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Macroeconomic Determinants of House Prices in Urban Ghana: Evidence from Valuation Data

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Abstract

While the determinants of house prices have enjoyed much research attention spanning many decades, the impact of macroeconomic variables has seen significantly less research. Of the studies that do exist, only a few cover developing markets, and the results from these studies are insufficient and controversial. In this paper, we examine the macroeconomic determinants of house prices in a developing economy - Ghana. Using primary empirical data on house prices, we examine the impact of macroeconomic variables on house prices in Accra, Kumasi and Urban Ghana (an aggregate of the two markets). We find strong evidence of cointegration between macroeconomic factors and house prices in Kumasi. The study reveals that in the long run, while Kumasi's house prices are influenced by population growth, GDP growth, interest rates and inflation, prices in Urban Ghana and Accra are only influenced by population growth. Our short-run estimates show that both contemporaneous and lagged values of GDP growth, interest rates, inflation, GSE growth rate, and population growth show significant relationships with house prices across Urban Ghana, Kumasi, and Accra. Additionally, the error correction terms indicate a strong and statistically significant speed of adjustment, suggesting rapid convergence to long-run equilibrium following short-run shocks. These findings are against the random walk model for house prices. This is the first study on the Ghana housing market that uses valuation data from multiple sources to understand the housing market and macroeconomic variables. The dataset used in this study is original, unique and a significant contribution to knowledge.

Keywords: House price determinants, macroeconomic determinants, housing market, housing valuation.

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Introduction

Housing is a major consumption good in most developing countries, typically shaped by social and political considerations and sometimes viewed as an adjunct to economic and industrial policy Piazzesi et al. (2007). However, housing is not merely a peripheral activity but a central force of sound economic development and must be considered an essential asset. Its construction and use influence economic growth through employment, savings, investment, and labour productivity (Harris & Arku, 2006). Therefore, housing should be accorded serious consideration in economic growth strategies (Tibaijuka, 2013).

Housing constitutes a vital element of a household's portfolio and has a significant impact on the business cycles of various developed countries (Hale, 2006; Owusu-Ansah et al., 2021). However, without careful strategic planning and understanding of its economic role, international dynamics can create local housing situations vulnerable to market and social failures (Haslam McKenzie & Rowley, 2013). It is critical to recognise that the housing market's performance has a significant impact on the overall performance of the economy. Therefore, the impact of housing on economic and social variables necessitates examining the elements that influence house prices (Cohen & Karpavičiūtė, 2017) to understand the dynamics for appropriate policy prescription better.

A large volume of literature has studied this relationship due to its significance (Akça, 2023; Benazić & Učkar, 2024; Duan et al., 2021; Pinjaman & Kogid, 2020; Wang et al., 2020; Wigren & Wilhelmsson, 2007; Wong et al., 2020), especially in developed economies, with the primary focus being on the relationship between house prices and other macroeconomic indicators and stock prices. House price changes have been ascribed to national income, interest rates and stock prices in advanced countries such as United States, Ireland, the Netherlands, the United Kingdom, Canada, and Australia (Sutton, 2002). Abelson et al. (2005) and Gasparėnienė et al. (2016) further establish that in the long-run, real house prices are determined significantly by macroeconomic factors such as real disposable income, consumer price index, interest rates, equity prices as well as the availability of bank loans. This is supported by an earlier study by Baffoe-Bonnie (1998) who confirms that the housing market is particularly sensitive to shocks in the employment growth and mortgage rates at both national and regional levels. These and other studies provide evidence that macroeconomic factors influence house price changes.

The existing literature, however, focuses predominantly on developed economies. Only a few such studies exist for developing economies, and for Ghana in particular, only one such study was found (Owusu-Ansah et al., 2021). Cohen and Karpavičiūtė (2017) and Gasparėnienė et al. (2016) have emphasised how insufficient results and scientific attention have been accorded to the impact of macroeconomic factors such as inflation, GDP, employment, demographics and the like on house price analysis in less developed countries, including Ghana, where the relationship between such indicators and house prices remains under-examined (Owusu-Ansah et al., 2021). As a result, the current study focuses on the Ghanaian housing market from a macroeconomic analysis perspective.

Ghana's housing market is booming, thanks to the inflow of non-resident Ghanaians and foreign homebuyers following a recent Year of Return initiative (Gebauer & Umscheid, 2021). Prices for completely furnished three-bedroom residences in Accra, Ghana's capital, range from $100,000 to $500,000, which is about 15% higher than the rest of the country. In Ghana, even though the fluctuations in house prices have been attributed to microeconomic factors such as characteristics of the local environment and costs of building materials (Danso & Obeng-Ahenkora, 2018), macroeconomic factors significantly impact house price levels, which surprisingly has not received commensurate attention. The relationship between macroeconomic indicators and house prices thus provides an opportunity to inform policy formulation (Owusu-Ansah et al., 2021) and provide insight into the state of the economy as well as influence prices of goods and services (Gasparėnienė et al., 2016).

The gap in the literature has remained unmet because the need to understand the relationship between the macroeconomy and housing market is exacerbated by the peculiar data challenges that plague emerging countries (Hoque, 2019; Monkam & Moore, 2015). The poor quality of data available for such analyses can be attributed to the lack of a centralised effort to collate and organise data, as exists in other developed economies. Econometric models require a significant level of detail not just for the price data for each housing unit but also macroeconomic variables to make the analysis possible. It is worthy to note that Ghana is slightly better placed, relative to other emerging markets (Hoque, 2019); but the level of data available still limits the level of rigorous analysis that can be conducted.

This paper, therefore, examines the macroeconomic determinants of house price movements in Ghana to contribute to this vital area of house price analysis. It demonstrates the use of a housing index to study the relationship between house prices and macroeconomic indicators. It thus represents a significant contribution to the extant literature, and for the Ghanaian market, is a near-novelty due to the uniqueness of the approach.

The rest of the paper is structured as follows: section 2 reviews the relevant literature, section 3 discusses the data, section 4 discusses the empirical strategy, section 5 presents and analyses the results, and section 6 concludes.

Review of Relevant Literature

There is extensive literature on the factors that influence house prices, generating an extensive list of determinants. Metzner and Kindt (2018) for example found that a total of 407 parameters has been used in hedonic valuation and performance analysis, which they further sort into higher and lower-level groups. House price determinants have been categorised into many groups (Owusu-Ansah, 2012), and a commonly used categorisation was suggested by Wilhelmsson (2000) who found four main categories of property price/value determinants: structural attributes, location/neighbourhood amenities, environmental attributes and macro determinants. Most empirical studies on house price determinants focus on some or all of these sets of determinants. The set of factors can be easily recategorized as micro determinants (consisting structural, locational and environmental factors) and macro determinants (including inflation, GDP, population growth, etc) with a significant majority of studies focusing on the former. In this paper, we explore the latter, which are discussed next.

