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Determinants of Currency Crisis in Ghana, 1990 to 2016

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Abstract

This article aimed at the determinants of currency crisis in Ghana using multinomial logistic regression. A composite variable, exchange market pressure index was constructed and categorized into three based on the following criteria; appreciation, depreciation in exchange market pressure and reference point where there is no need for exchange market pressure rise or fall. A monthly data from 1990 to 2016 was used for the analysis. It was found out that due to the appreciation in exchange market pressure index growth rate of domestic credit and growth rate of output are significant determining factors of currency crises As a result, increase in growth rate of domestic credit and increase in growth rate of output will reduce the probability of currency crisis. On the other hand, due to the depreciation in exchange market pressure index, broad money supply-reserves ratio is a significant determining factor of currency crisis occurring. As a result, decrease in broad money supply-reserves ratio will reduce the probability of currency crisis occurring. In conclusion, growth rate of domestic credit, broad money supply-reserves and growth rate of output are significant determinants of currency crisis in Ghana.

Keywords

Currency Crisis, Exchange Market Pressure, Multinomial Logistic Regression

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1. Introduction

In the late 1980s and early 1990s, most economies in the European Union, Asia, Latin American countries and Russia had experienced currency crises. These crises discomfited policy makers and led to huge losses in income. Therefore, the issue of currency crises has become the focus of research in many countries. Most researchers had made an attempt to develop systems that could help to understand currency crises better, explain the factors that caused it and also to predict the occurrence of currency crisis.

Ghana is an open economy with a flexible exchange rate against the major trading currencies. The threat of any potential crisis cannot be over looked. Therefore, this article will investigate the macroeconomic fundamentals that may contribute to the probability of the occurrence of currency crises due to appreciation or depreciation in the exchange market pressure. This article will use the multinomial logistic regression model to analyse the effects of macroeconomic fundamentals on the probabilities of currency crisis. These macroeconomic fundamentals that will be used depend on theories and empirical studies. The study will identify significant macroeconomic factors that can help in explaining the probabilities of the occurrence of currency crisis. Hence, this study will be useful in influencing policy decision. According to [8] Eichengreen et al (1995), in computing exchange market pressure index a change in nominal exchange rate, foreign exchange reserves and interest rates should be included. Based on this fact, this study will adopt these variables to compute exchange market pressure in Ghana.

The figure 1 below illustrates the trend in monthly percentage change in nominal exchange rate, foreign

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exchange reserves and interest rate from January 1990 to December 2016. From the figure, monthly percentage change in exchange rate varied. Most of the percentage changes were within positive or negative ten, some were within positive or negative twenty. However, few of the monthly percentage change exceed positive or negative forty. From the figure, monthly percentage change in interest rate varied but most of the percentage changes were within positive or negative ten. However, few of the monthly percentage changes reached positive or negative twenty. Finally, from the figure, monthly percentage changes in reserves generally falls within positive or negative ten. These suggested that there were possible issues of currency crises due appreciation or depreciation in the monthly percentage change in exchange rate, foreign exchange reserves and interest rate in Ghana.

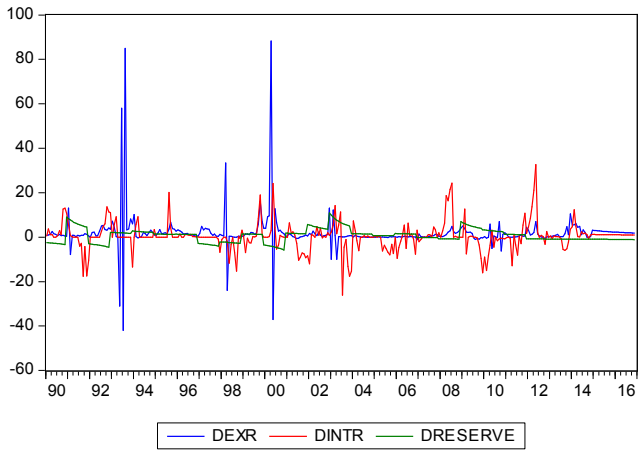

Figure 1. Percentage Change in Exchange Rate, Interest Rate and Reserves, 1990-2016.

From the above discussion, changes in nominal exchange rate, interest rate and foreign exchange reserves together could depict an environment that is called exchange market pressure which can be used to determine the occurrence of currency crisis in an economy. Therefore, this article will examine the macroeconomic factors that contribute to the probability of the occurrence of currency crisis in Ghana.

The remaining part of this article is arranged as follows: the theoretical framework and empirical literature on currency crises will be in Section two. Section three will cover the methodology and data used for the empirical analysis while section four covers results, findings and discussion. Finally, section five covers the summary, conclusion and policy recommendations.

