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An econometric modelling of the savings – investments nexus for Ghana

KEYWORDS

savings;
investment;
long term;
short-run;
ARDL approach

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ABSTRACT

Introduction. The problem under discussion is whether savings are associated with investments in the long-term and whether savings predict investment with feedback or not. Addressing the problem is important since it informs policy formulation in the financial sector in ensuring efficient financial intermediation.

The purpose of the article is looks at the savings-investment relationship for Ghana during the period 1960 to 2016.

Methodology. Utilizing ARDL (with bounds testing) approach, the Granger predictive test, the Generalised Impulse Response Function, and Variance decomposition function.

Results. The results indicate that a 1% increase in savings, GDP and financial development would result in a 0.069%, 0.266% and 0.125% increase respectively in investment in the short-term. It is discovered that savings do not cause investment in the long-run but rather in the short-run. The Granger causality test establishes a unidirectional causality running from savings to investment in the short-run.

Discussion and Conclusion. The ramifications of the finding are that there is capital fixed status globally. Future examinations ought to consider structural break(s) issues as well as panel analysis to determine if the findings of the current study would be reproduced.

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INTRODUCTION

Since Feldstein and Horioka original article [6], huge writing has developed that analyses the potential relationship between savings and investment in an economy. The subject of whether savings and investment are linked emphatically, feebly, or not in any manner has been an issue specifically compelling (Sach, 1981; Murphy, 1984; Obstfeld, 1986; Tesar, 1991; Baxter and Crucini, 1993). Feldstein and Horioka note that the savings-investment relationship is not predictable with capital versatility across fringes for the short run. This proposes that capital is fixed universally [6].

As substantiated by different analysts [3; 16] this has a suggestion for global trade and business. On the off chance that savings are associated with an investment, the legitimate ramifications are that capital is fixed globally. Be that as it may, on the off chance that savings are not related to investment, at that point capital is versatile globally. In this way, it is imperative to investigate the legitimacy of the savings-investments relationship theory as an experimental actuality in an open but small economy such as Ghana.

The present paper adds to the collection of information in writing in the zone of global capital mobility by empirically looking at the relationship between savings and investments in the context of a developing country with an underdeveloped financial sector in terms of mobilising and allocating financial resources (financial intermediation). The investigation is roused by the mixed findings which can be attributed to the choice of proxies use or the econometric techniques employed. Thus, we explicitly test the long-term and short-term link between savings and investments using the ARDL (with bounds testing) which performs better when dealing with small samples compared to the conventional cointegration techniques. The study answer questions such as, what is the nature of the link between savings and investments? and what is the direction of causality between savings and investment? The paper assumes that domestic savings are cointegrated with investment in the long-run and also saving predicts investment in the short-term.

The rest of the paper is organised into four sections. Section 2 deals with the literature survey. Section 3 considers the methodology and data, whereas section 4 looks at the results and discussions. Section 5 concludes the study and provides recommendations.

LITERATURE REVIEW

The empirical writings referred to arrive at the resolution that savings and investments are related utilizing both time-series information and cross-sectional information (Ozman & Parmaksiz [18]; Narayan [14]; Payne [19]; Kim et al. [11]; E. Telatar, F. Telatar, & Bolatoglu [22]; Fouquau, Hurlin, & Rabaud [7]; Singh [20]; Apergis & Tsoumas [2]; Onafowara, Owoye, & Huart [17]). The key element of each of these examinations is that they worked upon the

crafted work of Feldstein and Horioka [6] and arrived at a conclusion that savings are connected to investments and the relationship is strong in larger nations than smaller nations. Variables that accounted for the observed relationship are the existence of a policy target for the current account, the exchange rate regime, common shocks to investments and savings, the degree of openness, and country size (large or small).

Analysts have observed that for certain nations the size of the effect between savings and investments remains high whereas in others the effect size keeps declining. For instance, Onafowara et al. [17] detailed in their investigation that the relationship between savings and investments remained generally high in the OECD countries, about 0.57 over the period 1991-2001, yet it has significantly declined in the EU countries to 0.36 and in the Eurozone to 0.14.

