Investigating the Corruption- Currency Substitution Nexus for Ghana

Stephen Armah (Ashesi University)

Yayra Azaglo (Ashesi University)

Prince Baah (Ashesi University)

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Abstract

Foreign exchange liberalization and the relaxation of trade restrictions following the Structural Adjustment Program (SAP) in anglophone Sub-Saharan African (SSA) countries like Ghana was associated with corruption and currency substitution (CS). Some authors have suggested that CS occurred as elites fond a safe-haven for their looted wealth in a liberalized democratic dispensation that allows more avenues for corruption (the safe-haven hypothesis) and as citizens opt for the more stable and internationally recognized USA dollar (USD) to escape the consequences of currency depreciation. Is this really the case? Does corruption facilitate CS in Ghana? Is the relationship symmetrical and economically and statistically relevant? This research will answer these questions for Ghana for which there is limited research on the topic.

Although the consequences of CS can be benign, because CS can be used as a hedge against inflation, they can also be deleterious to the local economy, so the determinants of CS must be established. CS can compromise the accurate estimation of the money demand function, cripple monetary policy, and leave the economy exposed to internal and external shocks. CS can cause a depreciation of the local currency, deter investments, start a currency crisis, and even cause a recession, increasing unemployment and making poverty worse. This will undermine Ghana's efforts to attain the Sustainable Development Goals (SDGs). In comparison, apart from reducing efficiency and growth, corruption can worsen CS as it creates an uncertain macroeconomic environment. However, CS can also enhance efficiency in a bureaucratic environment thereby increasing productivity and the currency value and lessening the tendency to substitute the local currency for a stronger one. This research investigates the corruption - CS relationship to establish if Ghana's ongoing CS is related to corruption in a systematic way.

Using the Autoregressive Distributed Lag (ARDL) and the Non-Linear Autoregressive Distributed Lag (NARDL) models and data from 1997 to 2023, we investigate the corruption-CS nexus for Ghana. The findings should be useful to policy makers in Ghana and in anglophone SSA countries who are dealing with CS, and who like Ghana, have free floating exchange rates but do not belong to a currency union.

Key words: Corruption, Currency Substitution, Anglophone, SSA, SAPs, SDG and NARDL
JEL Classifications: 01 Econ Development; F31 Foreign Exchange and D 73 corruption

1. **Introduction**

Corruption is an evergreen developmental issue of interest especially in anglophone SSA countries like Ghana where it has been identified to cause poverty and political instability (Gyimah Brempong 2002 and Armah 2020). Corruption can also enhance macroeconomic challenges such as inflation (Armah and Berkoh 2025) and currency depreciation (Armah, Azenui and Berkoh 2025).

In the post COVID 19 era of economic challenges in anglophone SSA countries like Ghana, corruption, defined by Rose-Ackerman (1978) as *the abuse of the public trust for private gain* has been accused of incentivizing the purchase, use and stockpiling of foreign currency like the USD that hold their value over time, a phenomenon known as currency substitution (CS). CS is defined as a situation in which economic agents begin to use a foreign currency instead of the local currency (Milenkovich and Davidovich 2012). CS has been proposed to occur as corrupt politicians acquire copious amounts of foreign currency like the USD not only to insulate their wealth from inflation but also to avoid detection and to facilitate the transfer of wealth to other countries when persecuted for corruption (Akinlo 2022).

Does corruption really cause CS and is the relationship economically relevant and symmetric? This research will interrogate the nexus between CS and corruption for Ghana, an anglophone SSA country, which unlike its francophone neighbors, does not belong to a currency union and so can unilaterally increase the money supply, and where both corruption and CS are persistent problems.

There is some debate in the literature about the exact definition of CS. Currency substitution is defined by Kallon and Barrie (2023) *as the "continuous replacement of the local currency by a foreign currency."* Adom et al (2007) define CS as the phenomenon where foreign monies substitute for domestic money in its three traditional roles: as a medium of exchange, as a unit of account and as a store of value. While Milenkovich and Davidovich (2013) contend that CS occurs because of macroeconomic instability, Ajibola et al (2020), Like Adom (2007) claim CS typically occurs when *the local* currency loses the ability to perform the 3 key functions of money: medium of exchange, store of value and unit of account.

We adopt Kallon and Barrie's (2023) definition of CS which is identical to Akinlo (2022) definition for this paper. We recognize, however, that CS is often used interchangeably in the literature with dollarization (see Milenković and Davidović 2012), especially with research focusing on Latin American countries. However, given our focus on anglophone SSA countries, we do not use the dollarization definition of CS but rather stick with Kallon and Barrie's (2023) definition which is also consistent with the definition of Akinlo (2022) as both focused their work on anglophone SSA countries. We also differentiate between CS, which is legal and black market or parallel market activity (see Munjeyi and Schutte 2025), where foreign exchange activities occur outside the remit of the law.

It is important to note that CS as used in this paper is not always undesirable. CS can provide a means for domestic banks and private citizens to hedge against inflation and to preserve the value of

wealth (Akinlo 2022). However, CS can also have serious negative impacts on the economy (Milenković and Davidović 2012 and Bahmani-Oskooee & Techaratanachai 2001) so identifying the determinants of CS is vital.

In the SSA context, CS can influence the stability of the local economy, the evolution of the financial sector, and the success of monetary policies (Kallon and Barrie 2023 and Akinlo 2022). CS can compromise the accurate estimation of the money demand function. CS can also undermine the effectiveness of monetary policy and leave the economy exposed to internal and external shocks (Milenković and Davidović 2012, Girton and Roper 1981, Bahmani-Oskooee and IIker 2003, Yeyati 2004, Boamah et al. 2012, Laopodis 2011, Bawa, Omotosho & Doguwa, 2015, Miles, 1978, and Ho, 2003). CS can cause a depreciation of the local currency leading to a currency crisis. CS can deter investments, cause a recession, increase unemployment and make poverty worse (Akinlo 2022). These negative impacts of CS will make it difficult for anglophone SSA countries like Ghana to attain the UN's Sustainable Development Goals (UN SDGs).

Both corruption and CS can be either detrimental or benign. In fact, according to Meon (2005) among others, corruption is famous for its ability to deter business activity because it increases transaction costs and serves as a tax to businesses (*the sand the wheel hypothesis*). However, according to Leff (1964), Meon (2005), Antwi (2020) among others, corruption has also been known to increase efficiency in bureaucratic countries by helping to circumvent bureaucratic blockades to business (*the grease the wheel hypothesis*).

Like corruption, CS can also be beneficial or detrimental. This is because on the one hand, currency substitution serves as a hedge against inflation and allows banks to preserve the value of their wealth. On the other hand, however, CS undermines effective monetary and exchange rate policy by compromising the correct estimation of the money demand function (Akinlo 2022, Chang, 2000; Kalyoncu et al., 2015 and Mizen and Pentecost 1996)

Given that CS and corruption can both be either benign or malicious, and yet both often occur together, it is justifiable to investigate if Currency Substitution and corruption are related in an economically relevant way both in the long and short run. It is also pertinent to establish if the claim that corruption is partly responsible for CS in Ghana is valid.

We recognize that CS can create incentives for corruption leading to possible double causality. We also acknowledge that the time series data on corruption for SSA countries is typically short, leading to a small sample size. Further the data series may be integrated of different orders (I (0) or I (1) with possible cointegration between the variables (Armah and Berkoh 2025). We therefore employ the ARDL and NARDL models due respectively to Peseran and Shin (2001) and Shin Wu and Greenwold Nimoh (2014) to interrogate the corruption-CS nexus in Ghana. We apply these models to estimate the CS-corruption relationship for Ghana because they are especially suited for dealing with finite sample data with possible different orders of integration and possible cointegration between the series.

The NARDL differs from the ARDL in its ability to investigate symmetrical relationships between the dependent variable and its covariates but retains all the advantages of the ARDL (Shin Wu and Greenwold Nimoh 2014). The NARDL enables us to determine if the magnitude of change in CS obtained by decreasing corruption exactly matches the changes in the size of CS obtained by increasing corruption.

