

Original Research Article

Key Determinants of Inflation in Ghana

ABSTRACT

Inflation, and its deleterious effects on economies, has for long been the worry of governments especially among developing countries including Ghana. Several studies on the Ghanaian economy, have concluded that inflation in Ghana is purely a monetary phenomenon though in reality, the causes of inflation are numerous and vary. The main objective of this paper was to identify the key determinants of inflation in Ghana using the most recent monthly data from January 2000 to December 2014 (data period of 180 months). The study tested whether or not Crude Oil Price at the World Market, Exchange Rate, and Electioneering Spillover Quaternary Effects (ESQE) statistically affect inflation in Ghana either individually or jointly. The study found that crude oil price at the world market, exchange rate, and ESQE are key determinants of inflation in Ghana. The findings indicate a positive relationship between Crude Oil Price at the world market and Inflation, Cedi-Dollar Exchange Rate and Inflation as well as ESQE and Inflation (in the case ESQE, the study considered the first quarter of each post-election year within the data period). Each of the determinants: Crude Oil Price, Exchange Rate and ESQE was statistically significant at 1%. The study also indicated a high R-squared of more than 95% for the joint impact of all three determinants on inflation. This means that jointly, Crude Oil Price, Exchange Rate, and ESQE explain more than 95% of the variation in inflation in Ghana. The paper recommends further study into this subject matter by considering many other potential determinants of inflation in Ghana and the developing world as a whole.

Keywords: Inflation, Exchange Rate, Elections, Crude Oil Prices, Ghana

1. INTRODUCTION

Basic Economic theory indicates that prices of goods and services have enough power to deteriorate the purchasing power of the limited income and capital of individuals, households, firms and the central government[1][2]. Inflation has, for years, been one of the major obstacles of development for both developed and developing countries and is widely regarded as one of the most vital macroeconomic indicators[3][4]. It has gained much reputation and has become a major focus of economic policy appearing in yearly budgets of most countries[5]–[9][3], [4][10][11]. The developed countries have found some ways of limiting the adverse effect of inflation[12], [13][10], [11] but their developing counterparts still suffer from the snares of inflation[14]–[17]. Whereas most developed countries record single digit inflation values, more of the developing ones record double and sometimes triple digit inflation values. Ghana, Uganda, Sierra Leone and Zimbabwe are among the countries in Africa that has experienced triple and over inflation[14][10], [11], [18]. Inflation data reported by the Reserve Bank of Zimbabwe showed a yearly average of 52211.77% from 1999 until 2015, reaching an apex of 2660522.20% in July 2008 and a minimum of -7.50% in December of 2009[17][16], [19].

A major prerequisite to join the Economic Community of West African States (ECOWAS) common currency zone is to achieve a single-digit rate of inflation[3][20][21]. Regrettably, inflation has persistently remained above a single-digit mark in Ghana[3]. In a study of the determinants of inflation across different countries[22], it was found that the causes of inflation are numerous and vary from one country to the other; and that the forces that drive

the inflationary process are country-specific. The significance of establishing the determinants of inflation for any given country therefore cannot be overemphasized.

Most studies on the determinants of inflation in Ghana have all concluded that inflation in the country is purely monetary phenomenon; money supply by the central bank is the main driving force of inflation in Ghana[3][23][24][25]. However, studies have also shown that the determinants of inflation are numerous and vary from country to country[22]. Other findings and theories, for instance, cite electioneering activities as probable determinant of inflation especially during the early part of the post-election year[26][27][5], [9]. Researchers have attributed the rise in inflation after elections to pre-electoral expansionary policies by governments[28]. This study therefore considers among other factors, the after effects of elections on inflation in what is termed Electioneering Spillover Quaternary Effects (ESQE) in Ghana. Many studies on inflation in Ghana have relied on quarterly and yearly data to draw conclusions. Meanwhile, Quarterly or Yearly data have the capacity to overshadow actual effects of a variable since such data are normally multiple averages[29][30][31].

The main objective of this paper is to identify the key determinants of inflation in Ghana using the most recent monthly data from January 2000 to December 2014 (data period of 180 months). The study tests whether or not crude oil price at the world market, exchange rate, and Electioneering Spillover Quaternary Effects (ESQE) statistically affect inflation in Ghana either individually or jointly. The findings of this study will be invaluable insight to policy makers in fiscal policy management in Ghana and other countries

1.1 Literature Review

1.1.1 Crude Oil Prices and Inflation in Ghana

Crude oil has become an essential part of the Ghanaian economy[32]. Any Fluctuations in the world price of crude oil therefore has detrimental effects on the growth of the Ghanaian economy especially when the country is heavily dependent on imported crude oil to meet her energy needs[32].

Many describe the period between 1973 and 1983 as the dark years of the Ghanaian economy. The country within this period experienced a downward spiral in economic growth, high rates of inflation, shortage of goods and services among others[33][34][32]. These literature report a cumulative inflation rate reaching as high as 117% by 1977. This period, as reported, coincided with the first two oil price shocks experienced by the world economy as well as periods of political unsteadiness and economic maladministration in Ghana[32][34].