2. Literature on Currency Crisis Issues

2.1. Theoretical Framework

A paper published by [13] Krugman (1979) on balance of payments crises and its extensions by other authors are referred to nowadays as first-generation models of currency crisis. According to these authors currency crises occurred as a result of an inconsistency between an excessive public sector deficit that becomes monetized and the exchange rate system. Hence, a crisis is both unavoidable and predictable in an economy with a constant deterioration of its macroeconomic fundamentals. According to Krugman, currency crises occur when a continuous deterioration in the economic fundamentals becomes inconsistent with an attempt to fix the exchange rate. From this work the original source of the problems is the excessive creation of domestic credit to either finance fiscal deficits or to provide assistance to a weak banking system. This model assumes that the government has no access to capital markets, thereby forcing it to monetize its expenditures. As a result, an interest rate parity condition would induce capital outflows and a gradual loss of foreign exchange reserves. Finally, the economy eventually becomes the victim of a speculative attack on its foreign exchange reserves.

The second-generation models of currency crisis are alternative explanations of the occurrence of currency crises. The focus of this model has been on the possibility of crises even if a continuous deterioration in economic fundamentals were absence. Some papers along this vein are [4] Calvo (1995), [6] Cole and Kehoe (1996), [15, 16] Obstfeld (1994, 1996), [17] Sachs, Tornell and Velasco (1996), and [7] Drazen (1998). These models have two main assumptions: the government is an active agent that maximizes an objective function and that a circular process exists, leading to multiple equilibria. According to the authors, pure expectations lead to one or another equilibrium. Many of these models implicitly or explicitly accept the possibility of self-fulfilling crisis. According to them, these types of crises occur, when the sheer pessimism of a significant group of investors provokes a capital outflow that leads to the eventual collapse of the exchange rate system, thus validating the negative expectations. In this sense, some second-generation models emphasize the reinforcing effects of the actions of economic agents in determining the movements from one equilibrium position to another. Second-generation models also underscore the role of expectations by considering the strategic complementarities of the actions of economic agents in determining the final outcome.

Although, second-generation models have several features in common, they also differ in crucial aspects such as the role they assign to economic fundamentals. In some models, fundamentals play a key role in determining when a crisis may occur. In particular, they identify an intermediate range for crucial variables where a crisis may or may not occur. Thus, the probability of currency crisis occurring is determined by the position of the fundamentals and a country

with relatively "good" fundamentals will never experience a currency crisis. This result suggested that even though it may not be possible to predict the timing of a crisis, it is possible to infer which countries are susceptible of falling into a currency crisis. Some of these models also suggested that unexpected shocks or sudden changes in the macroeconomic environment may induce the authorities to abandon the exchange rate system [16] (Obstfeld, 1996).

In contrast, some models suggest that crises are not affected by the position of the macroeconomic fundamentals. Instead, they may simply occur as a consequence of pure speculation against the currency. According to [5] Calvo and Mendoza (1997) models of herding behaviour stressed that information costs may lead foreign investors to take decisions based on limited information and therefore, be more sensitive to rumors. A second line of thought stressed the possibility of contagion effects. In this line, two main variants of this hypothesis could be identified. The first variant focused on trade linkages and in the loss of competitiveness associated with devaluation by a main trading partner, which in turn leaves the domestic currency more vulnerable to an attack [11] (Gerlach and Smets, 1995). The second variant is related to multiple-equilibrium and suggests that a crisis in one country may raise the odds of a crisis elsewhere by signaling that devaluation is more likely as a result of the initial crisis. This signal may then lead to a self-fulfilling speculative attack [14] (Masson, 1998) and termed this interpretation as a spillover effect to differentiate it from a pure contagion effect.

2.2. Empirical Review

This paper used the probabilities to explain the occurrence currency crisis in Ghana; therefore, relevant studies based on the second-generation models are reviewed.

[10]Frankel and Rose (1996) studied the determinants of currency crashes using panel of annual data for 100 developing countries from 1971 to 1992. This study define a currency crash as a nominal depreciation of at least 25 percent in the bilateral exchange rate in relation to the U.S. dollar with respect to the previous year, with the rate of depreciation at least ten percent higher than the previous year's. It is also required that currency crashes to be at least three years apart. From the result, graphical analysis showed that several economic variables behaved quite differently in tranquil periods as compared to crises periods. Also, probit regression found out that low level of foreign direct investment, low international reserves as a share of imports, high domestic credit growth, high foreign interest rates and overvaluation of the real exchange rate increase the probability of a currency crash.

According to, [17] Pazarbasioglu and Otker (1997) currency crises in Mexico between 1982 and 1994 found that domestic macroeconomic variables played key roles in determining occurrence of currency crisis. Also, crises tend to be preceded by foreign reserve losses, expansionary fiscal and monetary policies (usually measured by net domestic credit creation) and high interest rate differentials.

