturing Sector Output in Nigeria: An Error Correction Analysis, International Journal of Business and Management Review, Vol. 1, No. 3, pp. 35 – 55.

Fagerberg, J. and Verspagen, B (1999). 'Modern Capitalism in the 1970s and 1980s', in M. Setterfield ed., Growth, Employment and Inflation, Houndmills, Basingstoke, MacMillan.

Imoughele, L. E. (2014). Empirical Investigation of the Impact of Monetary Policy on Manufacturing Sector Performance in Nigeria: 1989 to 2012. International Journal of Education and Research, vol 2, No. 1, pp: 1 – 20.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and control,* 12: 231-254.

Katuria, V., and Raj, R.S.N. (2009), Is Manufacturing an Engine of Growth in India? Analyis in the Post Nineties, Paper for the UNU-WIDER/UNU-MERIT/UNIDO.

Kaliappa Kalirajan (2004), Is the Manufacturing Sector in India an Engine of Growth? Institute for Social and Economic Change, Working Paper 151

Odior, E.S. (2013). MACROECONOMIC Variables and the Productivity of the Manufacturing Sector in Nigeria: A static Analysis Approach. Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB), Vol., No. 5, pp:362-380.

Loto, M. A (2012), The Determinants of Output Expansion in the Nigerian Manufacturing Industries, Journal of Emerging Trends in Economics and Management Sciences (JETEMS) 3(6): 991-996 © Scholarlink Research Institute Journals, 2012 (ISSN: 2141-7024

Ray, S. C. (1997). Regional Variation in Productivity Growth in Indian Manufacturing: A Nonparametric Analysis, Journal of Quantitative Economics, 13 (1), pp. 73-94.

Schatz, S.P. (1964). Development Bank Lending. The Federal Loan Board. Oxford Universiy Press Ibadan.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. Quarterly Journal of Economics, No. 70. Pp 65 94.

Sundararajan, V. (1987). The Debt-equity ratio of firms and the Effectiveness of Interest Rate Policy. IMF Staff Papers, 34, (2): 260 – 310.

Sehgal, S and Sharma, S. K. (2011), Total Factor Productivity of Manufacturing Sector in India: A Regional Analysis for the State of Haryana, Int. J. Manag. Bus. Res., 1 (4), 241-256, Autumn 2011

Szimai and Verspagen (2011), Manufacturing and Economic Growth in Developing Countries,1950-2005, UNU-MERIT Working Paper 2011-069.

Szirmai, A. (2009). Industrialisation as an Engine of Growth in Developing Countries, 1950- 2005, UNU-MERIT working paper, 2009-10.

Sangosanya, Awoyemi O. (2011), Firms Growth Dynamics in Nigeria's Manufacturing Industry: A Panel Analysis, Journal of Applied Econometrics Review, Vol 1, No. 1, 2011, ISSN 2220-9441.

Taham, Siew Yean (1997), Determinants of Productivity Growth in the Malaysian Manufacturing Sector, ASEAN Economic Bulletin Vol. 13, No. 3, pp. 333-343
Published by: Institute of Southeast Asian Studies (ISEAS

Tkalec, M. and Vizek, M. (2009). The Impact of Macroeconomic Policies on Manufacturing Production in Croatia. Privredna kretanja i ekonomska politika 121/2009.

Tregenna, F. (2007), Which Sectors Can be Engines of Growth and Employment in South Africa?: An Analysis of Manufacturing and Services, Paper presented at the UNU-WIDER CIBS Conference.

Ukoha, O.O. (2000). Determinants of Manufacturing Capacity Utilization in Nigeria, 1970- 1998. The Nigeria Journal of Economics and Social Studies, 42(2): 121-130