Curiously there exists an extant literature on the determinants of CS even though the very definition of CS is heatedly debated and discussed in the literature (see for example Kallon and Barrie 2023, Girton & Roper, 1977; Ho, 2003; Calvo & Vegh, 1992; De Nicolo, Honohan, & Ize 2005). The corruption - CS relationship is, however, not very well researched in the empirical literature, especially for anglophone SSA countries like Ghana, except for Adom (2007). However, Adom (2007) also ignored corruption and employed panel data from both North African and SSA countries and did not focus exclusively on Ghana. This raises questions about the applicability of his results to Ghana given the cultural and institutional differences in the makeup of countries in his panel dataset. Most other CS literature focus on the general economic determinants, impacts and remedies of CS but are concentrated among developed countries and Latin American countries and always seem to focus less on the corruption-CS relationship in SSA countries like Ghana.

We admit that there is some literature on the Corruption-CS nexus for anglophone countries, but it is mostly limited to Nigeria with Ayigheyisi (2013), and Akinlo (2022) making key contributions. In comparison Kallon and Barrie (2023) interrogate the corruption-CS for Sierra Leone.

Literature on the corruption - CS nexus in Ghana is virtually non-existent. The available literature on CS in Ghana focuses on confirmation of CS in Ghana or the identification of general macroeconomic determinants of CS in Ghana (Tweneboah et all 2019) but sidesteps entirely the specific role of corruption on CS.

For example, Adom et al (2007) find evidence of CS in Ghana when the CFA is the anchor currency but found no evidence of CS when USD is used as an anchor currency while Adenutsi and Yartey (2007) focus on determining the impact of the liberalization of Ghana's economy on currency substitution. In comparison, Tweneboah et al (2019) focus on the impact of financial sector development on CS in Ghana. For their part, Acheampong et al (2023) investigate the "correlates" or determinants of dollarization measured as currency substitution in their paper but again ignore corruption.

We contribute to the literature in three main ways. First, we focus specifically on the corruption-CS nexus for Ghana. Second, we use more recent data including post COVID 19 data where both corruption and CS were increasing for Ghana until recently and finally, we adapt both the ARDL and NARDL models to investigate the CS -corruption nexus for Ghana.

The rest of the paper is organized as follows: chapter 2 reviews the literature on the determinants of currency substitution and the impact of corruption on CS. Chapter 3 describes the empirical procedures and research methods, Chapter 4 presents and discusses the results and chapter 5 concludes.

2. Literature Review

CS can be linked to the "medium of exchange function of money" in small open economies such as Ghana. This is because globalization and the increasing economic integration of nations has highlighted the pertinence of the phenomenon of CS especially in developing countries like Ghana. This is key because the prominence of global free trade has resulted in the widespread usage of multiple currencies within a single country with associated positive and negative impacts. However, CS can also be linked to the "store of value function of money". This is reasonable as CS often takes place regardless of the trade practices of countries, especially when such countries face significant inflation and currency depreciation (**Adom 2007 and Brand 1993**).

This section presents a theoretical basis for the discussion of CS, clarifies the ambiguity in the literature about the definition of currency substitution and provides an overview of existing empirical literature on CS. The review concludes with a discussion of the literature that tackles the relationship between institutional variables and currency substitution in general and the impact of corruption on CS in SSA in particular.

Debates on the Definition of Currency Substitution

A review of empirical literature shows that there are varying approaches to measuring currency substitution (Adom 2007, Calvo and Vegh 1992, Mizen and Pentecost 1996, Milenkovich and Davidovich 2012, Tweneboa et al 2019, Akinlo 2022 and Kallon and Barrie 2023). While some studies have simply alluded to currency substitution by observing a decline in the demand for local currency, others define currency substitution as the ratio of foreign currency deposit to broad money. Akinlo (2022) modified this later ratio and measured currency substitution as the ratio of foreign currency deposits to broad money minus currency. Kallon and Barrie (2023) on the other hand, viewed the measurement of currency substitution from both a narrow and a broad perspective. Relying on the relative measure, they defined narrow currency substitution as the ratio of foreign currency deposit to demand deposit and broad currency substitution as the ratio of foreign currency deposit to broad money.

Kallon and Barrie (2023) argue that the distinction between narrow and broad CS is necessary to isolate the medium of exchange motivation for currency substitution from the store of value motivation of CS. This study, however, maintains that measuring currency substitution using the broad currency substitution (as used by Kallon & Barrie, 2023) suffices in capturing the different incentives for currency substitution.

We challenge the approach of inferring currency substitution from a decline in local money espoused by authors like Adom (2007), Kaplan, Kalyoncu, and Yucel (2008) and Wang (2017) by arguing that a decline in local money demand does not necessarily imply an adoption of foreign currency in place of the domestic currency especially in the developing country context. In particular, apart from rising interest rates, reduced transaction costs and technological innovations and other local factors

could be responsible for a decline in money demand. Further, even though the relative currency measure (the ratio of foreign deposits to broad money) potentially misses out on the substitutions that happen in currency in circulation, it remains a good measure of currency substitution, particularly if the focus is on the store of value function of money in interrogating the influence of institutional variables such as corruption on CS.

Our Consensus Definition of CS

According to Tweneboa et al (2019), although currency substitution and dollarization are sometimes used interchangeably in the literature, Calvo and Vegh (1992) differentiate between the two concepts by explaining that while currency substitution refers to the medium of exchange function of money, dollarization refers to the store of value and unit of account function of money. We note that this distinction may be troubling in the developing country context like Ghana because dollarization also refers to the policy of complete and voluntary replacement of a currency by the USD as observed in Ecuador and Panama [REFERENCE]. Some scholars have suggested that Ghana should in fact follow Ecuador's lead and dollarize the economy. This makes it confusing to define currency substitution for our SSA context as dollarization.

Akinlo (2022) partially resolves this ambiguity between the definition of currency substitution and dollarization by defining currency substitution as the ratio of foreign deposits to total reserves. This way, the evolution of the CS variable will illustrate the preference for more USD overtime relative to the local currency, if that is indeed the case, and is then different from an intentional policy to switch from the local currency to the USD.

As Akinlo (2022) focused on Nigeria which is more similar in context to Ghana, we will use Akinlo (2002)'s definition of CS substitution which is consistent with the definition of Kallon and Barrie (2023) in this paper instead of the definition by Calvo and Vegh (1992). Further we prefer Akinlo (2022) definition of CS not only because data on this variable exists for Ghana, but also because, in Ghana, there is a law (Act 723, 2006) that prohibits transactions and pricing in USD even though we do admit that in practice, almost all pricing in high-end real estate and expensive hotels in Ghana is still done in USD. Per Act 723, the power to determine who can acquire or use foreign exchange in Ghana is vested in the Bank of Ghana (BOG), the central Bank of Ghana. The BOG can issue licenses to qualified individuals to engage in business using foreign currency, provide directions about the use of foreign exchange and can generally be strict or flexible about use of foreign exchange in Ghana as they deem fit. Finally, per the law in Ghana, Calvo and Vegh (1992)'s definition of currency substitution is largely illegal, but the Akinlo (2022) definition of CS which is consistent with Kallon and Barrie (2023)'s definition and is legal in Ghana.

Theoretical Review

The phenomenon of currency substitution has been extensively interrogated in economics (Akinlo 2022, Kallon and Barrie 2023, Cuddington,1983, de Vries 1988; Girton & Roper 1981). Theories such as the money demand theory, and the portfolio balance theory (Mizen and Pentecost 1992) interrogate the CS phenomenon. There is also the safe-haven hypothesis that provides a possible theoretical justification of the relationship between corruption and currency substitution (Akinlo 2022).