Also, [12] Kaminsky et al (1998) examined currency crises using signal approach and proposed a specific early warning system. This study define currency crisis base on an exchange market pressure index that consists of changes in the nominal exchange rate and in the international gross reserves. It was found out that export, deviations of the real exchange rate from trend, ratio of broad money to gross international reserves, output and equity prices are significant factors that explained the occurrence of currency crises. Hence, an early-warning system to try to prevent future currency crisis was proposed.

On the other hand, [2] Aziz *et al.*(2000) used a comparison approach of pre- and post-crisis behaviour of indicators; measures of overheating, external imbalances, unemployment rate, short-term capital inflows and the world interest rate. It was found out that over valuation, terms of trade, inflation, domestic credit growth, M2-reserves ratio, world interest rate and the current account were all useful indicators in explaining the crises.

[19] Tambunan (2002) also used the signals approach and data for Indonesia to analyse currency crises. He defined currency crisis as a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in foreign exchange reserves when the values exceed the mean by 1.1 or 3 of standard deviation. It was found out that the changes in the exchange rate were the main indicator in any early warning system.

In addition, [9] Feridun (2008) studied currency crises in Turkey using a logistic model. The study showed that the ratio of M2 to foreign reserves, the domestic real interest rate and the use of contagion variables were significant factors that explain currency crisis.

Finally, [1] Al-Assaf et al (2013) examined the factors that explain any potential currency crisis in Jordan using the multinomial logit model. It was found out that real exchange rate, money supply-reserves ratio, growth rate of domestic credit and ratio of Central Bank foreign assets to liabilities play significant roles in explaining the currency crises.

In conclusion, these empirical studies used various models and variables to investigate the significant factors that contributed to the probabilities of occurrence of currency crises for a specific country or for a group of countries. From these empirical studies some important indicators of currency

crises were identified. In sum, the empirical evidence on the determinants of currency crises is not far from being conclusive. However, in the case of Ghana the question "what are the macroeconomic fundamentals that explain occurrence of any potential currency crises" remains unanswered. Base on theories and empirical studies, this article used the following variables to investigate the occurrence of currency crises in Ghana: real exchange rate, broad money supply-reserves ratio, growth rate of domestic credit, central bank foreign assets to liabilities ratio, growth rate of exports, growth rate of imports and output growth.

3. Methodology

This section dealt with the data, techniques used, the approach used in computation and categorization of the exchange market pressure, multinomial logistic regression and explanation of the variables used.

3.1. Exchange Market Pressure (EMP) Index

The Central Banks mediate in the foreign exchange market to safe guide the fluctuations in exchange market pressure through either reducing their foreign exchange reserves holdings or increasing the domestic interest rates. According to [8] Eichengreen et al. (1995), this composite variable, the exchange market pressure (EMP) index, can be calculated as:

$$EMP_t = \alpha\Delta er_t - \beta\Delta r_t + \gamma\Delta i_t \quad (1)$$

where: Δ denotes monthly percentage change in; i is the interest rate; er is the nominal exchange rate (GH¢ to US$); r is the Central Bank's foreignexchange reserves; discount rate or the parameters α, β, and γ are weighted average computed as $\alpha = \frac{1}{\sigma_{er}}$; $\beta = \frac{1}{\sigma_r}$ and $\gamma = \frac{1}{\sigma_i}$, with σ_{er}, σ_r and σ_i representing the standard deviation of the full sample for the exchange rate, foreign exchange reserves and interest rate, respectively, over the period: January 1990M01 to December 2016M12. However, these discount rates are country specific.

A positive value of EMP shows an increase in pressure from the foreign exchange market which can be attributed to combine effects of a devaluation of the nominal exchange rate, a loss of the reserves or an increase in the interest rate. This positive value represents depreciation in EMP. On the other hand, a negative value of EMP shows a decrease in pressure in the foreign exchange market which can be attributed to the combined effects of the appreciation of the nominal exchange rate, an increase of reserves or a decrease in the interest rate. This negative value represents appreciation in EMP.

Though, the EMP data generated is continuous and time series data, to capture the determinants of currency crisis due to appreciation or depreciation in EMP with reference to the pivot there is a need to categorize the EMP into three categories; namely, currency crisis due to appreciation in EMP, the pivot (where there is no pressure on EMP to change) and currency crisis due to depreciation in EMP.

