GOVERNMENT EXPENDITURE PATTERN & INVESTMENT BEHAVIOUR IN GHANA: FROM THE ABYSS INTO RECOVERY

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ABSTRACT

*The significance of Ghana's policy of Economic Recovery Programme **(ERP)** in stimulating gross investment and thus structurally shifting the economy away from the abyss of the pre-policy period was on course.*

Among the policy packages under the ERP included the use of realistic and flexible exchange rates, financial and expenditure reforms in the public sector, restrictive monetary credit measures and interest rate and investment code review to stimulate private and foreign sector activity. All these were purported to have significant effects on macro-economic variables.

Within the policy framework of the ERP the present study concludes on the basis of empirical evidence that investment behavior in Ghana, during the two decades beginning 1970, was dictated by output and government expenditure considerations.

Apart from the general reinforcement due to government expenditure as a whole, the empirical results also show that the functional pattern or structure of government expenditure impacted differently on investment. Government expenditure component related to human capital factors such as health, general administration and defence (and not excluding education) positively influenced investment. But government expenditure on community services as well as economic services tended to adversely affect gross investment. In a way, therefore, it is suggested that the ERP essentially mapped out the course towards human capital formation with its attendant long-term benefits.

These conclusions have rich implications for fiscal, monetary and mixed policy decisions in terms of the management of the menu of government expenditure patterns for achieving optimum macro-economic goals.

INTRODUCTION

The 1970-1983 period in Ghana was one of a sharp decline in economic activity. The lowest point was reached in 1983. But thereafter, the economic began to pick up under the comprehensive policy packages of the Economic Recovery Programme (ERP). In essence, the ERP was set up to achieve the short-term growth needed for the recovery and to restructure the economy towards greater reliance on privatisation and free market forces.

The critical role of investment towards recovery and restructuring of the economy in view of the deeply low level of the early eighties was a motivating factor for analysing investment, output and government expenditure relationship for Ghana for the two decades up to 1990. The pro-

Table 1: The Profile of Investment, Government Expenditure and Inflation in Ghana (1970-1990)

Year	Investment -GDP Ratio (%)	Expenditure GDP (%)	Investment Expenditure Ratio (%)	Inflation Rate* (%)
1970	14.0	19.2	72.9	5.7
1972	7.0	19.3	36.2	6.6
1975	13.0	27.2	47.7	30.4
1977	11.0	27.0	40.7	117.3
1980	6.0	18.8	31.9	50.1
1982	3.0	10.2	29.4	22.2
1983	3.7	8.3	44.5	122.3
1985	9.6	14.0	68.5	10.3
1987	13.4	14.3	93.7	39.8
1989	15.5	14.4	107.6	25.2
1990	16.0	13.9	115.1	37.2

Source: Ratios were compiled from Kapur et.al.. (1991) for 1983-1990; and from Rimmer (1992) for 1970-1982.
The Inflation rate is the percentage change in the annual average of the CPI (1977 = 100).

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file of Investment, Government Expenditure and Inflation during the period under review is presented in Table 1

Up to 1983, the Investment-GDP ratio and the Expenditure-GDP ratio both trended downward. The ratio of Investment to Expenditure showed some fluctuation but generally it declined from 73% in 1970 to 29% in 1982. The inflation rate indicated an upward trend from 5% in 1970 to as much as 117% in 1977, and further to 123% in 1983.

The steady decline of the economy from 1970 to 1983 was mostly the result of rigid exchange rate controls and overly-centralised fiscal and budgetary policies which discouraged incentives to domestic production and exports. In addition, the tax base dwindled; and budget and public sector deficits soared alongside trade deficits. Inflation also expanded rapidly and the country's socio-economic infrastructure nearly collapsed.

Table 1 shows that after 1983, however, the Investment ratio (to GDP) improved whilst the Expenditure-GDP ratio appeared to stabilise a 14%. Investment also rose over and above government spending, a situation which was quite suggestive of the availability and relevance of foreign capital inflow post 1983.

Though inflation was not fully contained, the rate was on the average far below the 1983 estimate of 122.8%, the highest for the two decades under review

The significance of the Economic Recovery Programme (ERP), as a factor of structural change in stimulating investment was on course. Under the ERP, the country's macro-economic performance improved compared with the abysmal level attained prior to the policy. The ERP brought about a realistic and flexible exchange rate system. There were financial and expenditure reforms in the public sector. In particular, budgetary and fiscal policy was decentralised to increase domestic and local resource mobilisation. Also under the ERP, a restrictive monetary and credit policy was embarked on; and there was an upward review to achieve positive and flexible interest rates so as to stimulate domestic savings and to create more investible funds. The Investment Code was also revised to stimulate private sector activity (see World Bank Report, 1985).

According to Rimmer (1992), the above changes also contributed towards the recovery of Ghana's external trade. Exports increased from US$ 439.1 million in 1983 to US$ 886.9 million in 1988. There was also improvement in the domestic savings ratio (to GDP) from 1% in 1983 to 8.5% in 1987; whilst an average annual growth of 5% was recorded for real GDP for the rest of the decade posts 1983 (Ibid., pgs. 185, 186).

The primary objective of this paper was to estimate a flexible accelerator investment function for Ghana for the two decades beginning 1970; to serve as an essential guide to macro-economic policy decision making.