The fundamental theoretical reasoning underpinning CS is premised on the arguments of the money demand theory (Mizen and Pentecost 1992). Since CS simply relates to using foreign currencies in place of domestic currency, it follows that understanding the drivers of consumer demand for money can explain, at least partly, the currency substitution phenomenon. The theories of money demand provide a theoretical understanding of why individuals choose to hold money (be it in local or foreign currency). From the classical to Keynesian perspectives, factors such as income, interest rates (foreign and domestic), exchange rate and its variability and transaction costs have been identified as critical for explaining individual behavior towards the holding of money balances (Akinlo 2022, Kallon and Barrie 2023)

The arguments for these identified factors relate to the fundamental functions of money which are money's roles as a medium of exchange, store of value and unit of account (Adom 2007 and Ajibola et al 2020). Serving as a medium of exchange, individuals hold money (and could alternate between local and foreign currencies) to undertake transactions. Similarly, to maintain the value of assets, individuals choose to hold foreign or domestic currencies. The demand for money informed by the need to store and retain value also relates to the portfolio balance theory (Ajibola et al 2020).

The portfolio balance approach suggests that individuals allocate their financial assets between domestic and foreign currency denominated assets based on relative expected returns (Milenković & Davidović, 2013). In this scenario, when the expected relative returns on foreign currencies increase, individuals are more inclined to substitute assets denominated in local currency with foreign currency-denominated financial assets. Further along this line of theoretical reasoning, individuals prefer to hold foreign currencies in place of domestic currencies to maintain the value of their wealth during uncertain times in the domestic economy when the domestic currency typically depreciates. The essence of this theoretical exposition is captured under the safe - haven hypothesis.

The safe-haven hypothesis argues that in environments characterized by governance failures, and corruption, individuals and businesses shift to well established and stable foreign

currencies to preserve their wealth (Akinlo, 2022). This is the intuition behind the corruption-CS relationship. Studies have also confirmed that corruption contributes to the triple problems of inflation, unemployment, and inequality (Bayar & Aytemiz, 2019; Enofe et al., 2016; Ozsahin & Ulcer, 2017). The existence of these issues in an economy often leads to civil unrest, violence, poverty, and macroeconomic instability, causing businesses and investors to switch to reliable foreign currency such as the USD for security (Akinlo, 2022; Tweneboah et al., 2019).

Corruption undermines confidence in domestic institutions, weakens legal protections for property rights, and fosters uncertainty (Armah 2020 and Armah and Berkoh 2025). These impacts of corruption erode trust in the local currency, causing individuals to seek to hold their assets or wealth in foreign currencies, thereby fostering currency depreciation (Armah, Azenui and Berkoh 2025). Significant currency depreciation results in currency substitution. Therefore, the safe - haven hypothesis offers a theoretical justification for the influence of corruption on currency substitution.

The theory of unofficial dollarization (understood here to mean CS) extends these arguments by demonstrating that when corruption undermines the effectiveness of monetary policy, the domestic currency loses its functions as a store of value and medium of exchange (Tweneboah et al., 2019). In such cases, economic agents increasingly transact in foreign currencies, to circumvent the negative effects of a weak and unstable monetary system.

Theoretical discussion of currency substitution in Ghana

The monetary authorities in Ghana define broad money to incorporate balances on foreign currency deposits (Kovanen 2011). As such, it is expected that some substitution between local and foreign currencies will happen given that individuals are allowed to hold deposits in both local and foreign currencies. To this end, the argument of currency substitution may not necessarily suggest negative outcomes of Ghana's financial system.

However, uncontrolled occurrences of the incidence of CS could be deleterious to the economy. Why? The reason is that apart from the fact that chronic CS is a signal of the failure of a local currency to serve its three essential functions: store of value, unit of account and medium of exchange (Ajibola et al 2020), CS can undermine the effectiveness of monetary policy (Milenković and Davidović 2012 and Akinlo 2022). Hence, there is the need to distill the enablers of currency substitution in the Ghanaian economy, while at the same time recognizing its permissibility. Further the possible impacts of corruption on currency substitution in Ghana, long neglected deserve a deeper look especially for Ghana where corruption is also associated with

inflation (Armah and Berkoh 2025) as well as currency depreciation (Armah Azenui and Berkoh 2025).

As previously mentioned, the core functions of money are that it serves as a medium of exchange, store of value and unit of account. Even though the definition of broad money in Ghana includes foreign currency deposits, according to the Ghana Foreign Exchange Act of 2006 (Act 723), there is an operational limit on the extent to which foreign currencies are allowed to perform the core functions of money in the Ghanaian economy.

Intuitively, the definition of broad money concept as used by Ghana, allows for foreign currencies to be used as a store of value. Also, as Ghana allows for prices to be posted in foreign currencies (at least in a practical sense) this means foreign currencies also meets the unit of account function of money in Ghana. However, when it comes to foreign currencies being used as a medium of exchange, there are legal rigidities, and it is generally not allowed as per Act 723. There are, however, exceptions where foreign currency is allowed as a medium of exchange in unique circumstances subject to regulatory approval. The Bank of Ghana is charged under **Act 723 of** Ghana's legal code with the crafting and regulation of the use of foreign currency and are responsible for publishing and updating the policy guiding the use of same.

The rigidities inherent in the use of foreign currency as a medium of exchange increase the transaction costs associated with holding and using foreign currencies like the USD as a medium of exchange in Ghana. Consequently, it is expected that individuals would hold more local currency balances to honor their transactional obligations in Ghana.

The incentive to hold local currency balances for transactions is eroded in an inflationary environment where the local currency quickly loses value compared to other currencies over time. If foreign currencies like the USD have store of value advantages that overcompensate for the associated transactions cost of holding foreign currencies for transactions in Ghana, then rational agents will substitute the local currency, the Ghana cedi, for a more internationally recognized and stable currency like the US dollar with possible negative consequences for the conduct of monetary policy. This situation, defined as CS is likely to be aggravated in the situation of high corruption where government officials who have acquired wealth by abusing the public trust have an incentive to shield their illegally acquired wealth from a failing currency which is their own doing and justifies a study of the CS-corruption relation.

In summary, currency substitution in Ghana can be analyzed from the function of money perspective, either as a medium of exchange or store of value. So far as individuals are permitted to hold deposits in foreign currencies, it follows that substituting local with foreign currencies is allowed in Ghana, particularly when one considers money as a store of value.

However, when it comes to using foreign currencies as a medium of exchange, the substitutability of foreign currencies for the Ghana cedi is controlled by the BOG, thereby introducing transactions costs to using foreign currencies for transactions. Despite these transaction costs, using foreign currencies as a medium of exchange in Ghana seems to be on the rise. This begs the question of why foreign currencies (especially the United States Dollar) seem to be increasingly replacing the Ghana Cedi as a medium of exchange, even though it is not generally permissible by existing monetary regulations in Ghana.

From the ongoing discussion changes in foreign currency balances relative to local currency holdings in Ghana can be directly attributed to the store of value argument. Nonetheless, traits of 'medium of exchange' tendencies can influence the degree of currency substitution when one considers irregular transactions which are usually occasioned by corruption. This brings to the fore the role of corruption in influencing currency substitution in Ghana. Understanding the magnitude of the potential influence of corruption on currency substitution is crucial because of the serious consequences it has on monetary policy effectiveness (Milenković & Davidović, 2013).

Ghana presents a compelling case for examining the impact of corruption on currency substitution. While the sparse research on Ghana have focused on macro determinants of CS and interrogated the effects of macroeconomic instability on currency substitution in Ghana, the specific role of corruption in this process remains relatively underexplored. Existing studies have primarily focused on macroeconomic variables such as inflation, exchange rate volatility, real GDP, monetary policies, and financial sector development (Antwi, 2020; Aryeetey & Fenny, 2017; Tweneboah et al., 2019). The outcomes of these studies indicate that Ghana's economic growth patterns have seen episodes of high inflation and exchange rate depreciation, which are correlated with increased use of foreign currency or currency substitution.

Following an institutional approach, Tweneboah et al. (2019) examined the relationship between financial development and dollarization, suggesting that corruption-induced inefficiencies in the banking sector contributed to increased reliance on foreign currency. Their research highlighted that in environments where corruption undermines financial sector stability, economic agents prefer to transact in foreign currencies, further entrenching currency substitution.

