

## Effect of Corruption on Human Capital in Franc Zone Countries: An Opportunity Cost Analysis

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### ABSTRACT

The objective of this paper is to analyze the impact of corruption on human capital in African Franc zone countries. Assuming that the representative agent is rational, we develop a theoretical model in which effort, the real component of the human capital accumulation process, encompasses learning time, the learner's personal resources, and the educational public good. The learner makes a trade-off between effort and corruption according to the opportunity cost of each option. Thus, in an environment where corruption (large and small) is endemic and where there are very few sanction mechanisms, the learner considers it rational to bribe at the expense of effort. Empirical analysis shows that a drop in the corruption perception index (reflecting an increase in corruption) of one-point leads to a drop in the human capital index of 0.175 percentage points. On the other hand, the impact is positive for public spending on education, official development assistance, real GDP per capita, and the management ratio. These variables reduce the opportunity cost of the effort. A number of recommendations are put forward with a view to reducing the cost of effort and increasing the cost of corruption.

**Keywords:** corruption; human capital; opportunity cost; effort; franc zone

### INTRODUCTION

The development of human capital is one of the priorities of the international community and national governments as a factor in economic growth, the empowerment of women and the reduction of social inequalities (UN, 2016). Human capital is defined as the set of productive capabilities that an individual acquires through general or specific knowledge and skills (Becker, 1964). This definition thus highlights the fundamental role of education in the process of human capital accumulation. Today, human capital is measured by a host of indicators, including the Human Capital Index developed by UNCTAD. This indicator, which ranges from 0 (lowest level of human capital) to 100 (highest level of human capital), has the advantage of taking into account not only the quantitative aspects but also, and above all, the qualitative aspects of human capital. It shows that the level of human capital in the African countries of the Franc zone is one of the lowest in the world. By way of illustration, for 2019, the value of the human capital index for African countries in the Franc zone was 34.58, i.e. 1.8 times lower than that of East Asia (62.90) and more than 2 times lower than that of the OECD (70.65) and the USA (78.82).

The same applies to completion rates for the various levels of education, which are among the lowest in the developing world.

In the literature, this weakness in human capital is explained by low public spending on education, political instability, poverty, social constraints and corruption, among other factors. Corruption is a polysemous social scourge, but it can be defined in the field of education as: "the systematic use of a public office for private advantage, which has a significant impact on the availability and quality of educational goods and services and consequently on the access, quality or equity of education" (Hallack and Poisson, 2002). This definition encompasses both petty and grand corruption, which manifest themselves in the African countries of the Franc zone through: (i) the monetization of recruitment, assignments and promotions, (ii) the over-invoicing of payment vouchers, (iii) the trafficking of scholarships, (iv) the misappropriation of subsidies and school property, (v) the sale of tests and grades, (vi) sexual harassment and (vii) the trafficking of diplomas (CONAC, 2010; Nya, 2016).

Statistics from the World Bank and Transparency International show that African countries in the Franc zone are among the most corrupt countries in Africa and even in the world. For example, they are 4 times more corrupt than African countries that are members of the Commonwealth and those of North Africa (Dontsi, 2022). Corruption is increasing in the Franc zone, as shown by the corruption control index, which went from -0.87 (very low level) in 1996 to -0.93 in 2019 (even lower level) (WGI, 2019).

Several theoretical and empirical studies have analysed the effect of corruption on human capital in various regions of the world (Sheifer and Vishny, 1993; Ehrlich and Lui, 1999; Boikos, 2016; Ashan and al, 2017; Mauro, 1997; Seka, 2013; Boly and al, 2020; Dridi, 2014; El Jabri and El Khider, 2020; Duerrenberger and Warning, 2018). Overall, the authors find that corruption has a negative and significant impact on the accumulation of human capital. However, with the exception of a few studies such as Boly and al (2020), the authors have not taken into account the heterogeneity of education, the possibility of sanctions if corruption is detected, or the environment in which training takes place. Pupils, who are at the heart of the educational process, have most often been theorized as passive agents who suffer corruption. Moreover, very few studies have formalized the relationship between corruption and human capital formation.

The aim of this article is to examine the effect of corruption on the accumulation of human capital in the African countries of the Franc zone. Its originality lies at several levels. First, we conceptualize teachers and students as rational economic agents who make trade-offs based on the gains and costs of corruption. Second, we include sanctions in the costs of corruption. Finally, in contrast to Boly and al (2020), we develop an effort function (a genuine human capital accumulation process) that takes into account the educational environment.