It is hypothesised that investment behaviour in Ghana during the sample period was not only influenced by output but also by the structural (functional) pattern rather than the level of total government expenditure per se. It is suggested, a priori, that there was an accelerator effect operating during the latter part of period; this being the result of the structural changes pursued by government under the ERP. Initiated at the beginning of the second quarter of 1983, the ERP was instituted to recover the economy from its lowest historical level in 1982/3 and to re-set it on the path towards attaining a reasonable and sustainable levels of income, output and employment, besides maintaining price stability and the achievement of other macro-economic goals.

The present paper provides an empirical evidence on the contributions and the relative performance of the ERP in terms of the extent to which the structural pattern of government expenditure has conditioned gross investment over the years.

The rest of the paper deals with a review of the related studies on investment, the concept of the operational model used, and the discussions of the empirical results and summary of the main conclusions.

RELATED INVESTMENT STUDIES

A lot of macro-models have been suggested for the investment relation; but in broader terms, investment functions may be classified into two forms namely, the Neo-Classical and Keynesian synthesis models on one hand, and the Accelerator modes on the other hand. The latter deals with the issue of output (and hence income) capacity impact on investment; whereas the former address the issue of capital cost (i.e. interest rate) and the return on capital and investment.

The accelerator model assumes that, at the macro level, output (and hence aggregate demand) is the single most important determinant of net investment, and therefore discounts the pragmatic role that profitability, capital cost and business expectation factors play in the decision to invest.

The Neo-Classical and Keynesian synthesis models are based on the theory of optimal capital accumulation, and contend that the desired (optimal) capital stock depends not only on output but most significantly on the user cost of capital, which in turn depends on the real interest rate as well as the rate of capital depreciation.

Studies like Jorgenson (1963), Jorgenson and Stephenson (1967), Eisner and Nadriri (1968), Hall (1977) and Clark (1979) have defined and explained the investment function in terms of the relative price (of output and capital) and income, which are critical elements in the classical, Neo-Classical and Keynesian tradition. In Jorgenson Stephenson (1967), for example, it was observed, using the appropriate price and income policy changes, that a relatively short but sharp boom in investment occurred in the US economy, beginning approximately one year after the policy measures were put into effect; and that the peak was built up approximately two years after the policy measures were undertaken.

As a critique to Jorgenson and Stephenson (1967), the so called "putty-clay" concept was developed by Eisner and Nadriri (1968) to distinguish between the responses of investment to changes in relative prices and investment responses due to changes in income. It was contented, among other things, that "If new capital can be moulded into any shape (putty) but once installed is not malleable (clay), then changes in relative prices leading to changes in equilibrium stock of capital..... would be affected to a large extent only as the older capital ..... wore out. In the case of increases in output, however, additional capital would be desired at once. *The effect of the expected change in relative prices on* (italised mine) the equilibrium response of capital to a change in output *is thus by comparison* relatively second order effect "Ibid., p 377).

Within the limits of the two approaches, there are various static and dynamic models of investment which differ in terms of the relevance of other variables introduced into the function to specifically and sufficiently explain the behaviour of a given investment relation. Such models include output as a factor and may be flexible and variable in variables.

One of the most flexible accelerator models of investment behaviour for developing countries is the study by Wai and Wong (1982). That study observed, among other things, that interest rate and capital cost concepts do not reflect the scarcity of capital in developing countries because their capital markets are either too small or not well developed. That study thus rejected the Neo-Classical and Keynesian synthesis type of models in favour of a modified flexible accelerator model in a cross-country sample involving five developing countries namely, Malaysia, Greece, Thailand, Mexico and South Korea. The Wai and Wong (1982) study used a recursive model (based on a reduced form equation for private investment), to specifically derive the direct and indirect impacts of public (government) investment on private investment.

The main hypothesis of that study was that private investment depended on government expenditure, changes in bank credit and the inflow of foreign capital to the private sector. These determinants were selected on the basis of theoretical significance, on the availability of data and on relevance for policy decisions.

One striking feature of the work of Wai and Wong (1982) was the selection criterion for the five countries used as case studies. The selection was based on the pattern of development as suggested by Chenery and Synquins (1975) as follows: Malaysia was selected on account of its primary produce specialisation; Greece and Thailand for Balanced Growth; Mexico for import substitution and South Korea was selected for industrial specialisation. The empirical results in that study for the period 1960-1976 identified government investment as the most important and significant factor for private investment in Greece, South Korea and Malaysia. Bank credit was identified as the significant variable in Thailand; whilst in Mexico, foreign capital inflow was found to have stimulated private investment.

Notably, Wai and Wong (1982) did not include an African country as a case study. But, more important, the effects of the level of the total as well as the structural (functional) pattern of government expenditure on investment were assumed away.

Another study by Blejer and Khan (1984) also estimated a private investment function for developing countries by pooling (together) 24 countries over the 1971-1979 period to yield a total of 216 observations. The investment function was defined in terms of four main variables. These were the change in previous output level; the change in bank credit to the private sector including net private capital flow; a proxy for cyclical factors (defined as the difference between actual and trend output); and the pre-existing level of private investment. Other variables like the actual, the trend and the expected levels of public sector investment were also introduced into the function for various specifications, possibly in search of the most appropriate specification.

Empirical results in Blejer and Khan (1984) suggested that in general a stable investment function can be estimated for developing countries. Much more specific, it was observed that private investment falls together with a reduction in the flow of credit to the private sector; but private investment rises as the structural component of government capital formation increases.

