

Original Research Article

The Determinants of Inflation in Ghana: The Impact of Crude Oil Prices, Exchange Rate and Electioneering Spillover Quaternary Effects (ESQE)

ABSTRACT

Inflation and its effects on economies in the developing world has for long been the headache of governments of such countries. Ghana is not an exception to this challenge and researches have concluded that inflation in Ghana is purely a monetary phenomenon. However in reality the causes of inflation are numerous and vary. 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 (a sample size of 180). 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 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 (but in this case, during the first quarter of the post-election year). Each of the determinants: Crude Oil Price, Exchange rate and ESQE is statistically significant at 1%.The study showed a high R-squared of more than 95% for the joint impact of all three determinants on inflation. This means that jointly, exchange rate, crude oil price, and ESQE explain more than 95% of the variation in inflation in Ghana.The paper recommends further study into this subject matter while considering many other potential determinants of inflation.

Keywords: Inflation, Exchange rate, ESQE, Crude Oil Prices, Ghana

1. INTRODUCTION

Basis 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. 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[1]. It has gained much reputation and has become a major focus of economic policy appearing in yearly budgets of most countries. The developed countries have found some ways of limiting the adverse effect of inflation but their developing counterparts still suffer from the snares of inflation. Whereas most developed countries record single digit inflation values, more of the developing ones record double and sometimes triple digit inflation values. Ghana and Zimbabwe are among the countries in Africa that has experienced triple and over inflation (World Bank, 2014). Inflation data reported by the Reserve Bank of Zimbabwe showed a yearly average of 53081.99% from 1999 until 2015, reaching an apex of 2660522.20% in July 2008 and a minimum of -7.50% in December of 2009[2] (Trading Economic,2015).

30 A major prerequisite to join the Economic Community of West African States (ECOWAS)
31 common currency zone is to achieve a single-digit rate of inflation. Regrettably, inflation has
32 persistently remained above a single-digit mark in Ghana[1]. In a study of the determinants of
33 inflation across different countries[3], it was found that the causes of inflation are numerous
34 and vary from one country to the other; and that the forces that drive the inflationary process
35 are country-specific. The significance of establishing the determinants of inflation for any
36 given country therefore cannot be overemphasized.

37 Most studies on the determinants of inflation in Ghana have all concluded that inflation in the
38 country is purely monetary phenomenon; money supply by the central bank is the main
39 driving force of inflation in Ghana[1][4][5][6]. However, studies have also shown that the
40 determinants of inflation are numerous and vary from country to country[3]. Other findings
41 and theories, for instance, cite electioneering activities as probable determinant of inflation
42 especially during the early part of the post-election year[7][8][9], [10]. Researchers have
43 attributed the rise in inflation after elections pre-electoral expansionary policies by
44 governments[11]. This study therefore considers among other factors, the after effects of
45 elections on inflation in what is termed Electioneering Spillover Quaternary Effects (ESQE) in
46 Ghana. Many studies on inflation in Ghana have relied on quarterly and yearly data to draw
47 conclusions. Meanwhile, Quarterly or Yearly data have the capacity to overshadow actual
48 effects of a variable since such data are normally multiple averages.

49 The main objective of this paper is to identify the key determinants of inflation in Ghana
50 using the most recent monthly data from January 2000 to December 2014 (a sample size of
51 180). The study tests whether or not crude oil price at the world market, exchange rate, and
52 Electioneering Spillover Quaternary Effects (ESQE) statistically affect inflation in Ghana
53 either individually or jointly. The findings of this study will be invaluable insight to policy
54 makers in fiscal policy management in Ghana and other countries
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59 **1.1 Literature Review**

60 **1.1.1 Crude Oil Prices and Inflation in Ghana**

61 Crude oil has become an essential part of the Ghanaian economy. Any Fluctuations in the
62 world price of crude oil therefore has detrimental effects on the growth of the Ghanaian
63 economy especially when the country is heavily dependent on imported crude oil to meet her
64 energy needs[12].

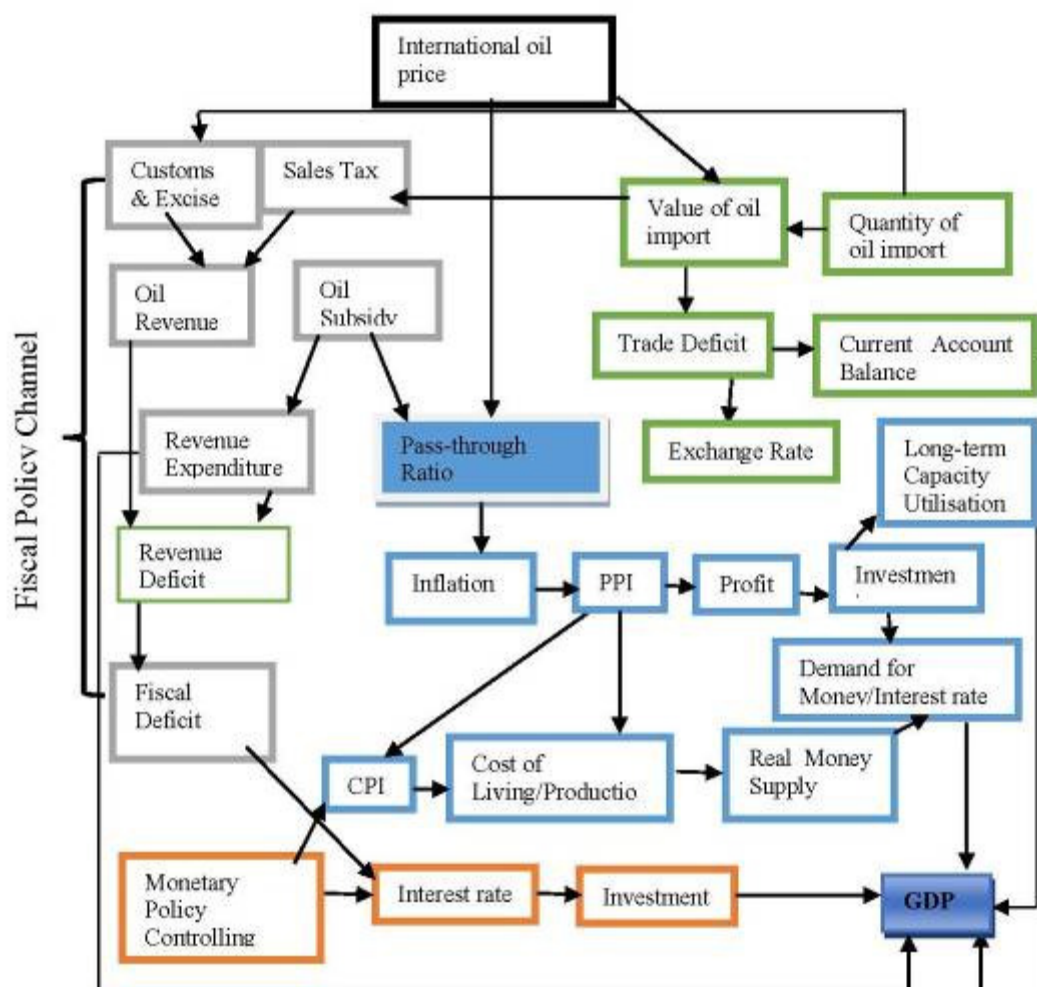
65 Many describe the period between 1973 and 1983 as the dark years of the Ghanaian
66 economy. The country within this period experienced a downward spiral in economic growth,
67 high rates of inflation, shortage of goods and services among others[13][14][12]. These
68 literature report a cumulative inflation rate reaching as high as 117% by 1977. This period, as
69 reported, coincided with the first two oil price shocks experienced by the world economy as
70 well as periods of political unsteadiness and economic maladministration in Ghana[12][14].