Globally, headline inflation started increasing in 2004 reflecting higher prices of crude oil.[7] Moreover, in its outlook for 2005, the Bank of Ghana expressed the likelihood that oil prices will increase in 2005 and contribute to the build-up of inflationary pressures[7]. In the view of the Bank of Ghana, oil price hikes is a dilemma for central banks in creating a stable economic policy[7]. This stems from the fact that higher oil prices not only push up inflation (thus calling for a rise in interest rates), but also stifle growth (necessitating rates to be lower than otherwise)[7]. The report also indicated that high oil prices had eroded some terms of trade gains of the nation even though Ghana's economy recorded the highest growth rate in twenty years with inflation declining significantly[7].

In a study to explore the long run and short run linkages between the world crude oil price and economic activity in Ghana, for the period January 1970 to April 2006, found that an unexpected oil price shock is followed by an increase in inflation rate and a decline in output in Ghana[35]. A similar study was conducted to investigate the impact of oil price change on real Gross Domestic Product growth, money supply and Consumer Price Index in Ghana using Structural Vector Autoregressive approach. The study revealed that oil price change has a lag effect on inflation. The study therefore concluded that oil price thus contribute to output growth, money supply and inflation volatilities[36].

Bank of Ghana reveals that headline inflation increased marginally by 0.26 percentage points in 2012[5]. The impact of crude oil prices on inflation in Ghana cannot be overstated. For instance, at 8.6 percent in January 2012, inflation rose to 9.5 percent by July 2012 on the back of among other factors, upward adjustment in petroleum prices earlier in the year[5]. Inflation subsequently declined to 8.8 percent by the end of 2012 as the price effects of the petroleum and exchange rate adjustments were offset by good staple harvests and tight monetary policy stance which countered potential inflationary pressures[5].

The effects of oil price increases on inflation is best explained through the use of an oil price change transmission model[32] as shown in Figure 1. Firstly, an increase in the international price of oil can affect an economy through an increase in the domestic price of the commodity[5], [6], [8], [9], [32]. In most developing countries, as has been the case in Ghana[32][7], the governments (through subsidies) only pass a portion of the price increase to the domestic consumers (as indicated in Figure 1 by link between oil subsidy and pass-through ratio)[32], [37]. Similarly, due to the changes in terms of trade that is likely to occur as a result of the oil price increase, the country's exchange rate will be affected and this is likely to affect the prices of commodities in the domestic market[5], [6], [14], [15], [24], [32], [38][39]. This is also indicated by the link between the exchange rate and pass-through ratio. Eventually, this proportion of the price increase (Pass-Through Ratio) that is passed onto the domestic market cause a rise in the level of inflation and subsequently lead to a rise in the cost of living and or production[32][24][37]. This phenomenon is indicated in Figure 1 by the link from international oil price to inflation, Producer Price Index(PPI), investment to long-term capacity utilization and interest rates and then to Gross Domestic Product(GDP).

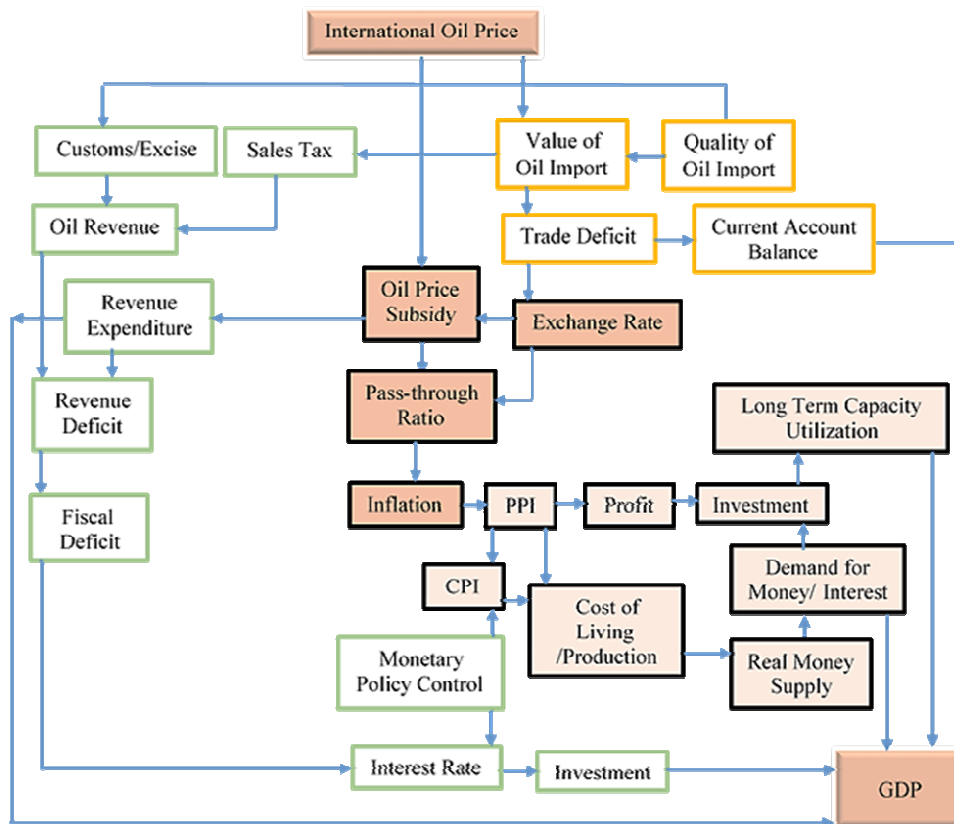


Figure 1: Transmission channels of oil price changes. Adapted from[32]