Once again Blejer and Khan (1984), as in Wai and Wong (1982), did not include a single African country in the case studies of the private investment function. Indeed, out of the 24 countries pooled into the study, 1 was from the Middle East (and that was Turkey); 6 were from Asia and the rest (17 in all) were Latin American and Caribbean countries. In a sense, therefore, the results in Blejer and Khan (1984) predominantly reflected the Latin American experience.

The review of the above study is particularly relevant in the sense that by using public sector investment (i.e. the infrastructure component of government capital formation) as one of the explanatory factors of the private investment function, that study provided the basis for estimating the effects of structural components of government expenditure on private investment in developing countries.

Within a macro-econometric framework, the private investment function for Turkey was specified by Yagci (1983) with aggregate demand, money supply, the current and previous values of imported capital goods as determinants. All variables were in real terms, and their estimated coefficients were statistically significant. The investment function in Yagci (1983) was flexible in that it defined private investment behaviour to reflect the prevailing situation in Turkey at the time when the inflow of capital goods and domestic monetary conditions posed tremendous pressure on the Turkish economy.

Unfortunately, documented empirical studies on investment for Ghana are grossly limited. A study by Y. Asante (1994) sought to examine investment behaviour in Ghana; but it was not based on the flexible accelerator model, neither did it incorporate government expenditure composition effect on private investment as has been defined in the present study.

The private investment function for Ghana in the present study therefore includes government expenditure structural variables. This is the major attribute of this paper. The flexible accelerator model was incorporated on the basis of theoretical and policy relevance. It is expected that the study will provide some relief to the dearth of empirically documented studies on investment in Ghana.

THE CONCEPTUAL MODEL

The model described in this section is the flexible accelerator model, the inherent assumptions and features of which are deduced as follows.

The current stock of capital (K_t) is equal to the previous level of capital stock (K_{t-1}), less current capital consumption, plus current gross investment (I_t^G);

i.e.

$$K_t = K_{t-1} - D_t + I_t^G \quad \text{-------------------------- (1)},$$

and therefore Net Investment in the current period t is given as

$$I_t^N = K_t - K_{t-1} = I_t^G - D_t \quad \text{-------------------- (2)}$$

where D_t = capital consumption (including mostly) depreciation) in period t.

It is also assumed that if the desired capital stock K* is achieved at the end of each period, then there is a fixed relationship between output and the desired capital stock such that:

$$Q_t = a K^*_t \quad \text{-------------------------- (3)},$$

$$\text{or } K^*_t = b Q_t \quad \text{-------------------------- (4)}$$

(where b = (1/a))

By substituting (4) into (2), and assuming zero depreciation, the simple accelerator model of (net) investment is achieved as in

$$I_t^N = b(Q_t - Q_{t-1}) = b\,\Delta Q_t \quad \text{---------------- (5)}$$

For the simple accelerator model, investment is not affected by the cost of capital or depreciation. However, capital consumption allowance (also a measure of depreciation) is usually considered as a given proportion, "$_c$" of the pre-existing capital stock. Thus, a la Mayes (1981),

$$D_t = c\,Kt\text{-}1 \quad \text{---------------------------- (6)};$$

and by substituting equations (4) and (6) into (1), and re-arranging for gross investment (I_t), equation (7) is obtained.

$$I_t^G = b\,Q_t - b(1-_c)\,Q_{t-1} \quad \text{-------------- (7)}$$

In the above equation, gross investment is used to account for the role of depreciation or capital consumption allowance in less-developed economies. In this sense, the simple accelerator model has assumed a "flexible" character. In fact, depreciation is more than just physical wear and tear that result from use and age. As explained by Dornbusch and Fischer (1994, p. 337), there is both physical depreciation and economic depreciation; and that the latter effect which is due to technological obsolescence may be more than the former.

The author's extension of Mayer (1981), assumes that the first-difference (change) in capital consumption or depreciation is directly proportional to current government expenditure (G_t); which is typical of an economy dominated by formal public sector activity. In Ghana, perceived relative increase in private sector activity was noticeably post-1990. Thus,

$$\Delta D_t = (D_t - D_{t-1}) = \lambda G_t \quad \text{---------------- (8)};$$

$$0 < \lambda < 1$$

By substituting equations (4), (6) and (8) into equation (1), the results after re-arranging for I_t is shown in equation (9) as follows:

$$K_t = K_{t-1} - D_t + I_t^G \text{ becomes}$$

$$bQ_t = bQ_{t-1} - [\lambda G_t + D_{t-1}] + I_t^G$$

$$= bQ_{t-1} - [\lambda G_t - + {}_cK_{t-2}] + I_t^G$$

$$= bQ_{t-1} - [\lambda G_t + {}_c(bQ_{t-2})] + I_t^G$$

$$= bQ_{t-1} - \lambda G_t - cbQ_{t-2} + I_t^G$$

$$\text{Or } I_t^G - bQ_t - bQ_{t-1} + cbQ_{t-2} + \lambda G_t \text{ ------- (9)}.$$

$$(I_t^G = b\Delta Q_t + cbQ_{t-2} + \lambda G_t)$$

In equation (9), current gross investment depends on the current year's output, the previous year's output, the output of the year before that, and the current level of government expenditure.

