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CAPITAL FORMATION IN SELECTED WEST AFRICAN COUNTRIES: THEORY AND EMPIRICAL EVIDENCE

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Abstract:

This paper empirically tests aggregate investment demand functions for ECOWAS countries in order to help in the designing of investment promotion policies in the region.

Introduction

There is no doubt that capital accumulation is a significant issue in the development process. Theoretically, capital accumulation brings about increases in income which raises savings and ultimately leads to additional capital formation. A country's productive capacity grows through the accumulation of capital, quantitative and qualitative expansion of the labour force and changes in the techniques of production.

Since capital accumulates only through investment, investment is a significant determinant of long-term growth. "Investment is essential to the process by which additions to the labour force are accommodated and is the primary means whereby new technology is introduced" (Ackley, 1978, p. 608).

The Economic Community of West African States (ECOWAS)[1] is nursing the idea of establishing a development bank in order to increase the supply of investible funds.

While the idea is most welcomed, it is also important to precisely certain the factors influencing the kinds of investment demand in the ECOWAS sub-region. Therefore, this paper focuses on demand side of capital-formation by empirically testing the received hypotheses on the subject matter. It is generally stated that a change in income (Y) will shift the investment function while the rate of interest is negatively related to investment. Because of the nature of the economies in the ECOWAS sub-region, we shall drop the rate of interest since it is largely decided by government and more over, it (interest rate) has remained almost constant for the period under study.

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On the other hand, we shall stipulate that gross investment function in the area is influenced by variables such as income, (Y), previous stock of capital (K_{t-1}), external reserves (ER), stock of high powered money (M_t), etc. Part I examines investment theorizing while in Part II, we present the results and conclusion of the paper.

Part I: Capital and Investment: A Priori Theorizing

At the micro level, an investment criterion is generally a formula for ranking or comparing alternative investment packages. Simply, the rational decision rule for a firm wishing to invest will be: It is desirable to undertake an investment X if the present value (PVx) of discounted revenue less discounted future costs exceeds the cost of the investment (C). That is invest if PVx > C. The present value and other criteria are outlined in Appendix A.

Studies of investment demand are usually cast in neo-classical orthodoxy because of its consideration of technological and price factors (Meyer and Kuh, 1957; Jorgenson and Stephenson, 1967; Jorgenson, 1971). Firms make investment decisions taking into account the state of technology, product and input prices. Let us attempt to summarize the neo-classical theories of investment demand without pretending to settle the inherent controversies.

The aim of the firm in choosing its production sphere is to maximize market value, discounted sum of cash flow less direct taxes. Given a production function, the firm maximizes profit at each period of time (t). Let:

$$Z_t = P_t Q_t - r_t L_t - S_t K_t \tag{1}$$

where:

Z = profit
P = price of output
Q = quantity of output
r = wage rate
L = quantity of Labour
s = price of capital services before taxes (shadow or accounting price)
K = capital stock.

The cost of capital, the price of investment goods, the rate of change of the price of investment goods and the tax structure are factors that influence the effective rental price of capital which a firm considers in attempting to maximize profits. For the procedure utilized in estimating s, see Jorgenson and Siebert, 1968a; Yotopoulos, 1967.

In order to derive the profit maximizing condition, we specify a Cobb-Doughlas production function exhibiting constant returns to scale:

$$Q = AK^a L^b \tag{2}$$

$$a + b = 1$$

Zmax, that is, maximizing profits implies:

$$\frac{dQ}{dL} = \frac{r}{P} \tag{3}$$

$$\frac{dQ}{dK} = \frac{s}{P} \tag{4}$$

From equations (3) and (4), the marginal product of each factor has been set equal to the ratio of input cost to product price.

From equation (4), the desired amount of capital, K* is derived. By definition:

$$\frac{dQ}{dK} = a(Q/K) \tag{4.1}$$

Hence:

$$K^* = a\frac{PQ}{s} \tag{5}$$

where a represents the elasticity of output with respect to capital services (see Appendix B).

The desired level of capital thus depends on both technological and market conditions as shown by the elasticity of output with respect to capital services and the price of the product relative to that of capital services. Having specified the desired level of capital, the neo-classical theory of investment behaviour can be collapsed within the frame of the flexible accelerator model.