The experimental check of the relationship between savings and investments has created blended discoveries in the writing. For instance, while some past examinations report a relationship between savings and investments different investigations do not bolster the nexus among reserve funds and speculation. Nasiru and Usman [16] observed a noteworthy long-run link between savings and investments for Nigeria for the period 1980 to 2011. Their discoveries bolster the Feldstein-Horioka [6] theory that proposes low capital versatility globally.

Kollias et al. [12] revealed a connection between savings and investments in Austria, Germany, Greece, Italy, Luxembourg, Spain, and the Assembled Realm. Anyway, a significant association was found in Denmark, Finland, France, Ireland, the Netherlands, and Sweden; while there was an uncertain connection in the Belgium and Portugal studies.

Esso and Keho [5] in their investigation showed that savings and investments are related and that household savings are significant factors in financing investments in three nations in their study. In the other four nations in their investigation, household savings rate and investment rate are not associated. Onafowara et al. [17] revealed a relationship between savings and investment in six nations. Be that as it may, the aftereffects of the course of causality delivered blended discoveries. There was proof of a long-run link between savings and investments with causality running from savings to investments in the Netherlands and a reverse causality existing in Denmark, Germany, and Luxembourg study, with bidirectional causality reported in Belgium study, and neutrality causality in France and Italy study. Chakrabarti [4] explored the connection between savings and investments for the board of 126 nations from 1960 to 2000. The examination produced a positive connection between savings and investments in support of the Feldstein-Horioka study for the board of 126 nations.

Narayan [14] investigation of the connection between savings and investments for the period 1960-1999 for Japan reported a significant stable long-term link between the two variables in line with the Feldstein and Horioka theory. The examination by Singh [20] on the savings-investment link for the period 1950-51 to 2001-02 indicated a significant long-term association between investments and savings which supports the existence of Feldstein-Horioka theory for India.

Esso and Keho [5] validated the Feldstein and Horioka assumption for member countries of UEMOA by testing for the long run and the direction of causality between savings

and investment using the Toda and Yamamoto (1995) and the Pesaran et al. (2001). The findings of their study indicate significant cointegration and a stable long-run link in the model estimated. There was unidirectional causality from savings to investment in Niger, Benin, and Côte d'Ivoire. They concluded that there is capital imperfect mobility in the Benin economy and capital immobility in the economy of Niger. In other countries in their study, savings does not play a significant role in investment, which indicates capital mobility internationally.

Mishra P., Das, and Mishra S. [13] investigated the savings-investments association for the period 1950-51 to 2008-09 in India. Their findings indicated a significant and stable short-term and long-term correlation between savings and investments. Their discoveries bolster the Feldstein-Horioka theory. Tehranchian and Behraves [21] examined the Feldstein-Horioka assumption for Iran by testing the long run and short run nexus. Their study findings revealed a stable long-run and short-run association between the two variables and indicated that the association is stronger in the long run than in the short run. They concluded that capital is immobile in Iran for the period under discussion. Al-Afeef and Ali Al-Qudah [1] investigated the savings-investment link for Jordan economy for the period 1980 to 2013 using the Johansen cointegration method and reported a significant long-run association between savings and investment and concluded that there is perfect capital mobility international in Jordan. Irandoust [8] assessed the direction of causality between savings and investment for six transition countries using the bootstrap panel causality test to verify whether capital is fixed internationally or mobile. The study findings indicate significant causality between savings and investment in the countries reviewed, indicating capital immobility internationally.

Other similar investigations have not bolstered the Feldstein-Horioka hypothesis for different nations. For instance, P. Narayan and S. Narayan [15] study did not bolster the theory for G7 nations over the period 1971-2002. Ketenci [10] study did not bolster the theory for Estonia and Portugal between 1995-2009. In any case, the examination upheld the theory for other 23 EU nations.

METHODOLOGY AND DATA DESCRIPTION

3.1 Data and variables measurements

Time-series techniques unlike panel data techniques are considered to explain the specificity of individual countries and give an avenue for researchers to examine the causality and its development over time as causality may differ across countries. The study utilizes annual time series data from 1960-2016 (i.e 54 observations) from Ghana. All the data were sourced from the World Development Indicators published by the World Bank. The information utilized are investments (INV), savings (SV), and total national output (Gross domestic product), and financial development (FD).