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Macro-level Determinants

The impact of macroeconomic variables on house prices has enjoyed some academic attention, with a significant number of studies empirically investigating this relationship. The commonest variables sampled in the existing literature are gross domestic product (GDP) or gross national income (GNI), population or population growth, inflation or consumer price index (CPI), employment or unemployment rate, interest rate and stock price (Owusu-Ansah et al., 2021). Table 1 below summarises some recent studies that investigate the relationship between macroeconomic variables and house prices. It is clear from the table that the commonest variables are GDP, interest rate, inflation rate, stock market index, foreign exchange rate, population, employment rate, and availability of financing.

Table 1: Recent Studies on Macroeconomic Determinants of House Prices

Author(s)/year	**Country/Region**	**Macroeconomic Variables**
Benazić and Učkar (2024)	Croatia	GDP, credit, CPI, interest rate, tourist arrivals
Bangura and Lee (2023)	Australia	Population
Churchill et al. (2021)	17 OECD Countries	GDP per capita, population, mortgage loans-to-GDP, interest rate, inflation rate, transport infrastructure
Bangura and Lee (2020, 2022)	Australia	Population, Stock index
Al-Masum and Lee (2019)	Australia	Gross disposable income, housing supply, unemployment rate, lending rate, GDP
Kaulihowa and Kamati (2019)	Namibia	GDP, mortgage loans
Kok et al. (2018)	Malaysia	Real GDP, interest rate, exchange rate
Wang et al. (2020)	Australia	Mortgage interest rates, consumer sentiment, stock market index, unemployment rate
Salihu and Yusof (2017)	South Africa	Inflation rate, long-term interest rate, short-term interest rate, GDP, exchange rate
Gasparėnienė et al. (2016)	Lithuania	GDP, inflation rate, interest rate, availability of funding
Ciarlone (2015)	16 emerging countries from Asia, Central and Eastern European countries	Average wage rate, interest rate, mortgage availability, employment rate, construction costs

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Lin et al. (2014)	USA	Interest rate, mortgage availability, rent-income ratio
Oktay et al. (2014)	Turkey	Inflation, public investment, interest rate, availability of housing, loans, GDP (GNI), household income, employment rate
Goddard and Marcum (2012)	USA	Inflation rate, interest rate, environmental pollution, availability of mortgages, currency exchange rate
Pomogajko and Voigtländer (2012)	OECD countries	GDP, convergence of business cycles, availability of credit
McCord et al. (2011)	Northern Ireland	Availability of mortgage, interest rate, income, liberalization of finance markets

Source: Author (Adapted from Owusu-Ansah, 2021)

Next, we discuss briefly the a priori relationship expected between house prices and some of these key variables.

GDP/GNI

GDP is the total amount of good and services produced by a country while GNI is the total amount of money earned by a nation's people and businesses. Both being measures of economic performance, they are used interchangeably to assess the health of a nation's economy. An increase in GDP/GNI thus leads to an increase in demand for goods and services, as people have more income to pay for these goods and services. Housing, being an economic good, is also expected to witness an increase in demand, which shifts prices up, holding supply constant. The reverse us also true, in that as the wealth of a nation (indexed by GDP/GNI) reduces, there is little money to purchase housing, which comes at a colossal cost, hence driving prices down. There is therefore an expected positive relationship between GDP growth and house prices. Several empirical studies have found this positive relationship between house prices and GDP in differing countries. Churchill et al. (2021) for instance, in a study that utilised data from 17 OECD countries from 1870 to 2016 constructed a parametric model that found that GDP per capita is positively related to house prices, among other variables. Other studies that found this positive relationship include Wang et al. (2020), Oktay et al. (2014) and Kok et al. (2018).

Population Growth

Given that housing is a derived good that provides utility for households, it is expected that population size or growth will influence house prices. An increase in population means more people will need housing and thus be making demand for housing. This increase, if unmatched my housing supply, will push house prices up as people will seek to outbid each other. This shows a positive relationship between population growth and house prices and has been confirmed by Miles (2012).

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Inflation Rate

Inflation is a measure of the rate of change of the prices of goods and services, often including housing. If prices of goods and services in a country are increasing, house prices are expected to increase along with it. Housing is thus regarded as a hedge against inflation, as house prices increase along with inflation. Recent studies that have investigated the inflation-rate-house-price relationship include Churchill et al. (2021) and Gasparėnienė et al. (2016).

Employment Rate

The employment rate of a country is a measure of the employment-to-population (OECD, 2020) and thus highlights the section of the total population that is currently employed and thus likely to have capacity to constitute effective demand. If employment rates are high, it means more people are earning income, some of which they can channel towards purchasing/renting housing, thus resulting in increased demand. This increased demand, as explained prior where unmatched with supply, will escalate prices. This demonstrates a positive relationship between employment rate and house prices and has been confirmed in empirical studies including Owusu-Ansah et al. (2021) and Post and Berkhout (2014).

Interest Rate

The impact of interest rates on house prices has seen significant research attention. It has been captured in many models (long and short-term) and via many varietals, mortgage rates, treasury bill rates, bank lending rates, to name a few. Interest rates are expected to have a negative relationship with house prices since they represent the cost of borrowing. A higher cost of borrowing is a disincentive for investors as it lowers the liquidity of investments and thus affects demand negatively. A related argument is that as interest rates increase, investors may consider alternative investment vehicles more prudent since the interest rate also represents the opportunity cost of capital. Lastly, discounting provides another explanation for the negative relationship. Since discount rates are indexed to interest rates, a negative correlation is expected with present values of houses (often similar to the price). Recent empirical studies that have found this negative relationship between interest rates and house prices include Awaworyi Churchill et al. (2020), Shi et al. (2021) and Owusu-Ansah et al. (2020). Conversely, Shi et al. (2014) found a positive relationship between real interest rates and house prices in New Zealand, relying on data between 1999 to 2009.

Stock Market Index

Stock market prices are expected to be positively corelated with house prices (Ball et al., 2010). This is because an increase in stock prices generally means an increase in wealth and associated discretionary income for stock owners (known as the wealth effect) which they can use to purchase housing, increasing the demand for housing and ultimately increasing house prices. Studies that have reported this positive relationship include Lean and Smyth (2014), Ibrahim (2010) and Bangura and Lee (2020). Lee et al. (2017) however found a negative lead–lag relationship between house prices and stock prices in Australia, arguing this can be attributed to capital switching activities between housing and stocks.