106 In the Assessment of Risks to the 2014 Inflation projections, Bank of Ghana Monetary Policy
107 Report indicated that the possible removal of government subsidies on utility and petroleum
108 products and subsequent upward adjustments in petroleum prices and its pass through
109 effect on prices was likely to induce some inflationary pressures[5]. The report also cites
110 domestic petroleum prices as a key microeconomic indicator in the assessment of
111 inflationary outlook for 2015[6]. On the impact of petroleum and utility prices adjustments on
112 inflation, the report was optimistic that the stabilizing international crude oil prices during the
113 third quarter of 2014 will weigh down on domestic petroleum prices and possible downward
114 effect on inflation[5].
115 Understanding the relationship between the world oil price and economic activity is important
116 because oil price increases lead to a rise in prices of petroleum products which serve as a
117 key production inputs and as an essential consumer goods[35][32]. These price increases
118 are considerable enough that they normally become temporary rise in the general rate of
119 inflation[35].

120 **1.1.2 Political Elections and Inflation in Ghana**

121 The Political Business Cycle (PBC) theory offers two distinct sets of political economy
122 models to explain the economic effects of elections: (i) the opportunistic models, and (ii) the
123 partisan models[26][40].

124 The Opportunistic PBC model predicts business cycles where incumbent governments try to
125 manipulate fiscal and monetary policy instruments, as election period approaches, so as to
126 increase their chances of being re-elected[26], [40], [41]. Tests of the opportunistic PBC
127 theory look for cycles in spending, deficits, and money growth, and seigniorage rather than
128 directly in inflation, unemployment, and growth[28], [41], [42]. This model has two important
129 results[26]. The first is a prediction of an increase in growth and a moderate increase in
130 inflation before the election period[26], [43]. The second is a permanent increase in inflation
131 after the election period even with contractionary aggregate demand policies[26], [43].

132 The second model; the partisan approach, in contrast, identifies a 'partisan' cycle in which
133 different parties, when in office, implement different policies[26], [40], [41][43]. For instance,
134 the left-wing party tackles unemployment, and the right-wing party fights inflation. The theory
135 predicts unemployment is permanently lower and inflation permanently higher during the
136 tenure of left-wing governments as compared with right-wing governments[41], [43]. That is
137 to say, Incumbents keep growth high and unemployment low just before an election. This
138 theory hereby predicts that a business cycle will be generated within the electoral cycle with
139 austerity after election and a thriving before the elections.

140 Empirical evidence for the Organization for Economic Co-operation and Development
141 (OECD) countries is rather consistent with the models of PBC theory[28]. Parallel studies
142 found that, in developed countries, economic policy is relatively loose in election years (with
143 low taxes and high spending)[27]. It has also been found that inflation tends to increase after
144 elections (probably because of pre-electoral expansionary policies)[28]. Furthermore,
145 evidence have also been found for political manipulation of fiscal instruments, particularly
146 transfers, only in some presidential elections. However, they report no electoral cycle in
147 taxes and spending within a term in office[44].

148 A longitudinal research conducted in India reports that economic activity in India lost pace
149 ominously over the past 30 years during a general election[45]. The report explains that
150 Government spending went up in an average election year, which tended to fuel inflation
151 rather than spur growth. The study found that, the average increase in nominal government
152 spending during election years is 15.84% compared with 11.38% for non-election years.
153 Average fiscal deficit for the election year is 5.87% compared with 5.08% for the non-
154 election years. The average inflation during election years is 8.56% since 1980, compared
155 with 7.55% for non-election years.

156 A few studies into political budget cycles for both developed and developing countries. have
157 anticipated finding more pronounced cycles in developing countries[42]. The studies noted
158 that less-consolidated democracies, have comparatively weaker institutions and fewer
159 controls on executive power and leads to manipulation of macroeconomic steering around
160 elections than in developed countries where structures are stronger and democracy is well-
161 established[42]. Researchers find African political systems more fragile due to the major
162 extensions of democracy[42][41]. A study using African data from the early 1980s and
163 1990s[41] reported that there is indeed averaging across African countries, a significant
164 propensity for government fiscal deficit to be higher in the years before election and reduced
165 thereafter. Other findings, similarly, show patterns of inflation to be correlated with political
166 events, prior to election which to them erodes macroeconomic management and brings
167 adverse effects to the economy at large[46]

168 The Opportunistic model seems to be the more relevant branch of the PBC theory for Africa,
169 given the characterization and the discourse in the preceding paragraphs[41]. Furthermore,
170 a study on Political Business Cycles, democratization and economic reform in Africa,
171 concluded that electoral and partisan incentives influence the structure of economic policy
172 making by governments[41]. This interaction between political and macroeconomic variables
173 in the election of new governments as the study explains, results in expenditures and halting
174 of policies that results in cycles of economic expansion and contraction that affect the
175 economic wellbeing of the people[41].