3.2. Estimation Procedure

The objective of this article is to capture the main macroeconomic determinants of the occurrence of the currency crisis. The following economic variables suggested by the theory and literature are used to model the probability of the occurrence of the currency crisis using the exchange market pressure (*EMP*) index: real exchange rate (*er*), central bank's foreign assets to foreign liabilities ratio (*al*), growth rate of exports (*ΔX)*, growth rate of imports (*ΔM),* growth rate of domestic credit (*dc)*, ratio of the money supply to total reserves (*m2r*) and growth rate of industrial production (*outpg*). Therefore, the linear model is expressed as:

$$\begin{aligned} EMP_t = {} & \beta_0 + \beta_1 er_t + \beta_2 al_t + \beta_3 \Delta X_t + \beta_4 \Delta M_t \\ & + \beta_5 dc_t + \beta_6 m2r_t + \beta_7 outpg_t + \varepsilon_t \end{aligned} \quad (2)$$

Following [19] Tambunan (2002) currency crisis is said to occur when the values of exchange market pressure index exceed its mean by 1.1 of standard deviation or if it falls below its mean by 1.1 of standard deviation. Therefore, the EMP can be categorized as follows:

$$Y = f(x) = \begin{cases} 1, & EMP > avg(EMP) + 1.1SD(EMP) \\ -1, & EMP < avg(EMP) - 1.1SD(EMP) \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

This shows that the function has three outcomes. The first outcome is when exchange market pressure exceeds its average by 1.1 of the standard deviation of exchange market pressure. This is represented by Y=1; in this case the crisis occurred due to a depreciation in exchange market pressure. Secondly, when exchange market pressure is less than its average by 1.1 of standard deviation of the exchange market pressure and it is denoted by Y=-1. In this case, the crisis occurred due to an appreciation in the exchange market pressure. Finally, when the exchange market pressure index lies within the two bounds and it is represented by Y=0. This is a zone where the exchange market pressure is not facing any pressure to change and this zone serves as the reference point or the pivot in this study. In the above situation, the dependent variable is categorical, therefore, a linear regression model cannot be applicable but a non-linear probability model like multinomial logistic regression model will be applicable. Therefore, in the case of (-1, 0, 1), the two independent binary logistic regression model with Y = 0 being reference point are written as follow:

$$\Pr(Y=1)=\Pr(Y=0)e^{\alpha_1+\beta_1 X}=\Omega(\alpha_1+\beta_1 X)=\frac{e^{\alpha_1+\beta_1 X}}{1+e^{\alpha_1+\beta_1 X}} \quad (4a)$$

$$\Pr(Y=-1)=\Pr(Y=0)e^{\alpha_2+\beta_2 X}=\Omega(\alpha_2+\beta_2 X)=\frac{e^{\alpha_2+\beta_2 X}}{1+e^{\alpha_2+\beta_2 X}} \quad (4b)$$

where Ω is the logistic cumulative distribution function and represents a vector of the coefficients of the explanatory variables. Positive values of these coefficients show an increase in the probability of currency crisis occurring and negative coefficients shows a decrease in the probability of the occurrence of currency crisis. In order to interpret the coefficients, the marginal effect for each coefficient will be estimated. In this case, the marginal effects represent the probabilities of occurrence of currency crisis relative the reference outcome. The marginal effect can be expressed as:

$$\frac{dy}{dx}=\beta_i\Omega'(\alpha_1+\beta_1 X) \quad (5)$$

The study used data from the [3] Bank of Ghana Monetary Statistics and [20] World Development Indicators to analyze the determinants of the currency crises in Ghana from 1990M01 to 2014M12. It used eight variables in the empirical analysis, namely exchange market pressure, *EMP*; the ratio of broad money supply to reserves ratio (*m2r)*; the growth rate of domestic credit (dc); central bank foreign assets to foreign liabilities ratio (al); were compiled from the Bank of Ghana's Monetary Statistics Data. While the real exchange rate (*er*); growth rate of exports (*ΔX)*; the growth rate of imports (*ΔM)* and the output growth rate approximated by growth rate of industrial production (*outpg)*; were annual data of Ghana from World Development Indicators which frequencies are converted to monthly data using Eviews frequency conversion.

3.3. Explanation of Variables

Real Exchange Rate (*rer*) is a measure of international competitiveness and is a proxy for over or under valuation. It is expected that the real exchange rate will impact negatively on *EMP*, where an overvalued real exchange rate leads to a high probability of a currency crisis.

Ratio of money supply to total reserves minus gold in the Central Bank (*m2r*) measures the available foreign exchange reserves. This indicator captures the extent to which the liabilities of the banking system are backed by foreign currencies. In the event of a currency crisis, individuals may rush to convert their domestic currency deposits into foreign currency and so this ratio captures the ability of the Central Bank to meet their demand. It is expected that *m2r*should have a positive impact on *EMP*.