Data

As discussed in the literature review, multiple macroeconomic variables have been found to influence house prices. To estimate house prices, we constructed a median house price index from primary valuation data for Accra, Kumasi and Urban Ghana (which combined the data from both the Accra and Kumasi datasets for an aggregate sample). The data source used in this paper consists of valuation reports of private and public valuation firms. The public firm contacted for house price records was the Land Valuation Division (LVD) of the Lands Commission, Ghana. The LVD is the statutory agency responsible for undertaking all state valuations. The LVD keeps hard copies of valuation reports in their respective case folders, and the ID numbers of these reports are entered into a hardcopy ledger.

The private sector data source consisted of the valuation reports of six leading valuation firms with considerable experience in the field. One of the firms granted permission for the download of all electronic copies of approved valuation reports onto an external disk for further data capture. The remaining firms agreed to have the researcher access their file rooms where hard copy valuation reports were kept. Thus, the researcher had access to the full range of valuation reports ever conducted by these firms since inception. It is noteworthy that these are relatively big firms with 5-10 valuers in each company. Gaining this access was a herculean task, because these companies were essentially releasing the full extent of their intellectual property accumulated over a long period. It took the researcher months of online lobbying, followed by weeks of face-to-face negotiation and security screening to access this data. The private valuation data collected therefore represents a rich dataset which was hitherto unavailable.

In a data-poor emerging economy like Ghana's, the efforts we made to gather broad-based data primarily for this study is a significant milestone. As explained in the introduction, the industry required to collate data from valuation reports from multiple sources in order to derive a dataset that is original and unique is, in itself, a significant contribution to knowledge. Again, the reliance on valuation data as against price data stems from the unavailability of a coherent, reliable source of sales transaction data in Ghana as noted by Baako (2019). The primary valuation dataset generated here thus fills a critical resource gap. Valuation data is also often used in studies of this nature (Hill, 2013), in place of or in addition to transaction data (Costello & Watkins, 2002; De Vries et al., 2009).

The data was entered manually from the valuation reports onto a custom Excel sheet to aid analysis. The data collection occurred over a five-month period, from October 2018 to February 2019. At the end of the process, initial records for 7,218 residential valuations were gathered, spanning the period 2005 to 2019. The final data sample available for analysis after validation consists of 5,086 residential valuations. The data entries for Accra and Kumasi are 3,592 and 1,494 valuations respectively which accurately reflects the formal housing market being more developed in the capital, Accra, than in Kumasi. This final dataset was obtained after the cleaned sample was validated by removing all mixed-use or partially completed properties, valuations with more than a reasonable limit for number of bathrooms and bedrooms for the respective markets, as well as properties with more than 5 stories, as the latter does not represent a typical, single-unit residential property.

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A hedonically adjusted house price index was not used in this macro model because the scarcity of the dataset meant that there were years for which there would be too few observations to use the estimated index for further analysis. A median house price index was therefore constructed from the newly derived dataset to represent changes in house prices. This index construction method is accepted and commonly used in practice. For a full review of literature on housing market indexation, particularly in a developing economy context, see Baako (2019). The median index presented here was constructed in quarterly frequency from Q1-2009 to Q4-2018.

For the independent variables, given the paucity of reliable time series data on macroeconomic indicators in Ghana, we culled available data from multiple secondary sources to input into the modelling. A fuller description of the data types and sources has been provided in Table 2 below.

Table 2: Data Types and Sources for Analysis

Predictor Variable	**Description**	**Source**
GDP Growth Rate	GDP growth (annual %)	World Bank
Interest Rate	91 Day Treasury Bill Rate (%)	Bank of Ghana
Unemployment Rate	Unemployment, total (% of total labour force)	World Bank
Inflation Rate	Average CPI	IMF Databank
Urban Population	People living in urban areas (%)	World Bank
GSE Rate of Change	Ghana Stock Exchange - Composite Index	Ghana Stock Exchange

As seen in Table 2 above, the main sources of data on macroeconomic variables were the websites of the Bank of Ghana, the World Bank, IMF and the Ghana Stock Exchange. Data was gathered on interest rate (91-day treasury bill rate), urban population growth rate, GDP growth rate, inflation rate, employment rate (estimated from the unemployment rate) and stock price index over the study period (2009 to 2018). The data was available in, or converted into, quarterly frequency for uniformity, thus yielding 40 observations. Table 3 presents the summary statistics of the variables included in the modelling. The average log median house price over the study period is 11.85%, with a standard deviation of 0.313. The skewness, kurtosis, and Jarque-Bera figures suggest that the log house price is normally distributed. While normality is not a strict requirement for time series analysis, it is a desirable property that support reliable statistical inference.

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Table 3: Descriptive Statistics of Variables

	LOG PRICE	GDP GR...	91 TBILL	QUARTER...	GSE RAT...	POPGOWTH	UNEMPLO...
Mean	11.85608	6.768750	18.89025	13.17417	-0.086446	2.379317	5.566062
Median	11.79778	5.705000	21.64500	12.35000	1.697312	2.346961	5.581625
Maximum	12.61670	25.00000	25.89000	20.46667	40.19187	2.603316	6.806000
Minimum	11.34839	-1.590000	9.390000	8.400000	-84.93721	2.217048	4.157000
Std. Dev.	0.313463	5.468027	5.641018	3.853082	18.99101	0.119504	0.786476
Skewness	0.821776	0.992177	-0.218245	0.378882	-2.094876	0.476939	-0.276966
Kurtosis	3.099189	4.469039	1.399986	1.739205	11.56663	1.928297	2.094118
Jarque-Bera	4.518501	10.15955	4.584283	3.606350	151.5687	3.430719	1.879104
Probability	0.104429	0.006221	0.101050	0.164775	0.000000	0.179899	0.390803
Sum	474.2431	270.7500	755.6100	526.9667	-3.457837	95.17267	222.6425
Sum Sq. Dev.	3.832112	1166.074	1241.022	579.0034	14065.68	0.556965	24.12321
Observations	40	40	40	40	40	40	40

Estimation Strategy

The study employed 10 years' quarterly data from 2009 to 2018. We examine the long and short relationship between the housing price index and macroeconomic factors in Ghana. The selected macroeconomic variables include i) GDP growth rate, ii) Inflation rate, iii) Unemployment, iv) Ghana stock exchange rate v) Urban Population, vi) Population growth and vii) 91days Treasury Bill rate. The selection of these factors is not arbitrary, but it is grounded in the established literature (Li et al., 2022; Okuta et al., 2024; Tham et al., 2022; Zulkarnain & Nawi, 2024). These economic indicators are key determinants of economic condition and influence purchase and investment decision (Ngoc et al., 2023). Consequently, their inclusion provides comprehensive framework for analysing how the macroeconomic environment influences housing prices. The study develops a model where the housing price index is a function of macroeconomic variables, expressed as follows.

$$HPI = f(GDP\ growth\ rate, interest\ rate, Inflation,$$

$$GSE\ growth, Pop\ Growth\ rate, employment)$$

We estimate the long-run and short-run relationship between House Price Index (HPI) and the macroeconomic variables for Accra, Kumasi, and Urban Ghana under Autoregressive Distributed lags (ARDL) framework.