71 Globally, headline inflation started increasing in 2004 reflecting higher prices of crude oil.[15]
72 Moreover, in its outlook for 2005, the Bank of Ghana expressed the likelihood that oil prices
73 will increase in 2005 and contribute to the build-up of inflationary pressures. In the view of
74 the Bank of Ghana, oil price hikes is a dilemma for central banks in creating a stable
75 economic policy. This stems from the fact that higher oil prices not only push up inflation
76 (thus calling for a rise in interest rates), but also stifle growth (necessitating rates to be lower
77 than otherwise). The report also indicated that high oil prices had eroded some terms of trade
78 gains of the nation even though Ghana's economy recorded the highest growth rate in
79 twenty years with inflation declining significantly[15].

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[16]. 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. He therefore concluded that oil price thus contribute to output growth, money supply and inflation volatilities[17].

Bank of Ghana reveals that headline inflation increased marginally by 0.26 percentage points in 2012[9]. At 8.6 percent in January, 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. 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[9].

The effects of oil price increases on inflation is best explained through the use of an oil price change transmission model[12] 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 (the Price Channel). In most developing countries, as has been the case in Ghana[12][15], 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). Secondly, increase in oil prices, affects trade and the countries exchange rate which is likely to affect the prices of commodities in the domestic market. 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 production[12][5].



112
113 *Figure 1: Transmission channels of oil price changes*

114 In the Assessment of Risks to the 2014 Inflation projections, Bank of Ghana Monetary Policy
115 Report indicated that the possible removal of government subsidies on utility and petroleum
116 products and subsequent upward adjustments in petroleum prices and its pass through
117 effect on prices was likely induce some inflationary pressures[9]. The report also cites
118 domestic petroleum prices as a key microeconomic indicator in the assessment of
119 inflationary outlook for 2015. On the impact of petroleum and utility prices adjustments on
120 inflation, the report was optimistic that the stabling international crude oil prices during the
121 third quarter of 2014 will weigh down on domestic petroleum prices and possible downward
122 effect on inflation[9].

123 Understanding the relationship between the world oil price and economic activity is important
124 because oil price increases lead to a rise in prices of petroleum products which serve as a
125 key production inputs and as an essential consumer goods. These price increases are
126 considerable enough that they normally become temporary rise in the general rate of
127 inflation[16].

128
129

130 **1.1.2 Political Elections and Inflation in Ghana**

131 The Political Business Cycle (PBC) theory offers two distinct sets of political economy
132 models to explain the economic effects of elections: (i) the opportunistic models, and (ii) the
133 partisan models[7][18].The model predicts business cycles where incumbent governments
134 try to manipulate fiscal and monetary policy instruments, as election period approaches, so
135 as to increase their chances of being re-elected. That is to say, Incumbents keep growth
136 high and unemployment low just before an election. This theory hereby predicts that a
137 business cycle will be generated within the electoral cycle with austerity after election and a
138 thriving before the elections. The second model; the partisan approach, in contrast, identifies
139 a 'partisan' cycle in which different parties, when in office, implement different policies. For
140 instance, the left-wing party tackles unemployment, and the right-wing party fights inflation.
141 The theory predicts unemployment is permanently lower and inflation permanently higher
142 during the tenure of left-wing governments as compared with right-wing governments[19],
143 [20].

144 Opportunistic PBC model has two important results[7]. The first is a prediction of an increase
145 in growth and a moderate increase in inflation before the election period. The second is a
146 permanent increase in inflation after the election period even with contractionary aggregate
147 demand policies. Other findings also show patterns of inflation to be correlated with political
148 events, prior to election which to them erodes macroeconomic management and brings
149 adverse effects to the economy at large[21].

150 A study on Political Business Cycles, democratization and economic reform in Africa,
151 concluded that electoral and partisan incentives influence the structure of economic policy
152 making by governments[19]. This interaction between political and macroeconomic variables
153 in the election of new governments as the study explains, results in expenditures and halting
154 of policies that results in cycles of economic expansion and contraction that affect the
155 economic wellbeing of the people[19].

156 A longitudinal research conducted in India reports that economic activity in India lost pace
157 ominously over the past 30 years during a general election[22]. The report explains that
158 Government spending went up in an average election year, which tended to fuel inflation
159 rather than spur growth. The study found that, the average increase in nominal government
160 spending during election years is 15.84% compared with 11.38% for non-election years.
161 Average fiscal deficit for the election year is 5.87% compared with 5.08% for the non-
162 election years. The average inflation during election years is 8.56% since 1980, compared
163 with 7.55% for non-election years.

164 Empirical evidence for the Organization for Economic Co-operation and Development
165 (OECD) countries is rather consistent with the models of PBC theory. Parallel studies found
166 that, in developed countries, economic policy is relatively loose in election years (with low
167 taxes and high spending)[8]. It has also been found that inflation tends to increase after
168 elections (probably because of pre-electoral expansionary policies)[11].Furthermore,
169 evidence have also been found for political manipulation of fiscal instruments, particularly
170 transfers, only in some presidential elections. However, they report no electoral cycle in
171 taxes and spending within a term in office[23].