The growth rate of domestic credit (*dc)* is obtained by taking the change in the natural logarithm of domestic credit. An increase in domestic credit growth may serve as an indicator of the fragility of the banking system so it is expected that *dc* will have a positive impact on *EMP*.

Central Bank's foreign assets to foreign liabilities ratio (*al*) is also an indicator of banking fragility. As a result, a decrease in this ratio reflects a decrease in the ability of the Central Bank to manage its foreign commitments. It is expected to have a negative impact on *EMP*.

The growth rate of exports and imports, *ΔX* and *ΔM*, are computed by taking the change in the natural logarithm of exports and imports, respectively. Declining export growth implies that there is a loss in competitiveness in the international goods market. This decline may be caused by overvalued domestic currency. Also, it reflects the weakness of the country's ability to earn foreign currency to finance an existing current account deficit. Therefore, it is expected to have a negative impact on *EMP*. On the other hand, excessive import growth may show that the exchange rate is overvalued, which could lead to a loss in competitiveness and a worsening in the current account position as it is expected to have a positive impact on *EMP*.

The growth rate of industrial production (*outpg*) is used as a proxy of the output growth, where a recession often precedes financial crisis. It is expected to have a negative impact on *EMP*.

4. Empirical Results and Discussion

This section shows summary statistics of exchange market pressure and frequency table of EMP, the stationarity properties of the variables under consideration and discussion of multinomial logistic regression result. The table 1 shows the summary statistics of the exchange market pressure. From the figure, the average exchange market pressure is positive, implying that during the study period, 1990M01 to 2016M12, the *EMP* depreciated by 0.1659 with standard deviation of 1.9235.

Table 1. Summary Statistics of the Exchange Market Pressure.

Mean	0.165879
Standard Error	0.10719
Median	-0.07265
Mode	-1.408
Standard Deviation	1.923455
Sample Variance	3.699677
Kurtosis	4.265378
Skewness	0.784499
Range	17.304
Minimum	-6.067
Maximum	11.237
Sum	53.41288
Count	322

The table 2 shows the frequency distribution of the categories of the exchange market pressure according to the definition of currency crisis used. From the table, there are evidences of occurrence of currency crises; in the case of appreciation there are 34 months and in the case of depreciation there are 43 months. These represented 10.4 and 13.2 percent of the total months under consideration, respectively.

Table 2. Frequency Table of Categorized Exchange Market Pressure.

	Frequency			Percentages		
Variables	**-1**	**0**	**1**	**-1**	**0**	**1**
EMP	34	249	43	10.4	76.4	13.2

4.1. Stationarity Properties

The Augmented Dickey-Fuller (ADF) test is used to check the stationarity properties of the variables being considered and the result is shown in table 3 below. From the table, all the variables are stationary at 5 percent level of significance with constant and trend, except central bank foreign assets to liabilities ratio which is stationary at 10 percent level of significance with constant. Therefore, all the variables: real exchange rate (*rer*), money supply-reserves ratio (*m2r*), growth rate of domestic credit (*dc*), central bank foreign assets to liabilities ratio (*al*), growth rate of exports(ΔX), growth rate of imports (ΔM)and industrial output (*outpg*) are integrated of order zero, I(0).

Table 3. The results of Augmented Dickey-Fuller test (ADF) for unit root.

	None		Constant		Constant and Trend	
Variable	**Level**	**Conclusion**	**Level**	**Conclusion**	**Level**	**Conclusion**
	t-obs		t-obs		t-obs	
rer	-1.5155		-2.3635		-3.9218	
p-value	0.1215		0.1532		0.0124	I(0)
m2r	-0.6244		-3.3789		-3.3773	
p-value	0.4462		0.0125	I(0)	0.0565	I(0)
dc	-0.8236		-3.1821		-3.5974	
p-value	0.3585		0.0221	I(0)	0.0318	I(0)
ab	-1.0822		-2.7360		-3.1018	
p-value	0.2526		0.0692	I(0)	0.1078	
ΔX	-5.4943		-5.5170		-5.6143	
p-value	0		0	I(0)	0	I(0)
ΔM	-6.1936		-6.6150		-5.5307	
p-value	0	I(0)	0	I(0)	0	I(0)
outpg	-4.8274		-4.8222		-4.812	
p-value	0	I(0)	0	I(0)		I(0)

4.2. Result of Multinomial Logistic Model

The result of the multinomial logistic regression, interpretation and discussion are shown in this section. Table 4 shows the result of the goodness of fitness test or testing whether the coefficients of all the variables in model are simultaneously significantly different from zero or not. From the table, the Likelihood Ratio (LR) statistic is 382.1 with the Chi-Square value of 78.95, degree of freedom, 14, and p-value of zero. Since the p-value is less than 0.05, the null hypothesis that all the coefficients of all the variables are simultaneously equal to zero is rejected. Therefore, all the variables in model are simultaneously statistically significant or valid at the 1% level of significance in explaining the probabilities of the occurrence of currency crises in Ghana.