Tweneboah et al. (2019) did not explicitly account for corruption but made suggestive inferences based on an empirical understanding of how corruption impugns financial development in Ghana. While recognizing Akinlo (2022)'s important analysis on the impact of corruption on CS for Nigeria, as of this study's compilation, the authors of this article have not

identified any existing research that quantitatively explores the direct relationship between corruption and currency substitution in Ghana although Akinlo (20222) did exactly this for Nigeria and Kallon and Barrie (2023) did same for Sierra Leone. We acknowledge the contribution of Tweneboah et al. (2019) analysis of the impact of financial sector development on currency substitution (which they defined as dollarization) in Ghana. However little analysis on the impact of corruption on CS in Ghana is available.

This highlights a gap in the literature regarding the analysis and estimation of the direct relationship between corruption and currency substitution in Ghana. Given the country's recent struggles with allegations of corrupt practices and diminishing confidence in the local currency, it is crucial to investigate how corruption affects currency substitution. We fill this gap in the literature investigating the impact of corruption on CS for Ghana.

Empirical review

There exists limited academic literature that specifically focuses on the effects of corruption on currency substitution in developing countries. While most of these existing studies focused on macroeconomic determinants of currency substitution in developing countries (Yusif et al., 2023; Aigheyisi & Isikhuemen, 2019; Milenković & Davidović, 2013; Pepic et al., 2015; Doguwa, 2014;), the role of institutional factors such as corruption and political climate is increasingly gaining traction in recent publications (Kallon and Barrie 2023, Akinlo, 2022; Tweneboah et al., 2019; Fielding & Shortland, 2012). The macroeconomic factors often considered to impact currency substitution include exchange rate, inflation rate, interest rate, gross domestic product, foreign direct investment, and government expenditure.

Using the ARDL approach, Doguwa (2014) estimated monthly time series data for Cambodia and found that exchange rate risk exerts a significant influence on currency substitution in Nigeria. This is supported by Aigheyisi and Isikhuemen (2019), who reached similar conclusion by estimating a fully modified OLS regression model. Aigheyisi and Isikhuemen (2019) further argued that inflation and real GDP are positively related to currency substitution whereas FDI exerts a significantly negative influence on currency substitution.

In one of the few papers focusing on CS in Ghana, using the fully modified Ordinary Least Square Model (FMOLS) estimation technique on monthly time series data for Ghana, Tweneboah et al. (2019) found that currency depreciation and financial development independently engenders currency substitution in Ghana. However, Tweneboah et al (2019) did not focus on corruption and the data they used did not cover the more recent post-COVID periods. Akinlo

(2022) used the ARDL methodology to estimate times series data in a pre-COVID period and found that exchange rate depreciation promotes currency substitution in Nigeria. Akinlo (2022) argued that the safe-haven hypothesis applies to Nigeria as increases in income levels result in rising incidence of currency substitution. Besides the macroeconomic factors, Akinlo (2022) argued that corruption in the short run enhances currency substitution.

Kallon and Barrie (2023) analyzed recent data for Sierra Leone and concluded that exchange rate depreciation and inflation drive currency substitution, while large international reserves ensure confidence in local currency. These previous studies focus on periods before the COVID pandemic and may not be reflective of the pandemic-instigated nuances. Further, there is limited focus on the corruption-CS relationship for Ghana despite pressures of currency substitution and persistent problems of corruption in the country. It is necessary to interrogate the determinants of currency substitution in Ghana using recent data. It is also important verify the safe-haven hypothesis for Ghana by determining if corruption is a statistically and economically relevant cause of CS in Ghana.

A critical literature review indicates a diverse range of methodologies employed to explore the relationship between currency substitution and corruption. Researchers have utilized both time series and panel data approaches, incorporating a variety of static and dynamic estimation techniques. Among the static methods, Ordinary Least Squares (OLS), as well as fixed and random effects estimators, have been prominently featured. However, given cultural and regional differences in economic and monetary policy across different countries, time series methods that focus on a single country may be preferred to the panel data approach.

Given that a significant number of studies rely on time series data, techniques such as Autoregressive Distributed Lag (ARDL) and Fully Modified Ordinary Least Squares (FMOLS) have become prevalent for examining the dynamic interactions between currency substitutions and its determinants. This comprehensive approach highlights the nuanced relationship between these variables and underscores the importance of selecting appropriate methodologies that fit the context in empirical analyses.

It is also evident that the existing studies on corruption do not necessarily distinguish between the direct and indirect measures of corruption. This study considers both direct and indirect measures of corruption to determine whether the measure of corruption adopted influences the relationship between corruption and currency substitution in Ghana.

3. Empirical Model and Procedures

3.1 Model Specification

Following Akinlo (2022) and Kallon and Barrie (2023), we employ the ARDL model due to Peseran et al (2001) to estimate the corruption- currency substitution relationship. The ARDL is applicable in finite samples and can accommodate variables integrated at different orders (Peseran, Shin and Smith 2001). Additionally, the NARDL model due to Shin, Yu, and Greenwold-Nimoh (2014) was also utilized to study the possible non-symmetric responses of the dependent variable (CS) to the explanatory variables. The flexibility of the NARDL model also makes it possible to identify potential non-linear effects when cointegration is tested among variables integrated of different orders (Armah & Berkoh, 2025 and Shin et al 2014).

The basic OLS specification of the model is specified below:

Currency Substitution = Corruption + Inflation + Money Supply + RGDPC + Exchange Rate + Interest Rate + Oil Price + Gold Price + Cocoa Price + ε_t (1)

Where the error term in (1) is assumed to be identically and independently distributed with a zero mean and standard variance. Subsequent sections below will describe how the model in (1) was extended to the ARDL and NARDL formats, including the tests and empirical approaches used in the estimation.

In (1), following Akinlo (2022) Currency substitution is measured as the ratio of deposit of foreign currency to money supply (M2) minus currency in circulation. *Corruption* refers to the Corruption Perception Index (CPI). However, in subsequent regressions for the purposes of comparison the Control of corruption (COC), and the authors' direct measure of corruption were also used as measures pf corruption. The direct measure of corruption is compiled annual data set from the office of Ghana's Auditor General. In other words, the empirical procedure employed involved estimating each econometric model using first the indirect measures and then the direct measure of corruption as the primary independent variable. The results were then compared. *RGDPC* is the percentage change in real gross domestic product per capita for the years under consideration to proxy changes in income levels which reflect productivity. Real GDP data was obtained from the World Bank Database. The exchange rate (*Exchange Rate)* is measured as the amount of cedis exchanged for a USA dollar, and the interest rate is the average lending rate. The exchange rate and interest rate (*Interest Rate)* came from the Bank of Ghana website and the oil price (*Oil Price)* is measured using the Brent crude index. Gold (*Gold Price)* and cocoa spot prices (*Cocoa Price)* are publicly available international prices

3.2 *Variable description and justification of choice of variables*

As was discussed in the literature review, and following Akinlo (2022), this paper defines Currency substitution as the ratio of foreign currency deposits to total currency deposits in the banking sector. As there was no direct measure of the currency substitution variable, data on total currency deposits and foreign currency deposits were obtained from the Bank of Ghana, out of which currency substitution for Ghana was calculated using Akinlo (2022)'s procedure.

Following Akinlo (2022), currency substitution was defined as the ratio of the total amount of foreign currency deposits to local currency deposits in Ghana cedis. Although this measure might include deposits made in other foreign currencies, the USA dollar is assumed to be the dominant foreign currency in Ghana. Ghanaians trade with other countries using the USD so this choice makes sense. The USD is also a popular choice as a reserve currency in many countries including Ghana due to its ability to maintain its value.

Corruption was measured using perception data because direct measures for corruption are scarce (Berkoh 2021, as cited by Armah and Berkoh, 2025). Thus, following Akinlo (2022) as well as Armah and Berkoh (2025), the corruption perception index (CPI) and the control of corruption (COC) were used as proxies for measuring corruption. CPI and COC were obtained from Transparency International and the World Bank, respectively. CPI data for Ghana has been reported since 1999, although Transparency International has been publishing CPI data since 1995 (Transparency International, 2002). Additionally, CoC has been reported for Ghana since 1996; however, there are gaps in the data for the years 1997, 1999, and 2001 (Kaufman et al, 2010). The timeframe for the study was limited due to limited data availability, especially of the main independent variables such as corruption. Thus, the study employed data from 1998-2023 as that was the period with available data for the complete set of variables. The direct measure of corruption was obtained from publicly available publications released from the office of Ghana's auditor general. CPI was identified as the main indirect measure of corruption, due to its popularity in literature (Armah and Berkoh 2025). CoC was identified as a second indirect measure of corruption to be employed in the study as a robustness check because it has the least missing data and thus spans more years. The missing data for the years 1998 and 2000 were obtained by interpolation.