> Capital stock is often achieved over several time periods, and investment represents the realization of these additions to the capital stock at each time period. (Yotopoulos and Nugent, 1976, p. 180).

Assuming that capital moves toward its desired level by a constant ratio of the difference between desired capital and actual capital, net investment is defined as a measure of the flow of capital in one time period. It is also specified as a distributed lag function of the following formulation:

$$I_n = K_t - K_{t-1} = (1 - \lambda) K_t^* - K_{t-1} \tag{6}$$

Following Kuznets, 1961, a complete theory of investment must include the rate of depreciation which represents a substantial share of aggregate investment expenditure:

$$I_g = (1 - \lambda)(K_t^* - K_{t-1}) + \phi (K_{t-1}) \tag{7}$$

where:

I_g = gross investment.

From equation (7), gross investment depends on the behaviour of net investment and the rate of depreciation, $\phi (k_{t-1})$.

The above analysis suggests a relationship between capital and investment. It is for this reason that some economists perceive the theory of investment as 'analogous' to the theory of capital (Keynes, 1936; Hirshleifer, 1958; Jorgenson, 1963; Barrett, 1975).

> A macroeconomic theory of investment cannot be treated as a mere derivative of a theory of capital. Rather, while investment must be seen as an "adjustment process" responding to the existence of current and previous gaps between k and k*, attention must be given to all factors that may significantly affect the rate of this adjustment (Ackley, 1978, p. 613).

Current net investment may vary as a result of factors affecting the size of desired stock of capital, present and past. This could also be due to factors affecting the adjustment process itself though most investment theories emphasize only factors affecting the size of desired capital stock.

Neo-classical investment orthodoxy proceeds from full equilibrium implying that not only does actual capital equal desired capital stock ($K = K^*$) but that desired capital stock is stagnant over time. This steady state equilibrium assumes no economic growth, that is, net investment is zero. However, in reality net investment is never zero and usually constitutes a large portion of gross product. Hence, theories are needed to explain the cumulative growth of desired capital stock found in developing countries.

In macroeconomic models, investment is viewed as a function of: (1) tha rate of interest; (2) income and (3) the change of output or income (the acceleration principle). Typically, a decrease in the rate of interest, increases the demand for investment while changes in income shifts the investment demand function over time. The above scenario is an ecclectic utilization of Keynesian and non-Keynesian perception of investment.

Keyne's theory of investment connects the changing pace of investment to variables which are determined in financial markets. Therefore, the market rate of interest is the cost of investment. If a project has to be financed by borrowed funds then the investor must pay interest. However, if the investor has his own funds then he must consider the possibility of using his funds to buy a financial asset, say bonds which will yield interest. Hence, the yield on the bond becomes the opportunity cost of using his own money to buy capital good (Keynes, 1936, pp. 135-137).

On the other hand, an investment project must earn a compound return to be equally attractive. Keynes labelled the compound rate of return on an investment project the marginal efficiency of capital (MEC). A viable project is that in which the M E C is greater than the market rate of interest (see Appendix A). Some economists do make a distinction between the M E C and the marginal efficiency of investment (M E I)[2].

In recent times, researchers have generally agreed that the responsiveness of investment to its determinants has been weakened by lags (Clark, 1979, pp. 73-113). In the developed economies "no more than a third of investment can take place in the year that economic changes make it apparent to firms that more capital is needed" (Hall and Taylor, 1986, p. 218). It therefore becomes difficult to gauge not only the behaviour of investment but its precise impact.

The question of lags creates new problems in investment theorizing. While it is true that major investments like an entire plant could take one or more years to put in place, it is also realistic that the marginal revenue from new capital projects may not equal its rental price. With lags in the investment process it becomes necessary to perceive investment as been positively related to the ratio of the marginal revenue on new capital to the rental price of capital. If this ratio exceeds 1, then the rental price is less than the marginal benefit of capital and the firm will invest in new capital. If the reverse is the case, then the firm is not investing.

