Effect of Human Capital on Growth: Does Corruption have role to play?

1. Introducation

Over the last two decades, there is extensive research on the role of human capital in growth process. There is no role of human capital in the textbook exogenous neoclassical Solow (1956) growth model. The findings of seminal work of Solow (1956) that huge amount (i.e., six out of seven) of growth is left explained and cannot be attributed to labor and capital alone, has not only raised a big question in the field of economic growth but at the same time stimulated immense research in the area of economic growth. Since then the role of human capital is well documented and it received a significance importance. It led to the emergence of augmented neoclassical growth model with an additional input in the production function; it has the direct effect on growth. The study is recorded as the pioneer work in assessing the effect of human capital on growth. The main weakness of the augmented neoclassical growth model is that the growth rate was determined outside the model and by not considering the rate effect of human capital. To tackle with this problem the new endogenous growth literature came into existence. Theoretically, endogenous growth literature has no doubt on the role on human capital in growth process but the empirical literature is surprisingly mixed and conflicting in nature.

The discouraging results of both cross sectional (Benhabib and Spiegel, 1994 and Pritchett, 2001) and panel data studies (Kumar 2006; Bond Hoeffler and Temple, 2001; Caselli, Esquuivel and Lefort, 1996; Islam 1995) on the effect of human capital and economic growth has motivated a great interest in exploring the possible explanations. The possible explanations include measurement errors (Krueger and Lindhal, 2001), data quality (de la Fuente & Domenech, 2000 & 2002, Cohen and Soto, 2007, Bassanini and Scarpetta, 2001) while others have worked with alternative estimation methodologies (Bassanini and Scarpetta, 2001, 2002; Freire-Seren, 2002).

There is also numerous literature on the harmful effects of corruption on economic growth. The bureaucratic corruption may take place through different channels, for example it may be due to the bribery and tax evasion (i.e., Blackburn, Bose, and Haque 2006) or due to the stealing of government resources by public officials (Mauro, 2002) and by misinforming government about the costs and quality of public goods (Haque and Kneller 2007).

In the literature of human capital and economic growth very limited attention is given to the role of corruption in a recent empirical analysis by Rogers (2008). The analysis can be criticized for it's arbitrary use of corruption index for only creating the sub-samples and the analysis don't meet the robustness checks, the results are sensitive to the arbitrary use of corruption index for creating sub-samples, sensitive to the alternative data sets, samples of countries included and suffer from the loss of information.

The objective of this chapter is to provide a theoretical model on the role of corruption in explaining the effect of human capital on growth. The model follows the influential work of (Blackburn, Bose, and Haque, 2006) in using the bribery and tax evasion mechanism while neoclassical augmented model of Lucas (1988) in using the human capital technology and productive use of government expenditures in spirit of Barro (1990). According to the theoretical predictions of the models, impact of human capital may be retarded by the bureaucratic efficiency. With the increase in level of education raises the bureaucratic efficiency which raises the corruption in the economy and results in lower growth.

The remaining of the chapter is organized as follows. The brief review of literature is presented in section 2. In the next section the objective of study is briefly discussed. The section 4 presents the general framework of the analysis of a simple model economy that is prone to bureaucratic corruption. In section 5 we consider the economy with no education. In section 6 we introduce the importance of education in the analysis. In section 7 we study in details how corruption might effect the development of the economy with education as compared to the case of no education. In section 8 we make few concluding remarks.

2. Brief Literature Review

In this section we briefly discuss the literature on human capital and economic growth, the literature on corruption and economic growth and human capital, corruption and economic growth.

2.1. Human Capital and Economic Growth

The starting point for the surprising results for role of human capital in empirical growth literature can be referred to the influential work by Benhabib and Spiegel (1994). They were among the first to notice insignificant and often negative coefficient on human capital. A noteworthy contribution in the literature was put forward by the influential work of Pritchett (2001). He was among the first in reconciling the micro estimates of the returns to schooling with the aggregate evidence on education and growth. He has also found the weak effect of human capital in growth process. These two studies were cross sectional in nature.

The conflicting results are not limited to the cross sectional regression analysis. Apart from the conflicting results found in the cross sectional studies there are number of cases in which the studies based on panel data could not find positive and significant effect of human capital (Kumar 2006; Bond Hoeffler and Temple, 2001; Caselli, Esquuivel and Lefort, 1996; Islam 1995).

From the above quick review of some non-exhaustive literature on the weak effect of human capital and economic growth, several studies have provided different explanations in response to the disappointing results found in the literature. One line o research argues that measurement errors (Krueger and Lindhal, 2001) are the possible explanation for the conflicting results found in the literature. Following this line of argument other studies (de la Fuente & Domenech, 2000 & 2002, Cohen and Soto, 2007, Bassanini and Scarpetta, 2001) have notices that the poor data may be the causing conflicting results. Other group of researchers argue about the estimation methodology to be responsible for the poor results (Bassanini and Scarpetta, 2001, 2002; Freire-Seren, 2002). Another possible explanation is that results may be influenced by a few influential countries. The study by Temple (1999) emphasize on the robustness of the results. He argues that in a large numbers of heterogeneous countries the possibility of some influential countries may be driving the surprising results. He recommends least trimmed squares (LTS) for identifying and eliminating the possible outliers and hence focusing on the more coherent part of the sample. He applied LTS to Benhabib and Spiegela (1994) and showed that results have been radically changed.

2.2. Corruption and Economic Growth

There is also huge literature measuring the impact of corruption on growth. Most of the theoretical and empirical research has claimed that corruption has harmful effects on growth. In explaining the adverse effects of corruption they have adopted different mechanisms for the existence of corruption. The bureaucratic corruption may take place through different channels, for example it may be due to the bribery and tax evasion of public officials (bureaucrats), private agents or stealing of government resources by public officials, misinforming government about the costs and quality of public goods. On theoretical side, the most recent and more influential contribution is undertaken by Blackburn, Bose, Haque, (2006). The study considers a dynamic general equilibrium model of growth for the joint determination of economic development and bureaucratic corruption. The latter mechanism is emphasized in Mauro (2002) through the existence of strategic complimentarity where the corruption becomes inevitable. The last view is raised by Blackburn, Bose, & Haque, (2004). Another view is put forward by Haque, & Kneller (2007), in their analysis although corruption increases public investment but it lowers the returns to public investment and hence retarding the economic development.

2.3. Human Capital, Corruption and Economic Growth

In addition to the aforementioned arguments our study will highlight another important issue which is relatively unknown in the literature. The attempt is made to discuss an additional channel which had received no or very little attention in the literature. The relatively unexplored channel in the literature of the effect of human capital and growth is that the effect of human capital may operate through corruption. On the theoretical side there is no such work in the literature while in case of empirical work there is only one exception. The study by Rogers (2008) gives cursory attention to this channel. He conducts a cross sectional analysis to investigate the effect of human capital on growth for the group of 76 countries by focusing on the productive use of schooling. In his analysis the corruption index is only used to create sub-samples and his study may be criticized for various reasons. The study is contingent on the arbitrary use of corruption index, the results are limited to the cross national analysis and moreover the results are subject to various robustness analysis (for example, the results are sensitive to the sample of country selected and the alternative data sets).

3. Objective of the Study

The aim of the study is to bridge a gap in the literature on the link between human capital and growth through introducing the role of corruption.