This article is structured as follows: a review of the literature is necessary to identify our modest contribution to the analyses carried out so far (1). Following this review, we formalize the effect of corruption on human capital (2). From this formalization will follow the specification of the econometric model (3). The econometric regression will lead to the presentation and discussion of the results, thus bringing the analysis to a close (4).

## LITERATURE REVIEW

The effect of corruption on human capital formation has been examined by a number of authors, both theoretically (1.1) and empirically (1.2).

### 1.1. Theoretical analysis

The first wave of authors will analyze the impact of corruption on human capital through public spending on education (Shleifer and Vishny, 1993; Ehrlich and Lui, 1999; Boikos, 2016; Ashan and al, 2017; Ortega and al, 2016; Mauro, 1998; Gupta and Davoodi, 2000).

These authors argue that corruption can negatively affect resource allocation and hinder development because of the bribes paid. In the theoretical modelling of Sheifer and Vishny (1993), for example, the increase in fees due to the demand for bribes prevents parents of pupils who are unable to pay from obtaining a place for their children. What's more, the civil servant who 'undercharges' the school fees pocket all the money without paying anything back to the state. Boikois (2016) develops a theoretical model in which the relationship between corruption and human capital is non-linear and operates through public spending on education and investment in physical capital. Indeed, when public spending (already reduced by embezzlement) is mainly allocated to the education sector, education will be of good quality and economic agents will be encouraged to invest more in this sector. On the other hand, if public resources are allocated more to the final production sector (physical capital), then the demand for individuals with less human capital will be high because agents will have to work to obtain income. Investment in physical capital will therefore reduce investment in education.

The second wave of authors is interested in the effect of corruption on human capital through the behavior of learners in search of knowledge (Seka, 2013; Dridi, 2014; Boly and al., 2020). Seka (2014) finds that the existence of corrupt behavior can spread and lead to a contagion that has a lasting effect on young people who lack reference points. The easy enrichment (through corruption) of individuals who leave school early can lead many talented young people to do the same. Boly and al (2020) analyze the behavior of heterogeneous learners in the presence of bribes. They show that when there is a high proportion of corrupt teachers, the overall level of effort will be reduced because the majority of students will choose not to make any effort. On the contrary, they will pay bribes to pass their exams, which reduces the qualitative level of human capital. Boly and al (2020) also find that corruption can increase human capital in quantitative terms by increasing the chances of obtaining a diploma even without any effort.

A few comments can be made about theoretical studies: Firstly, theoretical models generally consider an educational environment where all learners have the same chance of success and the same educational infrastructure and facilities. However, in the educational environment of developing countries in general and Franc zone countries in particular, not all learners have access to educational infrastructure and facilities. With the exception of a small proportion of the privileged who attend schools and universities up to standard, we are witnessing, among other things: (i) overcrowding in classrooms, (ii) a lack of appropriate equipment in laboratories and workshops, (iii) insufficient physical and digital resources in libraries, and (iv) a shortage of teaching staff. The availability or otherwise of teaching infrastructure and equipment determines the level of effort required of learners and therefore their attitude to corruption.

Secondly, the theoretical models only consider bribes as the cost of corruption for bribery. The possibility of detection and sanction has not been considered. In reality, however, most Franc zone countries have put in place mechanisms (legal instruments, bodies) to detect and punish acts of corruption in the economy in general and in the education system in particular. In Cameroon, teachers, pupils and students are regularly sanctioned by disciplinary boards at various levels. Acts of corruption generally involve cheating in examinations, falsifying marks, trafficking in diplomas and abuse of influence (CONAC, 2021). There are many sanctions. For example: (i) temporary or permanent exclusion from examination sessions, (ii) suspension of salary, (iii) disqualification from positions of responsibility and (iv) dismissal or even (v) imprisonment.

Thirdly, the authors believe that dropping out of school is motivated more by corruption. However, in Franc zone countries, there are several reasons other than corruption for dropping out of school. These include: (i) the precarious situation of pupils' parents, who struggle to pay their children's school fees; (ii) the remoteness of schools and universities; (iii) poor educational guidance; (iv) the inadequacy of teaching equipment, which does not facilitate learning; and (v) the less reassuring prospects for the future, given that many of their academic predecessors find themselves in the informal sector after long years of study.