3.2.1 *Expected sign of the relationship Corruption and Currency Substitution*

A positive relationship between corruption and currency substitution is justified by the literature although a negative relationship is not unreasonable. The justification for corruption

resulting in currency substitution comes from the "sand the wheel" theory of corruption due to Meon (2005), and the "safe haven hypothesis" discussed by Akinlo (2022) among others.

According to the "sand the wheel" hypothesis widespread corruption in an economy can result in a loss of confidence of foreign investors and the citizens in the prospects of an economy. This can occur because of increasing negative sentiments caused by reported news of corrupt activities. Thus, individuals may lose confidence in the leadership, the economy, and the national currency and this will impact on the domestic currency negatively. This negative impact, usually in the form of depreciation of the local currency, will then cause currency substitution where the rational players convert their wealth into a foreign currency to protect its value. In comparison, according to Akinlo (2022) the "safe haven hypothesis" has to do with the negative sentiments that is associated with corrupt governance in a developing economy. This causes government officials, investors and locals in an economy to convert their local currency to a foreign currency like the USD to hold its value as the local currency depreciates, so corruption is positively associated with CS.

A negative relationship between corruption and currency substitution is also possible and is justified by the literature. A negative relationship finds support in the "grease the wheel" theory of corruption due to Meon (2005), where corruption facilitates business activity and enables investors to overcome bureaucratic hurdles. The resulting efficiency can boost productivity and strengthen the local currency via the productivity bias hypothesis (Azaglo 2020). Citizens will maintain their wealth in the local currency and may even convert foreign currency holdings to the local currency, pointing to a positive relationship between corruption and currency substitution. Given that both positive and negative relationships between corruption and CS are possible, the actual direction of the relationship between corruption and currency substitution can only be resolved empirically.

3.2.2 Inflation and Currency Substitution

A positive relationship is expected between inflation and currency substitution even though theoretically a negative relationship is also feasible. Inflation is described as the persistent increase in general prices over a period. This implies that when there is inflation the currency is losing value rapidly over time. In other words, more Ghana cedis must be exchanged for a single USD.

Rampant inflation or hyperinflation causes the domestic currency to lose a lot of value over a short period, leading to a loss of confidence in the domestic currency to perform basic functions like a store of value and unit of account (Gomis-Porqueras, Serrano, & Somuano 2000)

Thus, rational players/citizens will rather convert their wealth into a foreign currency that is more stable to protect that wealth. Thus, we expect that as inflation increases, currency substitution will also increase.

It is important to realize however that inflation often results in currency depreciation, which can give a boost to a country's exports if the Marshall-Lerner conditions are satisfied. The boost in exports will bring in more USD, relative to the local currency boosting the currency value and reducing the desire of the locals to engage in CS: a negative relation between ER and CS. Keynesians will argue that inflation is not a negative phenomenon if it is within an acceptable range because it boosts the economy in the short run. This is what the Phillip curve predicts in the short run. Inflation can boost income growth which provides incentives for citizens to keep their wealth in their own national currency, justifying the negative relationship between inflation and currency substitution. The sign of the inflation-currency substitution relationship can therefore only be resolved empirically as both a positive and a negative relationship is possible.

3.2.3 Real GDP per Capita and Currency Substitution

The sign of the relationship between real GDP and CS is also ex ante indeterminate and can be only resolved empirically although it is likely negative. This is because, on one hand, bigger real GDP numbers represent increasing productivity which is expected to cause appreciation of the local currency by shoring up the local currency as explained by the productivity bias hypothesis due to Samuelson and Bellassa (Azaglo 2020). By this argument real GDP and CS are negatively related. However, on the other hand, increasing incomes can induce agents to acquire more of all normal goods including both local and foreign currencies. Therefore, increasing GDP can induce a preference for foreign over local currency which will lead to depreciation of the local currency and currency substitution. This means a positive sign between the CS and corruption variable is also possible.

3.2.4 Exchange Rate and Currency Substitution

We expect a positive relationship between the exchange rate and currency substitution. Exchange rate, in this scenario, refers to how many Ghana cedis can be exchanged for 1 USD. Thus, if the exchange rate rises (the cedi depreciates), we expect that more cedis will have to be exchanged for dollars, implying the Ghana Cedi is losing its value. As with the case of inflation, as the cedi loses its value on the international market, rational players/citizens will lose confidence in it and thus will choose to convert their cedis into a foreign currency, in this case, dollars. As the number of Ghana cedis needed to buy one USD (the exchange rate) increases, the likelihood of purchasing more USD to save the value

of wealth (CS) increases. A positive relationship between CS and the exchange rate is therefore justified. Although we focus on the exchange rate and not its variability, literature evidence pints to the fact that exchange rate variability does cause currency substitution. Yinusa and Akinlo (2008) using data from Nigeria concluded that exchange variability resulted in currency substitution or dollarization. Given the definition of the exchange rate as the number of cedis to exchange for 1 USD we expect a positive relationship between ER and CS

3.2.5. Commodity Prices and Currency Substitution.

Per Akinlo (2022), the coefficient of the commodity prices is indeterminate as it depends on which commodity is being considered and the global commodity market dynamics at the time. It could be negative or positive and can only be resolved empirically. This makes sense because Ghana is a major exporter of key commodities like gold (largest exporter in Africa) cocoa (3rd largest producer and producer of the most quality cocoa) and oil (8th largest producer in Africa).

When prices of internationally traded commodities like gold, cocoa and oil go up, they can result in a stronger economy for Ghana and reduce currency substitution as the local cedi strengthens. However, by the income effect, as Ghanaians get richer, they may get more of everything including a reliable currency like the USD relative to the cedi (to store value) which will weaken the cedi. It is also reasonable to expect that higher commodity prices affect world economics negatively and affect the export prospects of Ghana which can undermine economic performance and the strength of the Ghana Cedi.

3.2.6 Money Supply and Currency Substitution

Per the Mundell-Flemming model for a small open economy with free flow of capital and a flexible exchange rate, increasing the money supply leads to a depreciation of the currency (Mankiw 2009). Currency depreciation will lead to currency substitution (Akinlo 2022). We expect a positive relationship between the money supply and currency substitution.

3.3 Econometric Approach
The ARDL Model

Despite the possibility of endogeneity due to feedback from some explanatory variables in the currency substitution equation, the model of choice is the ARDL because of the limited sample size. This choice also makes sense given that single equation ARDL model has the potential to correct the endogeneity due to simultaneity by using lags of the variables as does the more general VAR systems approach. The difference is that VAR is a multiple equation approach where all variables

are endogenous and integrated of the same order (Armah and Berkoh 2025). In comparison, the ARDL is a single equation approach that accommodates the integration of different orders. We focus on ARDL because variables could be integrated of different orders, and the sample size is small.

The compact ARDL Model is specified as (2) below:

$$Y_t = \beta_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=0}^{q} \delta_i X_{t-i} + \varepsilon_t \tag{2}$$

Where, β_0 is a constant; Y_{t-i} refers to the lags of the dependent variable with corresponding coefficients α_i; X_{t-i} refers to the lags of the independent variables with corresponding coefficients δ_i. p and q are the lag lengths of dependent and the independent variables respectively which will be determined by the Akaike Information Criterion (AIC) optimal lag selection criteria. Th error term ε_t is assumed to be independently and identically distributed (*iid*) with a zero mean and a constant variance.