Table 4. Model Fitting Information.

Model	**Model Fitting Criteria**	**Likelihood Ratio Tests**		
	-2 Log Likelihood	**Chi-Square**	**df**	**Sig.**
Intercept Only	461.028			
Final	382.076	78.952	14	.000

The results in table 5 show the coefficient and corresponding marginal effects of the multinomial logistic regression estimated. In the case of currency crises occurring due to appreciation in EMP, that is (Y= -1), all the variables have expected signs which are consistent with theory except real exchange rate.

From the table, the coefficient of real exchange rate is negative showing that an increase (depreciation) in real exchange rate decreases the probability of the occurrence of currency crisis. The Wald statistics of 0.496 with p-value of 0.481 showed that the effect of the variable is not significant. The marginal effect associated with this is 0.876 showing that relative to the pivot, one unit increase in real exchange rate decreases the probability of the occurrence of currency crisis by a factor of 0.876 given that other variables in the model are held constant.

The coefficient of money supply-reserves ratio is negative

with the Wald statistics of 2.402 with p-value of 0.121, indicating that the effect of the variable is not significant. This shows that an increase in money supply-reserves ratio decreases the probability of currency crisis occurring due to appreciation in EMP. It has a marginal effect of 0.678. This shows that relative to the pivot one unit increase in money supply-reserves ratio decreases the probability of the occurrence of currency crisis by a factor of 0.678 given that other variables in the model are held constant.

Also, the coefficient of growth rate of domestic credit is negative with the Wald statistics of 12.505 with p-value of zero, indicating that the effect of the variable is significant. This shows that an increase in growth rate of domestic credit decreases the probability of currency crisis occurring due to appreciation in EMP. It has a marginal effect of 0.941. This shows that relative to the pivot one unit increase in growth rate of domestic credit decreases the probability of the occurrence of currency crisis by a factor of 0.941 given that other variables in the model are held constant. This marginal effect at 95 percent level of confidence lies between 0.910 and 0.973.

From the table, the coefficient of central bank foreign assets to liabilities ratio is negative with the Wald statistics of 0.004 with p-value of 0.947 indicating that the effect of the variable is not significant. This shows that an increase in central bank foreign assets to liabilities ratio decreases the probability of currency crisis occurring due to appreciation in EMP. The marginal effect associated with this is 0.994 which shows that relative to the pivot one unit increase in central bank foreign assets to liabilities ratio decreases the probability of the occurrence of currency crisis by a factor of 0.994 given that other variables in the model are held constant.

In addition, the coefficient of growth rate of exports is positive with the Wald statistics of 0.342 with p-value of 0.559, indicating that the effect of the variable is not significant. This shows that an increase in growth rate of exports increases the probability of currency crisis occurring due to appreciation in EMP. It has a marginal effect of 1.432. This shows that relative to the pivot one unit increase in growth rate of exports increases the probability of the occurrence of currency crisis by a factor of 1.432 given that other variables in the model are held constant.

Considering the coefficient of growth rate of imports is negative with the Wald statistics of 0.028 with p-value of 0.868, showing that the effect of the variable is not significant. This shows that an increase in growth rate of imports decreases the probability of currency crisis occurring due to appreciation in EMP. It has a marginal effect of 0.927. This showed that relative to the pivot one unit increase in growth rate of imports decreases the probability of the occurrence of currency crisis by a factor of 0.927 given that other variables in the model are held constant.

Finally, the coefficient of growth rate of industrial output is negative with the Wald statistics of 3.411 with p-value of 0.065, showing that the effect of the variable is significant at 10 percent level of significance. This shows that an increase in growth rate of industrial output reduces the probability of currency crisis occurring due to appreciation in EMP. It has a marginal effect of 0.347. This shows that relative to the pivot one unit increase in growth rate of industrial output reduces the probability of the occurrence of currency crisis by a factor of 0.347 given that other variables in the model are held constant. This marginal effect at 95 percent level of confidence lies between 0.113 and 1.067.

In the case of currency crises due to depreciation in the *EMP*, (Y=1), all the variables have expected signs and are consistent with the theory.

Considering the coefficient of real exchange rate is positive with the Wald statistics of 1.791with p-value of 0.181, showing that the effect of the variable is not significant. This shows that an increase in real exchange rate increases the probability of currency crisis occurring due to depreciation in *EMP*. It has a marginal effect of 1.276 showing that relative to the pivot one unit increase in real exchange rate increases the probability of the occurrence of currency crisis by a factor of 1.276 given that other variables in the model are held constant.