## 1.2. Empirical analysis

More empirical studies will follow in the footsteps of theory to assess the impact of corruption on human capital. Human capital will be captured mainly through public spending on education and the school enrolment rate. As far as public spending on education is concerned, the authors find a significant negative effect of corruption. The studies were carried out in different areas using different methods. This is the case, for example, of: (i) Mauro (1998) who uses the ordinary least squares (OLS) method on a panel of 85 countries; (ii) Devallade (2006) whose estimates based on the triple least squares method on a sample of 63 countries covering the period 1996-2004, show that corrupt practices weaken the expenditure ratio (by promoting physical capital expenditure to the detriment of education expenditure) in the poorest countries ; and (iii) Blessing (2020), which looks at data from 46 African countries over the period 2012-2018. A contradictory result was nevertheless obtained by Boikos (2016). This author uses the semi-parametric method with smooth coefficients and finds that an increase in corruption has a positive effect on total public spending in general and on public spending on education in particular.

The negative and significant impact of corruption is also found in the majority of studies that have looked at human capital through school enrolment rates. Indeed, Mokadden (2010) uses the generalized least squares method on data from 36 Arab and Sub-Saharan African countries over the period 2003-

2007 and shows that corruption has a negative impact on school results. Canfield (2011) uses the OLS method in 20 states and 79 districts in India and finds that corruption decreases the pass rate and increases the repetition rate of students. These results are also obtained by Seka (2013), Dridi (2014), Gupta and al. (2000), Boly and al. (2020), El Jabri and El Khider (2020) and Belkhatib (2022) on larger samples of countries. The same applies to Hao (2019) and El Khider and Elmaataoui (2021), who will rely on the fixed-effects method and the Autoregressive Distributed Shift method respectively.

A few critical remarks can be made about the empirical studies presented above. First of all, the level of human capital cannot be approximated to public spending in Franc zone countries. In fact, because public administration is slow, fussy and corrupt, a large proportion of public spending on education is diverted and/or directed towards very unproductive expenditure such as operating expenses (cars, fuel, and office furniture) which do not have a direct impact on the learner, who is at the heart of human capital accumulation. This is how we can have countries with very large education budgets and paradoxically low school success and completion rates. Secondly, the research ignored official development assistance (ODA). Yet ODA represents a non-negligible component in the education systems of African countries in the Franc zone. By way of illustration, support from foreign countries (Canada, Japan, China) has enabled Cameroon to densify its education system. This support has taken the form of, among other things: (i) building and equipping schools, (ii) building and equipping multimedia centers and (iii) recruiting thousands and thousands of primary school teachers. In this way, it can compensate for some of the public spending that has been hijacked by corrupt practices. Subsequently, research has focused more on the quantitative aspect of human capital, neglecting the qualitative aspect. Yet in a context of corruption, many learners can pass their exams without accumulating human capital (Boly and al., 2020). Finally, a number of empirical studies do not stem from the development of a theoretical model.

In the light of the comments on the theoretical and empirical analyses, this study will attempt to propose a theoretical model that not only takes into account the realities of Franc zone countries, but will also serve as a basis for empirical analysis.

## THE FORMALIZATION

This formalization is based on the work of Boly and al (2020), which has the merit of modelling the behavior of learners in the process of human capital accumulation, in the presence of corruption. We assume a world in which we have two major players (students, teachers) who are rational. They are thus guided by the concern to maximize their utility as a function of the opportunity cost of each decision. Pupils are heterogeneous and are distinguished by their innate ability ( $A$ ).

This innate ability is uniformly distributed between the values 0 (practically no student) and 1 (very intelligent student). Whatever the category of pupils considered, they enroll at school to obtain qualifications (V) that will enable them to work in the future; in other words, they seek to accumulate human capital. We assume that the value of (V) belongs to the interval [0,1].

The education system assesses the degree of skill acquisition during the learning process through examinations, which are organized either within the school (for intermediate classes or university levels) or at national level (for national diplomas). Students sitting the exam must achieve a certain mark to be admitted.

Let  $S$  be the exam performance of a candidate. We assume that this performance is given by a technology of the Cobb-Douglas type. It depends on intelligence quotient (A), effort (e) and corruption (K). Its mathematical expression is as follows:

$$S = Ae^{\alpha}K^{\beta} \quad (1)$$

With  $\alpha = 1 - \beta$

This equation implies that in order to pass the exam in a context of corruption, the individual can substitute corrupt practices for effort. They may therefore decide to devote more effort to learning and less to corruption, or vice versa. Corruption refers, for example, to the payment of bribes to the teacher-examiner in order to have the papers in advance, to compose at home and substitute one's own examination paper on the day of the assessment, to compose with unauthorized documents or, more directly, to obtain marks arbitrarily.