172 A few studies into political budget cycles for both developed and developing countries. have
173 anticipated finding more pronounced cycles in developing countries[24].They noted that less-
174 consolidated democracies, have comparatively weaker institutions and fewer controls on
175 executive power and leads to manipulation of macroeconomic steering around elections than
176 in developed countries where structures are stronger and democracy is well-established.
177 Researchers find African political systems more fragile due to the major extensions of
178 democracy. A study using African data from the early 1980s and 1990s[19] reported that

179 there is indeed averaging across African countries, a significant propensity for government
180 fiscal deficit to be higher in the years before election and reduced thereafter.

181 A study on African Political Business cycle has shown that pre-election boost of the
182 economy may or may not serve a useful political purpose for all incumbents[25]. This is
183 known to largely depend on whether the incumbent is a “dominant party” or has potentially
184 opposing political opponents (strong opposition). With the issue of Ghana, a pre-economic
185 boost becomes necessary since the incumbent acknowledges that the slightest chance, not
186 taken, would end their power.

187 The International Monetary Fund (IMF), reported that the 1992 general elections in Ghana
188 that restored representative democracy to Ghana also encouraged the government to spend
189 excessively. According to the report, concerned about the elections, the government granted
190 large salary increases, which worsened macroeconomic imbalances and rekindled inflation.
191 The fiscal balance turned from a surplus of 1.8 percent of GDP in 1991 to a deficit of 4.9
192 percent in 1992, financed by the banking system[26].

193 The Bank of Ghana praised the resilience of the Ghana economy in withstanding the 2004
194 election pressures, which in the past led to significant macroeconomic instability. It also cited
195 a surge in government expenditure in the run-up to the national elections as one of the key
196 factors causing high inflation.[15], [27]. A similar trend was also reported after the 2012
197 general elections[10].

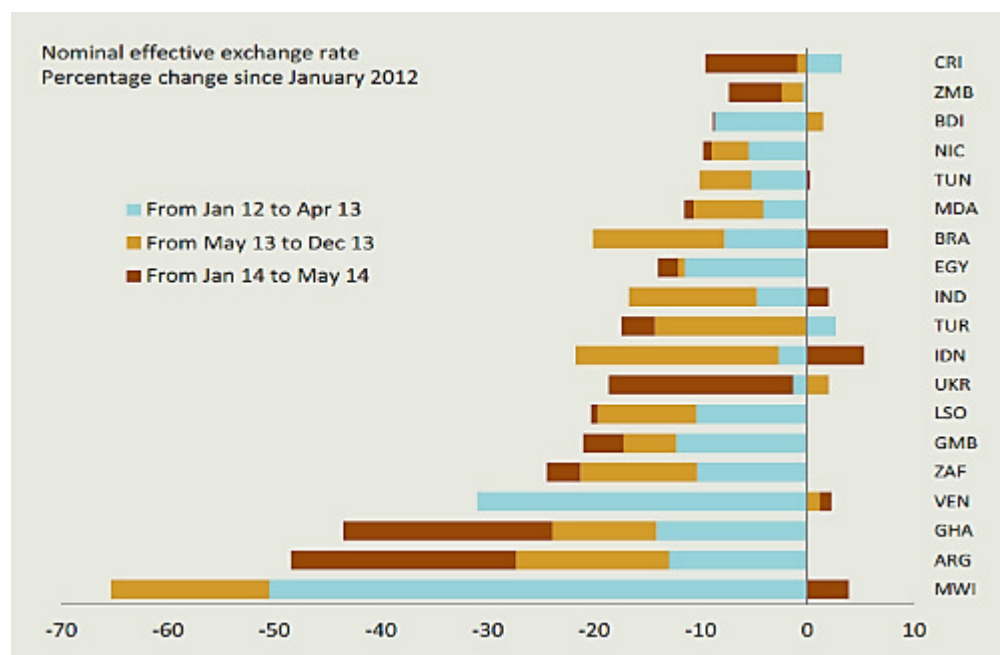
198 **1.1.3 Exchange Rates on Inflation in Ghana**

199 *1.1.3.1 Trend in Exchange rates and inflation in developing countries*

200 Exchange rates volatility have been identified as a major determinant of inflationary
201 pressures especially in developing economies[28]–[31]. A study on sources of inflation in
202 Developing Countries, reported that monetary growth and exchange rate are the typical
203 factors that relate to fiscal influences[32]. The report further explains that the impact of these
204 factors on the economies of developing countries depends largely on whether the exchange
205 rate regime is floating or fixed. A related research on an assessment of exchange rate
206 regimes, inflation and growth in developing countries, equally show some form of association
207 between exchange rate regimes and inflation[33].

208 The findings of a study on output, inflation, and exchange rate in developing countries: an
209 application to Nigeria, show mixed results on the impact of the exchange rate depreciation
210 on the output. Whereas the impulse response functions exerted an expansionary impact of
211 the exchange rate depreciation on the output in both medium and long terms, the opposite
212 was however observed for the short term horizon[34]. Other studies have also confirmed the
213 empirical relationship between the level of the real exchange rate and the rate of consumer
214 price inflation found for Asia, Latin America and selected industrialized countries[35] [36].