Autoregressive Distributed Lag (ARDL) Model for Long-Run Relationship

We employ ARDL estimation technique to examine the long run relationship between house prices and the macroeconomic variables. The technique identifies the relationship among variables (Persan & Pesaran, 1997) while controlling for errors of autocorrelation attributed by lag values of the model (Wong et al., 2020). According to Pesaran et al. (1997), the coefficients of the estimated long run relationship are consistent whether the regressors assumes I(1) or I(0) or mixture of both. The model is expressed as:

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$HPI_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} HPI_{t-i} + \sum_{i=0}^{q} \beta_{2i} GDP_{t-i} + \sum_{i=0}^{q} \beta_{3i} GSE_{CI\,t-i} + \sum_{i=0}^{q} \beta_{4i} Inf_{t-i} + \sum_{i=0}^{q} \beta_{5i} Unemp_{t-i} + \sum_{i=0}^{q} \beta_{6i} PopGrowth_{t-i} + \sum_{i=0}^{q} \beta_{7i} UrbanPop_{t-i} + \sum_{i=0}^{q} \beta_{8i} Tbill_{t-i} + \varepsilon_t$	(1)

where ε_t, represents the error term; and β_0-β_8 are coefficients to be estimated. "HPI" represents House Price Index, "GDP" represents GDP growth rate, "GSE_CI" represents stock index, "Inf" represents Inflation rate, "Unemp" represents Unemployment, "PopGrowth" represents Population growth rate, "UrbanPop" represents the Urban Population and "Tbill" represents 91days T-bill rate.

To test for the existence of long run relationship, the study employed Pesaran et al. (2001) bounds test approach following the hypothesis:

$H_o : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$

$H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$

The above null and alternate hypothesis are tested by doing a comparison of the estimated F-statistics of bounds test with two critical bound values (Upper and Lower bound). We reject the null hypothesis when the value of the F-statistics is higher than the upper bound critical value and we conclude that, there is a long run relationship between the House prices and macroeconomic factors. On the other hand, if the F-statistics is lower than the lower bound, we fail to reject the null hypothesis and we conclude that there exists no significant relationship between the variables. Finally, when F-statistics lies between the lower and upper bound, the relationship between the variables are classified as being inclusive.

Short-Run Relationship and Speed of Adjustment

The Error correction model (ECM) was employed in estimating the short run relationship. The Error correction term (ECT) is the speed of adjustment with which a shock in the short run equilibrates or adjusts to the long run. The Error correction model was based on Engle and Granger (1987) and depicts how the dependent variable reacts to independent variable shock. It may be expressed as follows:

$HPI_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta HPI_{t-i} + \sum_{i=0}^{q} \beta_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{q} \beta_{3i} \Delta GSE\_CI_{t-i} + \sum_{i=0}^{q} \beta_{4i} \Delta Inf_{t-i} + \sum_{i=0}^{q} \beta_{5i} \Delta Unemp_{t-i} + \sum_{i=0}^{q} \beta_{6i} \Delta PopGrowth_{t-i} + \sum_{i=0}^{q} \beta_{7i} \Delta UrbanPop_{t-i} + \sum_{i=0}^{q} \beta_{8i} \Delta Tbill_{t-i} + \lambda_1 ECT_{t-1} + \varepsilon_t$	(2)

where $\lambda_1 ECT_{t-1}$ represents the coefficient of the error-correction term. ECT_{t-1} is the lagged series of the long-run residuals, defined as.

$ECT_{t-1} = Y_{t-1} - \beta_0 - \sum_{k=1}^{n} \beta_1 X_{t-1}$

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Where Y_{t-1} is the lag of the dependent variable, and X_{t-i} is a vector of the independent variables (n). The coefficient λ captures the speed of adjustment, measuring how quickly the variables equilibrate in the long run, where -1 < λ <0.

Stationarity Test

The Augmented Dickey-Fuller unit root test was used to test for stationarity of the variables. The ARDL produces realistic and efficient estimates when the variables in the system are stationary at level I(1) or I(0) or combination of both (Pesaran et al., 1997). From Table 4, the stationarity of the variables in Accra, Kumasi, and joint Urban Ghana sample are mixed with I(1) and I(0) variables. With respect to the Kumasi series, Urban Population, Gross Domestic Product (GDP), Ghana stock exchange indicator, House Price index and Inflation rate are stationary at levels whereas 91days T-bill (a measure of interest rate), population growth rate and unemployment rate are stationary at first difference. Table 4 also depicts that the Accra series has Gross Domestic Product, House Price Index and Inflation rate being stationary at levels I(0), whilst 91days T-bill, Population growth, Unemployment, Urban population and Ghana stock exchange indicator are stationary at first difference I(1). It can also be seen from Table 4 that the series of the aggregate sample, Urban Ghana, has Gross Domestic Product (GDP), Ghana stock exchange indicator, House Price indicator and inflation rate being stationary at levels I(0), with 91days T-bill, Population growth, Unemployment and urban population being stationary at first difference.

Table 4: Unit Root test

Variables	**ADF-TEST STATISTICS**	
	At levels	**At 1st Difference**
KUMASI		
Log_house price		
91_Tbill	-1.532558	-4.684084***
Popgrowth	-1.676598	-2.653382*
Unemployment	-1.679919	-6.007064***
UrbanPop	-14.39898***	-10.85421***
GDP	-3.822916**	-8.372562***
GSE_CL	-3.528024**	-6.388068***
HPI	-12.25633***	-5.388625***
Inf	-3.011581**	-6.256687***
ACCRA		
Log_house price		
91_Tbill	-1.532558	-4.684084***
Popgrowth	-1.676598	-6.011707***
Unemp	-1.679919	-6.007064***
Urban Pop	-0.885450	-6.011707***
GDP	-3.822916**	-8.372562***
GSC_CI	-3.528024	-6.388088***
HPI	-7.430038***	-8.699067***
INF	-3.011581**	

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URBAN GHANA		
Log_house price		
91 Tbill	-1.532558	-4.684084***
Popgrowth	-3.8229***	-8.37256***
Unemp	-2.07286	-1.67154**
UrbanPop	-1.2887	-1.69133**
GDP	-3.8229 ***	-8.37256***
GSE_CI	-6.0307***	-11.9537***
HPI	-5.8926***	-5.63133***
INF	-3.5705**	-2.5586
Note (***), (**), (*) denote significance at 1%, 5% and 10% respectively		

With the results of the unit root test showing the all the variables are stationary at I(1) and I(0), the ARDL is suitable for this analysis.