176 The International Monetary Fund (IMF), reported that the 1992 general elections in Ghana
177 that restored representative democracy to Ghana also encouraged the government to spend
178 excessively[47]. According to the report, concerned about the elections, the government
179 granted large salary increases, which worsened macroeconomic imbalances and rekindled
180 inflation[47]. The fiscal balance turned from a surplus of 1.8 percent of GDP in 1991 to a
181 deficit of 4.9 percent in 1992, financed by the banking system[47].

182 The Bank of Ghana praised the resilience of the Ghana economy in withstanding the 2004
183 election pressures, which in the past led to significant macroeconomic instability[7]. It also
184 cited a surge in government expenditure in the run-up to the national elections as one of the
185 key factors causing high inflation.[7], [8]. A similar trend was also reported after the 2012
186 general elections[9].

187 However opportunistic the African context may seem, a study has equally shown that pre-
188 election boost of the economy may or may not serve a useful political purpose for all
189 incumbents[48]. This is known to largely depend on whether the incumbent is a “dominant
190 party” or has potentially opposing political opponents (strong opposition). With the issue of
191 Ghana, this study conjecture that a pre-economic boost becomes necessary since the
192 slightest chance may end the power of the incumbent[49].

193 **1.1.3 Exchange Rates on Inflation in Ghana**

194 *1.1.3.1 Trend in Exchange rates and inflation in developing countries*

195 Exchange rates volatility have been identified as a major determinant of inflationary
196 pressures especially in developing economies[50]–[53]. A study on sources of inflation in
197 Developing Countries, reported that monetary growth and exchange rate are the typical
198 factors that relate to fiscal influences[18]. The report further explains that the impact of these
199 factors on the economies of developing countries depends largely on whether the exchange
200 rate regime is floating or fixed[18]. A related research on an assessment of exchange rate
201 regimes, inflation and growth in developing countries, equally show some form of association
202 between exchange rate regimes and inflation[54].

203 The findings of a study on output, inflation, and exchange rate in developing countries: an
204 application to Nigeria, show mixed results on the impact of the exchange rate depreciation

on the output[55]. Whereas the impulse response functions exerted an expansionary impact of the exchange rate depreciation on the output in both medium and long terms, the opposite was, however, observed for the short term horizon[55]. Other studies have also confirmed the empirical relationship between the level of the real exchange rate and the rate of consumer price inflation for Asia, Latin America and selected industrialized countries[35] [36].

The Global Economic Prospects (GEP) report of the World Bank analyzes the link between currency and inflation patterns across developing economies, based on estimates of the size and timing of the exchange rate pass-through in 45 middle and low income countries including Ghana[53]. The analysis concludes that currency-related price pressures are mainly concentrated in a few large middle income economies, including Ghana[53]. The report cites Ghana as one the countries that has seen the largest currency depreciations since 2012. This trend is depicted in Figure 2[53].

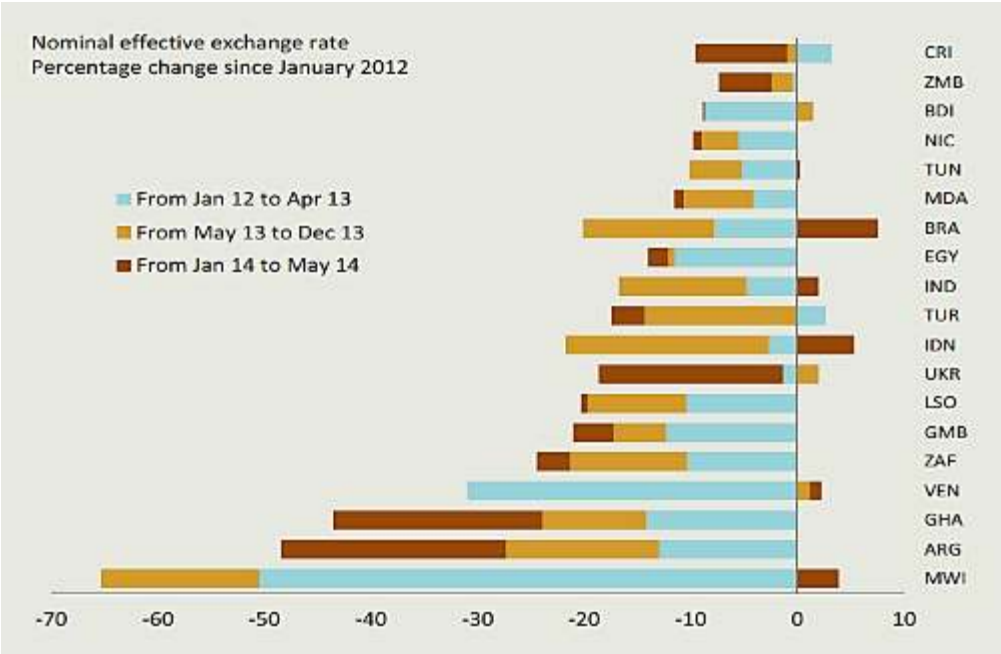


Figure 2: Countries having seen the largest currency depreciations since 2012[53]

In terms of annual average inflation, World Bank indicated that pressures resulting from past currency developments were still expected to build in 2014 in most regions (when compared with 2013[53]. This is shown in Figure 3[53].