Table 1

Data Description

Variable & Notation	Description	Data Source
Savings (SV)	Domestic savings as a ratio of GDP	WDI
Investment (INV)	Gross capital formation as a ratio of GDP	WDI
Total National Output (GDP)	Gross domestic product (GDP)	WDI
Financial Development (FD)	Domestic credit by banks as a ratio of GDP	WDI

Note: WDI = World Bank Development Indicators

3.2 Model Specification

For estimation and modelling, we specify the following general model to capture the association amongst the variables.

$$INV_t = f(SV_t, GDP_t, FD_t) \quad (1)$$

Where INV_t is Gross capital formation as a ratio of GDP at a time (t), SV_t is domestic savings as a ratio of GDP at a time (t), GDP_t is a gross domestic product at a time(t), and, FD_t is Domestic credit by banks as a ratio of GDP at a time (t). The estimation equation is thus stated as follows in a log-linear form:

$$\ln INV_t = \ln SV_t + \ln GDP_t + \ln FD_t + e_t \quad (2)$$

The estimation employs the use of the autoregressive distributed lag model (ARDL) bound test put forward by Pesaran et al. (2001) which is based on the ordinary least square regression (OLS) modelling technique. This method is used since the ARDL test is appropriate for a smaller sample size such as the current study. It is also appropriate when the data set is differently orderly integrated. That is $I(0)$ and $I(1)$ but not $I(2)$. In estimating the long-run association between investment and savings, the study employs the bounds testing approach for cointegration within the ARDL framework. The ARDL is generally specified as:

$$\Delta Y = \alpha + \sum_{i=1}^n \beta_i \Delta Y_{t-i} + \sum_{i=0}^p \sum_{q=1}^k \gamma_{qi} \Delta X_{qt-i} + Y_{t-1} + \sum_{q=1}^k X_{qt-1} + Y_{t-1} + \varepsilon_t \quad (3)$$

Where Δ is the first-difference operator, Y is the dependant variable and X is a vector of independent variables ε_t is the error term and α is the constant term. In this current study, for analysis, we conceptualize only one model using INV as the dependent variable for reasons of parsimony.

$$\begin{aligned} \Delta \ln INV_t = & \alpha_0 + \varphi_1 \ln INV_{t-1} + \varphi_2 \ln SV_{t-1} + \varphi_3 \ln GDP_{t-1} + \varphi_4 \ln FD_{t-1} \\ & + \sum_{i=1}^n \kappa_i \Delta \ln INV_{t-i} + \sum_{i=1}^n \beta_i \Delta \ln SV_{t-i} + \sum_{i=1}^n \delta_i \Delta \ln GDP_{t-i} + \sum_{i=1}^n \mu_i \Delta \ln FD_{t-i} + \varepsilon_t \end{aligned} \quad (4)$$

The first part with $\varphi_1, \varphi_2, \varphi_3, \varphi_4$ coefficients represent the long-run relationship of the model and the second part with $\kappa_i, \beta_i, \delta_i, \mu_i$ coefficients represent the short-run dynamics of the model, α_0 represents the drift element and ε_t signifies the white noise term. Concerning ARDL technique, $(p+1)^k$ regressions are estimated to obtain the optimal lag length for each series. “p” denotes the maximum number of lags that can be used and “k” is the maximum possible number of equations in the model (4) that can be estimated. Our optimal lag selection criteria were based on the Akaike Information Criteria (AIC). Using the bound testing approach for cointegration, the null hypothesis of no cointegration $H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$ if rejected against the alternative $H_1: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq 0$. Conventionally, two critical bounds are used when the regressors are $I(d)(0 \leq d \leq 1)$. In the absence of cointegration of long-run association based on the bound test estimation, the short-run model can be estimated. The short-run model is thus stated as follows:

$$\Delta \ln INV_t = \alpha_0 + \sum_{i=1}^n \kappa_i \Delta \ln INV_{t-1} + \sum_{i=1}^n \beta_i \Delta \ln SV_{t-1} + \sum_{i=1}^n \delta_i \Delta \ln GDP_{t-1} + \sum_{i=1}^n \mu_i \Delta \ln FD_{t-1} + \varepsilon_t \quad (5)$$

However, if there is evidence of cointegration or long-run association, we then proceed to estimation the long-run coefficients using the OLS techniques as stated in equation (6):

$$\Delta \ln INV_t = \alpha_0 + \varphi_1 \ln INV_{t-1} + \varphi_2 \ln SV_{t-1} + \varphi_3 \ln GDP_{t-1} + \varphi_4 \ln FD_{t-1} + \varepsilon_t \quad (6)$$