Unlike Boly and al (2020), for whom effort seems to be an autonomous concept emanating from the individual's willingness to devote more or less energy (time) to accumulating knowledge, we assume that effort is the result of a combination of several parameters, in particular learning time, the learner's personal pedagogical tools and the educational public good (School). In fact, learning time is the time that the learner devotes to following the teaching provided, learning his lessons and doing his homework. Similarly, the learner's effort derives from educational expenditure by parents or by the learner him/herself. This mainly involves spending on school fees and personal school supplies (books, exercise books, satchels, pens, kits for practical work) (UIS, 2011). Finally, the public good of education refers to the various infrastructures and equipment found in schools (classrooms, libraries, laboratories, workshops, teaching tools). When the public good of education is virtually non-existent or only marginally available, the learner's level of effort must necessarily increase to compensate for this lack. For example, the absence of a library, computer room or laboratory not only increases personal expenditure on books, a computer or practical work kit, but also the time that learners have to devote to their studies.

We therefore assume that the effort at the heart of the process of accumulating knowledge, and therefore of producing human capital, is given by a production function of the Cobb-Douglas type. Its mathematical expression is as follows:

$$e = T^a R^b E^c \quad (2)$$

Where  $0 < a < 1$ ;  $0 < b < 1$ ;  $0 < c < 1$

By merging equations (1) and (2), we obtain equation 3 below, which illustrates a candidate's performance in detail:

$$S = A(T^a R^b E^c)^{\alpha} K^{\beta} \quad (3)$$

We also assume that the final performance is given by the following equation:

$$S - \varepsilon \quad (4)$$

This equation indicates that the candidate's performance is measured with an error  $\varepsilon$  uniformly distributed over the interval [0,1]. Thus, passing the exam is proclaimed when performance is greater than or equal to a given threshold which is 0 ( $S - \varepsilon \geq 0$ ).  $S$  is a random variable that takes the value 1 if the candidate passes the exam and 0 otherwise. This can be translated into the following mathematical expression:

$$\begin{cases} S = 1 & \text{si } S - \varepsilon \geq 0 \\ S = 0 & \text{sinon} \end{cases} \quad (5)$$

The candidate therefore passes the exam with a probability equal to :

$$\begin{aligned} \text{Prob}(S = 1) &= \text{Prob}(S - \varepsilon \geq 0) \\ &= \text{Prob}(S \geq \varepsilon) = \int_0^S d\varepsilon = A(T^a R^b E^c)^{\alpha} K^{\beta} \quad (6) \end{aligned}$$

It follows from this equation that the probability of success increases with the level of effort, the candidate's innate ability and the extent of the corrupt practices initiated to pass the exam with little or no effort.

The performance thus obtained incorporates the corrupt practices undertaken by the learner himself (corruptor) towards the teachers (corrupted), in other words petty corruption. In the education system, however, we encounter not only petty corruption but also, and above all, grand corruption. In order to introduce grand corruption into the analysis, we will assume that it affects the supply of educational public goods. In an environment marked by imperfect information and corruption, managers may adopt opportunistic behavior in order to maximize their utility. One example is the misappropriation of part of the funds allocated to building and equipping schools.

Assume that  $\theta$  represents the influence of grand corruption on the learning process. The candidate's performance in the presence of grand corruption will be given by the following equation:

$$S = A(T^a R^b E'^c)^{\alpha} K^{\beta} \tag{7}$$

With  $E'$  is the quantity of public educational goods required in an environment marked by high levels of corruption. Its value is given by the following equation:

$$E' = \theta E \quad \text{with } \theta > 1 \tag{8}$$

Both effort and corrupt practices have costs that need to be defined. By referring to the effort function, we assume that the cost of effort encompasses its three components. Learning time represents a loss of earnings for a candidate. He could, for example, have used this time to work for himself or for a third party (company). If they were to work for a company, they would have to receive remuneration based on the hourly wage rate. Let us assume that we are in an environment where it is possible to obtain paid employment and that  $w$  is the average hourly wage rate received by a worker in the national economy. The opportunity cost of learning time would then be given by the following mathematical expression:

$$C(T) = w * T \tag{9}$$

With  $T$ , the time spent by the candidate on the apprenticeship (in hours). It can be seen that the higher the wage rate, the higher the opportunity cost of the apprenticeship time. Similarly, the longer the apprenticeship, the higher the opportunity cost.

To simplify the economic calculation, let's assume that the learner's personal teaching aids are homogeneous and are valued at the unit price  $P_R$  then the total cost of these tools is given by:

$$C(R) = P_R * R \tag{10}$$

With  $R$ , the number of personal learning tools acquired by the learner.