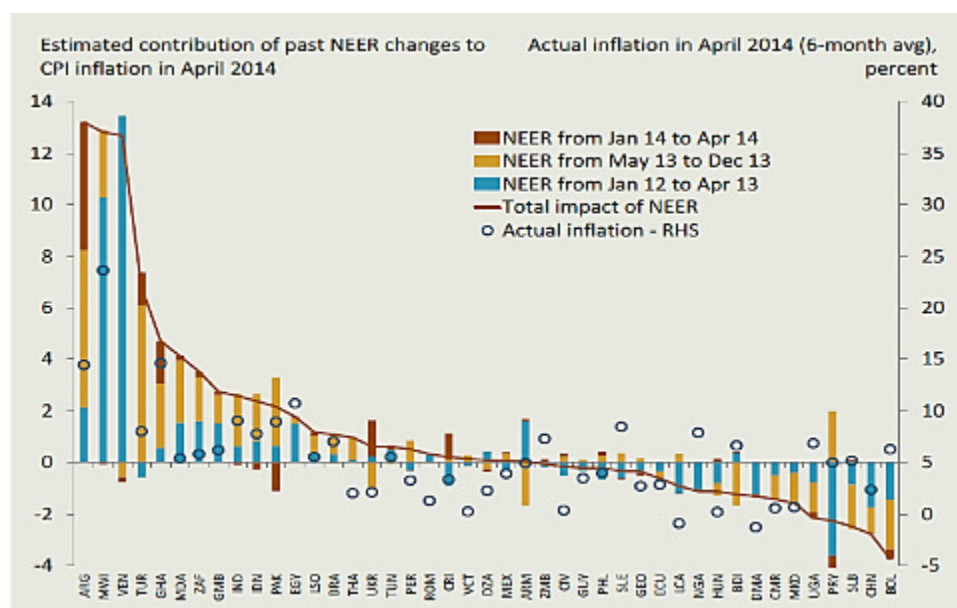
215 The Global Economic Prospects (GEP) report of the World Bank analyzes the link between
216 currency and inflation patterns across developing economies, based on estimates of the size
217 and timing of the exchange rate pass -through in 45 middle and low income countries
218 including Ghana. The analysis concludes that currency-related price pressures are mainly
219 concentrated in a few large middle income economies, including Ghana[31]. The report cites
220 Ghana as one the countries that has seen the largest currency depreciations since
221 2012. This trend is depicted in Figure 2.



222

223 *Figure 2: Countries having seen the largest currency depreciations since 2012(World Bank,*
224 *2014)*

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



228

229 *Figure 3: Exchange rate impact on current inflation (April 2014) across developing countries*
230 *(World Bank, 2014)*

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.

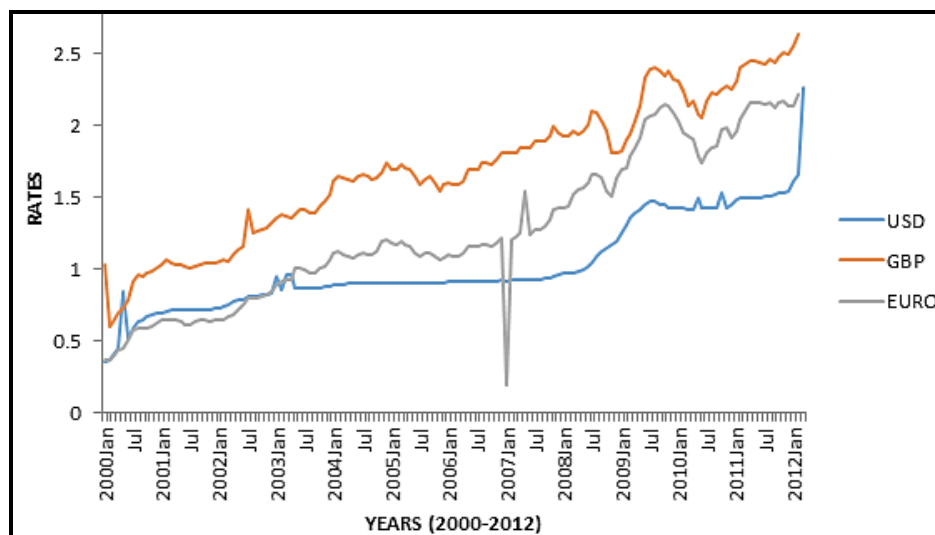


Figure 4: Trend in exchange rate in Ghana from 2000 to 2012(Bank of Ghana)

Bank of Ghana reports a close relation between inflation and exchange rate[10]. Figure 5 shows the relationship between inflation and exchange rate movement. The pass through from depreciation to inflation is obvious over the years.

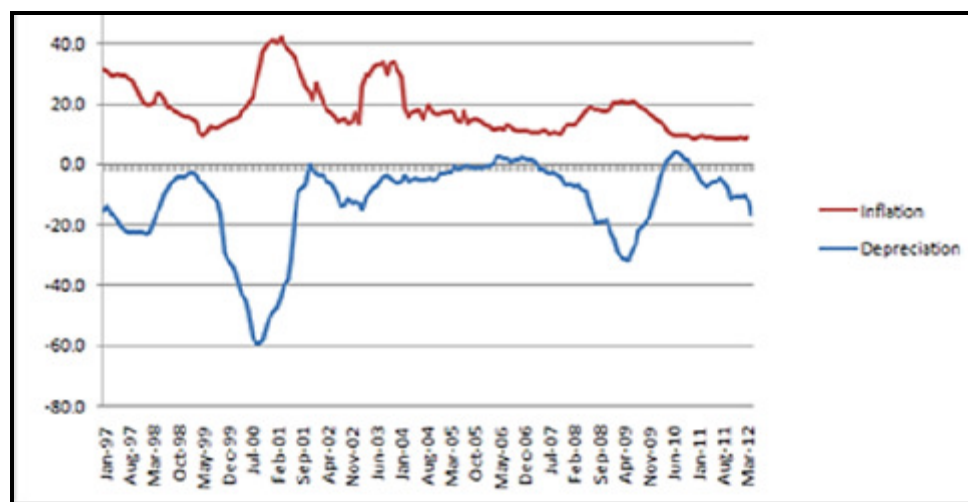


Figure 5: Inflation and Exchange rate(y/y), (Bank of Ghana, 2012)

1.1.3.3 The impact of exchange rate on Inflation in Ghana.

Exchange rate has been one of the most debatable effects of inflation in Ghana over the years. An increasingly high inflation rate in Ghana has been attributed to major devaluations of the official exchange rate[37]. The results of an empirical analysis conducted confirm the

fact that not only does monetary growth affect inflation but also exchange rate in a number of the Sub-Saharan African countries including Ghana[38]. The study concluded that both monetary growth and exchange rate impacted on inflation in Ghana with monetary policy having a higher impact. Moreover, a number study also indicated that, even though monetary policies has influenced the fluctuations in inflation of Ghana more than the exchange rate, policies that have the goal of stabilizing inflation must center on the stabilization of both the exchange rate and monetary policies[39]. Several other studies have concluded that indeed exchange rates have impacts on inflation in Ghana but have been sharply divided over the timing of the impact – whether long-term or short-term[28], [40], [41][42].