If cointegration is present, then we estimate the error correction term using the reduced form of equation (7):

$$\Delta \ln INV_t = \alpha_0 + \sum_{i=1}^n \kappa_i \Delta \ln INV_{t-1} + \sum_{i=1}^n \beta_i \Delta \ln SV_{t-1} + \sum_{i=1}^n \delta_i \Delta \ln GDP_{t-1} + \sum_{i=1}^n \mu_i \Delta \ln FD_{t-1} + \tau ECT_{t-1} + \varepsilon_t \quad (7)$$

Different indicative tests are utilized to survey the model. These are R-Square (R^2), Joint significance test, J-B Normality test, Breusch-Godfred LM test, White Heteroskedasticity test, and Ramsey RESET. The reset test for specification depends on the suspicion of satisfactory determination; heteroskedasticity test depends on the null assumption of heteroskedasticity not present; test for normality of residual depends on assumption that the errors are normally distributed and not skewed; LM test for autocorrelation up to arrange 1 depends on the null assumption that there is no autocorrelation. The soundness of the model is tried utilizing the combined whole of recursive residuals (CUSUM) and the total of squares of recursive residuals (CUSUMSQ). In the utilization of the two plots, CUSUM and CUSUMSQ, if the measurements remain inside the basic obligations of a 5% level of significance, the null hypothesis of all coefficients in the given relapse are steady and cannot be dismissed. CUSUM test for parameter steadiness depends on the null assumption that there is no adjustment in parameters assessed.

The direction causality among the variables is investigated using the Granger causality test (Engle & Granger, 1987) based on the error correction model. The Granger causality is based on the regression in the following form:

$$\Delta Z_t = \sum_{i=1}^n \psi_{1i} \Delta Z_{t-i} + \sum_{i=1}^n \omega_{1i} \Delta X_{t-i} + \lambda_{1i} \mu_{t-1} + \xi_t \quad (8)$$

$$\Delta X_t = \sum_{i=1}^n \psi_{2i} \Delta X_{t-i} + \sum_{i=1}^n \omega_{2i} \Delta Y_{t-i} + \phi_{2i} \mu_{t-1} + v_t \quad (9)$$

In equation (8) and (9), X does not Granger cause Z if ω_{1i} parameters are jointly 0 and Z does not Granger X if ψ_{2i} parameters are jointly 0.

However, neither ARDL nor Granger Causality tests give evidence whether any series responds to shocks in another series or not. Therefore, we use the GIRF of Koop et al. (1996) and Pesaran and Shin (1998) to ensure that that VAR innovation is not contemporaneously correlated. The ability of the GIRF to trace one-off shock to one of the innovations on the current and future values of the endogenous variables made it a preferred choice over the Cholesky decomposition method employed by Sims (1980) or the Bernanke (1986) factorization of the reduced form error covariances matrix. Also, the Cholesky approach is very sensitive to the ordering of the variables in the model when the covariance matrix is non-diagonal (see Awokuse, 2008). The Bernanke factorisation technique is less restrictive compared to the Cholesky method; however, it relies on the use of a priori knowledge from an economic theory to reach identification. Hence, these two methods can be subjective and capricious as it is not always that theory yields a clear identifying causal structure. The GIRF approach, in contrast, is invariant to the alternate orderings of the variables in the VAR system. As shown in the work of Koop et al. (1996), GIRFs are unique and clearly show the past patterns of the observed correlations among the several shocks. The scaled generalised impulse response can be specified as follow:

$$\Psi_j^g(n) = \sigma_{jj}^{-1/2} K_n \sum e_j, n = 0, 1, 2, \dots \quad (10)$$

Where σ_{jj} is the jj^{th} element in the covariance matrix Σ , and e_j is an $m \times 1$ vector

The GIRF is obtained by transforming the VAR model into an infinite moving average representation (see Pesaran and Shin, 1998).

$$\text{GIRF}(\beta_{jxt} N) = \frac{\beta_j' \varphi \Sigma e_i}{\sqrt{\alpha_{ii}}} \quad (11)$$

Hence, the GIRF in equation (11) establishes the effect of a unit shock to the i th variable pm the j th cointegrating relations.