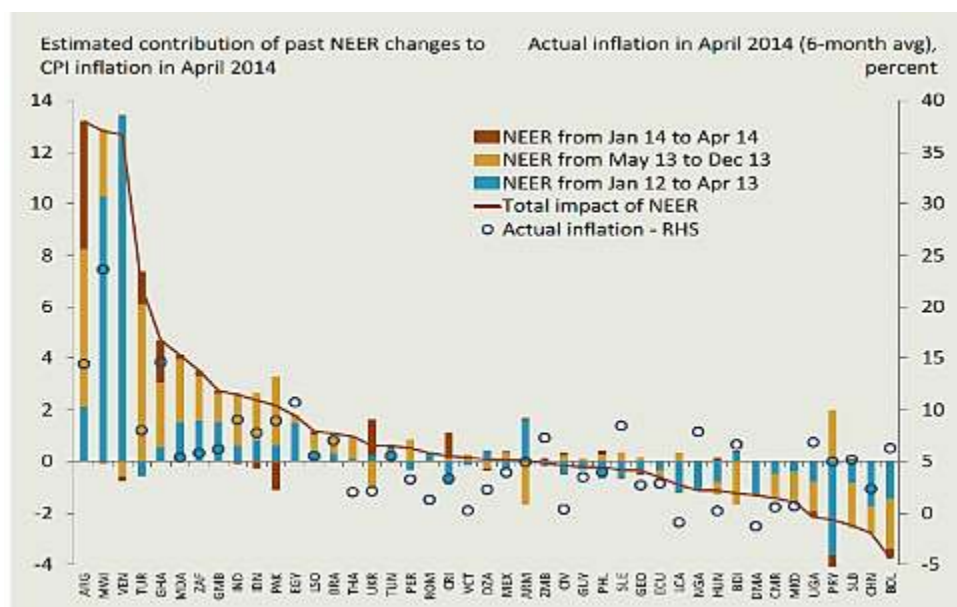


Figure 3: Exchange rate impact on current inflation (April 2014) across developing countries [53]

1.1.3.2 Trends in exchange rate and inflation in Ghana.

Obviously, Ghana has experienced unfavorable exchange rate trends over the years. This situation has not changed in recent times as the country continues to battle with the rapid depreciating of its currency. Figure 4 depicts an upward trend in the depreciation of the Ghana cedi against all the major currencies. The US dollar however showed a sharp upward trend from January 2012.

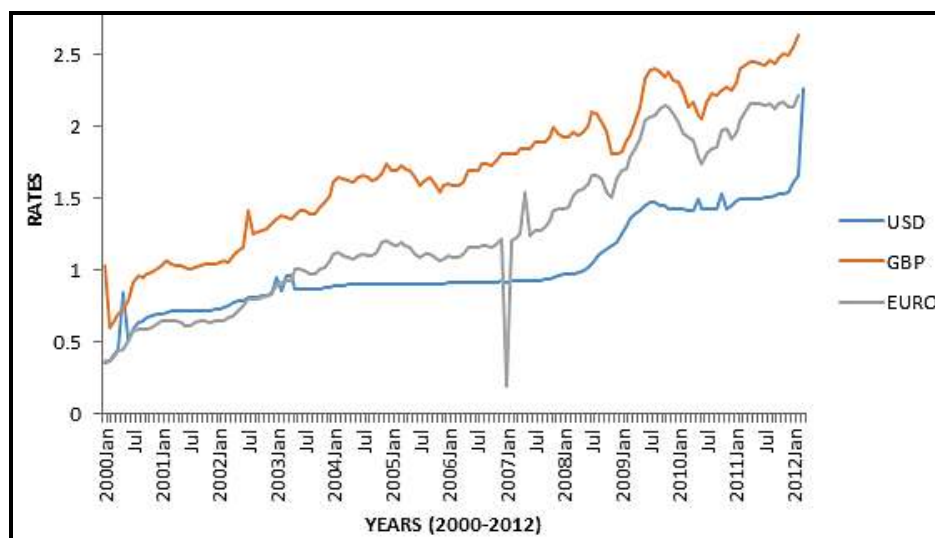


Figure 4: Trend in exchange rate in Ghana from 2000 to 2012[9]

Bank of Ghana reports a close relation between inflation and exchange rate[9]. Figure 5 shows the relationship between inflation and exchange rate movement. The pass through from depreciation to inflation is obvious over the years.

