EE
E u r o E c o n o m i c a
Issue 2(33)/2014 *ISSN: 1582-8859*

Does gross capital formation matter for economic growth in the CEMAC sub-region?

Emmanuel Nkoa ONGO[1], Andrew Wujung VUKENKENG[2]

[1]*Faculty of Social and Management Sciences, University of Buea, Cameroon, ongoema@yahoo.fr*

[2] *Faculty of Social and Management Sciences, University of Buea, Cameroon,, vukenkengwujung@yahoo.com*

Abstract. This paper examines the effect of gross capital formation on the economic growth of the CEMAC sub- region. It draws inspiration from the endogenous growth model. Data for the study is collected from the World Bank Development Indicators. The estimation technique used for this study is the Generalized Least Square estimation technique. The results show that private investment has a significant positive association with economic growth. This is also the case of technical progress and infrastructural development. On the contrary, labour force tends to affect negatively economic growth in this sub-region. This suggests that countries of the sub region need to implement realistic employment policies.

Keywords: gross capital formation, economic growth, technical progress, panel data, CEMAC

1 Introduction

Capital accumulation is considered as an important factor of economic growth. This assertion is observed both in theoretical and empirical literature. In fact since the analysis of Solow (1957), physical capital accumulation contributes to increase the level of production. The endogenous growth theory developed mainly by Romer (1986), Lucas (1988), Romer (1990) and Barro (1990) reconsidered this assertion by adding other factors (human capital, infrastructure, research and development) which accelerate gross capital formation. This thesis is supported by facts. Private investment has actually increased in the CEMAC sub region. Between 1980 and 2011 Cameroon witnessed a significant increase in the volume of her private investments which increased from 1349.8 million US dollar to 5004.8 million US dollars. Within the same period the negative rate of economic growth in 1980 (-1.96%) became positive and was 4.2 % in 2011. The same trend is observed in Gabon. In 1980 private investments stood at 1178.5 million US dollars. This increased to 4602.6 million US dollars in 2011 with a growth rate which increased from 2.55% to 4.81% within the same period. Chad was not left behind. In 2011 private investment s in this country stood at 2716.3 million US dollars with a growth rate of 1.3% (WDI 2013). This growth was sustained by investment projects in the extractive industries, construction and public works. The B.T.P. sub-sector represented 3.4% of GDP in 2011 in Cameroon due partly to government efforts in improving the road network.

From the experience of the countries mentioned above there is a direct relationship between private

investment and growth. However, this is not the experience of a country such as Congo which in 1980 had a growth rate of 7.42% with private investment of 610.9 million US dollars. In 2011, her growth reduced to 3.42% with private investments increasing by 3613.9 million US dollars. This makes it difficult to discern the influence of domestic investment on the growth of the CEMAC sub-region.

As concerns this problem empirical literature is scarce. In fact a majority of studies show a direct influence of private investments on economic growth. The indirect effects of physical capital accumulation on growth are little researched upon. It is therefore the objective of this paper to fill this gap especially as it concerns the CEMAC sub-region. Hence the study seeks to determine the influence of physical capital on economic growth in the CEMAC sub-region. The rest of the paper is organized as follows: Section 2 reviews both theoretical and empirical literature linking capital formation to economic growth. Section 3 discusses the method of analysis. Section 4 presents and discusses the findings. Section 5 concludes the paper with some policy implications.

2 Literature review

2.1 Conceptual and theoretical literature

2.1.1 The concept of capital formation

According to Singer (1950), capital formation consists of both tangible goods like plants, tools and machinery and intangible goods like high standards of education, health, scientific knowhow etc. To Kuznets (1955) domestic capital formation includes not only additions to constructions, equipment and inventories within the country but also other capital expenditures. Capital accumulation is often equated with investment of profit income or savings, especially in real capital goods. Capital accumulation also refers to real investment in tangible means of production, increasing the capital stock; investment in financial assets represented on paper, yielding profit, interest, rent, royalties, fees or capital gains; investment in *non-productive* physical assets such as residential real estate or works of art that appreciate in value; human capital accumulation, i.e., new education and training increasing the skills of the (potential) labour force which can increase earnings from work. Better still, Capital formation requires that a society or country does not apply the whole of its current productive activity to the needs and desire of the immediate consumption, but directs a part of it to the making of capital goods, such as tools and instruments, machines and transport facilities, plant and equipment, etc. In other words, it is the diversion of a part of society‘s currently available resources to the purpose of increasing the stock of capital goods so as to make possible an expansion of consumable output in the future. In essence, capital formation/accumulation is synonymous to investment.