258

259 **2. RESEARCH METHODOLOGY**

260 **2.1 Method of Estimation**

261 The study uses Ordinary Least Squares (OLS) estimator to find the effects of the exchange
262 rate, crude oil price and ESQE on inflation in Ghana. The OLS is preferred because it is the
263 Best Linear Unbiased Estimator (BLUE); in the midst of unbiased linear estimators OLS has
264 the minimum variance, efficient and consistent[43].

265 **2.2 Model Specification**

266 Economic theory identifies a number of variables that lead to inflation and also measure
267 inflation using different variables. This paper uses growth rate of the Consumer Price Index
268 (CPI) as a proxy for inflation and it is the dependent variable. CPI is preferred because it has
269 a wider basket of goods and services than the Producer Price Index (PPI) or Gross
270 Domestic Product (GDP) deflator[44]. The independent variables are the exchange rate,
271 crude oil price at the world market (per barrel) and ESQE. Other factors such as money
272 supply, fiscal deficit, external debt, government expenditure, etc on Ghana were not used in
273 this study because data on such variables are only available quarterly, semi-annually or
274 annually. Taking a quarterly data and dividing it by three, or a semi-annually data and
275 dividing it by six, or annually data and diving it by twelve may lead to misleading results[43].

276 The general model using the aforementioned variables is:

$$277 \psi_t = f(\overline{\alpha}_t, \overline{\alpha}_t, \overline{\alpha}_t, \overline{\alpha}_t) \dots\dots\dots(1)$$

278 *Where:*

279 ψ = rate of inflation;

280 $\overline{\alpha}$ = exchange rate (GHC to US\$);

281 $\overline{\alpha}$ = crude oil price per barrel (in UD\$);

282 $\overline{\alpha}$ = a measure of ESQE;

283 $\overline{\alpha}$ = the stochastic term which represent other relevant variables that were not
284 included in the equation;

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

286 The unit of measurement is unique for each variable in the model. To normalise the
287 differences in the elements of each variable the natural log is used. Taking the natural log of
288 variables bridges the gap between and among variables and make them relatively uniform
289 and to reduce the possibility of Heteroskedasticity[43].

290 From the year 2000 to 2014, Ghana has had four (4) democratic elections: 2000, 2004, and
291 2008 and 2012. Pioneers of the opportunistic PBC theory have indicated a permanent
292 increase in inflation after the election period even with contractionary aggregate demand

293 policies[7]. A similar study equally found that inflation tends to increase after elections
 294 (probably because of pre-electoral expansionary policies)[11]. This study therefore considers
 295 the after effects of elections on inflation in what is termed Electioneering Spillover
 296 Quaternary Effects (ESQE) in Ghana. The first quarter of the post-election year in Ghana is
 297 therefore considered in this study for the variable ESQE.

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

300 $\bar{5} = 1$ if it is a first quarter of the post-election years (January to March of 2001, 2005, 2009,
 301 2013)
 302 0 otherwise

303 Incorporating the new variable into the general model (equation (1)) gives the specific model
 304 below:

$$305 \ln A_t = \Omega_1 + \Omega_2 \ln \bar{X}_t + \Omega_3 \ln \bar{K}_t + \bar{5}_t \bar{5} + \bar{\eta}_t \dots \dots \dots (2)$$

306 Where:

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

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

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

311 $\bar{5}$ measures the extent by which the expected value (average) of inflation in post-
 312 election years (January to March of 2001, 2005, 2009, and 2013) differs from that of
 313 the control group (non-election years).

314 It is worth noting that from 2000 to 2014, Ghana has had four (4) elections; 2000, 2004,
 315 2008, and 2012. To introduce this effect into the model and to escape dummy variable trap,
 316 a total of three dummy variables were added to the general model in equation (1) above.
 317 These dummies are defined as:

318 Let $\bar{X}_{2001} = 1$ if January 2001 to March 2001

319 0 otherwise

320 $\bar{Y}_{2005} = 1$ if January 2005 to March 2005

321 0 otherwise

322 $\bar{K}_{2009} = 1$ if January 2009 to March 2009

323 0 otherwise

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

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

$$327 \ln A_t = \Omega_1 + \Omega_2 \ln \bar{X}_t + \Omega_3 \ln \bar{K}_t + \Omega_4 \bar{X}_{2001} + \Omega_5 \bar{Y}_{2005} + \Omega_6 \bar{K}_{2009} + \bar{\eta}_t \dots \dots \dots (3)$$

328 Where:

329 Ω_1 measures the expected value (average) of inflation of the last post-election year
 330 first quarter (January 2013 to March 2013) irrespective of the level of exchange rate
 331 and crude oil price;

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

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

334 Ω_4 measures the extent by which the expected value (average) of inflation in the first
 335 quarter of 2001 post-election year differs from that of the control group (January
 336 2013 to March 2013);

337 Ω_5 measures the extent by which the expected value (average) of inflation in the first
 338 quarter of 2005 post-election year differs from that of the control group (January
 339 2013 to March 2013);

340 Ω_6 measures the extent by which the expected value (average) of inflation in the first
 341 quarter of 2009 post-election year differs from that of the control group (January
 342 2013 to March 2013);

343 In order not to violate the classical linear regression assumptions, multicollinearity,
 344 heteroskedasticity and first order autocorrelation were checked. The Variance Inflation
 345 Factor(VIF) was used to test for multicollinearity; Breusch–Pagan–Godfrey (BPG) test to test
 346 for the presence of heteroskedasticity; and the Breusch–Godfrey (BG) Test to test for first
 347 order autocorrelation. The BPG test was used because unlike the Goldfeld-Quandt test, the
 348 BPG does not depend on the number of central observations and the variable causing the
 349 heteroskedasticity[43].The BG test was used to test for first-order autocorrelation because
 350 unlike the Durbin-Watson tests, it allows for non-stochastic regressors and can also be used
 351 for higher order auto regressive schemes [AR (1), AR (2), etc.][43].

352 2.3 Prior expectations

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

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

365 As indicated earlier, the pioneers of the Political Business Cycle (PBC) theory report an
 366 interaction between politics and microeconomic management during election years[7], [18].
 367 Based on this model, the paper makes the following assumptions on the ESQE variable:

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

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

378 2.4 Sources of data

379 This study used monthly data on all the variables. Although it is expensive – time and money
 380 – 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[45]

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

2.5 Data analysis

To achieve the research objectives two general hypotheses were tested. First the *t* test was used to test individually five 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. $H_0: \mathcal{J} = 0$; ESQE has no significant effect on inflation;
 $H_a: \mathcal{J} \neq 0$; ESQE has significant effect on inflation.