The ARDL employed is specified below:

$$Currency\ Substitution_t = a_0 + CS_{t-1} + \beta_1 Inflation_t + \beta_2 RGDP_t\ per\ capita +$$

$$\beta_3 ExchRate_t + \beta_4 Interest\ Rate_t + \beta_5 Money\ Supply_t + \beta_6 Currency\ in\ Circulation_t +$$

$$\beta_7 Gold\ Price_t + \beta_8 Oil\ Price + \beta_9 Cocoa\ Price +_t + \beta_{10}\ Corruption +$$

$$_t \sum_{i=1}^{p} \delta_{1i} Inflation_{t-i} + \sum_{i=0}^{q} \delta_{2i}\ RGDPC_{t-i} per\ capita + \sum_{i=0}^{q} \delta_{3i}\ ExchRate_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{4i}\ Interest\ Rate_{t-i} + \sum_{i=0}^{q} \delta_{5i}\ Money\ Supply_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{6i}\ Currency\ in\ Circulation_{t-i} + \sum_{i=0}^{q} \delta_{7i}\ Gold\ Price_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{8i}\ Oil\ Revenue\ Price_{t-i} + \sum_{i=0}^{q} \delta_{9i}\ Cocoa\ Price_{t-i} + \varepsilon_t$$

(3)

Where, CS_{t-1} is the lag of the dependent variable, corruption, $Inflation_t$, $RGDP\ per\ Capita_t$, $ExchRate_t$, $Interest\ Rate_t$, $Money\ Supply_t$, $Currency\ in\ Circulation_t$, $Gold\ Price_t$, $Oil\ Price_t$, $Cocoa\ Price_t$ **and Corruption**$_t$ are the contemporaneous independent variables with their coefficients β_1-β_5. $Inflation_{t-i}$, $RGDP\ per\ Capita_{t-i}$, $ExchRate_{t-i}$, $Interest\ Rate_{t-i}$, and $Money\ Supply_{t-i}$, $Currency\ in\ Circulation_{t-i}$, $Gold\ Price_{t-i}$, $Oil\ Price_{t-i}$ and $Cocoa\ Price_{t-i}$ are the lags of the independent variables with their coefficients δ_1-δ_1. p and q are the lag lengths of the dependent and the independent variables, respectively.

To test for cointegration among the variables, we specify the following ARDL Bounds test equation

(4):

$\Delta Currency\ Substitution_t$

$$= \delta_0 + \sum_{i=1}^{p} \delta_{1i}\,\Delta Corruption_{t-1} + \sum_{i=1}^{p} \delta_{2i}\Delta Inflation_{t-i} + \sum_{i=0}^{q} \delta_{3i}\,\Delta RGDPC_{t-1}$$

$$+ \sum_{i=0}^{q} \delta_{4i}\,\Delta ExchRate_{t-i} + \sum_{i=0}^{q} \delta_{5i}\,\Delta Interest\ Rate_{t-i}$$

$$+ \sum_{i=0}^{q} \delta_{6i}\,\Delta Money\ Supply_{t-i} + \sum_{i=0}^{q} \delta_{7i}\,\Delta Currency\ in\ Circulation_{t-i}$$

$$+ \sum_{i=0}^{q} \delta_{8i}\,\Delta Gold\ Price_{t-i} + \sum_{i=0}^{q} \delta_{9i}\,\Delta Oil\ Price_{t-i} + \sum_{i=0}^{q} \delta_{10i}\,\Delta Cocoa\ Price_{t-i}$$

$$+ \beta_1 Corruption_{t-i} + + \beta_2 Inflation_{t-i} + \beta_3 RGDP\ per\ Capita_{t-i}$$

$$+ \beta_4\ ExchRate_{t-i} + \beta_5\ Interest\ Rate_{t-i} + \beta_6\ Money\ Supply_{t-i}$$

$$+ \beta_7 Currency\ in\ Circulation_{t-i} + \beta_8\ Gold\ Price_{t-i} + \beta_9 Oil\ Price$$

$$+ \beta_{10}\ Cocoa\ Price_{t-i} + \varepsilon_t$$

(4)

Where, $\Delta Corruption_t$, $\Delta Inflation_t$, $\Delta RGDPC_t$, $\Delta ExhRate_t$, $\Delta Interest\ Rate_t$, $\Delta Money\ Supply_t$, $\Delta Currency\ in\ Circulation_t$, $\Delta Gold\ Price_t$, $\Delta Oil\ Price_t$ and $\Delta Cocoa\ Price_t$ are the short run components, with their coefficients δ_1-δ_6 **and** Δ is the typical difference operator with respect to time of variables.

$Corruption_{t-i}$, $Inflation_{t-i}$, $RGDPC_{t-i}$, $ExchangeRate_{t-i}$, $Interest\ Rate_{t-i}$, $Money\ Supply_{t-i}$, $Currency\ in\ Circulation_{t-i}$, $Gold\ Price_{t-i}$, $Oil\ Price_{t-i}$ **and** $Cocoa\ Price_{t-i}$ are the long run components with their coefficients, β_1-β_{10}.

We test the hypothesis:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$

(5)

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq 0 = \beta_{10} \neq 0$ (6)

The ECM version of the ARDL equation is shown below in (7)

$\Delta Corruption_t = \delta_0 + \sum_{i=1}^{p} \delta_{1i}\,\Delta Corruption_{t-1} + \sum_{i=1}^{p} \delta_{2i}\Delta Inflation_{t-i} +$

$\sum_{i=0}^{q} \delta_{3i}\,\Delta RGDPC_{t-1} + \sum_{i=0}^{q} \delta_{4i}\,\Delta Interest\ Rate_{t-i} + \sum_{i=0}^{q} \delta_{5i}\,\Delta Money\ Supply_{t-i} +$

$\sum_{i=0}^{q} \delta_{6i}\,\Delta Currency\ in\ Circulation_{t-i} + \sum_{i=0}^{q} \delta_{7i}\,\Delta Gold\ Price_{t-i} + \sum_{i=0}^{q} \delta_{8i}\,\Delta Oil\ Price_{t-i} +$

$\sum_{i=0}^{q} \delta_{9i}\,\Delta Cocoa\ Price_{t-i} + \varphi ECT_{t-1} + \varepsilon_t$ (7)

After establishing cointegration, we estimate an ARDL error correction model as displayed in (7) to investigate the short run and the long run dynamics. Every variable in (7) is explained as in (4)

and (6) above, except ECT_t, the error correction term, which is the lagged residuals of the long run model. φ is the coefficient of the error correction term, indicating the speed of adjustment to long run equilibrium.

The NARDL Model

The traditional ARDL assumes that there is symmetric effect of the independent variable on the dependent variable. Applied to this context, the magnitude of the effect of increasing inflation on corruption will be identical to the magnitude of the effect of decreasing inflation on corruption with the only difference being the sign. However, that might not be the case, as the relationship might be asymmetric so requiring the application of the Non-Linear ARDL approach (Armah and Berkoh 2025, and Shin, Yu and Greenwood-Nimoh (2014).

Taking this possibility of asymmetry into account, we estimate the Nonlinear ARDL Bounds test with the model specified below (8):

$$\Delta Corruption_t = \delta_0 + \sum_{i=1}^{p} \delta_{1i} \Delta Corruption_{t-1} + \sum_{i=1}^{p} \delta_{2i}^{+} \Delta Inflation^{+}_{t-i} +$$

$$\sum_{i=1}^{p} \delta_{3i}^{-} \Delta Inflation^{-}_{t-i} + \sum_{i=0}^{q} \delta_{4i}^{+} \Delta RGDP^{+}_{t-1} + \sum_{i=0}^{q} \delta_{5i}^{-} \Delta RGDP^{-}_{t-1} +$$

$$\sum_{i=0}^{q} \delta_{6i}^{+} \Delta Interest\ Rate^{+}_{t-i} + \sum_{i=0}^{q} \delta_{7i}^{-} \Delta Interest\ Rate_{t-i} + \sum_{i=0}^{q} \delta_{8i}^{+} \Delta Money\ Supply^{+}_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{9i}^{-} \Delta Money\ Supply^{-}_{t-i} + \sum_{i=0}^{q} \delta_{10i}^{+} \Delta Currency\ in\ Circulation^{+}_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{11i}^{-} \Delta Currency\ in\ Circulation^{-}_{t-i} + \sum_{i=0}^{q} \delta_{12i}^{+} \Delta Gold\ Price^{+}_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{13i}^{-} \Delta Gold\ Price^{-}_{t-i} + \sum_{i=0}^{q} \delta_{14i}^{+} \Delta Oil\ Price^{+}_{t-i} + \sum_{i=0}^{q} \delta_{15i}^{-} \Delta Oil\ Price^{-}_{t-i} +$$