Capital formation involves three distinct, if not interdependent, activities. One of such activities is saving, the activity by which claims to resources, which might be exercised in favour of current consumption, are set aside and so become available for other purposes. A second is finance, the activity by which claims to resources are either assembled from among those released by domestic saving, or obtained from abroad, or specially created, usually as bank deposits or notes, and then placed in the hands of those actually committed to the production of capital goods. Worth noting is the fact that the volume of capital formation depends on the intensity and efficiency with which these activities are carried out.

2.1.2 Capital accumulation and economic development xexus

Generally as already mentioned above, private investment is considered as capital formation. Enterprises invest if their sales increase (Villieu, 2000). The primordial principle of the first theory of investment is that of the accelerator which is traced back to Clark (1917). According to the principle of the simple accelerator, the stock of capital (K_t) is linked to production, equal to demand (Y_t) by a fixed coefficient (v), resulting from a technological constraint or from price rigidity of factors of production such that enterprises do not change their techniques of production: $K_t=vY_t$. Net investment defined as an increase in the stock of capital over time is a linear function of variation of demand: $IN_t = \Delta K_t = v\Delta Y_t$. The rate of net investments (IN_t / Y_t) is therefore proportional to the rate of demand: $IN_t / Y_t = v\Delta Y_t / Y_t$. As demand increases or decreases net investment is positive or negative. Net investment increases as demand accelerates and diminishes as demand decreases.

Against this background, the relationship between capital accumulation and economic development can be better appreciated in terms of the ends (importance) of capital formation in development. It is generally agreed that, the main purpose of economic development is to build capital equipment on a sufficient scale to increase productivity in agriculture, mining, plantations and industry, construction of schools, hospitals, roads, railways, etc. The essence of economic development is the creation of economic and social overhead capital. This is possible only if there is a rapid rate of capital formation in the country, i.e. if a smaller proportion of the country's current income or output is devoted to consumption and the rest is saved and invested in capital equipment. Furthermore, capital formation makes development possible even with increasing population.

Underdeveloped countries are faced with the problems of Balance of Payment (BOP) because they mostly export primary products like raw materials and agricultural product, and import almost all types of manufactured ,semi-manufactured and capital goods. To this end, domestic capital formation solves this problem of adverse BOP. In fact, *by* establishing import-substitution industries, the import of manufactured and semi-manufactured goods is reduced. This results in the increase production of all types of consumer and capital goods, and thus decrease import and the BOP problem is solved through capital formation.

More so, capital formation leads to technical progress in an economy thereby promoting the benefits associated with large scale production and increases specialization within the economy. Furthermore, when capital formation leads to adequate exploitation of natural resources and the establishment of different types of industries, levels of incomes increase permitting the numerous wants of people to be satisfied. Thus promotes economic welfare of citizens and acts as an indicator of economic development.

Again capital formation helps in making a country self-sufficient and reduces the burden of foreign debts. When a country borrows from a foreign country for long periods, it imposes a heavy burden on the future generations. With every loan, the debt charges increases day by day which can only be rapidly reduced by levying more or/and higher taxes. Thus the burden of taxes increases and money flow out of the economy in the form of debt repayments. This implies that, only capital formation brings freedom from foreign aids, reduces the burden of foreign debt and makes the country self-sufficient.

Worth reiterating also is the fact that Capital formation leads to the expansion of market. It is capital formation which helps remove market imperfection by the creation of economic and social overhead capital, and thus breaks the vicious circles of poverty both from the demand side and the supply side. Further, capital formation makes development possible even with increasing population. In

overpopulated underdeveloped countries the increase in per capita output is related to the increase in capital labour ratio but countries aiming at raising the capital labour ratio have to face two problems : first, capital ratio falls with increase in population so that large net investments is needed to overcome the fall of capital labour ratio. Secondly, when population is increasing rapidly, it becomes difficult to have sufficient savings for the required quantity of investment since a low per capital income keeps the propensity to save at a low level in such a country. The only solution to these problems is a rapid rate of capital formation.