Next, and in order to maintain the dynamic feature of the specification, a stock-adjustment assumption is posited, namely, that the change in the actual stock of capital is ultimately equivalent to the change in the desired capital stock at an adjustment rate δ as in

$$[K_t - K_{t-1}) = \delta(K^*_t - K_{t-1}) \text{ ---------------- } (10)$$
$$(0 < \delta < 1)$$

Thus, by combining equations (10), (8), (6) and (4) I series of substitution, first-differencing and re-arrangement of terms, a modified version of equation (9) is obtained as provided in equation (11). (see the Appendix for the proof).

$$I_t^G = \delta bQ_t - \delta b(1 - c)\, Q_{t-1} + \lambda G_t + (1 - \delta)\, I_{t-1}{}^G \text{ -- } (11).$$

Finally, and for operational purposes, equation (11) is modified to obtain (12). The latter included a dummy policy variable to account for the ERP effect in investment. In addition, the government expenditure (G) variable in (11) was decomposed into its functional classifications comprising the expenditure on General Administration and Defence (ADD), expenditure on Education (EDC), expenditure on Health (HTH), expenditure on Community Services (CSV) and the expenditure on Economic Services (ESV). Thus,

$$I_t^G = \alpha 0 + \alpha 1 Q_t + \alpha_2 Q_{t-1} + \alpha_3 \Sigma \lambda_{jt} G_{jt} + \alpha_4 DERP_t + \alpha_5 I_{t-1}{}^G + u_t \text{ -------------------- } (12)$$

for j = 1,2,3,4, and 5

and j = component government expenditure for ADD, EDC, HTH, CSV and ESV respectively

DERP = dummy policy variable for the ERP such that DERP
= 0 for years up to 1983,
= 1 for post-1983, years,

u = is the disturbance term

DATA RESULTS & DISCUSSIONS

Equation (12) was estimated for Ghana, using annual data for the two decades ending 1990. Data were obtained from IMF sources, specifically from International Financial Statistics (IFS) and Government Finance Statistic (GFS) series. All variables except the dummy binary variable are expressed in real values at 1985 constant prices. The OLS and AR(1) estimation methods were used for the double logarithmic form of equation (12). Thus, the direct coefficients of the estimated equations are also constant elasticity estimates of investment with respect to the regressors.

First of all, equation (12) was estimated by introducing the total government expenditure as well as the functional classification variables in separate distinct function. The intent was to test the effect of the possibility of zero inter-component substitutability and complementarily.

The empirical results based on the separate formulation of each of the component expenditure functional classifications are presented in Table A1 and A2 (see the Appendix). The degrees of fit of OLS equations in Table A1 were quite satisfactory, and ranged from 76% to 89% of explained total variation in investment. The results show that the dummy policy variable impact was positive and inelastic. Thus the ERP tended to influence gross investment; and this was statistically significantly so with respect to total to government expenditure and the component expenditure areas of general administration and defence (ADD), education (EDC) and health (HTH). It is worthy of note that real government expenditure on ADD increased from 7.4 billion cedis (in 1985 constant prices) in 1983 to 13.6 billion cedis in 1990. The expenditure on social services, comprising mainly of ED and HT., also improved from 6.3 billion cedis in 1983 to as much as 25.8 billion cedis in 1990 (see IFS of the IF, 1994).

The total government expenditure - investment elasticity was greater than unity (1.2) and statistically significant; whilst all the five expenditure components also yielded positive but inelastic estimates. Only the component expenditures for general administration and defence; education; and health were statistically significant, irrespective of the functional specification used. The coefficient of the component expenditures for community services and economic services were not based on statistical significance.

The positive and elastic estimate obtained for the total government expenditure variable was expected in view of the fact that public sector activity dominated the economy. Government spending thus dictated the level, direction and the pattern of other macro activity variables including (private) investment. But, as rightly pointed out by Huq (1989), however, government's direct intervention to influence investment decisions in Ghana did not necessarily imply that the price mechanism was completely replaced by a better investment allocation system. Indeed the private sector still continued to make investment decisions unequivocally on the basis of anticipated cost and profit considerations.

The results in Table A1 also show that whilst current output stimulated current investment, the level of previous output reduced current investment. Though these relationships were not based on statistical significance, these results were not unexpected as explained below. If the previous level of output is high, then current investment level will have to reduce in order to avoid the possibility of a glut in the commodity market. The adjustment process was however, in this case, low. It has been explained that in practice, the accelerator may not be as dramatic as theoretically expected (Sloman, 1994, p. 669). In the Ghanaian case, therefore, investment was neither "*highly volatile*" (Sloman, 1994, p. 669, nor "*extraordinarily variable*" (Baumol and Blinder, 1997, p. 588). Nevertheless, the accelerator effect did prevail in the sense that firms still took notice of changes in consumer demand in their decision to invest.

Current investment also changed directly as the change in previous investment; and the coefficient of change was consistently inelastic and statistically significant.

The results in Table A2 (see the Appendix) were based on the First Order AutoRegressive model (AR1) using the Cochrane-Orcutt Iterative method of transformation to correct autocorrelation problem of the OLS results in Table A1. The two results were essentially not very different from each other in terms of the policy (dummy) variable as well as the total and component government expenditure variables. In the AR1 model, however, the current output variable was found to be relatively more significant, statistically, than the previous level of output. Also, the pre-existing level of output exhibited additional traits of instability in terms of the directions of relationship; and this possibly must have resulted in the relatively wider range (36% - 94%) for the degrees of fit of the equations.