Diagnostic and Stability Tests

Serial correlation was tested using the Breusch-Godfrey serial correlation LM test while the stability of the model was tested using the CUSUM test. Testing for the presence of heteroscedasticity, the study employed the Breusch-Pagan test with the null hypothesis that suggests the existence of heteroscedasticity. Histogram was finally used to check the normality of the models. The results are provided in the Appendix.

Results and Discussion

Results of Long-Run Model

In this section, we present the long-run relationship between the house price and the macroeconomic variables. For insightful analyses, we show a separate model for Accra, Kumasi and Urban Ghana. For all the ARDL models, the Akaike Information Criteria (AIK) was used for the selection of optimal lag selection. The ARDL lag selection for the Accra, Kumasi, and Urban Ghana models based on the Akaike Information Criteria are (1,2,1,1 ,2,2), (2,1,2,0,0,1,1) and (1,2,1,1,2,2,0) respectively. We carried out the bound test for cointegration to determine whether there is a long-run relationship between the housing prices and the macroeconomic variables. The Bound F-statistics shown in Table 5 suggests a long-run relationship between the house prices and the macroeconomic variables. Specifically, the F-Statistics exceed the upper bound at all the significance level, and therefore reject the null hypothesis of no cointegration between the variables in the model. Albeit, for Accra model, the F-statistic falls below the upper bound, indicating an inconclusive or uncertain long-run relationship. We proceed to estimate our long run coefficients.

Table 6 presents the long run coefficient for the variables from our ARDL estimation. Across all the models, the results indicate that most of the macroeconomic factors are not individually

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significant in influencing house prices in Ghana. From Panel A and B, we find a large and statistically significant long-run relationship between house prices and only population growth in Urban Ghana and Accra. However, we find the results show not statistically significant long-run relationship between house prices, and other macroeconomic factors in these models. This finding is consistent with prior studies that report little to no long-term effect of macroeconomic variables on housing market dynamics.

In Panel C, Kumasi model, we find a significant long-run relationship between house prices and GDP growth, inflation, unemployment and population growth. More specifically, the results indicate that a 1% increase in GDP growth, inflation, unemployment, and population growth is associated with approximately a 7.5% increase, a 16% decrease, a 39% increase, and a 541% increase in house prices in Kumasi, respectively. These magnitudes suggest that population growth exerts an exceptionally strong influence on house prices in Kumasi, highlighting the dominant role of demographic pressures in shaping house prices in the long run. The significant negative long-run relationship between housing prices and inflation aligns with the hypothesis that increase in general prices of goods reduces housing demand, consequently reducing house prices (Follain Jr, 1982; Gallin, 2006).

In summary, most macroeconomic factors have a strong long-run influence on house prices in Kumasi. While population growth affects all three housing markets in Ghana, variables such as GDP growth, inflation and unemployment appear to impact only the Kumasi market. Overall, the results underscore that demographic changes are a primary driver of long-run dynamics in the Ghanaian housing market.

Table 5: Long run Cointegration test

Panel A: Urban Ghana Model

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.891458	10%	2.53	3.59
k	6	5%	2.87	4
		2.5%	3.19	4.38
		1%	3.6	4.9

Panel B: Accra Model

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.529917	10%	2.53	3.59
k	6	5%	2.87	4
		2.5%	3.19	4.38
		1%	3.6	4.9

Panel C: Kumasi Sample

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F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.806530	10%	2.53	3.59
k	6	5%	2.87	4
		2.5%	3.19	4.38
		1%	3.6	4.9

Table 6: Long Run coefficients

Urban Ghana Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP GROWTH RATE	0.084675	0.056119	1.508832	0.1456
INTEREST RATE	0.006323	0.064387	0.098204	0.9227
INFLATION	-0.140239	0.103941	-1.349213	0.1910
GSE RATE OF CHA...	0.021114	0.016923	1.247609	0.2253
UNEMPLOYMENT	0.329297	0.270214	1.218655	0.2359
POPGOWTH	5.724093	0.677511	8.448702	0.0000

Panel B: Accra Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP GROWTH RATE	0.074634	0.062057	1.202657	0.2419
INTEREST RATE	-0.006507	0.080012	-0.081320	0.9359
INFLATION	-0.169449	0.133741	-1.266996	0.2184
GSE RATE OF CHA...	0.024858	0.021655	1.147902	0.2633
UNEMPLOYMENT	0.461586	0.337150	1.369084	0.1848
POPGOWTH	5.941934	0.870722	6.824142	0.0000

Panel C: Kumasi Model

GDP GROWTH RATE	0.074570	0.037204	2.004361	0.0569
INTEREST RATE	0.022617	0.050498	0.447879	0.6584
INFLATION	-0.160490	0.083003	-1.933547	0.0656
GSE RATE OF CHA...	0.003378	0.010308	0.327688	0.7461
UNEMPLOYMENT	0.392277	0.200944	1.952170	0.0632
POPGOWTH	5.420301	0.520437	10.41490	0.0000

Results of Short-Run Model

In this section, we present the estimates for the short run relationship between the house prices and the macroeconomic variables from the Error Correction Model (ECM). The ECM determines the speed of adjustment; thus, the rate at which the relationship between the house prices and the macroeconomic factor under consideration returns to equilibrium in the short run. Table 7 presents the short-run results for Urban Ghana (Panel A), Accra (Panel B) and Kumasi (Panel C). Across all the models, the coefficient error correction term (ECM) is negative and statistically significant at 1% significance level, suggesting convergence to equilibrium. The results suggest that all the variables in the model converge to an equilibrium when there is a shock in the short run. Specifically, the estimated speeds of adjustment are

approximately 34% for Urban Ghana, 25% for Accra, and 59% for Kumasi, suggesting one-third, one-quarter, and more than half of short-run disequilibria are corrected in Urban Ghana, Accra, and Kumasi, respectively. The relatively higher adjustment speed in Kumasi indicates a stronger and faster convergence to equilibrium compared to Accra. The results show that lag house price has a significant short-run relationship with the house prices in the Urban Ghana Model. This is not the case for the Accra and Kumasi Model. The significant lag effect in the Urban Ghana model likely reflects stronger price persistence and spillover dynamics in the aggregated market, whereas in Accra and Kumasi, short-run price movements may be driven more by local structural factors than by past prices alone. We find no significant short-run relationship between GDP growth rate and the house prices across all the models.