As we said earlier, when the public good of education is not available, the learner is obliged to make an extra effort. Examples include the purchase (or hire) of laboratory tools to dissect a guinea pig or carry out practical work, the use of a tutor for refresher sessions, the purchase of an internet connection and many others. To simplify the economic calculation, let's assume that this public good is homogeneous and is valued at the unit price  $P_E$ . The total cost associated with the purchase of the absent public goods is given by the following equation:

$$C(E) = P_E * \theta E \tag{11}$$

With  $E$ , the number of educational public goods required by the learner.

Finally, we can reduce the overall cost of the effort, which is given by the following equation:

$$C(E) = w * T + P_R * R + P_E * \theta E \tag{12}$$

Furthermore, we consider, as do Boly and al (2020), that corrupt practices have a cost. However, the cost

of corrupt practices cannot be reduced to the total amount paid in bribes to unduly obtain favors. It is also the penalty that generates an opportunity cost (loss of future salary income). In fact, in an environment where mechanisms are put in place in terms of laws and institutions specializing in the fight against corruption, the learner, like the teacher-evaluator, runs a greater risk of being caught and punished.

To simplify the economic calculation, let us assume that  $P_{1K}$  is the unit amount of the bribes paid by the candidate to the teacher-assessor and that  $P_{2K}$  is the unit cost of the penalty that the candidate will have to pay for each corrupt practice. The mathematical expression of the cost of corrupt practices is as follows:

$$C(K) = (P_{1K} + P_{2K}) * K \tag{13}$$

With  $K$ , the number of corrupt practices undertaken by the candidate.

This cost is an increasing function of the unit cost of the bribes paid, the opportunity cost of the penalty and the number of corrupt practices.

The learner's total cost function, which combines effort and/or corrupt practices, is given by the formula below:

$$CT(e,K) = w * T + P_R * R + P_E * E + (P_{1K} + P_{2K}) * K \tag{14}$$

As mentioned above, the learner seeks to maximize the gains from education (utility) within the constraints of the costs he or she incurs.

If petty corruption exists, the learner's equilibrium results from maximization of the Lagrangian whose mathematical expression is as follows:

$$L = A(T^a R^b \theta^c E^c)^{\alpha} K^{\beta} - \lambda [w * T + P_R * R + P_E * \theta E + (P_{1K} + P_{2K}) * K] \tag{12}$$

Applying the first-order conditions for the existence of an optimum leads to the following relationships:

$$\frac{T}{K} = \frac{\alpha a (P_{1K} + P_{2K})}{w \beta} \tag{13}$$

$$\frac{R}{K} = \frac{\alpha b (P_{1K} + P_{2K})}{P_R \beta} \tag{14}$$

$$\frac{E}{K} = \frac{\alpha c (P_{1K} + P_{2K})}{\theta P_E \beta} \tag{15}$$

$$T = \frac{a \theta P_E}{w c} E \tag{16}$$

$$R = \frac{b \theta P_E}{c P_R} E \tag{17}$$

Equation 13 above shows the relationship between learning time and petty bribery.

It can be seen that as the wage rate increases, other parameters remaining constant, the learner will find that the opportunity cost of learning time is increasingly higher than the opportunity cost of bribery. They will therefore prefer to spend a large part of their time on paid work and little on their studies. Part of the income earned from work will be used for corrupt practices to help them pass their exams. By devoting less effort in terms of learning time, they will not be able to accumulate knowledge and therefore human capital, even if they ultimately pass their exams. On the other hand, if the unit price of corruption increases considerably (bribes, sanctions), the learner will feel that the cost of corruption is very high compared to the income he or she would earn by devoting more time to work. In some extreme cases, the income earned from work will not be enough to pay the bribes needed to obtain favors during the exam. In such cases, the learner will prefer to increase learning time at the expense of working time and corrupt practices, resulting in an accumulation of knowledge.

Equation 14 above establishes the relationship between the learner's personal learning materials and petty bribery. It shows that when the unit price of teaching aids increases, all other things being equal, the learner will find that the cost of acquiring these aids is increasingly higher than the cost of bribery. They will prefer to invest less effort in purchasing teaching aids. The teacher will then use some of the revenue saved to engage in corrupt practices that will enable him to pass the exam. In this case, the learner will accumulate less knowledge. The reasoning is reversed if the cost of bribery is relatively high compared to the cost of the teaching tools.