Next, all the five components of government expenditure variables were specified jointly and estimated for the private investment function of equation (12).

Tables B1 and B2 (of the Appendix) show the results of the investment function when all the component government expenditure variables were introduced jointly in equation (12). Three different equations were estimated. First, the investment function was estimated for the 1970-1983 sub-period to reflect the pre-ERP policy year. The next two functions were estimated to cover the entire sample period (1970-1990); but in one case, the policy (dummy) variable was excluded in order to observe the structural shift in investment due to the policy change. In the other case, the policy variable was included in the specification so that the partial effect due to the policy change can be directly estimated.

Both the OLS and AR(1) results indicated that the component expenditures for general administration and defence (ADD) and health (HTH) impacted positively and on a whole statistically significantly on investment. The component government expenditures for education (EDC), community services (CSV) and economic services (ESV), however, tended to reduce investment; but, statistically the relationship was not significant. In all cases, the elasticity estimates were below unity, implying that investment responded less than the proportionate change in a given component expenditure.

Since government expenditures on administration and defence (ADD), health (HTH), and education (EDC) directly involve training, rehabilitation and maintenance of human (labour) capital (and therefore depict the human capital factor), the positive relationship between these component expenditures and investment imply the existence of complementarily between government expenditure and private investment.

The inverse relationship between the component expenditure on community services (CSV) as well as economic services (ESV) and private investment may be interpreted ex-post. Consumption may be considered as the ultimate reason for investment in the sense that, money is expended for the provision of these services. This means that the public consumption of these services implies that investment has been realised. In a way, therefore, investment has to be accomplished in order for these services to be provided. Alternatively, a reduction in the flow of resource spending which reduces the physical stock of capital, and the increase in public sector consumption of community and economic services are equivalent. This, in principle, symbolises the short-term substitution or trade--off effect between investment and public consumption expenditure.

In an earlier stage, a step-wise regression was performed involving the component expenditure variables; and the regression results (provided in Table C1 and C2 at the Appendix) were consistent with the results of the joint component expenditure functions of Tables B1 and B2. The step-wise results further indicated that the two specifications which excluded government expenditure and its component variables did not explain the variation in investment adequately enough (71.2% and 77.8%), as compared to the other specifications.

It is shown from the results (Tables B1 and B2) that the investment function was output-elastic for nearly all the equations, and also statistically significant especially for the ARI specification. More specific, the pre-existing levels of output tended to stimulate current investment. Such improvements are usually the result of increased availability of essential raw materials, spares and equipment as well as realistic pricing of foreign exchange, capital and labour resources among others. In this case, investment, as a dynamic process, leads directly to additional demand for newly produced goods, and hence to greater productive capacity.

Also, for economic and social infrastructure projects such as road construction, seeds and irrigation in the agricultural sector, adaptive research and even credit schemes, a direct linkage may be envisaged between output and investment, but not without an lag.

Given the relatively low Gross Investment-GPD ratio in Ghana (16% in 1990), compared with UK (over 60% in 1992; see Sloman, 1994, p 589), the gap between Ghana's potential and actual level of investment is sizeable. Thus, given the facilities of structural change e.g. the ERP and the Structural Adjustment Programme (SAP), one expects pre-existing output levels to stimulate current investment in much the same way as pre-existing investment levels would need to step-up in order to increase production and capacity utilisation.

The ERP policy variable was tested for structural break or shift from 1984 onwards using Chow (1960) parametric stability test in addition to the HF (Hendry forecast) statistic for testing constant error variances, as a pre-test for the Chow stability test. The details of the structural stability test is found in Maddala (1989) and Cuthbertson, Hall and Taylor (1992).

The results shown in Tables B1 and B2 suggested that for the seven annual data points up to 1990, the hypothesis of constant error variances for the periods before the and after the ERP was rejected. The variances of the errors of the investment function for the two sub-periods were thus significantly different.

Though the Chow (1960) test for structural stability for the two sub-periods was not rejected, the specification which included the dummy policy variable when the entire sample was used, showed a definite positive and inelastic impact on investment. This was an indication of the significance of the ERP in stimulating investment.

The empirical results of the various HF estimates also showed that the actual impact on investment due to the structural shift of the ERP policy must have occurred between the third and fourth year after the ERP has been instituted.

CONCLUSION

This paper has estimated the investment function for Ghana for the two decades ending 1990 using the "flexible accelerator" mode, which specified that in addition to output as a factor, the level and functional components of government expenditure are also important in determining investment behaviour. This approach is an obvious approach form the Neo-Classical and Keynesian synthesis approach to investment behaviour which interest rate, the rate of returns on investment capital and business expectation factors. The Economic Recovery Programme (ERP) was included as a qualitative (policy) factor of structural change in investment. The empirical results of the study has led to the following conclusions.

First, total government expenditure stimulated investment, and the elasticity of impact was greater than unity.

Second, investment response due to the component variables of government expenditure was inelastic in each case. However, the component expenditure on general administration and defence, as well as the component expenditure on health both impacted positively on investment; whereas component expenditures on both community and economic services appeared to have dampened investment efforts.