ANALYSIS AND EMPIRICAL RESULTS

1 Descriptive Statistics and Correlation matrix

Table 2 reports the descriptive statistics of the series used in the model. The mean estimates the focal inclinations, and the values demonstrate a solid fitted model. The coefficients of variation measure the instability of the information. The outcomes show that financial development (0.3409) is less unstable than investment (0.4561) which is also less unstable than savings (0.5928), with total national output (0.5968) been increasingly unpredictable/volatile. Savings fall as low as 1.2583 and as high as 27.9960, while investments fall as low as 3.3776, and as high as 32.9370. GDP falls as low as 3.2039e+009 and as high as 1.9844e+010. The financial development variable falls as low as 0.4333 and high as 2.9636. The standard deviation quantifies the scattering of a lot of information from its mean. The more spread separated the information, the higher the deviation. The outcomes show that savings is less spread (5.2241) than financial development (0.6628), and investment (7.5191) with GDP more spread than savings and investment. The coefficient of skewness quantifies the nature of the normality of the data. The outcomes show investment (0.0829), savings (1.4586), and total national output (1.5853) are decidedly skewed positively, whereas financial development is negatively skewed. The coefficient of kurtosis measures the nature of peakedness. The values for savings (2.7482) and GDP (1.7933) are more than zero and does not show more flat-topped distribution. The value for investment (-0.9501) and financial development are less than zero which indicates more flat-topped distribution. Correlation test results are also reported in Table 2. The results indicate a positive association between the independent variables and the dependent variable. The coefficient of association between savings and investment is about 36%, which is small and positive in support of Feldstein and Horioka (1980).

Table 2

Summary Statistics and Correlation Matrix

Variables	SV	INV	GDP	FD
Mean	8.8128	16.486	6.8434e+009	1.9443
Maximum	27.9960	32.937	1.9844e+010	2.9636
Minimum	1.2583	3.3776	3.2039e+009	0.4333
Std. Dev	5.2241	7.5191	4.0840e+009	0.6628
C.V.	0.5928	0.4561	0.5968	0.3409
Skewness	1.4586	0.0829	1.5853	-0.4090
Ex. Kurtosis	2.7482	-0.9501	1.7933	-0.6776
Correlation				
Variables	lnINV	lnFD	lnSV	lnGDP
lnINV	1			
lnFD	0.793	1		
lnSV	0.357	0.336	1	
lnGDP	0.638	0.708	0.104	1

Note: C.V.= coefficient of variation; Std. Dev= standard deviation; SV= Domestic savings; INV= Gross capital formation; FD= Domestic credit by banks; GDP= Gross Domestic Product; ln = natural log.

2 Time Series Plot

The time series plot results are accounted for in figure 1 to figure 6. The figures show that the factors (SV, INV, and GDP) are non-stationary in levels (figure 1 to figure 4), notwithstanding, the factors achieved stationarity after they were first differenced (figure 5 to figure 8). The stationarity properties are further experimentally explored utilizing the ADF test, and the KPSS tests. The aftereffects of the test appear in Table 3.

Figure 1 Time series Plot of lnSV (levels)

Figure 2 Time series Plot of lnINV (levels)

Figure 3 Time series Plot of lnGDP (levels)

Figure 4 Time series Plot of lnFD (levels)

Figure 5 Time series Plot of ΔlnSV

Figure 6 Time series Plot of ΔlnINV

Figure 7 Time Series Plot of ΔlnGDP

Figure 8 Time Series Plot of ΔlnFD

3 Unit root tests

The two-unit root tests utilized in the present investigation are the Augmented Dickey-Fuller test (ADF), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS). The Augmented Dickey-Fuller test was first used to test for stationarity properties of the factors. The aftereffects of the ADF test in levels and first difference (logarithm) show that a portion of the series is non-stationary in levels (investment and gross national output) however, accomplished stationarity on first differenced. The null assumption of the ADF unit root was supported in levels for the two factors. Savings are stationary at levels and on the first difference. The null assumption of the ADF unit root was not supported for savings in levels and on first differenced. The KPSS test for analysing the stationarity properties (considering the null assumption that the data under scrutiny are stationary in levels against the alternative hypothesis that the data are not stationary in levels) was utilized notwithstanding the use of the ADF test. The outcomes (in levels and the first difference in their logarithm form) are accounted for in Table 3. Investment and income have unit roots in levels though savings do not have a unit root at a level. However, all the variables achieved stationarity on the first difference. The outcomes demonstrate that shock to investment and income is perpetual and not impermanent. Be that as it may a shock to savings is brief and not lasting. The results of the unit root tests also justify the use of the ARDL approach.