Second the *F* test was used to test for the overall effect of independent variables on inflation. The hypothesis for the test from equation (2) above is as follows:

- $$H_0: \Omega_2 = \Omega_3 = \mathcal{J} = 0; \text{ exchange rate, crude oil price, and ESQE jointly has no statistically significant effect on inflation;}$$
- $$H_a: \Omega_2 \neq \Omega_3 \neq \mathcal{J} \neq 0; \text{ exchange rate, crude oil price, and ESQE, jointly has statistically significant effect on inflation.}$$

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

Applying OLS to the data collected using model (3) above yields the results in Table 1. The regression result shows that there is a negative relationship between exchange rate and inflation; this result deviates from the expected relationship. This means that as the Ghanaian cedi depreciates – with more cedis being exchanged for the US dollar – inflation falls. The results indicates that for any one percentage point increase in the cedi-dollar exchange rate, inflation in Ghana falls by approximately 0.181 percentage points, holding other factors constant. In other words the country's general price level decreases (deflates). It is worth noting that is statistically significant at a 10% confidence level.

Table 1: OLS regression results of model (3)

	Coefficient(Ω_{ij})	Std. Error	t-ratio	p-value	
constant	3.8179	0.293215	13.0208	<.00001	***
$\ln \mathcal{X}_t$	-0.180887	0.094271	-1.9188	.05665	*
$\ln \mathcal{X}_t$	0.392589	0.0737401	5.3239	<.00001	***
$\mathcal{X}_{2001}$	0.122688	0.209744	0.5849	.55934	
$\mathcal{X}_{2005}$	-0.227195	0.206557	-1.0999	.27289	
$\mathcal{X}_{2009}$	0.390033	0.208599	1.8698	.06319	*
R-squared	0.199697	Adjusted R-squared	0.176700		
F(5, 174)	8.683536	P-value(F)	.000		

415 $n = 180$. Dependent variable: $\ln\hat{\pi}_t$ ***, ** and * denote significance at 1%, 5% & 10% respectively.

416 The regression output in Table 1 also shows a positive relationship between crude oil price
417 and inflation. Unlike the exchange rate, this result conforms to the expected relationship. The
418 results show that for any one percent increase in the crude oil price, inflation in Ghana
419 increase by approximately 0.391 percentage points, holding other factors constant. The
420 magnitude of the effect of crude oil price on inflation is more than twice that of exchange
421 rate. This effect is also statistically significant at a 1% confidence level.

422 In terms of the Electioneering Spillover Quaternary Effects (ESQE) on inflation, the
423 regression results show that, holding other factors constant, the expected value of inflation in
424 the first quarter of 2013 (the controlled year) was 3.8179. The expected value of inflation in
425 the first quarter of 2001 and 2009 were higher than that of 2013 by 0.122688 and 0.390033
426 respectively. However, only the 2009 average was statistically higher than that of 2013 at
427 10% significance level. The results also show that the expected value of inflation in the first
428 quarter of 2005 was lower than that of 2013 by 0.227195 but such difference is not
429 statistically significant at 1%, 5%, and 10% levels.

430 The initial regression results as shown in Table 1, depicts a low R-squared. From the results
431 exchange rate, crude oil price, and ESQE jointly explain only 19.97% of the variation in
432 inflation. Although R-squared is low the test of overall significance showed a test statistic
433 value of 8.6835 with a P -value = .000. This means that though R-squared is low, the three
434 independent variables jointly have statistically significant effect on inflation.

435 Furthermore, to verify that the results do not violate the classical linear regression
436 assumption, multicollinearity, heteroskedasticity, and autocorrelation (up to order one) were
437 tested. Table 2 shows the results of the test of multicollinearity.

438 *Table 2: Variance Inflation Factors (VIFs)*

$\ln\hat{\pi}_t$	2.506
$\ln\mathcal{X}_t$	2.542
$\mathcal{X}_{2001}$	1.037
$\mathcal{Y}_{2005}$	1.005
$\mathcal{X}_{2009}$	1.025

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

441 The results from Table 2 show that none of the variables has a VIF of 10 or more and hence
442 there is no multicollinearity problem in the results. Again, we tested for the presence of
443 Heteroskedasticity and autocorrelation. The Breusch-Pagan-Godfrey test for
444 Heteroskedasticity showed a test statistic of LM = 52.6315 with P -value = .000. Using the P -
445 value approach, a value of 4.00328e-010 is statistically lower than the level of significance
446 used in the study ($\alpha=0.05$). Hence, the null hypothesis that 'Heteroskedasticity not present'
447 must be rejected and therefore needs to be corrected.

The Breusch-Godfrey test for autocorrelation, AR (1) showed a test statistic of 929.643 with P -value = .000. Again, using the P -value approach, a value of 1.73483e-071 is statistically lower than the level of significance used in the study ($\alpha=0.05$). Hence, the null hypothesis of 'No autocorrelation' must be rejected and therefore needs to be corrected. The regression results for the Heteroskedasticity-corrected and autocorrelation-corrected model is shown in Table 3.

Table 3: Regression Results for Heteroskedasticity and Autocorrelation corrected model

	<i>Coefficient(Ω_i)</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
constant	4.61672	0.17284	26.7110	<.00001	***
$\ln \bar{\pi}_t$	0.348227	0.0652584	5.3361	<.00001	***
$\ln \bar{\pi}_t$	0.188113	0.0421041	4.4678	.00001	***
$\bar{\pi}_{2001}$	0.182444	0.0357776	5.0994	<.00001	***
$\bar{\pi}_{2005}$	-0.17833	0.0191332	-9.3204	<.00001	***
$\bar{\pi}_{2009}$	0.227487	0.0343405	6.6244	<.00001	***
R-squared	0.954028	Adjusted R-squared	0.952707		
F(5, 174)	722.1870	P-value(F)	.000		
		Durbin-Watson	0.115213		

n = 180. Dependent variable: $\ln \bar{\pi}_t$. ***, ** and * denote significance at 1%, 5% & 10% respectively

Contrary to the initial results in Table 1, the regression results of Table 3 show that there is a positive relationship between exchange rate and inflation; this result conforms to the expected relationship. It is also consistent with the findings of other studies[28]–[30][31], [32], [38]. The results show that a one percent point increase in the cedi-dollar exchange rate, cause inflation to increase by approximately 0.348 percentage points, holding other factors constant. As the Ghanaian cedi depreciates – when more cedis are exchanged for a United States dollar – the general price level increases. The Exchange rate is statistically significant at a 1% level.