The above conclusion suggests that, on the one hand, government expenditure which relates to the human capital factor such as administration and defence (mainly supervisory), and health as well as education complemented private investment activities in Ghana for the two decades up to 1990. But, on the other hand, government expenditure on community services including social welfare, social security and other amenities, and the expenditure on economic services (i.e. expenditure on oil refinery, public spending on roads, housing and construction), behaved as substitutes and therefore completed with investment in the private sector. In other words, the flow of investment resources had to be reduced to ensure the provision of these type of public expenditures.

Third, the output effect on investment, or the accelerator factor, was generally positive with pre-existing output level demonstrating relatively greater consistency (in terms of direction) than current output level. Both elastic and inelastic estimates were recorded. The accelerator factor thus did operate during the sample period, but its effect was not as dramatic as theoretically expected.

Fourth, it is concluded that the Economic Recovery Programme (ERP) was unequivocally responsible for stimulating investment in Ghana. Structural stability test indicated that the ERP brought about structural shift in the economy, and this stimulated investment and thus aided the recovery of the economy from the abyss in 1983 when the average annual growth rate was negative (-4.5%) into the reasonably moderate positive growth rate of 5% for the rest of the decade.

Table A1: The OLD Investment Function for Ghana Estimates & Summary Statistics (1970-1990)

Xcept	-17.912 (-1.408)	-13.317 (-1.251)	6.471 (0.467)	9.177 (0.653)	3.496 (0.194)	1.760 (0.119)
LnQ	1.736 (1.487)	0.342 (0.313)	0.996 (0.703)	1.513 (1.121)	1.862 (1.183)	1.996 (1.310)
$LnQ_{(-1)}$	-5.546 (-0.455)	0.667 (0.577)	-1.594 (-1.208)	-2.228 (-1.690)	-2.090 (-1.2900)	-2.147 (-1.392)
DERP	0.452 (2.739)	0.524 (3.519)	0.372 (2.000)	0.184 (0.980)	0.302 (1.430)	0.244 (1.131)
$LnI_{(-1)}$	-0.071 (-0.244)	0.321 (2.156)	0.424 (1.903)	0.525 (2.910)	0.807 (4.966)	0.823 (6.357)
LnGE*	1.246 (3.347)					
LnG_{ADD}		0.751 (4.318)				
LnG_{EDC}			0.744 (2.220)			
LnG_{HTH}				0.578 (2.285)		
LnG_{CSV}					0.151 (0.478)	
LnG_{ESV}						0.210 (0.844)
R^2(bar)	0.86	0.89	0.82	0.82	0.76	0.77
D-W	2.012	2.209	1.791	1.713	1.709	1.780
F	26.04	34.56	18.86	19.02	13.48	14.03
Durbin's h	-0.013	-0.584	0630	0.758	0.955	0.574

t-ratios are in parenthesis
The "h" is Durbin's (1970) t-statistic for AR1
*GE is total government expenditure

Table A2: The ARI (CORC) Investment Function for Ghana Estimates & Summary Statistics (1970-1990)

Xcept	-22.687 (-1.366)	-17.402 (1.813)	-0.841 (-0.543)	-12.775 (-0.543)	-27.003 (-1.196)	-33.863 (-1.156)
LnQ	1.508 (0.076)	-0.472 (-0.417)	1.290 (0.710)	1.798 (1.380)	2.423 (1.919)	2.451 (1.917)
$LnQ_{(-1)}$	0.080 (0.062)	1.803 (1.541)	-1.248 (-0.823)	-0.562 (-0.312)	0.117 (0.069)	0.695 (0.452)
DERP	0.462 (2.569)	0.582 (4.360)	0.337 (1.279)	0.071 (0.240)	0.425 (1.240)	0.531 (1.516)
$LnI_{(-1)}$	-0.128 (-0.365)	0.257 (1.824)	0.356 (0.877)	0.219 (0.643)	0.123 (0.474)	0.104 (0.104)
LnGE*	1.209 (3.169)					
LnG_{ADD}		0.816 (4.910)				
LnG_{EDC}			0.728 (1.714)			
LnG_{HTH}				0.604 (2.446)		
LnG_{CSV}					0.383 (1.633)	
LnG_{ESV}						0.273 (1.518)
R^2(bar)	0.88	0.94	0.75	0.61	0.39	0.36
D-W	1.851	1.373	1.697	2.07	1.813	1.868
F	28.28	60.21	11.91	6.69	3.34	3.05
"Rho"	-0.06	-0.277	0.165	0.479	0.760	0.800
t-stat.	(-0.159)	(-0.977)	(0.297)	(1.147)	(4.440)	(5.909)

t-ratios are in parenthesis
*GE is total government expenditure

Table B1: The Investment Function for Ghana Estimates & Summary Statistics. OLS Method

	(1970-1983)	(1970-1990)	(1970-1990)
Xcept	22.726 (0.732)	-25.805 (-1.471)	-19.713 (-1.312)
LnQ	-2.508 (-1.111)	2.003 (1.752)	0.417 (0.354)
$LnQ_{(-1)}$	1.125 (0.628)	0.242 (0.148)	1.292 (0.888)
DERP			0.457 (2.335)
$LnI_{(-1)}$	-0.118 (0.339)	0.334 (1.415)	0.278 (1.386)
LnG_{ADD}	1.235 (2.792)	0.529 (1.710)	0.797 (2.795)
LnG_{EDC}	-0.733 (-1.090)	-0.299 (-0.586)	-0.210 (-0.486)
LnG_{HTH}	1.371 (1.937)	0.798 (2.210)	0.468 (1.394)
LnG_{CSV}	-0.816 (-1.633)	-0.593 (-1.675)	-0.327 (-1.024)
LnG_{ESV}	-0.358 (-0.982)	0.015 (0.052)	-0.181 (-0.680)
R^2(bar)	0.88	0.84	0.89
D-W	2.95	1.90	2.55
SER	0.277	0.274	0231
F	12.71	14.32	18.49
Durbin's h	-11.7	0.265	-2.325
m	13	20	20