271 The general model using the aforementioned variables is:

$$272 \psi_t = f(R_t, E_t, C_t, \epsilon_t) \dots\dots\dots(1)$$

273 Where:

274 ψ = rate of inflation;

275 R = exchange rate (GHC to US\$);

276 C = crude oil price per barrel (in UD\$);

277 E = a measure of ESQE;

278 ϵ = the stochastic term which represent other relevant variables that were not
279 included in the equation;

280 t = time (from January 2000 to December 2014)

281 The unit of measurement is unique for each variable in the model. To normalise the
282 differences in the elements of each variable the natural log is used. Taking the natural log of
283 variables bridges the gap between and among variables and make them relatively uniform
284 and to reduce the possibility of Heteroskedasticity[63].

285 From the year 2000 to 2014, Ghana has had four (4) democratic elections: 2000, 2004, and
286 2008 and 2012. Pioneers of the opportunistic PBC theory have indicated a permanent
287 increase in inflation after the election period even with contractionary aggregate demand
288 policies[26]. A similar study equally found that inflation tends to increase after elections
289 (probably because of pre-electoral expansionary policies)[28]. This study therefore considers
290 the after effects of elections on inflation in what is termed Electioneering Spillover
291 Quaternary Effects (ESQE) in Ghana. The first quarter of the post-election year in Ghana is
292 therefore considered in this study for the variable ESQE.

293 In order to estimate the overall effect of ESQE on inflation, a new dummy variable defined
294 as:

295 $\bar{5} = 1$ if it is a first quarter of the post-election years (January to March of 2001, 2005, 2009,
296 2013)

297 0 otherwise

298 Incorporating the new variable into the general model (equation (1)) gives the specific model
299 below:

$$300 \ln\psi_t = \Omega_1 + \Omega_2 \ln R_t + \Omega_3 \ln C_t + \Omega_4 \bar{5} + \epsilon_t \dots\dots\dots(2)$$

301 Where:

302 Ω_1 measures the expected value (average) of inflation in non-election years
303 irrespective of the level of exchange rate and crude oil price;

304 Ω_2 measures the unique effect of exchange rate on inflation;

305 Ω_3 measures the unique effect of crude oil price on inflation;

306 Ω_4 measures the extent by which the expected value (average) of inflation in post-
307 election years (January to March of 2001, 2005, 2009, and 2013) differs from that of
308 the control group (non-election years).

309 Since from 2000 to 2014, Ghana has had four (4) elections (2000, 2004, 2008 and 2012), in
 310 order to introduce this effect into the model and to escape dummy variable trap, a total of
 311 three dummy variables were added to the general model in equation (1) above. These
 312 dummies are defined as:

313 Let $D_{2001} = 1$ if January 2001 to March 2001

314 0 otherwise

315 $D_{2005} = 1$ if January 2005 to March 2005

316 0 otherwise

317 $D_{2009} = 1$ if January 2009 to March 2009

318 0 otherwise

319 The last post-election year first quarter (January 2013 to March 2013) is used as the control
 320 group.

321 Adding the three dummies to the general model gives the following specific models:

322 $\ln \psi_t = \Omega_1 + \Omega_2 \ln R_t + \Omega_3 \ln C_t + \Omega_4 D_{2001} + \Omega_5 D_{2005} + \Omega_6 D_{2009} + \epsilon_t \dots\dots\dots (3)$

323 Where:

324 Ω_4 measures the extent by which the expected value (average) of inflation in the first
 325 quarter of 2001 post-election year differs from that of the control group (January
 326 2013 to March 2013);

327 Ω_5 measures the extent by which the expected value (average) of inflation in the first
 328 quarter of 2005 post-election year differs from that of the control group (January
 329 2013 to March 2013);

330 Ω_6 measures the extent by which the expected value (average) of inflation in the first
 331 quarter of 2009 post-election year differs from that of the control group (January
 332 2013 to March 2013);

333 In order not to violate the classical linear regression assumptions, multicollinearity,
 334 heteroskedasticity and first order autocorrelation were checked. The Variance Inflation
 335 Factor(VIF) was used to test for multicollinearity; Breusch–Pagan–Godfrey (BPG) test to test
 336 for the presence of heteroskedasticity; and the Breusch–Godfrey (BG) Test to test for first
 337 order autocorrelation. The BPG test was used because unlike the Goldfeld-Quandt test, the
 338 BPG does not depend on the number of central observations and the variable causing the
 339 heteroskedasticity[63].The BG test was used to test for first-order autocorrelation because
 340 unlike the Durbin-Watson tests, it allows for non-stochastic regressors and can also be used
 341 for higher order auto regressive schemes [AR (1), AR (2), etc.][63]. The Heteroskedasticity
 342 and autocorrelation were corrected using the Newey-West HAC (Heteroskedasticity and
 343 Autocorrelation Consistent) procedure. The Newey-West HAC procedure was used because
 344 it is strictly valid in large samples[63].