Table 3

Unit root results

Variables	ADF	KPSS
lnSV	-4.162 ^a	0.2142
ΔlnSV	-11.547 ^a	0.2522
lnINV	-1.674	0.4249 ^c
ΔlnINV	-7.707 ^a	0.2097
lnGDP	3.007	0.8529 ^a
ΔlnGD	-4.855 ^a	0.5642 ^b
lnFD	-0.845 ^a	0.4004 ^c
ΔlnFD	-6.981 ^a	0.1534

Note: Δ denotes 1st difference; a, b and c denote 1%, 5%, and 10% level of significance respectively

4 ARDL Bound Test Results

Table 4 depicts the test for cointegration results of the association between savings and investment. The results revealed the presence of a long-run association among investment and the independent variables since the F-statistic value is larger than the upper bound of the critical value at a 10% significance level (see Peseran et al., 2001). Hence, we conclude there is a cointegration relationship between investment, savings, GDP, and financial development. Since there is cointegration, the next logical step is to estimate the long-run equation and the error correction model as stated in equations (6) and (7) respectively.

Table 4

Results of Bounds F-test for Cointegration

y	Function	Optimal lag	F-statistics	Cointegration Status
lnINV	F(lnINV lnSV,lnGDP, lnFD)	(1, 1, 1, 1)	3.936	Cointegrated
ARDL bound test: critical values		(Pesaran et al., 2001)		
Level of significance (%)		Lower Bound	Upper Bound	
1%		4.29	5.61	
5%		3.23	4.35	
10%		2.75	3.77	
K=3				

We estimated the long-run coefficient elasticities of the cointegrating vectors using the ARDL model and the results are reported in Table 4. The results show that none of the coefficients of the predictor variables is statistically significant at the conventional levels. However, if the predictor variables were to be significant, it would have promoted investment (i.e. positive coefficients). One intuitive expectation is a positive impact of savings on investment which is also supported by the endogenous growth models. However, the empirical data does not support this view given the insignificant impact of savings on investment. It is worthy to note that although the impact of GDP and financial development are statistically insignificant, given the size of the parameter estimates, they are economically significant.

The short-run dynamics using the ECM version of the ARDL are also displayed in Table 5. The model contains the error correction term (ECT_{t-1}). The coefficient of the error correction term (i.e. speed of adjustment) captures the size of disequilibrium in investment in one period which is corrected in the next period. The higher the error correction coefficient, the shorter the period whereby the economy returns to a steady (i.e. equilibrium) rate of investment after a shock. Theoretically, the coefficient of the ECT_{t-1} , where -1 indicates that 100% of the disequilibrium in investment is corrected in the next period. However, the error correction term should be negative and statistically significant. The coefficient of our error correction term is -0.272 which implies that approximately 27% of last year's disequilibria are corrected in the current year, indicating a poor speed of adjustment in the relationship process following a shock in the last year. The negative sign on the error correction coefficient gives evidence to support the expected convergence process in the long -run. In the short-run, savings, GDP, and financial development significantly at the 1% level promote investment. A 1% increase in savings, GDP, and financial development would result in a 0.069%, 0.266% and 0.125% increase respectively in investment.

Additionally, Table 5 presents the diagnostic test performed on the ARDL model. The results indicate that the estimated long-run and error correction model is free from serial correlation, heteroscedasticity, and non-normality as all their estimated coefficients are not significant. The adjusted R-Squared which is approximately 88% indicates a good fit for the model. The model is free from any functional misspecification as indicated by the Ramsey RESET test. The plots of the CUSUM and CUSUMSQ statistics (see Figure 1) are well fitted within the 5% critical bounds implying that the model is stable over the sample period of 1960-2016.