Chow (7,4) = 0.966 < $F_{0.05}(7,4)$

HF (3) = 4.471 < Chi-squared$_{0.05}$ (3)

HF (4) = 15.672 < Chi-squared$_{0.05}$ (4)

HF (7) = 91.027 > Chi-squared$_{0.05}$ (7)

t-ratios are in parenthesis. HF is the Hendry forecast statistic, a pre-parametric stability test. The "h" is Durbin's (1970) t-statistic for AR1.

Table B2: The Investment Function for Ghana Estimates & Summary Statistics ARI (CORC)

	(1970-1983)	(1970-1990)	(1970-1990)
Xcept	10.810 (0.700)	-33.465 (-1.825)	-29.237 (-2.697)
LnQ	-3.035 (-2.290)	1.497 (1.202)	-0.922 (-0.799)
$LnQ_{(t-1)}$	2.516 (2.170)	1.454 (0.787)	3.424 (2.835)
DERP			0.674 (3.745)
$LnI_{(-1)}$	-0.112 (-0.523)	0.145 (0.539)	0.241 (1.261)
LnG_{ADD}	1.534 (5.770)	0.635 (2.177)	1.102 (4.087)
LnG_{EDC}	-1.016 (2.710)	-0.475 (-0.918)	-0.439 (-1.378)
LnG_{HEH}	1.081 (2.915)	0.826 (2.315)	0.302 (1.194)
LnG_{CSV}	-0.453 (-1.103)	-0.323 (-0.918)	-0.123 (-0.382)
LnG_{LSV}	-0.373 (-1.340)	-0.129 (-0.478)	-0.341 (-1.248)
R^2(bar)	0.922	0.77	0.977
D-W	3.344	1.954	2.30
SER	0.117	0.252	0.159
F	190.96	8.755	89.43
"Rho"	-0.804	0.288	-0.595
t-stat	(-2.984)	(0.765)	(-2.594)
n	12	19	19

Chow (7,4) = 0.966 < $F_{0.05}(7,4)$
HF (3) = 4.471 < Chi-squared$_{0.05}$ (3)
HF (4) 15.672 > Chi-squared$_{0.05}$ (4)
HF (7) 91.027 > Chi-squared$_{0.05}$ (7)

t-ratios are in parenthesis. HF is the Hendry forecast statistic, a pre-parametric stability test.

Table C1: The Investment Function for Ghana. Estimates & Summary Statistics (1970-1990) for the Stepwise Regression. The OLS Method

Xcept	-0.869 (-0.057)	-13.317 (-1.251)	-17.144 (-1.018)	-14.629 (-1.018)	-21.630 (-1.502)	-19.712 (-1.311)
LnQ	1.994 (1.321)	0.342 (0.313)	0.386 (0.343)	0.462 (0.397)	0.621 (0.558)	0.419 (0.354)
$LnQ_{(-1)}$	-1.819 (-1.230)	0.667 (0.577)	0.959 (0.730)	0.687 (0.476)	1.197 (0.848)	1.292 (0.888)
DERP	0.296 (1.443)	0.524 (3.519)	0.535 (3.465)	0.485 (2.628)	0.415 (2.292)	0.457 (2.335)
$LnI_{(-1)}$	0.856 (7.011)	0.321 (2.156)	0.365 (2.086)	0.357 (1.972)	0.343 (1.996)	0.278 (1.385)
LnG_{ADD}		0.751 (4.318)	0.858 (3.143)	0.816 (2.792)	0.792 (2.852)	0.797 (2.795)
LnG_{EDC}			-0.208 (-0.519)	-0.288 (-0.657)	-0.253 (-0.607)	-0.210 (-0.486)
LnG_{HTH}				0.149 (0.533)	0.408 (1.291)	0.468 (1.394)
LnG_{CSV}					-0.424 (-1.518)	-0.327 (-1.024)
LnG_{ESV}						-0.181 (-0.680)
R^2(bar)	0.778	0.898	0.892	0.886	0.897	0.892
D-W	1.908	2.209	2.363	2.251	2.551	2.553
F	17.710	34.564	27.345	22.190	21.816	18.497
Durbin's h	0.081	-0.991	-1.832	-1.581	-2.557	3.865

t-ratios are in parenthesis.
The "h" is Durbin's (1970) t-statistic for AR1
Estimates in column (2) are the same as those in column (2) of Table A1.
Estimates in column (6) are the same as those in column (6) of Table B1.