345 2.3 Prior expectations

346 It is expected that exchange rate, crude oil price and ESQE all have positive effect on
 347 inflation. As a country's currency deteriorate (larger values of exchange rate), it becomes
 348 expensive to import because importers need more of the local currency (Ghana Cedis) to
 349 exchange for the US dollar. All profit oriented importers will shift this high cost to the
 350 consumer by factoring the high import cost into the price they charge the final consumer; the
 351 higher the cost of import the higher the price of the commodity. This will make $\Omega_2 > 0$.

Crude oil has become an integral part of the Ghanaian economy. As the price of crude oil on the world market increase, it becomes expensive to produce goods and services because producers need to pay more to use the same level of oil it hitherto used. With profit as the ultimate aim of commercial companies, firms will shift this high cost to the ultimate consumer; the higher the cost of crude oil the higher the price of the commodity. This will make $\Omega_3 > 0$.

As indicated earlier, the pioneers of the Political Business Cycle (PBC) theory report an interaction between politics and microeconomic management during election years [26], [40]. Based on this model, the paper makes the following assumptions on the ESQE variable:

- i. Political parties spend more during election years;
- ii. The money they spend goes directly into people's pockets;
- iii. The beneficiaries of the money pumped into the economy do not use it for income generating activities; they save it for transactionary purposes;
- iv. The beneficiaries spend the money they received after they have finished voting.

More money in the hands of the public will increase aggregate demand; if aggregate supply is held constant – because it takes time to increase supply – the end result will be higher prices. It is therefore expected that $\Omega_4 > 0$.

2.4 Sources of data

This study used monthly data on all the variables. Although it is expensive – time and money – to get monthly data, it is better than a yearly data because monthly data are fast to compute, easier to model, easier to identify changes in trends, and is better for strategic long term forecasting [29]

All data used in this study were from secondary sources. Data on CPI were from Ghana Statistical Service (GSS) [33]. Data on exchange rate were extracted from Bank of Ghana (BoG) data bank [65]. Data on crude oil price per barrel were also extracted from US Energy Information Administration (EIA) databank [66].

2.5 Data analysis

To achieve the research objectives two general hypotheses were tested. First, the *t*-test was used to test individually three hypotheses that:

- i. $H_0: \Omega_2 = 0$; exchange rate has no significant effect on inflation;
 $H_a: \Omega_2 \neq 0$; exchange rate has significant effect on inflation.
- ii. $H_0: \Omega_3 = 0$; crude oil price has no significant effect on inflation;
 $H_a: \Omega_3 \neq 0$; crude oil price has significant effect on inflation.
- iii. $H_0: \Omega_4 = 0$; ESQE has no significant effect on inflation;
 $H_a: \Omega_4 \neq 0$; ESQE has significant effect on inflation.

Second, the *F* test was used to test for the overall effect of independent variables on inflation.

In all the tests, the *p*-value approach as well as the critical value approach were used in drawing conclusions. A 5% level of significance is used in the study.

3. RESULTS AND DISCUSSION

To ensure that the results do not violate the classical linear regression assumption, multicollinearity, heteroskedasticity, and autocorrelation (up to order one) were tested. Table 1 shows the results of the test of multicollinearity.

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400
401
402
403

Table 1: Variance Inflation Factors (VIFs)

$\ln R_t$	2.506
$\ln C$	2.542
D_{2001}	1.037
D_{2005}	1.005
D_{2009}	1.025

404 **Note:** $VIF(j) = 1 / (1 - R(j)^2)$, where $R(j)$ is the multiple correlation coefficient between variable j and the other
405 independent variables. Minimum possible value = 1.0. Values > 10.0 may indicate a multicollinearity problem

406 The results from Table 1 show that none of the variables has a VIF of 10 or more and hence
407 there is no problem of multicollinearity. Again, we tested for the presence of
408 heteroskedasticity and autocorrelation. The Breusch-Pagan-Godfrey test for
409 heteroskedasticity showed a test statistic of LM = 52.6315 with P -value = .0000. Using the P -
410 value approach, a value of .0000 is statistically lower than the level of significance used in
411 the study ($\alpha=0.05$). Hence, the null hypothesis that 'Heteroskedasticity not present' must be
412 rejected and therefore needs to be corrected.

413 The Breusch-Godfrey test for autocorrelation, AR (1) showed a test statistic of 929.643 with
414 P -value = .0000. Again, using the P -value approach, a value of .0000 is statistically lower
415 than the level of significance used in the study ($\alpha=0.05$). Hence, the null hypothesis of 'No
416 autocorrelation' must be rejected and therefore needs to be corrected.