$$\sum_{i=0}^{q} \delta_{16i}^{+} \Delta Cocoa\ Price^{+}_{t-i} + \sum_{i=0}^{q} \delta_{17i}^{-} \Delta Cocoa\ Price^{-}_{t-i} + \rho_1 Corruption_{t-i} +$$

$$\beta_2^{+} Inflation^{+}_{t-i} + \beta_3^{-} Inflation^{-}_{t-i} + \beta_4^{+} RGDP^{+}_{t-i} + \beta_5^{-} RGDP^{-}_{t-i} +$$

$$\beta_6^{+} Money\ Supply_{t-i} + \beta_7^{-} Money\ Supply^{-}_{t-i} + \beta_8^{+} Currency\ in\ Circulation^{+}_{t-i} +$$

$$\beta_9^{-} Currency\ in\ Circulation^{-}_{t-i} + \beta_{10}^{+} Gold\ Price^{+}_{t-i} + \beta_{11}^{-} Gold\ Price^{-}_{t-i} +$$

$$\beta_{11}^{+} Oil\ Price^{+}_{t-i} + \beta_{12}^{-} Oil\ Price^{-}_{t-i} + \beta_{13}^{+} Cocoa\ Price^{+}_{t-i} + \beta_{14}^{-} Cocoa\ Price^{-}_{t-i} + \varepsilon_t$$

$$(8)$$

Where, $\sum_{i=0}^{q} \delta_i^{+}$ and $\sum_{i=0}^{q} \delta_i^{-}$ denote the short run response to a positive change in X_i and negative change in X_i, respectively; $\frac{-\beta_i^{+}}{\rho}$ and $\frac{-\beta_i^{-}}{\rho}$ are the long run positive and negative asymmetric effects of X_i (*the* βi) on corruption scaled by the coefficient on the lagged dependent variable ρ.

Bounds Test of Cointegration

Following **Shin-Yu and Greenwood-Nimoh (2014),** to test for the cointegration in the context of long-run asymmetric response, we test the following hypothesis (9):

$$H_0: \rho = \beta^{+} = \beta^{-} = 0 \qquad (9)$$

If we reject H_0, then we conclude that, the variables are cointegrated in the presence of asymmetry. Once long-run asymmetric cointegration is established, we proceed to jointly test the significance of the asymmetric coefficients as shown below (10):

$$H_0 = \frac{-\beta_i^+}{\rho} = \frac{-\beta_i^-}{\rho} \qquad (10)$$

If H_0 is rejected, we conclude that there is a significant long-run asymmetric effect.

4.0 Results

4.1 Descriptive Statistics

Panels A and B of Table 1 respectively present summary statistics and a correlation matrix for the main variables used in the regressions. All the variables in the model are log - transformed. From panel A, Currency Substitution (CS) shows moderate variation with a mean of -0.785 and standard deviation of 0.216. Similarly, all other variables display moderate standard deviation except for money supply, which recorded a standard deviation exceeding 5. This suggests that the distributions of the transformed variables do not include outliers, and are comparable to a normal distribution as evidenced by their low kurtosis and skewness. The correlation matrix in Panel B shows moderate correlation among the explanatory variables, except for the high correlation between GDP per capita and the exchange rate and the money supply. Overall, it does not seem multicollinearity will be a big problem. The pairwise relationships among per capita GDP, exchange rate, money supply and corruption seem consistent with theoretical expectation.

Table 1: Summary Statistics and Correlation Matrix

	Currency Substitution	Per capita GDP	Monetary Policy Rate	Exchange Rate	Inflation Rate	Money Supply	Oil Price	Corruption
Panel A: Summary Statistics								
Mean	-0.785	7.305	2.955	0.717	2.713	9.266	4.062	3.681
Std. Dev.	0.216	0.267	0.275	1.02	0.508	1.925	0.508	0.112
Min	-1.055	6.919	2.539	-1.312	1.935	5.835	3.196	3.497
Max	-0.041	7.682	3.384	2.702	3.696	12.263	4.716	3.871
Skewness	1.501	-0.118	0.152	0.16	0.371	-0.221	-0.5	-0.231
Kurtosis	6.436	1.471	1.599	2.172	2.237	1.872	1.979	2.036
Observation	26	26	26	26	26	26	26	26

Panel B: Pairwise Correlation Matrix							
Per capita GDP	1						
Monetary Policy Rate	-0.135	1					
Exchange Rate	0.957	0.017	1				
Inflation Rate	-0.23	0.732	-0.006	1			
Money Supply	0.987	-0.162	0.973	-0.186	1		
Oil Price	0.63	-0.576	0.514	-0.382	0.647	1	
Corruption	0.805	-0.173	0.725	-0.264	0.779	0.622	1

Source: The Author

Note: The corruption variable is measured by the CPI which is a perception-based and indirect measure of corruption. The appendix contains estimation with other indirect measures of corruption such as the Control of Corruption (COC) index as well as a direct measure of corruption collated by the Ghana Office of the Auditor general.

To determine the nature of the relationship between corruption and currency substitution in Ghana, we employ the ARDL approach developed by Pesaran et al. (2001) specifically because we have a small sample size. To begin with ARDL estimations, necessary preconditions with regards to the unit root property of variables must be satisfied. In essence, although ARDL estimation is valid even if some variables are I(0) and others are I(1), an ARDL estimation requires that none of the variables is integrated of order 2 [I(2)] (Shin, Smith and Greenwold Nimoh 2014) .

We tested for the presence of unit roots using both the Augmented Dickey-Fuller (ADF) and Philip-Peron (PP) unit roots tests. The results are reported in Table 2 below. The results of the two tests are consistent: CS and money supply are stationary at levels, whereas the remaining variables are I(1). Given that none of the variables is I (2), we proceed to test for cointegration among the variables using the Bounds F-test developed by Pesaran et al. (2001). The results of the Bounds test for the three models are presented in Table 3.

Table 2: Results of Unit Root Tests

Variables	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)	
	Levels	First Difference	Levels	First Difference
Currency Substitution	-4.547***	-	-4.553***	
Per capita GDP	-0.336	-3.391**	-0.372	-3.395*
Monetary Policy Rate	-1.690	-3.141**	-2.018	-3.128*
Exchange Rate	-0.532	-5.171***	-0.590	-5.124***
Inflation	-2.523	-5.377***	-2.653*	-5.413***
Money Supply	-2.972**	-	-2.877*	
Oil Price	-1.923	-4.605***	-1.902	-4.597***
Corruption	-2.060	-7.114***	-1.992	-7.021***

Notes: (i) ***, ** and * denote 1%, 5% and 10% significance levels, respectively. (ii) The null hypothesis of both the ADF and PP tests is that a unit root exists.

The critical values for both ADF and PP tests are −3.750, −3.000 and –2.630 at 1%, 5% and 10%, respectively.

Source: The Author

According to Pesaran et al. (2001), the ARDL Bounds Test approach tests the null hypothesis of no levels relationship among variables in the long run. The decision criteria follows that we reject the null hypothesis if the F-statistic is greater than the relevant critical value. From Table 3, the F-statistics exceed the upper critical values at the 1 percent significant level for all the models. For instance, for Model 1, the F-statistics of 6.087 exceeds the upper bound value of 4.68 at 1% significance level. Therefore, we reject the null hypothesis and conclude that there is cointegration in all 3 models.

Having established that the variables are cointegrated, we proceeded to estimate the long-run and short-run relationships of the three models after incorporating the error correction term. In estimating the ARDL models, the maximum lag length was set equal to 2 based on the Akaike Information Criteria (AIC) for each model. The results of the long-run and short-run estimations are shown in Table 4A and Table 4B respectively, after homoskedasticity was confirmed.