Equation 15 establishes the relationship between educational public goods and petty corruption. It can be seen that when the unit price of the public goods to be purchased increases, all other things being equal, the learner will find that the cost of acquiring these goods is increasingly higher than the cost of corruption. They will therefore prefer to devote less effort to purchasing the necessary public goods which, unfortunately, the public administration has not made available to them. They will be tempted to use their income to engage in corrupt practices that will enable them to pass the exam. In this case, the learner will accumulate less knowledge even if he or she obtains the diploma. Conversely, when the unit price of public goods falls significantly (or when the cost of corruption is high), the learner will find that corrupt practices are relatively more costly. They will therefore make more effort to the detriment of corruption. It should also be noted that the unit price of public educational goods can increase in a context where there are very few public educational goods available at the school level. For example, when laboratories are not equipped and each student has to go to the market to buy a test tube or a microscope to carry out practical work, the unit price of this equipment will increase because of the high demand for it on the market.

These three relationships also depend on the elasticity coefficients. For example, in an environment where the coefficient of elasticity of corruption is very high compared to that of public educational goods (the case where a large proportion of teacher-evaluators are dishonest and corrupt), the learner will tend to prefer to bribe the teacher-examiner rather than devote a large part of his income to the purchase of the missing public educational goods. On the other hand, when the coefficient of elasticity of public educational goods is higher than that of corruption (the case where a good proportion of teacher-evaluators are honest), the learner will prefer to turn away from corruption in favor of purchasing public educational goods that the school does not have.

Equation 16 shows the relationship between learning time and the high degree of corruption in the supply of educational public goods. Indeed, when increases (i.e. as grand corruption increases), more learning time would be needed to compensate for the shortfall in educational public goods. However, a day has only 24 hours, which the learner must devote to all existential activities. Faced with a remarkable lack of educational public goods, learners can find themselves in a situation of total discouragement, which has a negative impact on the effort production function and, consequently, on the knowledge accumulation process.

Equation 17 establishes the relationship between personal educational tools and grand corruption. Assuming that all other parameters are fixed, when the level of grand corruption is very high in the economy ( $\theta$  is much higher than 1), more personal teaching aids would be needed to compensate for the shortfall in educational public goods. But the financial capacity of the learner or his family is limited. This is why too great a deficit in public educational goods would discourage learners or their families, who would consider the opportunity cost of education to be very high. As a result, there will be a break in the process of accumulating knowledge. The intensity of discouragement is also a function of the unit prices of personal educational tools, the unit prices of educational public goods, the coefficient of elasticity of personal educational tools and the coefficient of elasticity of educational public goods.

We have just shown that corruption, whether large or small, has a negative impact on the process of human capital accumulation by the learner. An empirical analysis will confirm this.

## METHODOLOGY AND DATA

### 1. Specification of the econometric model

Our starting point is equation 3, which is recalled below:

$$S = A(T^{\alpha} R^{\beta} E^{\gamma})^{\alpha} K^{\beta}$$

This equation indicates that the learner's level of performance is a function of IQ, learning time, the learner's personal resources, educational public goods, and corruption. The econometric specification will not consider learning time for two reasons. The first is linked to the fact that the theoretical model shows that it is more of a substitute than a complement to corruption. The second is that it is difficult to find statistical data that would allow us to assess it on a country level. The introduction of the log allows us to linearize the equation and we obtain a new equation which is as follows:

$$\ln S_t = \ln A + \alpha b \ln R_t + \alpha c \ln E_t + \beta \ln K_t \quad (18)$$

With S, the level of human capital; A, the intelligence quotient; R, the learner's personal resources; E, educational public goods and K, the level of corruption. Let's simplify equation 18 by posing:

$$\ln A = C ; \alpha b = \alpha_1 ; \alpha c = \alpha_2 ; \beta = \alpha_3 \quad (19)$$

We obtain equation 20 below:

$$\ln S_t = C + \alpha_1 \ln R_t + \alpha_2 \ln E_t + \alpha_3 \ln K_t \quad (20)$$

In this study, human capital is taken into account through the Human Capital Index developed by the United Nations Conference on Trade and Development (UNCTAD). This index integrates the quantitative and qualitative aspects of human capital. The learner's resources are approximated by real GDP per capita, which indicates the average level of income in a country. The underlying idea is that the more affluent the population (especially parents), the more they are able to spend on education (especially children's education). The public goods variable is assessed using three parameters. These are public spending on education, official development assistance (ODA) and the pupil-teacher ratio. In most developing countries, like the African countries in the Franc zone, public goods are the most important component of the education system. We assume that the more the state invests in educational infrastructure and equipment, the lower the opportunity cost of the effort in relation to corruption and the greater the accumulation of human capital. These investments are made through public spending and ODA. In Cameroon, for example, ODA has enabled the construction and equipping of primary schools (Japanese support) and technical high schools (Canadian support).