Table 5

Long run Causality and Short-run Dynamics

Long-run relationship	
lnSV	0.069 (0.310)
lnGDP	0.266 (0.994)
lnFD	0.125 (0.446)
C	-4.300 (-0.699)
Short-run and error correction form [ECT]	
$\Delta \ln SV$	0.178a (3.063)
$\Delta \ln GDP$	2.162a (3.248)
$\Delta \ln FD$	0.414a (2.917)
ECT-1	-0.272a (-3.040)
Model diagnostic and stability tests	
R-squared	0.895
Adjusted R-squared	0.879
F-statistic	58.319a
Jaque-Bera test of normality	6.174 [0.4560]
Serial Correlation LM Test	0.857 [0.431]
Heteroskedasticity Test	1.599 [0.159]
Ramsey RESET Test	1.405 [0.242]
CUSUM	Stable
CUSUM of Squares	Stable

Note: a denotes significance level at 1%; Values in (#) denote T-values; Values in [#] denote P-values

Figure 9 Plots of CUSUM and CUSUM of Squares

5 Granger Predictability Test

The null assumptions (H_0) of the test are that investment (INV) does not Granger causes the determinants and the determinants do not Granger cause investment (INV). The alternative assumptions (H_A) are that investment (INV) Granger causes the determinants and the determinants Granger causes investment (INV). Table 6 exhibits the results. The results show that investment does not granger cause any of the determinants in the model aside from financial development. However, savings granger cause investment without feedback. That is, there is a unidirectional causality running from savings to investments in the short run. Financial development predicts savings without feedback. Economic growth granger predicts investment without feedback.

Table 6

Granger-Predictability Test Results

Variables	Chi-square value	P-values	Decision
FD cannot, Granger, predict INV	0.1379	0.7118	Accept Ho
INV cannot, Granger, predict FD	15.3939	0.007 ^b	Do not accept Ho
SV cannot, Granger, predict INV	2.8747	0.0958 ^c	Do not accept Ho
INV cannot, Granger, predict SV	1.7853	0.1872	Accept Ho
GDP cannot, Granger, predict INV	2.8720	0.0960 ^c	Do not accept Ho
INV cannot, Granger, predict GDP	2.1745	0.1462	Accept Ho
SV cannot, Granger, predict FD	0.8798	0.3525	Accept Ho
FD cannot, Granger, predict SV	5.6364	0.0212 ^b	Do not Accept Ho
GDP cannot, Granger, predict FD	1.7187	0.1955	Accept Ho
FD cannot, Granger, predict GDP	0.7445	0.3921	Accept Ho
GDP cannot, Granger, predict SV	0.9493	0.3343	Accept Ho
SV cannot, Granger, predict GDP	0.0519	0.8206	Accept Ho

Note: *a*, and *b* indicate significant at 5%, and 10% levels

6 Results of Impulse Response Test

The generalised impulse response function (GIRF) of the Model shows the response of domestic investment to one standard deviation shock in each of the shock variables. The GIRF traces out the magnitude of the responsiveness of the target variable in the VAR model to shocks in each of the dependent variables. The unrestricted VAR level has a standard error band of ± 2 S.E. The response which is produced from each unit shock applied to the error term of the dependent variable in the model is traced over time. The specific forecast horizon the impact of a unit shock is observed in the VAR model is 10 years. The graphs of the output of the GIRF generated from the VAR model are shown in Figure 10. The standard error bands are shown by the two outer dashed lines and they signify the 95% confidence bands obtained from the asymptotic response of the standard errors while the line in the middle depicts the impulse response function.

In the Model, the results show that a large response of investment in the system is due to its shock. This is consistent with the result of the variance decomposition (VDC) reported in Table. Investment remained positive over the horizon, though it was declining as the forecast horizon increased into the future. This suggests that the investment will return to its initial equilibrium value of zero if there are no further shocks in the system over some time. A standard innovation to domestic savings results in a decline in investment.

The impact of the shock was positive up to about the middle of the 3rd year when it crossed the zero line and became negative, persisting all through the period of the forecast. Furthermore, the response of investment to a standard innovation in financial development is positive from the beginning of the forecast period and remained so for a greater part of the period till the effect of the shock began to fizzle out and move towards the zero lines from about the beginning of 7th year. GDP shock is quite high at the initial stage but after the 2nd period, the effect begins to decline yet it remains positive and continues after the 10th period.

We can conclude that there is a unidirectional Granger causality from the shock to investment in Ghana. However, the results should be analysed with caution. This is because the impact of one standard deviation innovation in any of the shock variables is associated with a gamut of economic interactions at the macro level.