Concerning interest rates, we find a negative significant short-run relationship between the current and lag inflation rates and house prices across all the models. More specifically, the results show that 1% increase in current interest rate leads to 5.8%, 4.5% and 8.2% reduction in house prices in Urban Ghana, Accra and Kumasi, respectively. Similarly, 1% increase in previous quarter interest rate leads 3.6%, 2.9%, 3.5% increase in house price Urban Ghana, Accra and Kumasi, respectively. This finding is consistent with economic theory and aligns well with the Ghanaian context. An increase in interest rates raises the cost of borrowing, which directly affects mortgage financing and construction loans, reducing households' affordability and weaken effective housing demand. Further, an increase in the 91-day Treasury bill (T-bill) rate encourages investors to reallocate into safer government securities (T-Bills) which reduces funds available for property purchases and housing development. Overall, the finding suggest that house prices respond strongly to contemporaneous and past monetary tightening, with the effect being particularly pronounced in Kumasi. The decline in the magnitude of the coefficient in the lagged term reflects a decay effect, implying that while interest rate shocks have an immediate and substantial impact on house prices, their influence weakens as the market gradually adjusts. This finding reflects the importance of the banking lending channel of monetary policy in housing price modelling.

Concerning inflation, we find that while the current inflation rate does not affect house prices in short run, an increase in inflation rates in the past quarter increase house prices across all the models. More specifically, 1% increase in inflation rate in the past three months, increases house prices in Urban Accra by 13.5%, Accra by 11.3%, and 14.1%. This is not surprising as one would expect the rate of change in prices of goods and services to affect house prices. The significant short-run relationship indicates that the housing markets in Ghana are responsive to change general price of goods and services, consistent with previous findings (Owusu-Ansah et al., 2021). The insignificant effect of the current inflation rate may be due to adjustment delays and expectation dynamics in the housing market, consistent with findings from studies in other countries.

In term of Ghana stock exchange, we find significant negative short-run relationship between the GSE change rate and house prices across all the models. The negative significant relationship between house prices and stock prices is consistent with the findings of Lee et al. (2017) who found a negative lead–lag relationship between house prices and stock prices in Australia, attributable to capital switching activities between housing and stocks.

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We find a large and statistically significant short-run relationship of current population growth rate and house prices across the models. This suggests that demographic pressures exert an immediate influence on housing demand, thereby driving price movements in the short run. This is intuitive as increase in population growth directly increase demand for housing, which in turn raises the house prices particularly in urban areas where housing supply is inelastic. The consistency of this effect across Urban Ghana, Accra, and Kumasi indicates that demographic dynamics are a key driver of short-run housing market fluctuations.

In summary, the study finds that the short run, house prices in Urban Ghana, Accra, and Kumasi have a significant relationship with GDP growth rate, interest rate, inflation, GSE growth rate, and population growth. Thus, the pattern of house prices in Ghana are consequences of macroeconomic factors. A key finding from the study is that the relationship between housing prices and these macroeconomic factors come into equilibrium after a shock in the short run. These findings are against the random walk model for house prices.

Table 7: Short-run coefficient

Panel A: Urban Ghana Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HOUSE PRICE(-1))	-0.212890	0.123816	-1.719398	0.0996
D(GDP GROWTH R...	-0.005913	0.006623	-0.892695	0.3817
D(INTEREST RATE)	-0.058263	0.016004	-3.640622	0.0014
D(INTEREST RATE(-1))	-0.036017	0.014350	-2.509926	0.0199
D(INFLATION)	-0.032471	0.043412	-0.747986	0.4624
D(INFLATION(-1))	0.135551	0.046379	2.922656	0.0079
D(GSE RATE OF C...	-0.001589	0.001621	-0.980079	0.3377
D(GSE RATE OF C...	-0.005594	0.001754	-3.189850	0.0042
D(POPGOWTH)	86.90198	18.75145	4.634414	0.0001
CointEq(-1)*	-0.348922	0.072357	-4.822203	0.0001

Panel B: Accra Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HOUSE PRICE(-1))	-0.206497	0.140804	-1.466561	0.1566
D(GDP GROWTH R...	-0.004677	0.006221	-0.751811	0.4601
D(INTEREST RATE)	-0.045506	0.015465	-2.942473	0.0075
D(INTEREST RATE(-1))	-0.029600	0.013608	-2.175146	0.0406
D(INFLATION)	-0.047910	0.043463	-1.102313	0.2822
D(INFLATION(-1))	0.113244	0.043808	2.585030	0.0169
D(GSE RATE OF C...	-0.001571	0.001553	-1.011912	0.3226
D(GSE RATE OF C...	-0.005443	0.001690	-3.221562	0.0039
D(POPGOWTH)	72.97339	19.84569	3.677040	0.0013
CointEq(-1)*	-0.257414	0.066804	-3.853262	0.0009

Panel C: Kumasi Model

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_GROWTH_R...	-0.005016	0.008390	-0.597824	0.5558
D(INTEREST_RATE)	-0.082440	0.020829	-3.958012	0.0006
D(INTEREST_RATE(-1))	-0.035385	0.019392	-1.824682	0.0811
D(INFLATION)	-0.049003	0.055824	-0.877820	0.3891
D(INFLATION(-1))	0.141214	0.059440	2.375741	0.0262
D(GSE_RATE_OF_C...	-0.006546	0.002152	-3.041274	0.0058
D(GSE_RATE_OF_C...	-0.005510	0.002147	-2.566229	0.0173
D(POPGOWTH)	162.4350	27.29652	5.950759	0.0000
CointEq(-1)*	-0.594064	0.097904	-6.067816	0.0000

Diagnostic Tests

In this section we examine the robustness of our models by conducting residual and stability diagnostics tests. First, we check the for normality, heteroscedasticity and serial correlation of the residuals of the model (shown in Appendix). In Appendix 1, Figure A1, the normality plot, skewness and kurtosis, and Jarque-Bera probability value suggest that the residuals across the three models are normally distributed. In Appendix 2, the Breusch-Pagan-Godfrey test of heteroskedasticity confirms that that all the models are homoskedastic. In Appendix 3, The Breusch-Pagan-Godfrey serial correlation LM test clearly shows that the residuals of all the models are not serially correlated. In Appendix 4, Figure A2, we show the CUSUM stability test of our coefficients for all the models, plotted within the 5% significance critical bounds. If the plot remains within the bounds, it is stable but considered otherwise if it crosses the bounds. Across the panels, the blue lines lie within the 5% critical bounds suggesting that our models are stable over the period.

Conclusion

In this paper, we empirically examined the macroeconomic variables that influence house prices to understand the nature and magnitude of influence the macroeconomy has on house prices. By regressing a median house price index against a suite of macroeconomic variables, we found that changes in the macroeconomy influence house prices in Ghana. The analysis covered Accra and Kumasi, separately and aggregated.