The results from Table 3 also shows that there is a positive relationship between crude oil price per barrel at the world market and inflation in Ghana. Similar to the exchange rate, this result conform to the expected relationship. This is also consistent with the findings of [12], [16], [17]. The results is indicative that for any one percent increase in the crude oil price at the world market, the general price level in Ghana increase by approximately 0.188%, ceteris paribus. Although the magnitude of the effect that crude oil price has on inflation is less than that of exchange rate, they two variables are individually statistically significant at a 1% level.

Furthermore, Table 3 also shows that, all else equal, the average level of inflation in the first quarter of 2013 (the controlled year) was 4.61672. The expected value of inflation in the first quarters of 2001 and 2009 were all statistically and significantly higher (at 1% level) than that of 2013 by 0.18244 and 0.227487 respectively. The results also show that the expected value of inflation in the first quarter of 2005 was lower than that of 2013 by 0.17833 and the difference is statistically significant at 1% level.

Again, the regression results in Table 3 depicts a high R-squared. Thus jointly, exchange rate, crude oil price, and ESQE explain more than 95% of the variation in inflation. Not only is the R-squared high, the test of overall significance showed a test statistic value of 722.1870 with a P -value = .000. This means that aside the R-squared being high, the three

independent variables jointly have statistically significant effect on inflation in Ghana at 1% level. The Durbin-Watson test confirm it that there is no autocorrelation in the results.

Once the results are free from violating the classical linear regression assumptions, the next is to test for statistical significance of the ESQE variable. The result showed a t-test statistic of 36.6355 and a P -value = .000. There is therefore enough grounds to reject the null hypothesis that 'ESQE has no significant effect on inflation' in Ghana.

491

492 **4. CONCLUSION**

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(a sample size of 180). 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 study found that crude oil price at the world market, exchange rate, and Electioneering Spillover Quaternary Effects (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 Elections and inflation (but in this case, during the first quarter of the post-election year). Each of the determinants: Crude Oil Price, Exchange rate and ESQE is statistically significant at 1%.

The study showed a high R-squared of more than 95% for the impact of all three determinants on inflation. This means that jointly, exchange rate, crude oil price, and ESQE explain more than 95% of the variation in inflation in Ghana.

The findings of this study are novel, very insightful and relevant to fiscal policy direction in Ghana as well as in other developing countries. As indicated earlier, 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[1], [4], [5][6]

The findings of this study however is contrary to that assertion. Not only is the R-squared high in this study, but the test of overall significance showed a test statistic value of 722.1870 with a P -value =.000. This means that aside the R-squared being high, the three independent variables jointly have statistically significant effect on inflation in Ghana at a 1% level.

This paper agrees with the findings of a previous study of the determinants of inflation across different countries, which 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[3]. The paper therefore recommends further study into this subject matter while considering many other potential determinants of inflation.

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523 **REFERENCES**

[1] G. Adu and G. Marbuah, "Determinants of Inflation in Ghana: an Empirical Investigation," *South African J. Econ.*, vol. 79, no. 3, pp. 251–269, 2011.

[2] B. Mandizha, "Inflation and Exchange Rate Depreciation: A Granger Causality Test at the Naissance of Zimbabwe's Infamous Hyperinflation(2001-2005)," *Econ. Financ. Rev.*, vol. 3, no. 09, pp. 22–42, 2014.

- 529 [3] M. Campillo and J. A. Miron, "Why Does Inflation Differ Across Countries?," in
530 *Reducing Inflation: Motivation and Strategy*, Chicago: University of Chicago Press,
531 1997, pp. 335–357.
- 532 [4] F. Ahiakpor, "Rethinking about Determinants of Inflation in Ghana: Which
533 Econometric Model Tell the True Story," *Eur. J. Bus. Manag.*, vol. 6, no. 6, pp. 78–86,
534 2014.
- 535 [5] S. Frimpong and A. Adam, "Exchange rate pass-through in Ghana," *Int. Bus. Res.*,
536 vol. 3, no. 2, pp. 186–192, 2010.
- 537 [6] A. Chiaraah and P. K. Nkegbe, "GDP Growth, Money Growth, Exchange Rate and
538 Inflation in Ghana," *J. Contemp. Issues Bus. Res.*, vol. 3, no. 2, pp. 75–87, 2014.
- 539 [7] W. D. Nordhaus, "The Political Business Cycle," *Rev. Econ. Stud.*, vol. 42, no. 2, pp.
540 169–190, 1975.
- 541 [8] A. Alesina, N. Roubini, and G. D. Cohen, *Political Cycles and the Macroeconomy*.
542 Cambridge, MA: MIT Press, 1997.
- 543 [9] Bank of Ghana, "Bank of Ghana Monetary Policy Report: Inflation Outlook &
544 Analysis," Accra, 2013.
- 545 [10] Bank of Ghana, "BANK OF GHANA Annual Report 2012," Accra, 2012.
- 546 [11] A. Alesina and N. Roubini, "Political Cycles in OECD Economies," *Rev. Econ. Stud.*,
547 vol. 59, no. 4, pp. 663–688, 1992.
- 548 [12] W. Cantah, "Crude oil price and economic growth: the case of Ghana," in *CSAE*
549 *Conference 2014: Economic Development in Africa*, 2014, pp. 1–22.
- 550 [13] E. Hutchful, "Ghana's Adjustment Experience: The Paradox of Reform," *J. Contemp.*
551 *African Stud.*, vol. 21, no. 3, pp. 489–502, 2003.
- 552 [14] E. Aryeetey and R. Kanbur, "Ghana's Post-Independence Economic Growth 1960-
553 2000," in *The Economy of Ghana: Analytical Perspectives on Stability, Growth &*
554 *Poverty*, R. Kanbur, Ed. Oxford: James Currey, 2008, pp. 36–77.
- 555 [15] Bank of Ghana, "Bank of Ghana Annual Report," pp. 25–27, 2004.
- 556 [16] G. Tweneboah and A. M. Adam, "Implications of Oil Price Shocks for Monetary Policy
557 in Ghana: A Vector Error Correction Model," *Munich Pers. RePEc Arch. Pap.*, no.
558 11968, pp. 1–21, 2008.
- 559 [17] D. M. Aanye, "What is the Impact of Oil Price Change on Ghana's Economy?,"
560 *CAR(CEPMLP) Annu. Rev.*, vol. 17, pp. 1–20, 2012.
- 561 [18] A. Lindbeck, "Stabilization Policy in Open Economies with Endogenous Politicians,"
562 *Am. Econ. Rev.*, vol. 66, no. 2, pp. 1–19, 1976.