Underdeveloped countries are faced with the problem of balance of payments because they mostly export primary products like raw materials and agricultural products, and import almost all types of manufactured, Simi manufactured and capital goods. Domestic capital formation is one of the important solutions to this problem of adverse balance of payment. By establishing import substitution industries, the imports of manufacture goods and Simi manufacture goods are reduced. On the other hand, with the increasing production of all types of consumer and capital goods the composition of export changes. Thus capital formation helps in solving the problem of balance of payment.

A rapid rate of capital formation gradually dispenses with the need for foreign aid. In fact, capital formation helps in making a country self sufficient and reduces the burden of foreign debt. When a country borrows from foreign country for long periods it imposes a heavy burden on the future generations. With every loan the debt charges increase day by day which can only be repaid by levying more or/and higher taxes. The burden of taxes increases and money flows out of the country in the form of debt repayments. Therefore, it is capital formation that brings freedom from foreign debt and reduces the burden of foreign debt and makes the country self sufficient.

Another way through which capital formation influences economic development is through its effects on price level. Theoretically it is assumed that Inflationary pressure on a developing economy can be removed to a considerable extent by increase capital formation. The output of agriculture products and manufactured consumer goods tends to increase with a rise in the rate of capital formation. On the other hand, when income increases with capital formation, it increases the demand for goods. In the short-run, it is not possible to match this increase demand by increase in supply and this result in the development of inflationary pressure in the economy. It is, however, a steady rise in the rate of capital formation in the long run that augments the supply of goods, controls inflation and brings stability in the economy.

Capital formation also influences the economic welfare of a country. It helps in meeting all the requirements of an increasing population in a developing economy. When capital formation leads to the proper exploitation of natural resources and the establishment of different types of industries, levels of income increase and the varied wants of the people are satisfied. They consume a variety of commodities, their standard of living rises and their economic welfare increases. An increase in economic welfare ceteris paribus is an indication of economic development.

According to Nurkse (1953), the circles of poverty in underdeveloped countries can be broken through capital formation. Nurkse explains that, due to low levels of income in such countries demand, production and investment are deficient. This results in the deficiency of capital goods which can be removed by capital formation. Thus, capital formation leads to increase in the size of national output, income and development thereby solving the problems of inflation and balance of payments, and making the economy free from the burden of foreign debts.

2.2 The link between capital accumulation and economic growth

On the part of capital accumulation, both non-financial and financial capital accumulation is usually needed for economic growth, since additional production usually requires additional funds to enlarge the scale of production. Smarter and more productive organization of production can also increase production without increased capital. Capital can be created/accumulated without increased investment by inventions or improved organization that increase productivity, discoveries of new assets (oil, gold, minerals, etc.), the sale of property, etc. On the basis of this a series of empirical studies have been carried out to establish the correlation and impact of capital formation/accumulation on economic growth. For instance, De Long and summers (1991 and 1993) studied the relation between investment or physical capital and the total factor productivity and found out that the countries that confer a greater portion of their product to investments in machinery tend to register a higher level of Total Factor Productivity (TPF). Also, De Long and Summers (1994) showed that, excluding developed countries from the sample, the investment in machines comes from imports, and this is how foreign technology is incorporated. In the same way, Rodrik (1994) and Lee (1995), for example, recommended the opening to information technology, especially in what concerns the importing of capital goods.

Englander and Gurney (1994), evaluated the contributions of new approaches to the theory of economic growth striving toward the understanding of the productivity evolution in the OECD. Essentially, they noticed that the accumulation of human and physical capital (including infra-structures), research and development (R&D), technical knowledge and trade are presented as main sources of growth in the long-term. As far as the significance of trade is concerned they hold that these factors speed up the diffusion of new products, processes and results of Research & Development among economies. Maddison (1991) justified the positive correlation between labour productivity and the increase of exports, as well as between labour productivity and the difference between the rates of growth of exports and economic growth. The most performing firms are seen as those that successfully participate in the world markets.

3 Methodology

3.1.1 Economic model

This article adopts the theoretical/conceptual models of Mankiw, Romer and Weil (1992):

$$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta} \quad (1)$$

Where 'K' is physical capital, 'H' human capital, 'A' technical progress and 'L' Labour: α, β, and (1-α-β) represent, respectively, the elasticity of physical and human capital, labour and technical progress.