Overall, we find a large and statistically significant long-run relationship between house prices and only population growth in Urban Ghana and Accra. However, we find the results show not statistically significant long-run relationship between house prices, and other macroeconomic factors in these models. This finding is consistent with prior studies that report little to no long-term effect of macroeconomic variables on housing market dynamics. In Kumasi, however, we find a significant long-run relationship between house prices and GDP growth, inflation, unemployment and population growth.

In the short run, we find that house prices in Urban Ghana, Accra, and Kumasi have a significant relationship with GDP growth rate, interest rate, inflation, GSE growth rate, and population growth. Thus, the pattern of house prices in Ghana are consequences of macroeconomic factors. A key finding from the study is that the relationship between housing

prices and these macroeconomic factors come into equilibrium after a shock in the short run. These findings are against the random walk model for house prices.

These findings have significant implications for policymakers and housing market stakeholders alike. For macroeconomic policymakers, the insights provided by this study will serve as an excellent guide in setting the policy framework that is used to influence house prices in Ghana. For example, there are varied results between the two cities studied, indicating that policy efforts may need to be nuanced and specialised, and adds to calls for the decentralisation of policy approaches in Ghana. Property markets are heterogeneous and divergent characteristics are expected. For investors, the findings of this paper will serve as a guide that informs when they enter or leave the property investment market by predicting the response of house prices to trends in macroeconomic variables. For other stakeholders, including homeowners and valuers, this paper's insights help them to anticipate the trends property prices will form in response to changes in macroeconomic variables.

The study is limited by the availability of credible data over the long-term and could not investigate the impact of black swan effects such as the GFC and the COVID-19 pandemic. Also, the study could not cover other macro variables such as rent-income ratio and availability of financing owing to the same data availability challenge. These could be the areas of future research focus if the data challenge can be overcome. Further studies that can generate or access larger volumes of data can employ other house price indexation methods like hedonic and repeat sales indices. Additionally, the relatively short study period can be expanded if a more comprehensive dataset becomes available.

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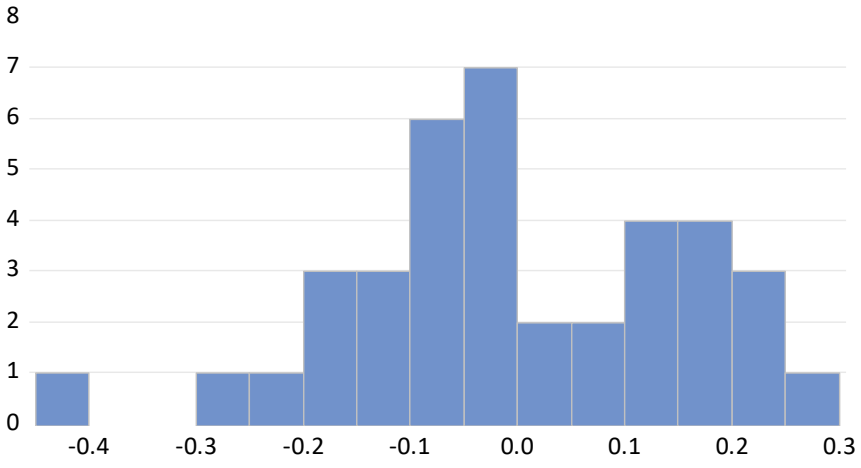
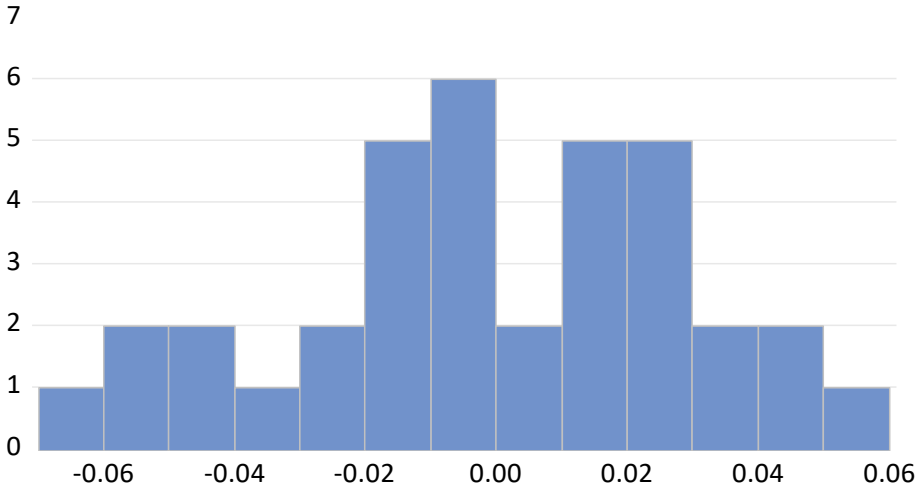
Appendix 1:Normality Test

Panel A: Urba Ghana Model



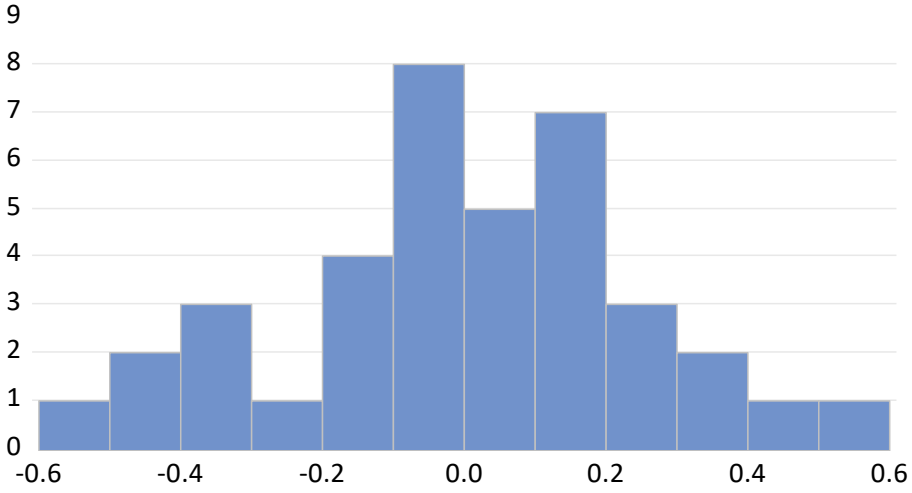
Series: Residuals	
Sample 2009Q3 2018Q4	
Observations 38	
Mean	-2.26e-15
Median	-0.024206
Maximum	0.296637
Minimum	-0.448690
Std. Dev.	0.160542
Skewness	-0.291973
Kurtosis	3.054523
Jarque-Bera	0.544612
Probability	0.761621