- 563 [19] S. A. Block, "Political Business Cycles, Democratization, and Economic Reform: The
564 Case of Africa," *J. Dev. Econ.*, vol. 67, no. 1, pp. 205–228, 2002.
- 565 [20] D. A. Hibbs, "Political Parties and Macroeconomic Policy," *Am. Political Sci. Rev.*, vol.
566 71, no. 4, pp. 1467–1487, 2012.
- 567 [21] S. Haggard and R. Kaufman, "The Political Economy of Inflation and Stabilization in
568 Developing Countries," *Econ. Dev. Cult. Change*, vol. 42, no. 2, p. 235, 1994.
- 569 [22] P. Bhattacharya and R. Krishnan, "How do elections affect the economy?," 2014.
570 [Online]. Available:
571 [http://www.livemint.com/Politics/RRDNEebSEiPECEiclpqZmM/How-do-elections-](http://www.livemint.com/Politics/RRDNEebSEiPECEiclpqZmM/How-do-elections-affect-the-economy.html)
572 [affect-the-economy.html](http://www.livemint.com/Politics/RRDNEebSEiPECEiclpqZmM/How-do-elections-affect-the-economy.html). [Accessed: 06-Mar-2015].
- 573 [23] W. R. Tufte, *Political Control and the Economy*. Princeton, New Jersey: Princeton
574 University Press, 1980.
- 575 [24] A. Brender and A. Drazen, "Political budget cycles in new versus established
576 democracies," *J. Monet. Econ.*, vol. 52, no. 7, pp. 1271–1295, 2005.
- 577 [25] P. Mosley and B. Chiripanhura, "The African Political Business Cycle: Varieties of
578 Experience," Sheffield, No. 2012002, 2012.
- 579 [26] S. P. Leite, A. Pellechio, L. Zanforlin, G. Begashaw, S. Fabrizio, and J. Harnack,
580 "Ghana: Economic development in a democratic environment," *IMF Occas. Pap.*, no.
581 199, pp. 1–83, 2000.
- 582 [27] Bank of Ghana, "Bank of Ghana Annual Report," Accra, 2008.
- 583 [28] M. Bawumia and P. Abradu-Otoo, "Monetary Growth, Exchange Rates and Inflation
584 in Ghana: An Error Correction Analysis," *Bank Ghana Work. Pap. Ser.*, vol. 2003, no.
585 05, pp. 1–15, 2003.
- 586 [29] J. A. Reyes, "Exchange Rate Pass-through Effect and Inflation Targeting in Emerging
587 Economies : What is the Relationship ?," *Rev. Int. Econ.*, vol. 15, no. 3, pp. 538–559,
588 2007.
- 589 [30] A. R. Sanusi, "Exchange Rate Pass-Through to Consumer Prices in Ghana :
590 Evidence," *West African J. Monet. Econ. Integr.*, vol. 10, no. 1, pp. 25–47, 2010.
- 591 [31] World Bank, *Global Economic Prospects (GEP)*, vol. 9. Washington DC: The World
592 Bank, 2014.
- 593 [32] P. Loungani and P. Swagel, "Sources of Inflation in Developing Countries,"
594 WP/01/198, 2001.
- 595 [33] M. Bleaney and M. Francisco, "Exchange Rate Regimes, Inflation and Growth in
596 Developing Countries -- An Assessment," *B.E. J. Macroecon.*, vol. 7, no. 1, 2007.

- 597 [34] A. F. Odusola and A. E. Akinlo, "Output, Inflation, and Exchange Rate in Developing
598 Countries: An Application to Nigeria," *J. Dev. Econ.*, vol. 39, no. 2, pp. 199–222,
599 2001.
- 600 [35] J. Lohi, "Exchange Rate Regimes and Inflation in Sub-Saharan Africa," *J. Econ. Int.*
601 *Financ.*, vol. 6, no. 8, pp. 173–189, 2014.
- 602 [36] M. Klau, "Exchange rate regimes and inflation and output in sub-Saharan countries,"
603 BIS Working Papers No.53, 1998.
- 604 [37] A. Chhibber and N. Shafik, "Exchange Reform, Parallel Markets, and Inflation in
605 Africa: The Case of Ghana," Washington DC, World Bank Policy Research Working
606 Paper No.WB-427, 1990.
- 607 [38] E. Canetti and J. E. Greene, "Monetary Growth and Exchange Rate Depreciation as
608 Causes of Inflation in African Countries: An Empirical Analysis," *IMF Work. Pap.*
609 *Ser.*, vol. 67, no. 91, pp. 1–49, 1991.
- 610 [39] L. Panovska and I. Donayre, "Asymmetric Exchange Rate Pass-Through Behavior
611 over the Business Cycle," 2015.
- 612 [40] J. Asafu-adjaye, "Determinants of inflation in Ghana, 1964 to 2006," *Ghana Policy J.*,
613 vol. 2, pp. 51–69, 2008.
- 614 [41] J. K. Atta, K. R. Jefferis, and I. Mannathoko, "Small Country Experiences with
615 Exchange Rates and Inflation: the Case of Botswana," *J. Afr. Econ.*, vol. 5, no. 2, pp.
616 293–326.
- 617 [42] E. D. Maka, "Asymmetric Pass-Through of Exchange Rate Changes to CPI Inflation
618 in Ghana," *Int. J. Econ. Financ. Manag.*, vol. 2, no. 5, pp. 338–350, 2013.
- 619 [43] D. N. Gujarati and D. C. Porter, *Basic Econometrics*, 5th ed. New York: The McGraw-
620 Hill Series, 2009.
- 621 [44] K. E. Case and R. C. Fair, *Principles of Economics*, 8th ed. Prentice Hall Business
622 publishing, 2007.
- 623 [45] P. J. Miller and D. M. Chin, "Using Monthly Data to Improve Quarterly Model
624 Forecasts," *Fed. Reserv. Bank Minneap. Q. Rev.*, vol. 20, no. 2, p. 16, 1996.
- 625