Tobin (1977) has shown that the return on holding shares of firms is the same as the return on bonds. Consequently, the market value of a firm's shares is directly related to the marginal revenue from capital. The ratio of the market value of the price of a firm's capital is often labelled *Tobin's q*. It facilitates investment formulation because it is easy to measure. It requires knowledge of a firm's share price and price indexes for capital.

The investment formulations discussed above[3] may correctly describe the behaviour of investor decision making in developed countries where, for example, the price of capital services often reflects the real scarcity of financial sources. In most developing countries, stock exchanges are not fully developed and other financial and capital markets are still embroynic. To what extent can orthodox investment theories describe the demand for investment in developing countries?

Investment Demand and Developing Countries

All the countries in the ECOWAS sub-region are developing countries. In developing countries, capital and capital goods markets are relatively imperfect; the financial infrastructure is grossly inadequate. Hence, changes in finance costs or in costs of capital goods which have significant role in the neo-classical investment demand paradigm fail to capture the complete impact of these constraints.

> A rise in the interest rate which would normally be expected to reduce the desired capital stock and investment to remedy the shortage of loanable funds, is often not allowed under institutional conditions in LDCS, where interest rates and prices of capital goods are usually controlled (Yotopoulos and Nugent, 1976, p. 182).

It is therefore not surprising that in developing countries capital rationing is often used-import licensing. This definitely will affect investment decisions of firms.

The role of developing countries as suppliers of raw materials may well influence the type of investment demand. Moreover, most of the companies in the ECOWAS sub-region are subsidiaries of multinational corporations and this influences the nature of investment. "The case against foreign private investment does not rest on political factors and economic nationalism alone. It is often buttressed by economic arguments which cannot be lightly dismissed. It is argued that foreign private investment may have an adverse effect on the balance of payments of host countries, destroy instead of creating employment opportunities, thwart national economic objectives, and aggravate income disparities". (Odebunmi, 1984, p. 231).

In the ECOWAS sub-region, government policies affect investment demand. Government is usually the one that seeks for investible funds through foreign aid, grants and or loans. The availability of external reserves influences investment. Government often implements policies to increase external reserves so as to stimulate the inflow of capital (Orimalade and Ubogu, 1984). It is for this reason that external reserves should be considered as a variable influencing the level of investment demand in developing countries.

As epitomized by Ackley, 1978, "Investment theory has received a great deal of attention in the last two decades. Nevertheless, it is fair to say that there is no clear consensus among economists as to a single 'best' theory of investment". He further asserted that empirical generalizations about investment behaviour are inconclusive and that no econometric investment functions performs very well (Ackley, 1978, p. 612). Nevertheless, it is necessary to attempt a test of the factors influencing investment demand in certain West African Countries.

Realizing that a major portion of investment in the ECOWAS sub-region is externally financed and moreover interest rates and prices of capital goods are largely decided upon by government policy we specify the following gross investment function:

$$I_t = f(Y_{t-2},\ K_{t-1},\ M_{t-1},\ ER_t) \tag{8}$$

$$I_t^s = f(S_{t-1},\ K_{t-1},\ M_{t-1},\ ER_t) \tag{9}$$

where:

I_t = level of gross investment
Y = income
K = stock of capital
I_t^s = level of gross investment with savings as an argument
M = stock of high powered money

ER= external reserves in US$ dollars
S = level of domestic savings.

Because of the paucity of data, the single-equation approach is adopted, that is both the planning and implementing stages have been combined. All variables, except external reserves, are lagged, that is predetermined. The reason for this is the influence of government on most economic variables in the West African economies. In equation (8), the income variable is lagged by two time periods to make it more reliable given the fact that laws that affect incomes are often enacted. Also, money stock (M) is included as a proxy for the stock of credit. M is lagged (predetermined) because it is a policy instrument. In equation (9), the level of savings (s) is included with the assumption that savings is income not consumed. It must be noted that a large part of savings is by government. External reserves (ER) are investible funds consisting of foreign aid, grants, loans, revenue from exports, etc., in convertible foreign currency, and in this case the U$ dollar. Foreign private investment is directly related to the availability of external reserves. The foreign companies must be able to repatriate profits in foreign currencies and these are usually written against the external reserves of the host country. We expect that an increase in any of the independent variables in equations (8) and (9) would increase the level of investment.