417 To correct for heteroskedasticity and autocorrelation, the Newey-West HAC standard errors
418 procedure was used. The regression results of the heteroskedasticity and autocorrelation
419 corrected model is presented in Table 2. Although the Durbin-Watson statistic of 0.115213 is
420 suggestive of positive autocorrelation, the HAC procedure takes that into account and has
421 already corrected the OLS standard errors[63].
422

423 **Table 2: Regression Results**

	Coefficient(Ω_i)	Std. Error	t-ratio	p-value	
Constant	4.61672	0.17284	26.7110	<.00001	***
$\ln R_t$	0.348227	0.0652584	5.3361	<.00001	***
$\ln C$	0.188113	0.0421041	4.4678	.00001	***
D_{2001}	0.182444	0.0357776	5.0994	<.00001	***
D_{2005}	-0.17833	0.0191332	-9.3204	<.00001	***
D_{2009}	0.227487	0.0343405	6.6244	<.00001	***

424

R-squared	0.954028	Adjusted R-squared	0.952707
F(5, 174)	722.1870	P-value(F)	.000
		Durbin-Watson	0.115213

425 $n = 180$. Dependent variable: $\ln \pi_t$. ***, ** and * denote significance at 1%, 5% & 10% respectively

426 The regression results in Table 2 show that there is a positive relationship between
427 exchange rate and inflation; this result conforms to the expected relationship. It is also
428 consistent with the findings of other studies[50]–[52][18], [53], [58].The results show that a
429 one percent point increase in the Cedi-Dollar exchange rate, cause inflation to increase by
430 approximately 0.3482 percentage points, holding other factors constant. As the Ghanaian
431 Cedi depreciates – when more Cedis are exchanged for a United States dollar – the general
432 price level increases. The exchange rate is statistically significant at a 1% level.

433 The results from Table 2 also shows that there is a positive relationship between crude oil
434 price per barrel at the world market and inflation in Ghana. Similar to the exchange rate, this
435 result conform to the expected relationship. This is also consistent with the findings of other
436 studies[32], [35], [36]. The results is indicative that for any one percent increase in the crude
437 oil price at the world market, the general price level in Ghana increase by approximately
438 0.1881%, ceteris paribus. Although the magnitude of the effect that crude oil price has on
439 inflation is less than that of exchange rate, the two variables are individually statistically
440 significant at a 1% level.

441 Furthermore, Table 2 also shows that, all else equal, the average level of inflation in the first
442 quarter of 2013 (the controlled year) was 4.61672. The expected value of inflation in the first
443 quarters of 2001 and 2009 were all statistically and significantly higher (at 1% level) than that
444 of 2013 by 0.18244 and 0.227487 respectively. The results also show that the expected
445 value of inflation in the first quarter of 2005 was lower than that of 2013 by 0.17833 and the
446 difference is statistically significant at 1% level.

447 Again, the regression results in Table 2 depicts a high R-squared of 0.952707. Thus jointly,
448 exchange rate, crude oil price, and ESQE explain more than 95% of the variation in inflation.
449 Not only is the R-squared high, the test of overall significance showed a test statistic value of
450 722.1870 with a P -value = .0000. This means that aside the R-squared being high, the three
451 independent variables jointly have statistically significant effect on inflation in Ghana at 1%
452 level.

453 Once the results are free from violating the classical linear regression assumptions, the next
454 is to test for statistical significance of the ESQE variable. The result showed a t-test statistic
455 of 36.6355 and a P -value = .00001. There is therefore enough grounds to reject the null
456 hypothesis that 'ESQE has no significant effect on inflation' in Ghana.

457

458 4. CONCLUSION

459 The main objective of this paper was to identify the key determinants of inflation in Ghana
460 using the most recent monthly data from January 2000 to December 2014(data period of
461 180 months). The study tests whether or not crude oil price at the world market, exchange
462 rate, and Electioneering Spillover Quaternary Effects (ESQE) statistically affect inflation in
463 Ghana either individually or jointly.

464 The study found that crude oil price at the world market, exchange rate, and Electioneering
465 Spillover Quaternary Effects (ESQE) are key determinants of inflation in Ghana. The findings
466 indicate a positive relationship between Crude Oil price at the world market and inflation,
467 Cedi-Dollar exchange rate and inflation as well as Elections and inflation. Each of the
468 determinants: Crude Oil Price, Exchange rate and ESQE is statistically significant at 1%.

469 The study also showed a high R-squared of 0.952707. This means that jointly, exchange
470 rate, crude oil price, and ESQE explain more than 95% of the variation in inflation in Ghana.

471 The findings of this study are novel, very insightful and relevant to fiscal policy direction in
472 Ghana as well as in other developing countries. As indicated earlier, most studies on the
473 determinants of inflation in Ghana have all concluded that inflation in the country is purely

474 monetary phenomenon; money supply by the central bank is the main driving force of
475 inflation in Ghana[3], [23], [24][25]

476 The findings of this study however is contrary to that assertion. Not only is the R-squared
477 high in this study, but also indicative that the three independent variables jointly have
478 statistically significant effect on inflation in Ghana at a 1% level.

479 This paper agrees with the findings of a previous study of the determinants of inflation
480 across different countries, which found that the causes of inflation are numerous and vary
481 from one country to the other; and that the forces that drive the inflationary process are
482 country-specific[22]. The paper therefore recommends further study into this subject matter
483 by considering many other potential determinants of inflation in Ghana and the developing
484 world as a whole.

485

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