In this study we present a theoretical model to investigate the disappointing effects of human capital on growth. We use three period overlapping generation model (OLG) model with labor augmenting neoclassical model in spirit of Barro (1990) and the human capital technology in spirit of Lucas R. (1988). In this model the effect of human capital depends on two opposing forces, bureaucratic efficiency and productive efficiency. The effect of former is expected to be negative whilst the effect of latter is assumed positive. It is necessary here to clarify that what we mean by bureaucratic efficiency and productive efficiency. As we are assuming three period overlapping generation model (OLG) with the understanding that the individuals decide whether to acquire education or work for the home production in the first period, supplying skilled or unskilled labor in the middle ages and consuming in the third period. With more human capital the bureaucrats become efficient in context of reducing the cost of concealment by hiding their money as well as their identity as corrupt. The concealment costs are the costs associated with the corrupt bureaucrat that are necessary to incur for becoming indistinguishable to government and incurring the costs to hide the illegal money earned through bribery because if caught the money will be confiscated by the government as fine. In this manner human capital may have harmful effects on economic growth through increased bureaucratic efficiency. For example, higher human capital leads to higher bureaucratic efficiency while higher bureaucracy is associated with higher corruption (e.g. bribery) resulting in loss of government revenue and hence retarding the economic growth. On the flip side of the argument is the view that human capital may have positive effect on growth. For example increase in human capital may lead to higher production efficiency. As the individual is simultaneously working as well as acquiring education. Education has a direct positive effect on growth and it may further produce positive externality to other co-workers by learning by doing and hence generating positive production effects of human capital. The effect of human capital on growth is contingent upon the relative shares of negative bureaucratic efficiency effects and positive production efficiency effects. If the negative bureaucratic efficiency effects surpass the positive production efficiency effects then in nutshell the human capital may have negative effects on growth.

4. Basic Framework

Time is discrete and indexed by t = 0,….,∞. All the agents live for three-periods with constant population and belong to overlapping generations of dynastic families. The agents of each generation are divided into two groups of citizens- households (or workers), of whom there is a fixed proportion of m, and bureaucrats (or civil servants), of whom there is a fixed proportion of $n < m$. We suppose that households are endowed with $\lambda > 1$ units of labour and are liable to pay tax, while the bureaucrats are endowed with one unit of labour and are exempt from paying tax. Taxes are lump sum and are collected by bureaucrats who are held responsible for the administration of the public policy, which requires funding for public expenditures. Households work for firms in the production of output in return for wage rate while bureaucrats work for government in implementing the public policy in return for salary. Public policy comprises of a package of taxes and expenditures designed to provide public goods and services which contribute to the efficiency of output production. Corruption arises from the incentive of bureaucrat to appropriate (steal) public resources thereby reducing the provision of public services. We assume that a fraction, $v \in (0,1)$, of bureaucrats are corruptible while the remaining fraction, $1 - v$, are non-corruptible, with unobservable identity of the bureaucrats by government. All agents are risk neutral, acquiring education or working for home production when young, only working (skilled/unskilled) in the middle-age and consuming when old. All markets are perfectly competitive.

4.1. The Government and Public Services

We consider the role of government as providing public goods and services which function as inputs to private production (e.g., Barro 1990). The government expenditures comprise of public goods (services) and bureaucrats' salaries. Any bureaucrat (corruptible or non-corruptible) can work for a firm by supplying one unit of labor to receive a non-taxable income equal to the wage paid to households. Any bureaucrat who is willing to accept a salary less than this wage must be expecting to gain through appropriation (stealing) of public resources and is immediately identified as being corrupt. As in other analyses (e.g., Acemoglu and Verdier 1998; Blackburn et al. 2005; Blackburn and Forgues-Puccio 2005), we assume that a bureaucrat who is discovered to be corrupt is subject to the maximum fine of having all of his legal income (salary) confiscated (i.e., he is fired without pay). Given this, no corruptible bureaucrat would ever expose himself in the way as discussed earlier. The government ensures complete bureaucratic participation and minimizes its costs by setting the salaries of all bureaucrats equal to the wage paid by firm to the households.

We assume that one unit of public spending is transformed into one unit of productive public service. Each bureaucrat is provided with public fund g. If the bureaucrat does not steal the fund, then he spends the whole amount that he has been allocated. In the case where all bureaucrats decide not to be corrupt (i.e., not to steal), then government can provide total public services that are equal to $\hat{G} = ng$. Conversely, if all the bureaucrats steal a fraction, $\theta < 1$, of public fund that they are responsible for, then the total productive public services in the economy would be equal to $\tilde{G} = (1-\theta)ng$, where 'θ' is proportion of government resources stolen by the corrupt bureaucrats and lies between 0 and 1.

The government in each period finances its expenditures by running a continuously balanced budget. Its revenue consist of taxes collected from households, plus any fine imposed on bureaucrats' who are discovered engaging in corruption. We assume that the households are endowed with $\lambda > 1$ units of labor and are liable to taxation, while the bureaucrats are endowed with only one unit of labor and are exempt from paying tax. We denote τ_{t+1} the lump-sum tax levied on each household in the middle age of their life. We assume that government knows about the amount of tax revenue in absence of corruption (as it knows the number of households), any shortfall of public funds below this amount reveals that some funds are being misappropriated as considered in Blackburn and Forgues-Puccio (2005). Under this scenario, the government investigates the behavior of bureaucrats using costly monitoring technology which is positive function of the human capital accumulated by the corrupt bureaucrats. This technology entails d units of additional resources and implies that a bureaucrat who is corrupt faces a probability, $P \in (0,1)$, of avoiding detection, and a probability, $1-P$, of being caught. We assume that government incurs higher monitoring costs when bureaucrats are educated as compared to the case when they are not educated. The more educated bureaucrats posses more stealing efficiency than the less or uneducated bureaucrats and hence the monitoring costs to the government increases with education of bureaucrats.

4.2. Households

Each household of generation t saves all of its income to acquire a final wealth of x_{t+2} when it reaches old-age. Households consume part of this wealth and bequeath the remainder to its offspring (i.e., is altruistic). Its lifetime utility is defined as, $U_t = x_{t+2} - b_{t+2} + u(b_{t+2})$, where $x_{t+2} - b_{t+2}$ is consumption, b_{t+2} is the bequest and $u(\cdot)$ is a strictly concave function that satisfies the usual Inada conditions. The utility is maximized by setting $u'(\cdot) = 1$, implying an optimal fixed size of bequest from one generation to the next: that is $b_{t+2} = b$ for all t. The expected utility of a household is determined when its expected wealth is determined.

Each household when young has an option to either acquire education and supply skilled labor (i.e., $H_{t+1} = (1 + h_{t+1})l_{t+1}$) in the middle age of his life or engage in home production and supply raw labor in the middle age of his life. Every household receives bequest b_t and is liable to pay lump-sum taxes of τ_{t+1}. Household if educated saves its entire net income $(1 + h_{t+1})\lambda w_{t+1} - \tau_{t+1} + b_t$, or, $(1 + r)\overline{w} + \lambda w_{t+1} - \tau_{t+1} + b$ if not educated, in order to finance retirement consumption and bequests to its own offspring.

We assume that the household derives linear utility from consumption and makes bequests according to the warm-glow/joy–of-giving motive. The lifetime utility of the household who acquire education and supply skilled labor is given as, $u_t^{h,e} = (1 + r_{t+2}^e)[(1 + h_{t+1})\lambda w_{t+1} - \tau_{t+1} + b] - b + v(b)$ while the lifetime utility for the household who don't acquire education and supply raw labor is, $u_t^{h,ne} = (1+r_{t+2}^{ne})\left[(1+r)\overline{w} + \lambda w_{t+1} - \tau_{t+1} + b\right] - b + v(b)$, the utility is maximized by setting $v'(\cdot) = 1$, implying an optimal fixed size of bequest from one generation to the next: that is $b_{t+2} = b$ for all t, where $v(\cdot)$ is strictly concave function that satisfies the usual Inada conditions.