Part II: Empirical Analysis*

Based on the conditions prevalent in the ECOWAS sub-region, we attempted an estimation of two gross investment equations of the following form for Ghana, Ivory Coast, Nigeria and Senegal:

$$I_t = b_0 + b_1\ Y_{t-2} + b_2\ K_{t-1} + b_3\ M_{t-1} + b_4\ ER_t + U_t \tag{10}$$

$$I_t^s = c_0 + c_1 S_{t-1} + c_2 K_{t-1} + c_3 M_{t-1} + c_4 ER_t + U_t \tag{11}$$

where:
U = stochastic error term; all other variables are as defined in equations (8) and (9) above.

Applying ordinary least squares (OLS) and using time-series data from 1970 to 1981, we present the following results (t ratios in parentheses):

Ghana

$$I_t = -17.83 + .01Y + 1.69K_{t-1} - .185M_{t-1} - 1.171ER \tag{12}$$
$$(.350)\quad (2.48)\quad (.622)\quad (.873)$$
$$R^2 = .97$$

$$I_t^s = 42.27 + .270S_{t-1} + 1.239K_{t-1} - .069M_{t-1} - 1.884ER \tag{13}$$
$$(1.253)\quad (2.707)\quad (.826)\quad (-2.715)$$
$$R^2 = .98$$

* See Appendix C for data sources.

Ivory Coast

$$I_t = 16.672 - .086Y_{t-2} + 1.114K_{t-1} + .203M_{t-1} - .092ER \tag{14}$$
$$(-.902)\quad (5.532)\quad (1.537)\quad (-1.587)$$
$$R^2 = .99$$

$$I_t^s = 3.332 - .004S_{t-1} + .936K_{t-1} + 0.89M_{t-1} - .041ER \tag{15}$$
$$(.294)\quad (22.84)\quad (2.016)\quad (-2.383)$$
$$R^2 = .99$$

Nigeria

$$I_t = 57.473 - 2.774Y_{t-2} + 1.057K_{t-1} - 2.487M_{t-1} + .013ER \tag{16}$$
$$(-.257)\quad (40.201)\quad (-.152)\quad (1.089)$$
$$R^2 = .99$$

$$I_t^s = 65.060 - .034S_{t-1} + 1.072K_{t-1} - .010M_{t-1} + .040ER \tag{17}$$
$$(-2.395)\quad (79.020)\quad (-1.167)\quad (2.889)$$
$$R^2 = .99$$

Senegal

$$I_t = 20.5 + .20Y_{t-2} - .65K_{t-1} + .133M_{t-1} - .470ER \tag{18}$$
$$(1.290)\quad (-1.677)\quad (.412)\quad (-1.492)$$
$$R^2 = .89$$

$$I_t^s = 16.99 + .456S_{t-1} + .276K_{t-1} + .368M_{t-1} - .493ER \tag{19}$$
$$(3.962)\quad (1.127)\quad (3.677)\quad (-2.803)$$
$$R^2 = .95$$

From the above results, it seems that in the Ghanian economy, past income, past savings and the stock of capital in the previous period have had an important influence on the level of investment. The coefficient of previous stock of capital is statiscally significant at the .05 level. The supply of high powered money and external reserves have not shown the required signs.

It should be noted that Gahna's large foreign debt may be responsible for the non-positive influence of external reserves on the level of investment.

In the case of Ivory Coast, past stock of capital and high-powered money have the required signs, implying that increases in these variables would raise the level of investment. The coefficients of past capital stock and high-powered money are statistically significant at the .05 level. Past income, previous savings and external reserves have had no significant influence on the level of investment in the economy of Ivory Coast.

For Nigeria, past income, savings and high-powered money play no significant role on investment demand. On the other hand, lagged capital stock and external reserves influence positively the level of investment. The coefficients of past capital stock and external reserves are statistically significant at the .05 level. Beginning in 1974, petroleum

exports contributed enormously to Nigeria's external reserves and this must have facilitated the demand for investment.