The coefficient of money supply-reserves ratio is positive with the Wald statistics of 10.591 with p-value of 0.001, showing that the effect of the variable is significant. This shows that an increase in money supply-reserves ratio increases the probability of currency crisis occurring due to depreciation in EMP. It has a marginal effect of 1.549. This showed that relative to the pivot one unit increase in money supply-reserves ratio increases the probability of the occurrence of currency crisis by a factor of 1.549 given that other variables in the model are held constant. This marginal effect, at 95 percent level of confidence, lies between 1.190 and 2.017.

In addition, the coefficient of growth rate of domestic credit is positive with the Wald statistics of 0.125 with p-value of 0.724, indicating that the effect of the variable is not significant. This shows that an increase in growth rate of domestic credit increases the probability of currency crisis occurring due to depreciation in EMP. It has a marginal effect of 1.005. This shows that relative to the pivot one unit increase in growth rate of domestic credit increases the probability of the occurrence of currency crisis by a factor of 1.005 given that other variables in the model are held constant.

The coefficient of central bank foreign assets to liabilities ratio is negative. The Wald statistics of 1.697 with p-value of 0.193, these indicated that the effect of the variable is not significant. This shows that an increase in central bank foreign assets to liabilities ratio decreases the probability of the depreciation in EMP. It has a marginal effect of 0.860. This shows that relative to the pivot one unit increase in central bank foreign assets to liabilities ratio decreases the probability of the occurrence of currency crisis by a factor of 0.860 given that other variables in the model are held constant.

Also, the coefficient of growth rate of exports is positive with the Wald statistics of 0.173 with p-value of 0.677, indicating that the effect of the variable is not significant. This shows that an increase in growth rate of exports increases the probability of currency crisis occurring due to depreciation in EMP. It has a marginal effect of 1.298. This showed that relative to the pivot one unit increase in growth rate of exports increases the probability of the occurrence of currency crisis by a factor of 1.298.

The coefficient of growth rate of imports is negative with the Wald statistics of 0.322 with p-value of 0.570, showing that the effect of the variable is not significant. This shows that an increase in growth rate of imports decreases the probability of currency crisis occurring due to depreciation in EMP. It has a marginal effect of 0.781.

Finally, the coefficient of growth rate of industrial output is negative with the Wald statistics of 0.441 with p-value of 0.506, indicating that the effect of the variable is not significant. This shows that an increase in growth rate of industrial output decreases the probability of currency crisis occurring due to depreciation in EMP. It has a marginal effect of 0.694.

Table 5. Parameter Estimates of the Multinomial Logistic Regression.

mpo[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
-1	Intercept	2.802	2.757	1.033	1	.309			
	rer	-.133	.188	.496	1	.481	.876	.605	1.267
	m2r	-.389	.251	2.402	1	.121	.678	.414	1.108
	gdc	-.061	.017	12.505	1	.000	.941	.910	.973
	alib	-.006	.088	.004	1	.947	.994	.837	1.181
	⊿m	-.076	.458	.028	1	.868	.927	.377	2.275
	⊿x	.359	.614	.342	1	.559	1.432	.430	4.775
	outpg	-1.057	.573	3.411	1	.065	.347	.113	1.067
1	Intercept	-3.708	2.529	2.150	1	.143			
	rer	.244	.182	1.791	1	.181	1.276	.893	1.825
	m2r	.438	.135	10.591	1	.001	1.549	1.190	2.017
	gdc	.005	.015	.125	1	.724	1.005	.976	1.036
	alib	-.150	.115	1.697	1	.193	.860	.686	1.079
	⊿m	-.248	.436	.322	1	.570	.781	.332	1.835
	⊿x	.261	.627	.173	1	.677	1.298	.380	4.432
	outpg	-.365	.550	.441	1	.506	.694	.236	2.039

a. The reference category is:.00.

In sum, due to the appreciation in EMP, growth rate of domestic credit and growth rate of industrial output are significant determining factors of currency crisis. From the result, increase in growth rate of domestic credit or the fragility of the banking system will reduce the probability of currency crisis occurring. Also, an increase in growth rate of industrial output helps to reduce the probability of currency crisis occurring. On the other hand, due to the depreciation in EMP, broad money supply-reserves ratio is significant determining factor of currency crisis. From the result, decrease in money supply-reserves ratio will reduce the probability of currency crisis occurring. These findings confirmed [2]Aziz *et al.*(2000) who concluded that domestic credit growth and M2-reserves ratio were significant in explaining the occurrence of currency crisis. Also, these findings confirmed [9]Feridun (2008) which concluded that M2 foreign reserve ratio played a significant role in predicting the occurrence of currency crisis. Finally, it confirmed the result of [2]Al-Assaf et al (2013) that money supply-reserves ratio and growth rate of domestic credit play significant roles in explain the currency crisis.