4.3. Bureaucrats

Each bureaucrat of generation t saves all of its income to acquire a final wealth of x_{t+2} when it reaches old-age. For convenience, we assume that a bureaucrat consume all of this wealth (i.e., is non-altruistic), derive lifetime utility of $V_t = x_{t+2}$. As earlier, a bureaucrat's expected utility is fully determined when his expected wealth is determined.

Each bureaucrat when young is endowed with one unit of labor, which he uses either to acquire education and accumulates human capital, $H_{t+1} = (1+h_{t+1})l_{t+1}$ in the middle age of his life or works for the home production when young and supplies raw labor in the middle age of the life. The bureaucrats are designated as the role of as an agent for the government in the administration of the public policy. In performing this role, a bureaucrat is delegated with the responsibility for controlling the public funds. It is due to this designation of authority that corruption might occur as the bureaucrat may be interested to appropriate (steal) some of the public funds for himself. As indicated earlier, we assume that there are some public officials who are corruptible in this way, and others who are non-corruptible.

By definition a bureaucrat who is non-corruptible is never corrupt and will never participate in the appropriation (stealing) of public funds. The final wealth of such a bureaucrat is $(1+h_{t+1})w_{t+1}$ if educated and $(1+r)\overline{w}+w_{t+1}$ if not educated. In contrast, a bureaucrat who is corruptible may or may not comply with the rules of public office. If he does, then his income is $(1+h_{t+1})w_{t+1}$ if educated and $(1+r)\overline{w}+w_{t+1}$ if not educated, as before. If he does not, then his income is uncertain and depends on the amount of fund he appropriates, the chances of being caught and the penalties incurred if he is exposed. Such a bureaucrat engages in appropriation of public funds. Although the bureaucrat receives g in public funds, he spends and provides the economy with $(1-\theta)g$ amount of public services. Thus 'θg' is the amount of funds that a bureaucrat may appropriate. The corrupt individuals may try to remain unobtrusive by concealing their illegal income, by investing this income differently from legal income and by altering their pattern of expenditure. For simplicity, we assume that corrupt bureaucrats must consume their illegal income immediately if they are to stand any chance of not being caught. By doing so, he can make sure that he can consume this illegal income when he is old. Due to the imprecise government monitoring with probability p, the bureaucrat may get caught and punished for his legal income (i.e., salary) and left with only the illegal income. With probability $(1-P)$, the individual escapes detection and mange to save the amount $(1-p)[(1+h_{t+1})w_{t+1}+\theta\text{g - C}]$ if educated and $(1-p)[(1+r)\overline{w}+w_{t+1}+\theta g-C]$ if not educated. Where 'C' is the cost of concealment a corrupt bureaucrat has to incur for hiding the amount he appropriated from public funds. We assume that the act of being corrupt is not entirely costless, but entails some disutility for the individual. For example, a bureaucrat may need to spend some resources for concealing his illegal activities. It is plausible to imagine that these costs are directly proportional to the appropriated fund and inversely related to the level of human capital. Thus the cost of concealment to the corrupt bureaucrat is $C = [1-\phi(1+h_{t+1})]\theta g$ if educated and $C = [1-\phi]\theta g$ if not educated. Accordingly, his income when educated is $(1+h_{t+1})w_{t+1}$ with probability p, and $[(1+h_{t+1})w_{t+1} + \theta \text{g - C}]$ with probability (1-p), implying an expected income of $[(1-P)(1+h_{t+1})w_{t+1} + \theta g - C]$ or $[(1-P)(1+h_{t+1})w_{t+1} + \phi(1+h_{t+1})\theta g]$. Similarly, his income when not educated is $(1+r)\overline{w} + \theta g - C$ with probability p, and $[(1+r)\overline{w} + w_{t+1} + \theta g - C]$ with probability $(1-P)$, implying an expected income of $[(1+r)\overline{w} + (1-P)w_{t+1} + \theta g - C]$ or $[(1+r)\overline{w} + (1-P)w_{t+1} + \phi\theta g]$.

4.4. Firms

The representative firm combines $(1+h_{t+1})l_{t+1}$ units of skilled labor with k_{t+1} units of capital to produce y^e_{t+1} units of output according to

$$y^e_{t+1} = A[(1+h_{t+1})l_{t+1}]^{\alpha} k^{1-\alpha}_{t+1} K^{\alpha}_{t+1} G^{\alpha} \qquad \text{----------------- (1)}$$

(A > 0, $\alpha \in (0,1)$) where K_{t+1} denotes the aggregate stock of capital. The firm hires labour from households at the competitive wage rate w_{t+1} and rents capital from all agents at the competitive interest rate r_{t+1}. Firm uses the economy-wide capital as in Romer (1986) and productive public good as in Barro (1990). Profit maximization implies that wage, $w_{t+1} = \alpha A(l_{t+1})^{\alpha-1}[(1+h_{t+1})]^{\alpha} k^{1-\alpha}_{t+1} K^{\alpha}_{t+1} G^{\alpha}$. Since $l_{t+1} = l = \lambda m$ and $k_t = K_t$, we may write these conditions as

$$w^{e}_{t+1} = \alpha A(\lambda m)^{\alpha-1}(1+h_{t+1})^{\alpha} k_{t+1} G^{\alpha} \text{ -----------------} \quad (2)$$

$$r^{e}_{t+1} = (1-\alpha) A(\lambda m)^{\alpha}(1+h_{t+1})^{\alpha} k_{t+1} G^{\alpha} \text{ -----------------} \quad (3)$$

Similarly, the representative firm combines l_{t+1} units of raw labor with k_{t+1} units of capital to produce y^{ne}_{t+1} units of output according to

$$y^{ne}_{t+1} = A l^{\alpha}_{t+1} k^{1-\alpha}_{t+1} K^{\alpha}_{t+1} G^{\alpha} \qquad \text{-------------------} \qquad (4)$$

Profit maximization implies that the wage rate and interest rate is given as,

$$w^{ne}_{t+1} = \alpha A(\lambda m)^{\alpha-1} k_{t+1} G^{\alpha} \qquad \text{-------------------} \qquad (5)$$

$$r^{ne}_{t+1} = (1-\alpha) A(\lambda m)^{\alpha} k_{t+1} G^{\alpha} \qquad \text{-------------------} \qquad (6)$$

4.5. The Incentive to be Corrupt

A corruptible bureaucrat will appropriate public funds if his expected utility is from doing so is no less than his utility from not doing so. From the preceding analysis, we may write this condition for an economy with education as

$E\left(\tilde{z}^{b,e}_{t+2}\right) \geq E\left(\hat{z}^{b,e}_{t+2}\right)$ if educated

or

$E\left(\tilde{z}^{b,ne}_{t+2}\right) \geq E\left(\hat{z}^{b,ne}_{t+2}\right)$ if not educated

The above conditions can also be written as

$$(1+r_{t+2})\left[(1-P)(1+h_{t+1})w_{t+1} + \phi(1+h_{t+1})\theta g\right] \geq (1+r_{t+2})\left[(1+h_{t+1})w_{t+1}\right] \text{ ---------------} \quad (7\text{-a})$$

and

$$(1+r_{t+2})\left[(1+r)\overline{w} + (1-P)w_{t+1} + \phi\theta g\right] \geq (1+r_{t+2})\left[(1+r)\overline{w} + w_{t+1}\right] \text{ --------------------} \quad (7\text{-b})$$