Furthermore, a fall in the pupil-teacher ratio reflects an improvement in the quality of teaching (Belkchatab, 2022) and, in turn, a fall in the opportunity cost of effort. Finally, corruption is measured by the corruption perception index. Integrating these parameters into equation 20 gives the following equation:

$$\ln Kh_t = C + \alpha_1 \ln PIBh_t + \alpha_{21} \ln DPE_t + \alpha_{22} \ln APD_t + \alpha_{23} \ln QE_t + \alpha_3 \ln Cor_t \quad (21)$$

With **Kh**, the level of human capital; **GDP<sub>h</sub>**, real GDP per capita; **PED**, public expenditure on education; **ODA**, official development assistance; **QE**, the management ratio and **COR**, the level of corruption.

For a sample of countries whose data cover a fairly long period, as is the case in this study, the econometric model is specified in panel data as follows:

$$\ln Kh_{it} = C + \alpha_1 \ln PIBh_{it} + \alpha_{21} \ln DPE_{it} + \alpha_{22} \ln APD_{it} + \alpha_{23} \ln QE_{it} + \alpha_3 \ln Cor_{it} + u_i + v_t + \varepsilon_{it} \quad (22)$$

Where the indices i and t represent the country and time respectively;  $u_i$  captures unobserved country-fixed effects,  $v_t$  measures the time-fixed effect common to all countries and  $\varepsilon_{it}$  is the error term.

## 2. Data

The data used to estimate equation 22 covers 14 African countries in the Franc zone (excluding the Comoros) over the period 2000 to 2019. They come from 4 sources: (i) World Development Indicators for real GDP per capita, public spending on education and ODA; (ii) UNCTAD for the human capital index; (iii) UNESCO for the pupil-teacher ratio and (iv) Transparency International for corruption. Real GDP per capita is valued in constant USD. Public expenditure on education is captured through the share of government expenditure allocated to education in GDP. ODA is also expressed as a proportion of GDP. The pupil-teacher ratio indicates the number of pupils attending school for one teacher. The human capital index integrates education, skills, health conditions, and the overall integration of research and development into the structure of society. It ranges from 0 (low level of human capital) to 100 (high level of human capital). Corruption is captured by the corruption perception index. This index takes values ranging from 0 (too much corruption) to 100 (very little corruption). Table 1 below presents the descriptive statistics for the variables.

TABLE 1: Descriptive statistics for the data.

Variables	Comments	Average	Standard deviation	Minimum	Maximum
Human Capital Index	294	30,78	5,25	18,66	41
Corruption Perceptions Index	294	26,73	7,11	16	45
Public spending on education	254	3,14	1,00	1,10	5,72
GDP per capita	294	1991,3	2793,97	338.16	14222.5
Official development assistance	294	49.71	36.0	-7.92	388.13
Pupil/teacher ratio	224	45.21	10.16	23.22	82.791

Source: Calculations based on raw data.

Table 1 shows that, with an average of 30.78, the human capital index is very low in the African countries of the Franc zone. The maximum reached by these countries is 41. Similarly, the corruption perception index averages 45 for the sample, showing that African countries in the Franc zone are highly corrupt. Observation of the data on the other variables shows that these countries are also less affluent, with the exception of official development assistance, which is very high. This represents around 50% of GDP on average, while public spending on education accounts for less than 3.15% of GDP.

In the econometric analysis, we excluded the Central African Republic and Guinea-Bissau due to the absence of data on the management ratio variable.

## RESULTS AND DISCUSSION

Table 2 below presents the results of the econometric estimation of the impact of corruption on human capital. The probability of the Hausman test is 0.1736, showing that the random effect model is more appropriate for this regression. There are therefore country-specific effects that influence the results.

**TABLE 2:** Econometric estimation results.

Variables	Coefficient
Perception of Corruption	0.175*** (0.000)
Pupil/teacher ratio	-0.144*** (0.00)
Public spending on education	0.136*** (0.00)
GDP per capita	0.28*** (0.000)
Official development assistance	0.0339*** (0.000)
Constant	1.17*** (0.00)
Number of observations	208
Number of countries	12
Hausman (P value)	0.1736
R <sup>2</sup>	0.447

**Note:** \*\*\*, \*\* and \* denote significance at 1%, 5% and 10% respectively.

These results show that the coefficient associated with corruption is positive and significant in Franc zone countries. This means that an increase in the corruption perception index (i.e. a reduction in the level of corruption) of one point leads to an increase in the human capital index of 0.175 percentage points. Corruption therefore has a negative impact on human capital formation. This result is consistent with that found by Boly et al (2020), Seka (2013), Dridi (2015), El Jabri and El Khider (2020) and Belkhatab (2022). In a highly corrupt environment where there are very few sanctions, corruption in all its forms (embezzlement, nepotism, bribes, teacher absenteeism, selling of marks) increases the opportunity cost of effort and inhibits pupils' motivation at school.