The estimated results for Senegal appear interesting. All lagged variables (income, savings, capital stock and high powered money) had positive influence on the level of investment for the period spanning 1970-1981. From equation (19), coefficients of past savings, and high powered money are significant at the .05 level. However, external reserves show a negative correlation on the level of investment. The implications from the results suggest that policies in Senegal must continue to stimulate incomes, savings and capital stock. A sound external reserve position would enable Senegal to have a better bargaining position when negotiating for investment.

On the whole, the results confirm the established notion that incomes and savings are low in developing countries. How to reverse this trend is not really the aim of this paper, however, government must continue to play an important role in seeking investible funds. Against this background, the formation of an ECOWAS development bank is a step in the right direction. This would provide the respective West African countries another source of funds for investment. In the four countries analysed, except Nigeria, external reserves had no influence on the level of investment. While the debt burden of these countries could partly explain the situation, it is nevertheless important to implement policies that would strengthen external reserves. Since the level of external reserves partly depends on what a country exports, there is need to address the issue of export promotion and the nature of manufacturing within the ECOWAS sub-region. The value of R^2 in our estimated investment functions indicate a 'strong' association between the level of investment demand and its arguments.

The empirical results may seem weak because the conventional investment hypothesis does not mirror the experiences of countries in West Africa. Considering the usual variables, only the stock of capital appear significant and we earlier explained why interest rate as a factor influencing investment behaviour was dropped.

Conclusion:

We have attempted to bring empirical evidence to bear on some economic variables that ought to influence the level of investment demand. Given the paucity of data and conditions in developing countries, we estimated gross investment equations for Ghana, Ivory Coast, Nigeria and Senegal. The results suggest that except for Nigeria, external reserves have had no positive influence on the level of investment. Previous stock of capital have had significant influence on the level of investment in the four countries. Though, past income appears to have contributed to the level of investment in Ghana, and Senegal, its coefficient was statistically not significant. High powered money have had a positive impact on investment demand in Ivory Coast and Senegal.

It seems to us that the debt problems of the countries studied coupled with the fluctuations in the prices of their exports must have eroded the impact of external reserves on investment. Since it is generally agreed that no econometric investment function performs very well and hence it becomes difficult to predict the path of investment with much certainty, this study, if nothing else, has 'confronted' neo-classical investment theory with the realities of some West African countries.

Appendices

A. (1) If R_i refers to a return expected after i years, then the formula for the present value (PV) of an asset bringing a return stream over n years is denoted by:

$$PV = \frac{R_1}{1ti} + \frac{R_2}{(1ti)^2} + \frac{R_3}{(1+i)^3} + \ldots + \frac{R_n}{(1+i)^n}$$

If the cost (C) is known, the compound rate of return, r, can be computed by:

$$C = \frac{R_1}{1+r} + \frac{R_2}{(1+r)^2} + \frac{R_3}{(1+r)^3} + \ldots + \frac{R_n}{(1+r)^n}$$

If $r > i$ then $PV > C$.

Keynes called the r the marginal efficiency of capital (MEC).

(2) The internal rate of return, α, may be expressed as:

$$R_0 + \frac{R_1}{1+\alpha} + \frac{R_2}{(1+\alpha)^2} + \ldots + \frac{R_n}{(1+\alpha)} \quad n = 0$$

The internal rate of return criterion solves for α (given a present value of zero). The decision rule is usually to invest when $\alpha > r$.

B. Given a Cobb-Douglas production function:

$$Q = AK^a L^b$$

$$a + b = 1$$

$$\frac{dQ}{dk} = a\ AK^{a-1}\ L^b = a\frac{(Q)}{K} \tag{1}$$

Out:

$$\frac{dQ}{dk} = \frac{s}{p} \tag{2}$$

Hence:

$$a\frac{(Q)}{K} = \frac{s}{p} \tag{3}$$

$$K^* = a\frac{PQ}{S}$$

C. Data Sources

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NOTES

1 ECOWAS started with the Treaty of Lagos in May, 1975. The present members are: Benin, Cameroon Republic, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Nigeria, Senegal, Sierra Leone, Togo and Burkina Faso.

2 The M E I is a return on investment where investment represents a change in the capital stock (Barrett, 1975; Evans, 1969).

3 The theories are not exhaustive. For example, the internal funds theory of investment a la Tinbergen (1938) is not covered. See also Grunfeld (1960).

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