Rearranging,

$$Pw_{t+1} \leq \phi\theta g \qquad \text{----------------- (8)}$$

Intuitively, a bureaucrat is more likely to corrupt the more he expects to gain in illegal income if he evades the detection. The key feature of the incentive condition (8) is that it depends on the economy-wide variable w_{t+1}. The wage is determined by current event in the economy, which in turn is a function of the aggregate level of corruption. This reflects that higher wages of the agents imply higher costs to bureaucrats if they are caught. This means that the motivation for each corruptible bureaucrat to be corrupt depends on the number of other bureaucrats who are expected to be corrupt. Consequently, bureaucratic decision-making entails strategic interactions, which may result in multiple equilibria. We begin to explore this possibility by studying the incentive of an individual corruptible bureaucrat to be corrupt under two alternative scenarios- one in which no other bureaucrat is corrupt and the other in all other bureaucrats are corrupt. Recall in equilibrium, $l_{t+1} = l = \lambda m$ and from (2), we have $w^e_{t+1} = \alpha A(\lambda m)^{\alpha-1}(1+h_{t+1})^{\alpha} k_{t+1} G^{\alpha}$. Thus as mentioned earlier, w_{t+1} is determined by the level of capital stock, k_{t+1} and by the total public service, G, both of which are determined by the aggregate level of corruption.

Equation (8) can be used to determine the critical level of capital for an economy with education as

$$\phi\theta g \geq \alpha PA(\lambda m)^{\alpha-1}(1+h_{t+1})^{\alpha} k_{t+1} G^{\alpha}$$

or

$$k_{t+1}^{e} \le \frac{\phi\theta g}{\alpha AP(\lambda m)^{\alpha-1}\left(1+h_{t+1}\right)^{\alpha} G^{\alpha}} \cong \kappa^{e} \qquad \text{---------------- (9)}$$

Consider the case where no bureaucrat is corrupt. Total government expenditure on public good is $G = ng$, while the total public service obtained from this spending is $\hat{G} = ng$. Under this situation, wage rate is $\hat{w}_{t+1}^{e} = \alpha A(\lambda m)^{\alpha-1}\left[\left(1+h_{t+1}\right)\right]^{\alpha} n^{\alpha} g^{\alpha} k_{t+1}$ and the incentive condition in (8) becomes

$$\phi\theta g \ge \alpha PA(\lambda m)^{\alpha-1}\left(1+h_{t+1}\right)^{\alpha} k_{t+1}(ng)^{\alpha}$$

or,

$$k_{t+1} \le \frac{\phi\theta g}{\alpha AP(\lambda m)^{\alpha-1}\left[\left(1+h_{t+1}\right)\right]^{\alpha} n^{\alpha} g^{\alpha}} \cong \hat{\kappa}^{e} \qquad \text{---------------- (10)}$$

For the case in which bureaucrats are corruptible, the total productive services in the economy will be, $\tilde{G} = n[v(1-\theta)g + (1-v)g] = (1-v\theta)ng$, under such situation, the wage rate in (2) is $\tilde{w}_{t+1}^{e} = \alpha A(\lambda m)^{\alpha-1}\left[\left(1+h_{t+1}\right)\right]^{\alpha} \lambda^{\alpha}\left[\left(1-v\theta\right)ng\right]^{\alpha} k_{t+1}$ and the incentive condition in (8) becomes

$$\phi\theta g \ge P\alpha A(\lambda m)^{\alpha-1}\left[\left(1+h_{t+1}\right)\right]^{\alpha} \lambda^{\alpha}\left[\left(1-v\theta\right)ng\right]^{\alpha} k_{t+1}$$

or,

$$k_{t+1} \le \frac{\phi\theta g}{\alpha PA(\lambda m)^{\alpha-1}\left[\left(1+h_{t+1}\right)\right]^{\alpha} \lambda^{\alpha}\left[\left(1-v\theta\right)ng\right]^{\alpha}} \cong \tilde{\kappa}^{e} \qquad \text{--------- (11)}$$

We may observe that, since $\theta < 1$, it is easily verifiable that $\tilde{w}^e_{t+1} < \hat{w}^e_{t+1}$: that is, for any given stock of capital, k_{t+1} wages are lower under corruption than under non-corruption.

Similarly, the incentive condition in an economy with no education as given in (8) can be written as

$\alpha PA(\lambda m)^{\alpha-1} k_{t+1} G^{\alpha} \leq \phi\theta g$

or,

$$k^{ne}_{t+1} \leq \frac{\phi\theta g}{\alpha AP(\lambda m)^{\alpha-1} G^{\alpha}} \cong \kappa^{ne} \quad \text{------------------------- (12)}$$

As discussed earlier, the case where no bureaucrat is corrupt. Total government expenditure on public good is $G = ng$, while the total public service obtained from this spending is $\hat{G} = ng$. Under this situation, wage rate is $\hat{w}^{ne}_{t+1} = \alpha A(\lambda m)^{\alpha-1} n^{\alpha} g^{\alpha} k_{t+1}$ and the incentive condition in (8) becomes

$\alpha AP(\lambda m)^{\alpha-1} n^{\alpha} g^{\alpha} k_{t+1} \leq \phi\theta g$

or

$$k^{ne}_{t+1} \leq \frac{\phi\theta g}{\alpha AP(\lambda m)^{\alpha-1} n^{\alpha} g^{\alpha}} \cong \hat{\kappa}^{ne} \quad \text{------------------------- (13)}$$

Also in case of the economy with education, in the case in which bureaucrats are corruptible, the total productive services in the economy will be, $\tilde{G} = n[v(1-\theta)g + (1-v)g] = (1-v\theta)ng$, under such situation, the wage rate in (5) is $\tilde{w}^e_{t+1} = \alpha A(\lambda m)^{\alpha-1} \lambda^{\alpha} \left[(1-v\theta)ng\right]^{\alpha} k_{t+1}$ and the incentive condition in (8) becomes

$$\alpha AP(\lambda m)^{\alpha-1}\lambda^{\alpha}\left[(1-v\theta)ng\right]^{\alpha}k_{t+1} \leq \phi\theta g$$

or,

$$k_{t+1}^{ne} \leq \frac{\phi\theta g}{\alpha AP(\lambda m)^{\alpha-1}\lambda^{\alpha}\left[(1-v\theta)ng\right]^{\alpha}} \cong \tilde{\kappa}^{ne} \qquad \text{---------------} \ (14)$$

4.6. Equilibria

The preceding analysis identifies the conditions for an individual bureaucrat to be corrupt, given that all other bureaucrats are corrupt or not. It is also observed that the incidence of the aggregate level of corruption affects aggregate economic outcomes such as wages and public services. We know proceed to determine whether or not corruption forms part of equilibrium depends on the level of development of the economy.

The essential conditions for determining equilibrium behaviour are given in (10), (11), (13) and (14) and shown in figure (1). It is evident that in both non-corrupt and corrupt environment the critical value of capital with no education is higher than the critical value of capital with education (i.e., $\hat{\kappa}^{e} < \hat{\kappa}^{ne}$ and $\tilde{\kappa}^{e} < \tilde{\kappa}^{ne}$ as $\hat{w}_{t+1}^{e} > \hat{w}_{t+1}^{ne}$ and $\tilde{w}_{t+1}^{e} > \tilde{w}_{t+1}^{ne}$).