The pupil-teacher ratio has a significant impact on the accumulation of human capital. In fact, a one percentage point increase in the number of pupils per teacher (translating into more effort for the learner) leads to a 0.144 percentage point drop in the level of human capital. This result is in line with the work of Bechatab (2022).

The variable public expenditure on education has a positive and significant impact on human capital. A one percentage point increase in the share of public spending on education in GDP leads to a 0.136 percentage point increase in human capital. This result, which is in line with that of Tatsabong Tako et al (2020), shows the importance of public spending on building educational infrastructure, equipping laboratories and workshops, and training and recruiting teachers.

The variable GDP per capita has a very strong positive impact on the level of human capital. A one-unit increase in GDP per capita raises the level of human capital by 0.28 percentage points. Moreover, it is out of the resources available that parents pay for their children's schooling, school supplies and other education-related expenses. Relatively well-off parents will be less inclined to send their young children into the street (school drop-out) in search of a means of subsistence.

Finally, official development assistance has a positive and significant impact on the accumulation of human capital.



An increase of one percentage point in the ODA/GDP ratio leads to an increase in human capital of 0.033 percentage points. As mentioned above, ODA helps to support government efforts to develop teaching staff and educational infrastructure and equipment. It therefore reduces the opportunity cost of the effort to be made by the learner in the same way as public spending on education and the pupil-teacher ratio.

### CONCLUSION AND RECOMMENDATIONS

The objective of this article was to analyze the influence of corruption on human capital in African Franc zone countries, assuming an environment where the representative agent is rational. Based on the work of Boly and al (2020), a theoretical model was developed considering that effort, the real component of the human capital accumulation process, is an endogenous parameter. It includes learning time, the learner's personal resources and the public good of education. The economic agent makes a trade-off between making the effort and engaging in corrupt practices, taking into account the costs generated by each option. The cost of corruption includes not only the bribes but also the penalty (implicit cost). When the environment is highly corrupt (grand and petty corruption) and the cost of corruption is low (as is the case in most African countries in the Franc zone), learners will devote less effort and engage in corruption because they consider the effort relatively more costly than the corruption. Empirical analysis has shown that corruption has a negative and significant effect on the level of human capital in African Franc zone countries. Similarly, the variables that could reduce the opportunity cost of the effort, i.e. public spending, official development assistance and the management ratio, have a positive and significant effect on human capital. The positive effect is also observed when the level of per capita income increases. Following these results, a number of recommendations can be made with a view to reducing the cost of effort and increasing the cost of corruption. These are as follows

- **Subjecting the recruitment and promotion of managers and teachers in the education system to the logic of the market:** to this end, the State should issue a call for candidates via an independent firm, specifying the terms of reference based on experience, competence, probity and specifications. The successful candidates will be evaluated at the end of their contract (4 to 5 years) and reappointed if their results are satisfactory.
- **Reinforcing sanctions in the education system:** this involves rigorously applying strong sanctions such as exclusions, revocation of diplomas, suspensions, financial penalties and prison sentences. The aim is to deter any attempt at corruption on the part of managers, teachers or learners. To this end, the State, through its inspectors, must increase the number of unannounced inspections in the field, and try to transfer these inspectors each time.
- **Diversify the sources of funding for schools:** one source of diversification would be the introduction of income-generating activities within schools. To this end, in the form of a performance contract, the State should provide schools with equipment and workshops. Managers will use these allocations to undertake profitable activities. The income generated will be used to pay performance bonuses, maintain infrastructure and equipment and acquire new equipment. Not only will this make it possible to transform schools into true centres of excellence, it will also, and above all, combine theory with practice, a link that is so lacking in the education system of Franc zone countries.
- **Improving the school map:** as part of a kind of strategic planning, the State will have to identify the present and future needs of the education system by region, because the country's regions do not have the same needs. While some regions have a greater need for new schools, others only need state-of-the-art equipment. Similarly, state resources are often wasted by having too many schools in areas that already have them, while other needy areas are neglected.

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