5. Conclusion

This article aimed at finding out the macroeconomic fundamentals that explain the occurrence of currency crises in Ghana using multinomial logistic regression model. A composite variable, exchange market pressure index was constructed which depicted the currency crisis environment in Ghana. The paper used monthly data starting from January 1990 to December 2016. The composite variable was categorized into three based on appreciation, depreciation in EMP and reference point or pivot. It was found out that due to the appreciation in exchange market pressure index growth

rate of domestic credit and industrial output are significant determining factor of occurrence of currency crisis. Therefore, increase in growth rate of domestic credit and of industrial output will reduce the probability of currency crisis occurring. On the other hand, due to the depreciation in exchange market pressure index money supply-reserves ratio is significant determining factor of occurrence of currency crisis. Therefore, decrease in money supply-reserves ratio will reduce the probability of currency crisis occurring.

Base on the above findings the following policy recommendations are made. During currency crises due to appreciation in EMP policy makers have to encourage the growth rate of domestic credit as its growth reduced the probability of currency crisis occurring. Policy-makers need to encourage the growth industrial output as improvement in industrial output reduces the probability of currency crisis occurring. Finally, during currency crises due to depreciation in EMP, the policy makers should ensure that broad money supply-reserves ratio is stable or declining as its decrease leads to a decline in the probability of currency crisis occurring.

References

[1] Al-Assaf, G., Al-Tarawneh, A and Alawin, M. (2013). Determinants of Currency Crisis in Jordan. A Multinomial Logit Model. *European Scientific Journal.* December, vol.9, No.34 p 354-369.

[2] Aziz, J., Caramazza, F and Salgado, R. (2000). Currency Crisis: In Search of Common Elements. IMF Working Paper 00/67.

[3] Bank of Ghana: Statistical Bulleting (various issues). https://bog.gov.gh/index.php?option=com_content&view=category&layout=blog&id=117&Itemid=232).

[4] Calvo, Guillermo (1995). "Varieties of Capital-Market Crisis," mimeo, University of Maryland.

[5] Calvo, Guillermo and Enrique G. Mendoza (1997). "Rational Herd Behavior and the Globalization of Securities Markets," mimeo, University of Maryland, November.

[6] Cole, Harold. R. and Timothy J. Kehoe (1996). "A Self-fulfilling Model of Mexico's 1994-95 Debt Crisis," Journal of International Economics, 41, November, 309330.

[7] Drazen, Allan (1998). "Political Contagion in Currency Crises," University of Maryland, mimeo, March.

[8] Eichengreen, B., Rose, A. K. and Wyplosz, C. (1995). Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks. *Economic Policy*, 21.

[9] Feridun, M. (2008). *Exchange Market pressure and Currency Crisis in Turkey: An Empirical Investigation*. Unpublished PhD Thesis, Loughborough University, UK.

[10] Frankel, Jeffrey and Rose, Andrew K. (1996). "Currency Crashes in Emerging Markets: An Empirical Treatment," Journal of International Economics, 41, November, 351-366.

[11] Gerlach, Stefan and Smets, Frank (1995). "Contagious Speculative Attacks," European Journal of Political Economy, 11, 45-63.

[12] Kaminsky, G., Lizondo, S and Reinhart, C (1998). Leading Indicators of Currency Crisis. *IMF working paper* No.79.

[13] Krugman, Paul (1979). "A Model of Balance of Payments Crises," Journal of Money, Credit and Banking, 11, 311-325. Cambridge University Press).

[14] Masson, Paul R. (1998), "Contagion Effect: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria," unpublished, International Monetary Fund.

[15] Obstfeld, Maurice (1994). "The Logic of Currency Crises," NBER Working Paper No. 4640 (Cambridge, Massachusetts: National Bureau of Economic Research).

[16] Obstfeld, Maurice (1996). "Models of Currency Crises with Self-fulfilling Features," European Economic Review, 40, 1037-1047.

[17] Pazarbasioglu, Ceyla and Otker, Inci (1997). "Likelihood versus Timing of Speculative Attacks: A Case Study of Mexico," European Economic Review, Papers and Proceedings, April 1997, 41, 837-845

[18] Sachs, J., Tornell, A. and Velasco, A. (1996). "Financial Crises in Emerging Markets: The Lessons from 1995," Brookings Papers on Economic Activity: 1, 147-215.

[19] Tambunan, T. (2002). Building an Early Warning System for Indonesia with the Signal Approach. *Thailand Development Research Institution*.

[20] World Bank. World Development Indicators Ghana. http://data.worldbank.org/country/ghana