It is also evident that in both cases when bureaucrats are educated or uneducated, the critical level of capital under no corruption will be smaller than under corruption (i.e., $\hat{\kappa}^{e} < \tilde{\kappa}^{e}$ and $\hat{\kappa}^{ne} < \tilde{\kappa}^{ne}$ as $\tilde{w}_{t+1}^{e} < \hat{w}_{t+1}^{e}$ and $\tilde{w}_{t+1}^{ne} < \hat{w}_{t+1}^{ne}$).

Finally, it is reveled that the critical value of capital in a corrupt environment is higher than the non-corrupt environment when bureaucrats are educated as $\hat{w}_{t+1}^{e} > \tilde{w}_{t+1}^{e}$. It implies that the economy with all educated and all corrupt would provide more incentive for an individual to be corrupt than under the economy with all educated but all non-corrupt bureaucrats.

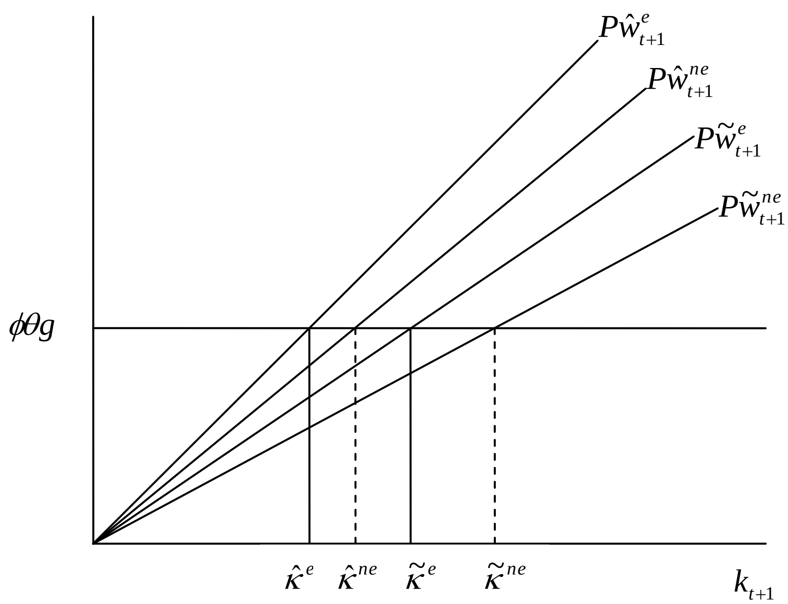


Figure (1)

The interesting situation occurs in an economy with all educated and all corrupt the incentive condition for an individual to be corrupt may go either way and may provide more/less incentive for an individual to be corrupt than under an economy with all non-corrupt and non-educated. It may be true that some development region the sample of countries may assume the values of the parameter that indicate that $\hat{w}_{t+1}^{ne} > \tilde{w}_{t+1}^{e}$, implying that in an economy with all educated and all corrupt the incentive for an individual to be corrupt may provide more incentive for an individual to be corrupt than under the economy with all non-educated and all non-corrupt bureaucrats.

4.7. Public Finance

So far we have discussed the extent of corruption depends on the level of development but it is also true that the development process itself is affected by corrupt activity. This process is described by the path of capital accumulation that can be obtained from the equilibrium condition that the total demand for capital is equal to the total supply of savings. To study how corruption affects savings, it is essential to know how corruption affects public finances as the government's decides the level of taxes required to maintain balance budget. Recall that $v(1-v)$ is the fraction of bureaucrats who are corruptible (non-corruptible) and that $P(1-P)$ is the fraction of corrupt bureaucrats who succeed (fail) in evading detection.

Consider the economy with education when corruption is absent. The government obtains the tax revenue $m\tau_{t+1}$ which is used to finance its expenditures on public services (ng) and bureaucratic salaries $[n(1+h_{t+1})w_{t+1}]$.

$$m\hat{\tau}^{e}_{t+1} = ng + n(1+h_{t+1})\hat{w}^{e}_{t+1} \quad \text{----------------- (15)}$$

While in an economy with no education and no corruption, the level of taxes in this case is therefore given as

$$m\hat{\tau}_{t+1}^{ne} = ng + n\hat{w}_{t+1}^{ne} \qquad \text{-----------------} \quad (16)$$

Now consider the case in which corruption is present. We assume that there exists a fraction of corruptible (non-corruptible) bureaucrats $v(1-v)$ in the economy with probability $P(1-P)$ of being detected (escaped). The government investigates the activities of the corrupt bureaucrat by employing an imprecise monitoring technology that is increasing function of the human capital accumulated by the bureaucrats and is defined as $d = \gamma(1+h_{t+1})ng$ under education and $d = \gamma ng$ under no education. We suppose that government has to incur additional resources to monitor the corrupt bureaucrats if they are educated as compared to the bureaucrats with no education. Education increases the stealing efficiency of the corrupt bureaucrats and allows them to reduce the concealment costs and hence it also increases the monitoring costs to the government. The tax revenue of the government ($m\tau_{t+1}$) is used to finance the expenditures on public services (ng), the salaries of the fraction of non-corrupt bureaucrats [$n(1-v)(1+h_{t+1})w_{t+1}$], the salaries of the corruptible bureaucrats who escape detection [$n(1-p)v(1+h_{t+1})w_{t+1}$] and the monitoring cost (d).

$$m\tilde{\tau}_{t+1}^{e} = n(1-vp)(1+h_{t+1})\tilde{w}_{t+1}^{e} + ng + \gamma(1+h_{t+1})ng \qquad \text{---------------} \quad (17)$$

The level of taxes in an economy with no education and corruption is

$$m\tilde{\tau}_{t+1}^{ne} = n(1-vp)\tilde{w}_{t+1}^{ne} + ng + \gamma ng \qquad \text{-------------------} \quad (18)$$

A comparison of (15)-(17) and (16)-(18) reveals that for any given w_{t+1} and G_{t+1}, $\tilde{\tau}_{t+1} < \hat{\tau}_{t+1}$: taxes are higher in a corrupt environment than in non-corrupt environment. This is true because corruption leads to loss of public resources and increase in government expenditure.

5. Capital Accumulation Under no-education

The capital accumulation in the economy with no education, k_{t+2}^{ne}, is equal to the total savings of households plus total savings of bureaucrats which depends on the whether corruption exists or not as discussed earlier. In the absence of corruption, each household saves $(1+r)\overline{w} + \lambda w_{t+1} - \tau_{t+1} + b$ and each bureaucrat saves $(1+r)\overline{w} + w_{t+1}$, implying total savings in an economy with no education and no corruption, $\hat{s}_{t+1}^{ne} = (1+r)\overline{w} + \lambda m w_{t+1} - m\tau_{t+1} + mb + nw_{t+1}$. In the presence of corruption, savings of households remains the same as earlier, i.e., $(1+r)\overline{w} + \lambda w_{t+1} - \tau_{t+1} + b$ while each corruptible bureaucrat saves either $(1+r)\overline{w} + \theta g - C$ with probability p of being detected or $(1+r)\overline{w} + w_{t+1} + \theta g - C$ with probability $(1-p)$ of avoiding the detection, the savings of the corrupt bureaucrats is equal to $\tilde{s}_{t+1}^{ne} = (1-P)w_{t+1} + (1+r)\overline{w} + \theta g - C$. Substituting the cost of concealment (i.e., $C = (1-\phi)\theta g$) the savings of the corrupt bureaucrats may also be written as $(1+r)\overline{w} + (1-P)w_{t+1} + \phi\theta g$. Combining the savings of households and bureaucrats the total savings in an economy with no education and corruption,