This leads us to specify the following function:

$$Ln(Y)_{it} = \beta_0 + \beta_1 Ln(K)_{it} + \beta_2 Ln(L)_{it} + \beta_3 Ln(H)_{it} + \beta_4 Ln(A)_{it} + \beta_5 Ln(Infras)_{it} + \varepsilon_{it} \quad (2)$$

Where $\varepsilon_{it} = u_i + v_t + \eta_{it}$,

u_i measures the specific individual effects , v_t temporal specific effect and η_{it} the rest of the random effect.

3.1.2 Description of the variables, data and estimation method

In this section we describe the variables along side their sources and method of estimation.

Table 1 Description of variables

Variables	Description	Sources of data	Expected sign
Ln(Y)	Loga of rean GDP	World Development Indicator (WDI, 2011)	
Ln(K)	Log of Gross Fixed Capital formation	(WDI, 2011)	+
Ln(L)	Log of labour measured by the active population	(WDI, 2011)	+
Ln(H)	Loga of number enrollment in secondary education	(WDI, 2011)	+
Ln(A)	Log of technological progress measured by total factor productivity	(WDI, 2011)	+
Ln(Infras)	Log of number of persons having access to a telephone line	(WDI, 2011)	+

The variables used in this study are generally those which allow the estimation of the endogeneous growth model. Data is obtained from the World Development Indicators. Tables 2 and 3 gives the discriptive statistics and the correlation matrix.

Table 2 Descriptive statistics

Variables	Cameroon	Congo	Gabon	Equatorial Guinea	CAR	Chad	Global model
Log (Y)	12.80	11.656	12.198	9.683	11.786	11.917	2.916
	(0.085)	(0.097)	(0.076)	(4.396)	(0.045)	(0.207)	(0.505)
Log (K)	10.76	11.533	11.684	7.377	10.333	8.288	5.835
	(3.586)	(0.298)	(0.112)	(5.606)	(1.931)	(4.975)	(1.267)
Log (L)	6.482	5.847	5.480	5.044	5.966	6.229	8.140
	(1.208)	(1.091)	(1.022)	(0.945)	(1.110)	(1.161)	(2.312)
Log (H)	26.482	54.777	41.602	26.593	12.916	0.777	1.646
	(8.723)	(12.091)	(6.653)	(12.688)	(1.840)	(0.466)	(0.332)
Log (A)	1.179	0.122	6.321	1.304	1.105	1.781	8.088
	(1.320)	(0.226)	(1.174)	(2.146)	(0.197)	(2.037)	(0.519)
Log (Infras)	0.610	0.585	0.521	0.412	0.612	0.532	0.542
	(0.539)	(0.152)	(0.142)	(0.231)	(0.135)	(0.147)	(0.214)
Nbers of obs.	31	31	31	31	31	31	186

Note : values in parentheses are the standard deviations.

The first observation from the above table is the low fluctuation of the variables. The standard deviation rotates around 1.56 except in the case of human capital which has a standard deviation of 20.13. In fact there is a great disparity among the countries when we consider human capital measured in terms of enrolment rate into secondary school. For example in Cameroon this rate is 59.36% in 2010 with an average of 35.46% between 1980 and 2010. In Congo this rate is about 70% and in the Republic of Central Africa and Chad it is about 18% and 23% respectively (WDI 2011). In the sub-region the value of the average GDP for the period studied is 11.6% i.e. 1935.291 billion. The disparity at this level is not very high. Four of the CEMAC countries in 2011 recorded a GDP of between 6500 and 13,000 billion FCFA. We have Cameroon (12611.8 billion frs CFA), Congo

(6661.1 billion francs CFA), Gabon (729.6 billion francs CFA), and Equatorial Guinea (7280.6 billion francs CFA) (CEA 2011). The Republic of Central Africa and Chad had 1153.1 billion francs CFA and 4742.5 billion FCFA respectively. The active population employed shows the nature of the workforce. This variable is used to measure the hours of work and has a very high average (5.84) and a very low variation (Standard deviation = 1.17).