The main result of the study is presented under Model 1 in both Table 4A and Table 4B. The other models were included to gauge the independent influences of money supply and oil price changes and are in essence robustness checks. The adjustment coefficients (the error correction) from Table 4B suggest that the system over-adjusts in models 2 and 3 and suggestive of possible misspecifications. However, for model 1, the error correction process exhibits oscillatory convergence (Yunil et al., 2023; Narayam & Smith, 2006). According to Narayam and Smith (2006), an ECM term between -1 and -2 implies that long-run equilibrium is attained in a fluctuating form.

Table 3: Bounds F-test for Cointegration

Estimated Model	K	F-statistics	Outcome	Model
$CS = f(corr, gdp, mpr, er, inf)$	5	6.087***	Cointegration	1
$CS = f(corr, gdp, mpr, er, inf, ms)$	6	11.187***	Cointegration	2
$CS = f(corr, gdp, mpr, er, inf, ms, oilp)$	7	55.811***	Cointegration	3
Significance Level	LCB I(0)		UCB I(1)	
Model 1	3.41		4.68	
Model 2	3.15		4.43	
Model 3	2.96		4.26	

Note: ***denotes 1% significance level.
Source: The Author

The long-run results presented in Model 1 of Table 4A reveal a positive relationship between corruption (CPI) and currency substitution (CS) and therefore a negative relationship between corruption and currency substitution in the long run. This relationship is statistically significant at 5 percent significance level. Specifically, a one percent increase in the CPI results in an increase in currency substitution of 1.2 percent. Thus, since all variables are in log form, currency substitution is fairly corruption elastic. This also means that as perceived corruption improves (ie. corruption falls), currency substitution increases, justifying the negative long-run relationship between corruption and currency substitution. Since by the grease the wheel hypothesis corruption can boost income and prop up the currency value in the long run, the finding that corruption eventually reduces CS is not surprising. However, the result is inconsistent with some literature findings such as Akinlo (2022) and Kallon and Barrie (2023).

In comparison, currency substitution increases with monetary tightening in the long run. On the exchange rate, as the Ghana cedi depreciates by one percent, currency substitution increases by approximately 0.8 percent in the long run. For the monetary policy rate, a 1 percent increase leads to a 0.3 percent increase in currency substitution in the long run. The finding that currency depreciation increases currency substitution is consistent with Akinlo (2022) and Kallon and Barrie (2023).

The long-term results also show that inflation exerts a negative and statistically significant influence on currency substitution. In effect, a 1 percent increase in the inflation rate results in about 0.4 percent drop in currency substitution. Furthermore, income (measured by per capita GDP) has a significantly negative influence on currency substitution. In that CS falls by 3.84 percent for every percentage increase in income.

It is observed that the relationships for the long run and the short run are not identical for most of the independent variables. For inflation and income, the results in the long run deviate from their short-run narrative. The short-run results in Table 4B differ from the long-run results for corruption as well. From Model 1 in Table 4B, corruption is not significantly related to CS in the short run because the difference of CPI variable is not significant and the first lag of the difference of corruption is only significant at

10%. This is different from the long-run situation where corruption and currency substitution are negatively and significantly related.

However, the short-run results do show a strongly positive influence of income on currency substitution, making currency substitution highly responsive to changes in income in the short run. Specifically, a unit increase in the first difference of the natural log of income increases the natural log of currency substitution by approximately 10.8 units. In the same vein, the short-run estimate for inflation depicts a positive relationship contrary to the negative long-run relationship.

Table 4A: Estimated Long-run Coefficients from ARDL Models

Variables	(1) Model 1	(2) Model 2	(3) Model 3
Long Run			
Per capita GDP	-3.840**	-5.334***	-7.766*
	(1.213)	(0.834)	(0.617)
Monetary Policy Rate	0.283*	0.343*	0.420
	(0.144)	(0.136)	(0.0880)
Exchange Rate	0.810**	1.061**	1.699*
	(0.291)	(0.250)	(0.239)
Inflation Rate	-0.417*	-0.352**	-0.697*
	(0.219)	(0.110)	(0.0799)
Money Supply		0.0375	-0.00967
		(0.0930)	(0.0808)
Oil Price			0.0363
			(0.0850)
Corruption	1.246**	2.112**	3.081*
	(0.487)	(0.471)	(0.353)
Constant	40.71***	84.20**	152.4*
	(12.77)	(19.60)	(16.43)

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: The Author

Table 4B: Estimated Short-run coefficients from the ARDL Models

Variables	(1) Model 1	(2) Model 2	(3) Model 3
LD.lnCS	0.446	0.974**	1.443*
	(0.249)	(0.304)	(0.175)
D.lnpcGDP	10.78***	22.56**	32.38*
	(2.801)	(5.316)	(3.701)
LD.lnpcGDP		5.748*	14.02*
		(2.252)	(2.210)
D.lnMPR	0.129	-1.469*	-2.119
	(0.430)	(0.549)	(0.627)
LD.lnMPR	0.556	1.416*	1.925*
	(0.390)	(0.530)	(0.263)
D.lnER	-0.513	-1.930*	-3.475
	(0.451)	(0.762)	(0.994)

LD.lnER			0.165
			(0.163)
D.lnINF	0.679**	1.326**	2.407*
	(0.261)	(0.307)	(0.357)
LD.lnINF	0.165	0.343*	0.794*
	(0.121)	(0.124)	(0.122)
D.lnM2		-2.403**	-2.080
		(0.712)	(0.496)
LD.lnM2		-1.649	-2.579
		(0.930)	(0.474)
D.lnoilpx			0.498
			(0.210)
D.lncorr		-0.0721	-2.807
		(0.753)	(0.754)
LD.lncorr		1.048*	0.416
		(0.447)	(0.281)
Constant	40.71***	84.20**	152.4*
	(12.77)	(19.60)	(16.43)
Adjustment			
L.lnCS	-1.831***	-2.867***	-3.465**
	(0.367)	(0.435)	(0.243)
Observations	24	24	24
R-squared	0.924	0.986	0.999

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusions

The paper sought to investigate the determinants of currency substitution (CS) in Ghana from the Ghana cedi to the United States Dollar and to confirm or refute an economic and statistically relevant relationship between currency substitution and corruption. The justification for the corruption-CS nexus comes from the safe -haven hypothesis where corrupt officials who acquire money and wealth in a corrupt way try to avoid public scrutiny by depositing their wealth as foreign currency with local banks.

We admit that CS can also be facilitated by currency depreciation which could be the result of corruption-motivated money printing. As the local currency loses value rational consumer substitute local Ghana Cedis for foreign currency, typically the USD.

Using the ARDL model (since the NARDL model did not converge), specifically the Peseran et al. (2001), ARDL Bounds Test approach we find that the variables in the empirical model are cointegrated. After establishing cointegration we estimated the long-run and short run relationships of the three models after incorporating the error correction term. The long-run results reveal an unexpected and positive relationship between corruption (CPI) and currency

substitution (CS) and therefore a negative relationship between corruption and currency substitution in the long run because of the way CPI is defined.

As discussed, all variables are in log form, so the coefficients are elasticities so currency substitution is fairly corruption elastic. This also means that as perceived corruption improves (ie. corruption falls), currency substitution increases, justifying the negative long-run relationship between corruption and currency substitution. By the grease the wheel hypothesis, corruption can boost income and prop up the value of the Ghana cedi in the long run, so the finding that corruption eventually reduces CS is plausible but not totally convincing.

It is observed that the short-run relationships differ from the long run relationships for most of the independent variables. Corruption is not significantly related to CS in the short run at 95% confidence level but is positively related to CS at 90% confidence. For inflation and income, the results in the long run deviate from their short-run narrative. The short-run estimate for inflation depicts a positive relationship contrary to the negative long-run relationship.

The finding of weak positive short run impact of corruption on CS but negative and significant long run impact suggests that corruption does cause some depreciation and eventually currency substitution in the short run. However, the weak currency may boost exports and productivity if the Marshall Lerner Conditions are fulfilled. By the Productivity Bias hypothesis this will strengthen the Ghana cedi and cause a reverse substitution of USD for the Ghana cedi. Policymakers should therefore redouble their efforts to increase productivity and exports in Ghana as endemic corruption may cause currency substitution in the short run.

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