$\tilde{s}^{ne}_{t+1} = (1+r)\overline{w} + \lambda m w_{t+1} - m\tau_{t+1} + mb + n(1-p)w_{t+1} + n\phi\theta g$. These results can be used to determine two alternative paths of capital accumulation. We recall the expression for $\hat{w}^{ne}_{t+1}, \hat{\tau}^{ne}_{t+1}, \tilde{w}^{ne}_{t+1}$ and $\tilde{\tau}^{ne}_{t+1}$ from (5), (16) and (18). The capital accumulation in the absence of corruption and education is described by

$$\hat{k}^{ne}_{t+2} = m\lambda B k_{t+1} + mb + (1+r)\overline{w} - ng \qquad \text{----------------------- (19)}$$

Where $B = \alpha A(\lambda m)^{\alpha-1}(ng)^{\alpha}$, while capital accumulation in the presence of corruption and no education is described by

$$\tilde{k}^{ne}_{t+2} = [\lambda m - np(1-v)](1-v\theta)^{\alpha} B k_{t+1} + mb + (1+r)\overline{w} - ng - [\gamma - \phi\theta]ng \quad \text{------ (20)}$$

The equations (19) and (20) exhibit the stationary points associated with the steady state levels of capital $\hat{k}^{ne*} = \dfrac{mb + (1+r)\overline{w} - ng}{(1 - m\lambda B)}$ and $\tilde{k}^{ne*} = \dfrac{mb + (1+r)\overline{w} - ng - (\gamma - \phi\theta)ng}{1 - (\lambda m - np(1-v))(1-v\theta)^{\alpha}}$ respectively. It is quite obvious that $\tilde{k}^{ne*} < \hat{k}^{ne*}$ for any given k_t. The capital accumulation is lower under no-education and corruption than under no-education and no-corruption. It shows that corruption has detrimental effect on economic development. The results suggest that corruption and development is negatively related and there exist multiple development regimes and multiple long run equilibria. The incentive condition to be corrupt defines the corruption occurs for any level of capital, k_t, below (above) the critical level, κ^{ne}. Under such conditions, the economy is in a low (high) development regime. For a given initial capital stock $k_0 < \kappa^{ne}$, the final outcome of the economy depends whether $\kappa^{ne} < \tilde{k}^{ne*}$ or

$\kappa^{ne} > \tilde{k}^{ne*}$. We explain this in figure (2) and (3). Assume that $\kappa^{ne} < \tilde{k}^{ne*}$ then the economy evolves along $\tilde{k}_{t+2}^{ne}$ until it reaches κ^{ne} and then it approaches $\hat{k}_{t+2}^{ne}$ and reaches $\hat{k}^{ne*}$. This process describes the process of transition from the low development regime with high corruption to the high development with low corruption. Now consider $\kappa^{ne} > \tilde{k}^{ne*}$, the economy is locked forever on $\tilde{k}_{t+2}^{ne}$, converging forever towards to $\tilde{k}^{ne*}$. In this case there is no transition and the economy remains poor and corrupt forever.

6. Capital Accumulation with education

Like before, he capital accumulation in the economy, k_{t+2}^{ne}, is equal to the total savings of households plus total savings of bureaucrats which depends on the whether corruption exists or not. In the absence of corruption, each household saves $(1+h_{t+1})\lambda w_{t+1} - \tau_{t+1} + b$ and each bureaucrat saves $(1+h_{t+1})w_{t+1}$, implying total savings in an economy with education and no corruption, $\hat{s}_{t+1}^{e} = m(1+h_{t+1})\lambda w_{t+1} - m\tau_{t+1} + mb + n(1+h_{t+1})w_{t+1}$. In the presence of corruption, savings of households remains the same as earlier, i.e., $(1+h_{t+1})\lambda w_{t+1} - \tau_{t+1} + b$ while each corruptible bureaucrat saves either $\theta g - C$ with probability p of being detected or $(1+h_{t+1})w_{t+1} + \theta g - C$ with probability $(1-p)$ of avoiding the detection, implying total savings in an economy with education, $\tilde{s}_{t+1}^{e} = m(1+h_{t+1})\lambda w_{t+1} - m\tau_{t+1} + mb + n(1-p)(1+h_{t+1})w_{t+1} + n\theta g\phi(1+h_{t+1})$. These results can be used to determine two alternative paths of capital accumulation. Using equation (2) and (15), the capital accumulation in the absence of corruption and education is described by

$$\hat{k}^{e}_{t+2} = m\lambda B(1+h_{t+1})^{1+\alpha} k_{t+1} + mb - ng \qquad \text{----------------------- (21)}$$

Where $B = \alpha A(\lambda m)^{\alpha-1}(ng)^{\alpha}$, while capital accumulation in the presence of corruption and education is described by

$$\tilde{k}^{e}_{t+2} = [\lambda m - n(1-v)p](1+h_{t+1})^{1+\alpha}(1-v\theta)^{\alpha} Bk_{t+1} + mb - ng - [\gamma - \phi\theta](1+h_{t+1})ng \quad \text{---------- (22)}$$

The equations (21) and (22) exhibit the stationary points associated with the steady state levels of capital $\hat{k}^{e*} = \dfrac{mb-ng}{1-m\lambda B(1+h_{t+1})^{1+\alpha}}$ and $\tilde{k}^{e*} = \dfrac{mb-ng-ng[\gamma - v\theta\phi](1+h_{t+1})}{1-(\lambda m - n(1-v))B(1+h_{t+1})^{1+\alpha}(1-v\theta)^{\alpha}}$ respectively. Like the earlier case with no education, $\tilde{k}^{e*} < \hat{k}^{e*}$ for any given k_t. The capital accumulation is lower under an economy with education and corruption than under the economy with education non-corruption. Thus corruption continues to impede capital accumulation and growth. The effect of corruption is greater under current circumstances with education.

With education the loss of resources is higher as bureaucrat acquires more skills to steal and government has to incur high monitoring costs. In this way, human capital defined as the education increases bureaucratic stealing efficiency and may depress economic growth if the negative bureaucratic stealing effect of human capital exceeds the positive productivity enhancing effect. Our results are consistent with the recent empirical findings of Rogers (2008) which notes the adverse effect of human capital on economic growth for the sample of high corrupt countries as compared to the sample of low corrupt countries. The relationship between corruption and development remains negative as earlier there exist multiple development regimes and multiple long run equilibria. For any capital stock, k_t, below (above) the critical level, κ^e, the economy is in a low (high) development regime and displaying a high (low) incidence of corruption. For a given initial capital stock $k_0 < \kappa^e$, the transition between regimes may or may not be feasible depending on the final outcome of the economy whether $\kappa^e < \tilde{k}^{e*}$ or $\kappa^e > \tilde{k}^{e*}$. In the case of the latter, initial conditions determines the outcome defined as the poverty trap equilibrium.

7. Education, Corruption and Growth: An Evaluation

The results obtained hitherto show how the corruptness and education of an economy might be important factors in explaining various outcomes. The result also suggest that the effect of corruption depend on whether or not the economy has education, while the effects of education (human capital) depends whether or not the economy is corrupt.

Education has number of implications as the economy develops. First, it increases the efficiency of production, it causes the transition function to become steeper, irrespective of whether or not corruption exists (i.e., $\hat{k}^e_{t+2} > \tilde{k}^e_{t+2}$ and $\hat{k}^{ne}_{t+2} > \tilde{k}^{ne}_{t+2}$). Second, it increases the stealing efficiency of bureaucrats and also the monitoring costs incurred by the government, exacerbates the effect of corruption in the transition function downwards (i.e, $\tilde{I}^e < \tilde{I}^{ne}$).