Table 3 Correlation Matrix

	Ln(Y)	Ln (K)	Ln (L)	Ln (H)	Ln (A)	Ln (Infras)
Ln (Y)	1					
Ln (K)	0.4872*	1				
Ln (L)	0.2924*	0.3385*	1			
Ln (H)	0.0923	0.2386*	-0.1206	1		
Ln (A)	0.1436	-0.2541*	0.0082	0.1340	1	
Ln (Infras)	0.1801*	0.1491*	-0.2268*	0.5693*	0.6508*	1

*Note : * signification à 5%*

The above table represents an average positive correllation between production and the explanatory variables. The correlation between the explanatory variables is very low. This shows the absence of multicolinearity. More specifically , 48% economic growth is explained by physical capital, 29% by labour, 9% by human capital, and 14% by total factor productivity.These results seem to confirm the economic theory according to which all these factors influence production .The estimation of the model in table 5 allows us conduct a further analysis of this phenomenon.

Table 4 Choosing between Panel data and OLS (Using Fischer-test) and choosing between Fixed and Random effets (Using Hausman-test)

Tests	Probability	Degree of freedom	Statistic
Fischer-test	0.0000	(5 ; 104)	210.14
Hausman test	0.0000	5	950.37
Breusch-Pagan test	1.0000	1	0.0000

Building on the procedure for the estimation of panel data, the results of the general model suggests the technique of generalized least squares (GLS). Indeed, Fisher's exact test shows that F (5, 104) = 210.14 and is higher than the probability of F (Prob> F = 0.0000), but less than 5%. This leads to the adoption of panel data estimation. The presence of random effects is not confirmed by the Breusch-Pagan test since the probability is greater than 5%. The Hausman test highlights the lack of correlation between the individual effects and the explanatory variables. His statistics (Chi2 (5) = 950.37) is greater than the probability (Prob> chi2 = 0.0000). In this case we prefer the fixed effect model. However, for reasons of clarification, we present results of both methods of estimation.

4 Presentation and discussion of results

Generally the results confirm our a priori expectation except in the case of labour.

Table 5 Estimation results

Dependant variable : Ln (Y)						
	Model estimation method fixed effects			**Model estimation method random effects**		
Explanatory Variables	**Coefficients**	**Statistics *t***	**P-value**	**Coefficients**	**Statistics *t***	**P-value**
Ln (K)	0.833***	0.313	0.000	0.101**	0.040	0.013
Ln (L)	-1.586***	0.783	0.000	0.104	0.152	0.498
Ln (H)	0.0005	0.005	0.927	-0.0034	0.007	-0.47
Ln (A)	1.838***	0.073	0.000	0.095	0.085	0.262
Ln (Infras)	0.596***	0.1007	0.000	0.104	0.291	0.721
_Cons	9.206***	0.321	0.000	10.132***	0.844	0.000
Number of Obs.	115			115		
Number of Grp.	6			6		
R-sq Within	0.8851			0.0892		
R-sq Between	0.0545			0.3166		
R-sq Overall	0.0519			0.1130		

*Note: *;**;*** significant at 10%, 5% and 1%*

Private investment measured by gross capital formation is positive and strongly significant. In fact a 1% variation of physical capital leads to an increase of 0.833% of economic growth. The decomposition of this capital shows a domination of fixed and movable assets. Computers and highly performant equipment constitutes important investments for enterprises. This physical capital increases production through reduction in wasted time as well as permitting quality goods and services to be produced. There are ongoing efforts in the countries of the CEMAC region to provide a favourable framework or climate for private investments. For example Cameroon in 2013 revised her investment code with aim to attract more private investments. During creation enterprises are exempted from paying the VAT on imported equipment and other materials.

Between 2000 and 2010 the volume of private investments increased from 1105.6 billionFCFA to 2787.22 billionFCFA. That is, an increase of 152.08% economic growth between the two periods (WDI 2012). Similarly , in Congo, investments increase from 251.08 billionFCFA to 532 billionFCFA (147.74% rate of economic growth between the two periods). The same trend is observed in the other countries of the sub-region.

The labour force (L) identified as the main factor of economic growth is not positive in this study. This can be explained by a number of factors. The rate of unemployment is very high in the sub-region. There are no realistic employment policies in some of the countries of the sub-region. Age of first employment is very high. The economies of the sub-region are still strongly dualistic in nature. The informal sector is very dominant and creates very few paid jobs.