Panel B: Accra Model



Series: Residuals	
Sample 5 40	
Observations 36	
Mean	-2.94e-13
Median	-0.002656
Maximum	0.054554
Minimum	-0.060764
Std. Dev.	0.030649
Skewness	-0.301692
Kurtosis	2.388680
Jarque-Bera	1.106678
Probability	0.575027

Panel C: Kumasi Model



Series: Residuals	
Sample 3 40	
Observations 38	
Mean	2.27e-15
Median	-0.006623
Maximum	0.553586
Minimum	-0.523233
Std. Dev.	0.243874
Skewness	-0.119194
Kurtosis	2.780438
Jarque-Bera	0.166308
Probability	0.920209

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Figure A1: Normality Test

Appendix 2: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Panel A: Urban Ghana Model

F-statistic	0.329632	Prob. F(15,22)	0.9845
Obs*R-squared	6.973235	Prob. Chi-Square(15)	0.9584
Scaled explained SS	2.401007	Prob. Chi-Square(15)	0.9999

Panel B: Accra Model

F-statistic	1.262632	Prob. F(16,21)	0.3038
Obs*R-squared	18.63206	Prob. Chi-Square(16)	0.2882
Scaled explained SS	4.875382	Prob. Chi-Square(16)	0.9963

Panel C: Kumasi Model

F-statistic	1.088283	Prob. F(15,22)	0.4181
Obs*R-squared	16.18613	Prob. Chi-Square(15)	0.3698
Scaled explained SS	4.783095	Prob. Chi-Square(15)	0.9938

Appendix 3: Breusch-Godfrey Serial Correlation LM Test

Panel A: Urban Ghana Model

F-statistic	0.081511	Prob. F(2,24)	0.9220
Obs*R-squared	0.256377	Prob. Chi-Square(2)	0.8797

Panel B: Accra Model

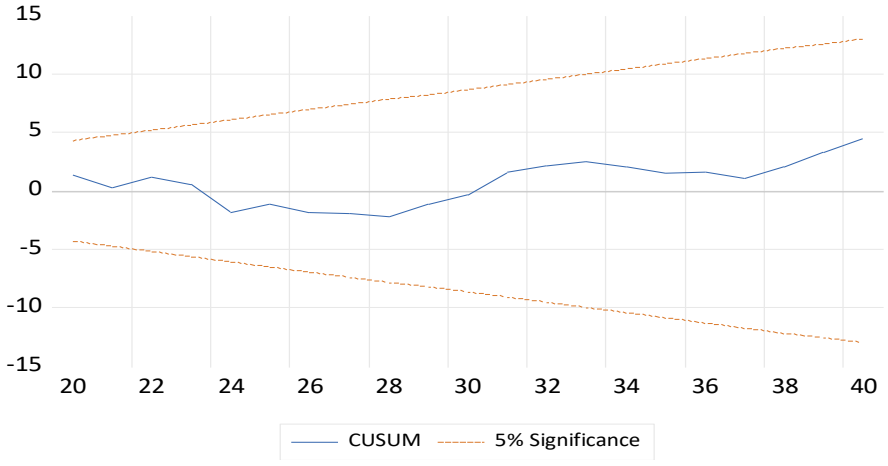
F-statistic	3.136450	Prob. F(5,8)	0.0734
Obs*R-squared	24.50119	Prob. Chi-Square(5)	0.0002

Panel C: Kumasi Model

F-statistic	0.138528	Prob. F(2,21)	0.8714
Obs*R-squared	0.494810	Prob. Chi-Square(2)	0.7808

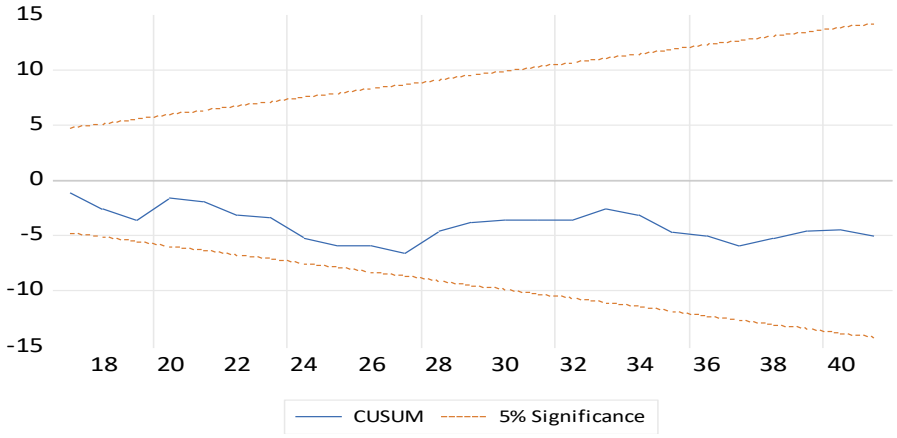
Appendix 4: Residual Stability Test

Panel A: Urban Ghana Model



DOI: https://doi.org/10.64361/14445921.2026.212325

Panel B: Accra Model



Panel C: Kumasi Model

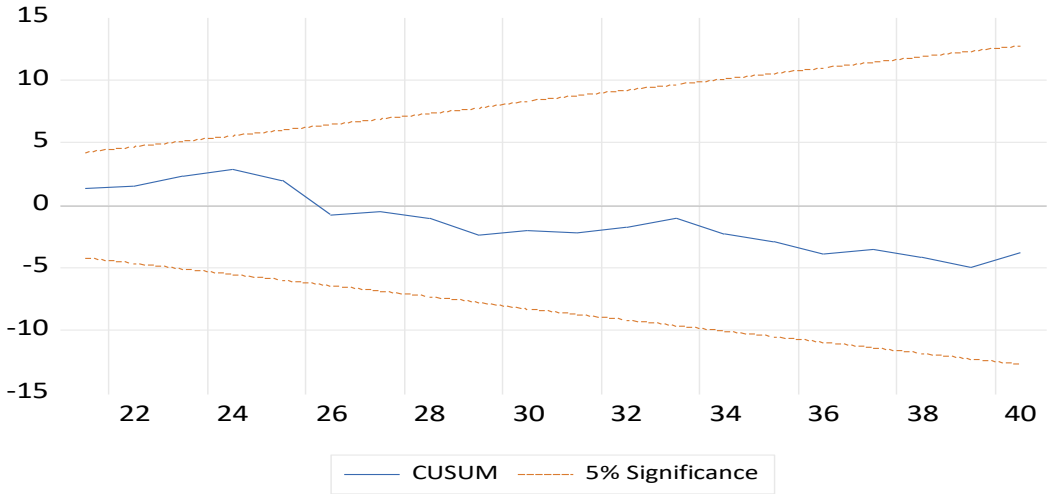


Figure 1: CUSUM Residual Stability Test