In Figure (9) and (10) we suppose that $\kappa^{ne} < \tilde{k}^{ne*}$ implies that transition between development regimes is feasible in an economy under no education and $\tilde{k}^{e*} < \tilde{k}^{ne*}$ showing that the long-run equilibrium of a corrupt economy with education is worse than the long-run equilibrium of a corrupt economy under no education. Recalling the earlier discussion, we consider three cases - $\kappa^{ne} < \kappa^{e} < k_{t+1}$, $\kappa^{ne} < k_{t+1} < \kappa^{e}$ and $k_{t+1} < \kappa^{ne} < \kappa^{e}$.

Consider the first case $\kappa^{ne} < \kappa^{e} < k_{t+1}$, corruption is not an issue because the incentive condition of corruption is violated. Under such situation, the effect of education is to increase the efficiency of production thereby increasing growth. For any initial value of $k_0 < k_{t+1}$, the economy is on $\hat{k}^{ne}_{t+2}$ path, progressing towards $\hat{k}^{ne*}$, the economy with education has the higher path $\hat{k}^{e}_{t+2}$ and converges towards $\hat{k}^{e*}$. The results indicate that education in the absence of corruption is unambiguously good for economic growth.

For the case in which $\kappa^{ne} < k_{t+1} < \kappa^{e}$, corruption is not an issue for an economy with no education but becomes an issue for an economy with education because in the change in the incentive condition. As mentioned earlier, the economy is initially on $\hat{k}^{ne}_{t+2}$, converging towards $\hat{k}^{e*}$ without any bureaucratic corruption. In an economy with education, the bureaucrats now engages in the corrupt practices and the economy now achieves the transition path $\tilde{k}^{e}_{t+2}$. The final outcome depends whether $\kappa^{e} < \tilde{k}^{e*}$ or $\kappa^{e} > \tilde{k}^{e*}$: if the former conditions holds then the incentive condition is reversed and economy moves back to $\hat{k}^{e*}$ at κ^{e}, and approaches the $\hat{k}^{e*}$, a situation with no corruption; if latter, then the economy remains on $\tilde{k}^{e}_{t+2}$ and converges towards $\tilde{k}^{e*}$ describing a poverty trap equilibrium. These results show that education in the presence of bureaucratic corruption can be costly to economic growth.

Finally, for the case in which $k_{t+1} < \kappa^{ne} < \kappa^{e}$, corruption matters for both economies with and without education as the incentive condition for corruption is always satisfied. In the case of an economy with education, the bureaucratic stealing efficiency is enhanced. The economy is initially located on $\tilde{k}^{ne}_{t+2}$ with corruption. If there is no economy with education, then the economy progresses to $\hat{k}^{ne}_{t+2}$ at κ^{ne} and then converges to $\hat{k}^{ne*}$ without corruption. By contrast, the economy with education causes a downward shift to $\tilde{k}^{e}_{t+2}$ with the final outcome being dependent on whether $\kappa^{e} < \tilde{k}^{e*}$ or $\kappa^{e} > \tilde{k}^{e*}$ as mentioned earlier: in the case of former, the incentive condition reversals at κ^{e} and corruption disappears and capital accumulation progresses along $\hat{k}^{e}_{t+2}$ towards $\hat{k}^{e*}$, in the latter case the economy remains on $\tilde{k}^{e}_{t+2}$ and converges towards $\tilde{k}^{e*}$ with a poverty trap equilibrium. These results, like those earlier, show that education in the presence of corruption can have adverse effects on economic growth.

The foregoing analysis shows that bureaucratic corruption can be important factor in determining the impact of education on economic growth. It also indicates that corruption may rise in the presence of education as the bureaucratic stealing efficiency increases with education. We notice that although education has positive effect on economic growth in the absence of corruption but in the presence of corruption, education may not have significant effect on economic growth. In addition to the positive productivity enhancing effect of education, it may have negative impact on growth in the presence of corruption because education may enhance the stealing efficiency of the corrupt bureaucrats which may in turn have negative impact on economic growth. The total effect of education on growth is dependent on whether the positive productivity enhancing effect is stronger than the negative growth reducing effect by increasing the stealing efficiency of corrupt bureaucrats.

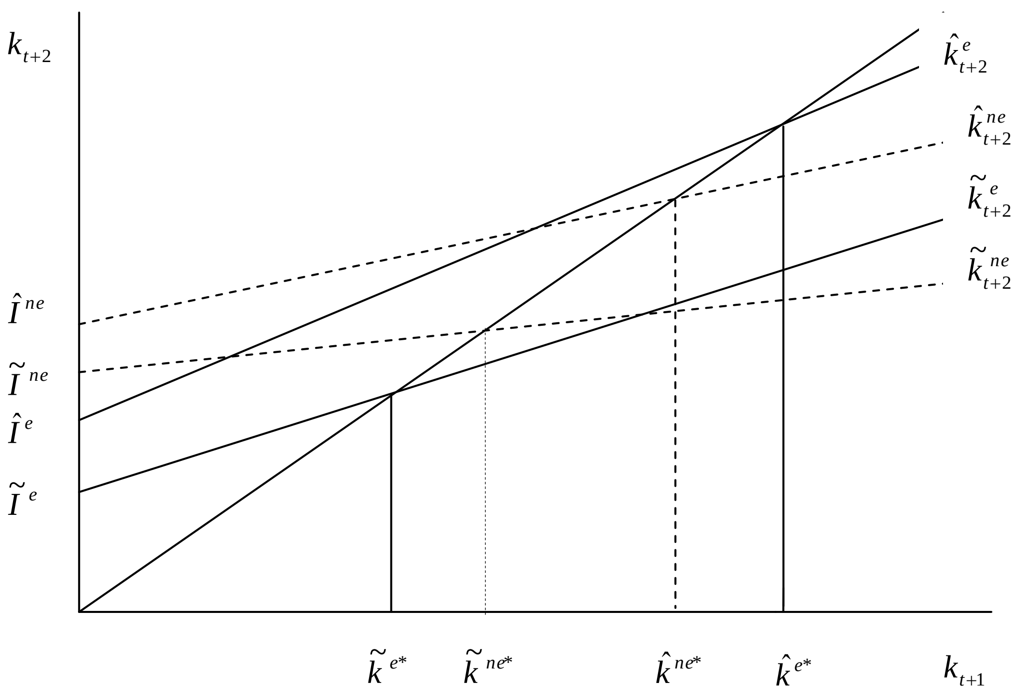
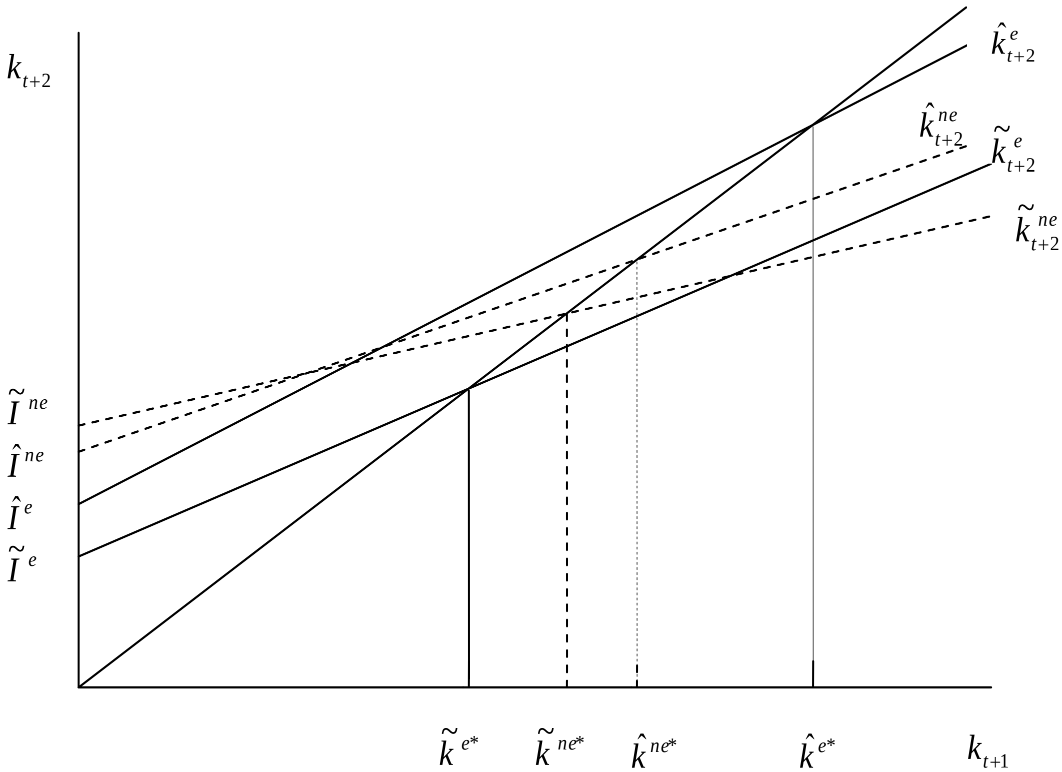