Human capital (H) is positive but not significant. Education in the countries of the sub-region has witnessed profound changes during the recent years. Many important changes have been introduced in

the secondary and higher education sectors. Higher education is free and private secondary education is available and affordable in Congo. Primary education is free in Cameroon and there are many professional training opportunities offered to the youth. However all these efforts are compromised by the scarcity of a decent workforce.

Technical progress (A) improves economic growth in the CEMAC sub-region by 1.83%. Increasingly, authorities are putting in place a lot of importance on the importation of goods of high technology. Foreign direct investments come to fill the gap of inadequacy in research and development. On the average, technical progress stands at 17.8% in the CEMAC sub-region. Again far below the average in South Africa (24.7%), technical progress in the CEMAC sub-region has all the same increased from 11.6% to 18%.

5 Conclusion and policy implications

This paper has empirically analysed the influence of private investment on economic growth in the CEMAC sub- region.The theoretical framework is built on the endogenous growth model. The method of Generalised Least Squares was used to estimate the data which was obtained from World Bank Development Indicators. The main results show that private investment influences directly economic growth in the sub –region. However, the influence of private investment on economic growth is reinforced by human capital.

6 References

Barro R. (1990), "Government Spending in a Simple Model of Endogenous Growth", *journal of Political Economy*, 98, 5, 103-125.

Clark J.M. (1917), "Business Acceleration and the Law of Demand", *Journal of Political economic.*

CEA, (2011), *Les Economies de l'Afrique Centrale 2011 : Enjeux et opportunités des politiques industrielles en Afrique Centrale*, *JePublie*.

De Long; B. and Summers, L. (1991), Equipment investment and economic growth, *Quarterly Journal of Economics*, vol. 106, no 2, May, pp. 445-502.

De Long; B. and Summers, L. (1993), How strongly do developing economies benefit from equipment investment?, *Journal of Monetary Economics*, vol. 32, pp. 395-415.

Englander.S. and Gurney.A. (1994). OECD productivity growth: Medium Term Trends, OECD Economic Studies, No.22, Spring,pp 49-109.

Krishna, K. and Ozyildirim, A.(1998), "Trade, Investment and Growth: Nexus, Analysis and Prognosis", Pennsylvania State University Working Paper.

Kuznets, S (1955). International Differences in Capital Formation and Financing"in: Capital Formation and Economic Growth, pages 19-111, National Bureau of Economic Research, Inc.

Lucas R. (1988), "On the mecanisme of economic development", *Journal of Monetary economics*, 22, 2-42.

Maddison .A.(*1991*), Dynamic Forces in Capitalist Development, Oxford University Press pp. 226–237.

Mankiw G. Romer, D. et Weil D. (1992), "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, 107, 407-437.

Mass, R. and Tally, I. (1990). *Money and Capital in Economic Development*. Washington.

Nurkse, R. (1953) .Problems of Capital Formation in Underdeveloped Countries, Oxford: Basil Blackwel

Pereira, A. (1996), Importação de bens de capital e evolução económica interna: os casos da Grécia e de Portugal, *Banco de Portugal*, Boletim Económico, December, pp. 59-66.

Romer P. (1986), "Increasing returns and long run growth", *Journal of Political Economy*, 94, 1002-1037.

Romer P. (1990), "EndogenousTechnological Change", *Journal of Political Economy*, 98, 71-102.

Singer, H.W. (1940). *Unemployment and the Unemployed*. London: P.S. King and Son, Ltd.
Singer, H.W. (1950). Distribution of Gains between Investing and Borrowing Countries. *American Economic Review, Papers and Proceedings*, *40*(May), 473-485.
Singer, H.W. (1984). The terms of Trade Controversy and the Evolution of Soft Financing: Early Years in the U.N. In Meier and Seers (Eds) (1984).
Solow R. (1957), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, 70, 65-94.
Summers, P. (1988). "Financial Innovation". In G. Constantinides. *The Handbook of the Economics of Finance*. North Holland: Elsevier.
Villieu P. (2000), *Macroéconomie : l'investissement, La Découverte*, p.130.
WDI (2013), World Development Indicator data base