Table C2: The Investment Function for Ghana. Estimates & Summary Statistics (1970 - 1990) for the Step-wise Regression. ARI (CORC)

Xcept	-9.062 (-0.430)	-17.401 (-1.813)	-33.493 (-3.450)	-34.768 (-3.056)	-35.604 (-3.413)	-29.239 (-2.697)
LnQ	2.036 (1.154)	-0.472 (-0.417)	-0.793 (-0.946)	-0.881 (-0.961)	-0.039 (-0.041)	-0.922 (-0.799)
$LnQ_{(-1)}$	-1.141 (-0.680)	1.803 (1.541)	3.488 (3.253)	3.675 (2.787)	3.016 (2.386)	3.424 (2.835)
LnI(-1)	0.760 (3.187)	0.257 (1.821)	0.359 (3.023)	0.363 (2.918)	0.431 (3.632)	0.241 (1.261)
LnG_{ADD}		0.816 (4.910)	1.300 (5.513)	1.329 (4.888)	1.073 (3.743)	1.102 (4.087)
LnG_{EDX}			-0.754 (-2.376)	-0.740 (-2.257)	-0.600 (-1.837)	-0.437 (-1.378)
LnG_{HTH}				-0.589 (-2.501)	0.249 (0.914)	0.302 (1.194)
LnG_{CSV}					-0.412 (-1.723)	-0.123 (-0.382)
LnG_{ESV}						-0.341 (-1.248)
R^2(bar)	0.712	0.942	0.971	0.970	0.975	0.977
D-W	1.856	1.373	1.835	1.885	2.258	2.300
F	12.169	60.218	103.997	84.506	91.218	89.439
"Rho"	0.126	-0.277	-0.568	-0.589	-0.576	-0.595
t-stat	(0.298)	(-0.977)	(-2.617)	(-2.501)	(-2.130)	(-2.594)

t-ratios are in parenthesis
Estimates in column (2) are the same as those in column (2) of Table A2
Estimates in column (6) are the same as those in column (6) of Table B2

APPENDIX 2

Given that:

$K_t = K_{t-1} - D_t + {}_tG_t$ (1)

$K^*_t = b\,Q_t$ (4)

$D_t = c\,K_{t-1}$ (6)

$\Box D_t = (D_t - D_{t-1} = \ddot{e}G_t$ (8)

And $(K_t - K_{t-1}) = \ddot{a}(K^*_t - K_{t-1})$ (10)

IT IS REQUIRED TO PROVE THAT

${}_tG_T = \ddot{a}bQ_t - \ddot{a}b(1-c)Q_{t-1} + \ddot{e}G_t + (1-\ddot{a})I^G_t$ (11)

THE PROOF:

$I^G_t = (K_t - K_{t-1}) + G_t$ (using (1)).

$= (K_t - K_{t-1}) + \ddot{e}\,G_t + D_{t-1})$ (i)

(using(8)).

Then, $I^G_{t-1} = (K_{t-1} - K_{t-2}) + (\ddot{e}G_{t-1} + D_{t-2})$ (ii)

Subtracting (ii) form (i) yields

$I^G_t - I^G_{t-1} = (K_t.K_{t-1}) - (K_{t-1} - K_{t-2}) + (\ddot{e}G_t + G_{t-1}) - (\ddot{e}G_{t-1} + D_{t-2})$

$= \ddot{a}(K^*_t.K_{t-1}) - (K_{t-1} - K_{t-2}) + \ddot{e}G_t + G_{t-1}$

$-\ddot{e}G_{t-1} - D_{t-2}$ (iii)

(using 10))

But $\ddot{a}(K^*_t - K_t.1) = \ddot{a}(bQ_t - K_t.1$ (using(10).(4)).

$= \ddot{a}[bQ_t - (K_t\text{-}2 - D_t\text{-}1 + I^G_{t-1})]$

by inductive substitution using(1)

Thus (iii) becomes:

$I^G_t - I^G_t.1 = \ddot{a}bQ_t - \ddot{a}K_t\text{-}2 + \ddot{a}D_t\text{-}1 - \ddot{a}I^G_t\text{-}1 - (K_t\text{-}1 - K_t.2)$

$+ \lambda G_t - \lambda G_t\text{-}1 + D_t\text{-}1 - D_t\text{-}2$

$= \ddot{a}bQ_t - \ddot{a}K_t\text{-}2 + \ddot{a}cK_t\text{-}2 - \ddot{a}Ig_t\text{-}1 - (K_t\text{-}1 - K_t\text{-}2)$

$+ \lambda G_t - \lambda G_t\text{-}1 + \lambda G_t\text{-}1$

(using(6). (8)):

$= \ddot{a}bQ_t - \ddot{a}bQ_t\text{-}2 + \ddot{a}cbQ_t\text{-}2 - \ddot{a}Ig_t\text{-}1 - (bQ_t.1\,bQ_t\text{-}2) + \lambda G_t$

(using(4)):

In the long run when the adjustment process is complete (i.e. $Q_t = Q_t\text{-}1 = Q_t\text{-}2 = \ldots$)

Then, $I^G_t - I^G_t\text{-}1 = \ddot{a}bQ_t - \ddot{a}bQ_t\text{-}1 + \ddot{a}cbQ_t\text{-}1 - \ddot{a}Ig_t\text{-}1 - (bQ_t\text{-}1 - bQ_t\text{-}1) + \lambda G_t$

$= \ddot{a}bQ_t - \ddot{a}b(1-c)Q_t\text{-}1 + \ddot{a}G_t - \ddot{a}I^G_t\text{-}1$

And finally,

$I^G_t = \ddot{a}bQ_t - \ddot{a}b(1-c)(Q_t\text{-}1 + \lambda G_t + (1-\ddot{a})I^G_t\text{-}1$ (11)

QED

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