Figure (2)



k_{t+2}
$\hat{k}^{e}_{t+2}$
$\hat{k}^{ne}_{t+2}$
$\tilde{k}^{e}_{t+2}$
$\tilde{k}^{ne}_{t+2}$
$\tilde{I}^{ne}$
$\hat{I}^{ne}$
$\hat{I}^{e}$
$\tilde{I}^{e}$
$\tilde{k}^{e*}$
$\tilde{k}^{ne*}$
$\hat{k}^{ne*}$
$\hat{k}^{e*}$
k_{t+1}

Figure (3)

8. Conclusion:

The literature on the impact of human capital on economic growth often reports insignificant and even negative coefficient on human capital. Many researchers came up with alternative explanations including quality of data, econometric technique etc. According to our best of knowledge no study has introduced the role of governance in terms of corruption except the recent work by Rogers (2008). The cross sectional study by Rogers (2008) uses the corruption index only to obtain the sub-sample of high and low corrupt countries and suggest that the impact of human capital is higher in the sub-sample of low corrupt countries as compared to the sub-sample of high corrupt countries. There is no theoretical work explaining the link of corruption between human capital and growth. In this chapter we considered three period over-lapping generation model with two groups of agents- households and bureaucrats. The households pay lump-sum tax while the bureaucrats hold the public office and are responsible for taxation. Corruption arises through appropriation (stealing) of public funds by the bureaucrats. We consider the dynamic general equilibrium model where the decision of corruptible bureaucrat affects the public finances and hence the capital accumulation in the economy. It is also show that the human capital accumulated by the corrupt bureaucrat increases the stealing efficiency in terms of lower concealment costs. Our results are straightforward; the capital accumulation under education is always higher than the capital accumulation under no education no matter whether bureaucrat engage in corrupt activities or not, the most striking result is the comparison of the capital accumulation in an economy between corrupt and non-corrupt environment while all bureaucrats are educated. The results show that the capital accumulation under no corruption and education is higher than corruption and education.

Human capital has two opposing effects, positive productivity enhancing effect and negative stealing efficiency of corrupt bureaucrats. There may be some development regions where some sample of countries may observe a higher stealing efficiency of corruptible bureaucrats than the productive efficiency due to the accumulation of human capital, the net effect of which may result in the insignificant effect of human capital on growth.

References

Barro, R.J., (1990). “Government Spnding in a simple model of endogenous growth”, *Journal of political economy,* 98, S103-S125.

Bassanini A. and S. Scarpetta (2001). “Does human capital matters for growth in OECD countries? Evidence from pooled mean-group estimates”, OECD Economic Departmetn Working paper no. 282.

Bassanini A. and S. Scarpetta (2002). “Does human capital matters for growth in OECD countries? A pooled mean group approach” *Economic Letters,* 74, pp. 399-405.

Benhabib, J. and Mark M. Spiegel (1994). “The role of human capital in economic development: evidence from aggregate cross-country data.” *Journal of Monetary Economics,* 34, pp. 143-173.

Bond, S. Hoeffler, A., Temple, J. (2001). “GMM estimation in empirical growth models”, CEPR Discussion Paper 3048.

Blackburn, K., Bose, N., & Haque, M. E., (2006), "The Incidence and Persistence of Corruption in Economic Development", *Journal of Economic Dynamics and Control,* 30, 2006: 2447-67.

Caseli, F., Esquivel, G. and Lefort, F. (1996), “Reopening the Convergence debate: a new look at cross-country growth empirics”, *Journal of Economic Growth,* Vol. 1, 3, pp. 363-389.

Cohen D. and M. Soto (2007). “Growth and Human Capital: good data, good results” *Journal of Economic Growth*, 12, pp. 51-76.

de la Fuente A. and Domenech R. (2000). “ Human capital in growth regressions: how much difference does data quality make?” OECD Economic Department Working Paper No. 262, Paris.

de la Fuente A. and Domenech R. (2002). “ Human capital in growth regressions: how much difference does data quality make? An Update and further results”, CFPR discussion paper no. 3587.

Haque, M.E. & Knellar, R. (2007)."Public investment and Growth: The Role of Corruption", CGBR.

Freire-Seren, M. J. (2002), “ On the relationship between human capital accumulation and economic growth”, *Applied Economic Letters*, 2002, 9, pp. 805-808.

Islam, Nazrul (1995), “Growth empirics: a panel data approach”, *Quarterly Journal of Economics*, Vol. 110, 4, pp. 1127-1170.

Krueger, A. and M. Lindhal (2001). “Education for growth: why and for whom?” *Journal of Economic Literature*, 39, pp. 1101-1136.

Kumar C. S. (2006). “Human capital and growth empirics” *Journal of Development Areas*, 40, 1, 153-179.

Lucas, Robert E. (1988), “On the Mechanics of economic development” *Journal of Monetary Economics*, Vol. 22, 1.

Mankiw, N. G., D. Romer and D. N. Weil (1992). "A contribution to the empirics of economic growth." *Quarterly Journal of Economics*, 107, 407-437.

Mauro, P., (2002), " The Persistence of Corruption and Slow Economic Growth", IMF Working Papers, 02/213.

Nonneman, W. and P. Vandhoudt (1996): A further augmentation of the Solow Model and the empirics of economic growth for OECD countries", *Quarterly Journal of Economics* 111, pp. 943-953.

Rogers, M. (2008), "Directly Unproductive Schooling: How Country Characteristics Affect the Impact of Schooling on Growth" *European Economic Review*, 52, pp. 356-385.

Solow, Robert M. (1956), "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, Vol. 70, 1, pp.69-94.

Pritchett, Lant (2001), "Where has all the education gone?", *World Bank Economic Review*, Vol. 15, 3, pp. 367-391.

Temple, J. (1999). "A positive effect of human capital on growth." *Economic Letters*, 65, pp. 131-134.