Response to Generalized One S.D. Innovations ± 2 S.E.

Figure 10 Generalised Impulse Response of the Unrestricted VAR Model

7 Variance Decomposition Test Results

Results of the variance decomposition analysis for the VAR model are reported in Table 8. The forecast horizon remains 10 years to allow us to observe how the system advances over time and enable us to assess the contribution of the dependent variable's shock and the shocks of the regressors in the model. Our interest is in how much of the future variations in investment are explained by own shocks, financial development, domestic savings, and GDP. The results of the variance decomposition of investment, financial development, domestic savings, and GDP accounted for 0.18%, 15.25% and 7.21% of the variations in investment over the forecast horizon respectively. However, investment own shock accounted for 77.37%.

Examining the whole forecast horizon, the share of financial development in the variability in investment increased from 0.09% in the 2nd year to 0.136% and 0.182% in the 6th and 10th year respectively. The share of investment declined from 95.32% in the 2nd year to 83.81% and 77.37% in the 6th and 10th year respectively, in explaining itself. Also, the share of variability in investment explained by domestic savings increased from 1.04% in the 2nd year to 9.50%

at 15.25% in the 6th and 10th year respectively. The variability in investment explained by domestic savings is not as large as we expected, hence we conclude that domestic savings shock has an indirect and a marginal impact on investment. The share of GDP tends to follow a similar trend as that of domestic savings. The result shows that the contribution of GDP to the variability in investment increased from 3.56% in the 2nd year to 6.55% and 7.21% in the 6th and 10th year respectively.

The evidence from the VDC suggests that a contemporaneous shock in domestic savings and GDP would have a significant impact on investment over time. The implication is that the variability in investment due to own shock will decline over a longer period following a contemporaneous shock in domestic savings and GDP, unless the government, monetary or fiscal authorities intervene by putting up measures to cushion the impact of the shock.

Table 8

Variance Decomposition of the Unrestricted VAR Model

Variance Decomposition of LNINV Explained by Shocks in:					
Period (years)	S.E.	LNINV	LNFD	LNSV	LNIGDP
2	0.318	95.318	0.088	1.035	3.559
4	0.408	88.947	0.138	5.031	5.885
6	0.453	83.810	0.136	9.504	6.550
8	0.480	80.085	0.132	12.893	6.890
10	0.497	77.365	0.182	15.245	7.208

Source: Author's Calculation November 2019

DISCUSSIONS

The paper has inspected the savings-investments nexus utilizing the ARDL and the Granger predictability test for Ghana for the period 1960-2016. There is a marginally significant cointegration link between savings and investment, but there is a stable short-run association between savings and investments. There is also, a significant positive weak correlation between savings and investment according to the correlation matrix test results. The weak association between savings and investments is in sync with the original work of Feldstein and Horioka [6] and other previous investigations, for example, Kollias et al. [12], Esso and Keho [5], Onafowara et al. [17] that established a significant association between savings and investments. The ramifications of the discoveries are that worldwide capital fixed status does exist in Ghana for the period being talked about. The discoveries do not bolster the study of P. Narayan and S. Narayan [15] that did not support the savings -investments link for G7 nations over the period 1971-2002, and Ketenci [10] for Estonia and Portugal between 1995-2009. The findings of causality from savings to investments in the study are in line with that of Esso and Keho [5], and Irandoust [8] that reported unidirectional causality from savings to investment, indicating, savings spur domestic investment.

CONCLUSIONS AND RECOMMENDATIONS

The paper re-examined the savings-investments nexus utilizing the ARDL bound testing approach, and the Granger causality test for Ghana for the period 1960-2016. The study found evidence of a significant and weak correlation and a short-run link between savings and investment. The findings of weak association indicate that capital is fixed in Ghana which supports the hypothesis under investigation. Since capital is reported to be fixed universally, the burden of corporate annual taxes does not fall basically on work/labour; and that public deficit swarm/crowd out private investment; that increments in savings do raise residential investment; and that monetary and tax policies alter the real net rate of return on domestic capital.

Future research should take into consideration the effect of structural breaks Likewise, a similar examination utilizing different nations in a comparative study using small but open economy and large and open economy ought to be considered to determine if the current findings would be reproduced.

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