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Where does Education go? – The Role of Corruption

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Abstract:

This paper provides an explanation for recent empirical evidence on the heterogeneous effects of human capital on economic growth in developing countries. In a two-period overlapping generations economy with physical and capital accumulation, state-appointed bureaucrats are responsible for procuring productive public goods. Corruption arises because of an opportunity for bureaucrats to misappropriate public funds. The decision of the corruptible bureaucrat affects public finances and hence the capital accumulation in the economy. Alongside the positive productivity enhancing effect, human capital is assumed to increase the efficiency of corrupt bureaucrats in embezzlement. If the latter dominates the former, the incentive for bureaucrats to acquire education rises. The net effect may result in an insignificant (or even negative) effect of human capital on growth. Our main results are as follows: (1) corruption is always bad for economic development, but its effect is worse in the economy with (more) human capital; (2) the incidence of corruption may, itself, be affected by both the development and human capital level of the economy; (3) education is good for development when accompanied by good governance, but may be bad for development when governance is bad; and (4) corruption and poverty may co-exist as permanent, rather than just transitory, fixtures of an economy.

Keywords: Corruption, human capital, Public spending, Development

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1. Introduction

The importance of human capital in generating higher productivity and economic growth is undeniable as per the theory of human capital, which has been pioneered by Becker (1964) and Schultz (1981), and followed by the new wave of endogenous growth models such as Lucas (1988) and Romer (1986, 1990). This has been well established in micro-empirical literature as well, which followed the wage equation proposed by Mincer (1974). Yet at macro level, the empirical growth literature is surprisingly mixed in their conclusion and gives conflicting messages on the impact of human capital on economic growth. While following Mankiw, et. al. (1992), a group of studies show that human capital as an additional input in production can explain growth positively, there are a good number of studies that show the negative and/or insignificant coefficient of human capital variable in growth regressions (Benhabib & Spiegel, 1994; De Gregorio, 1992; Islam, 1995; Miller & Upadhyay, 2000; and Pritchett, 2001, 2004, 2006). These studies have identified some specific causes for the poor estimates of human capital on growth, which are necessarily only of empirical nature. For example, country heterogeneity, measurement errors, data quality, alternative estimation methodologies, presence of outliers, and model specification and endogeneity (Baldacci, et. al., 2008; Krueger & Lindahl, 2001; de la Fuente and Domenech, 2000 and 2002, Cohen and Soto, 2007, Bassanini and Scarpetta, 2001; Kumar 2006; Bond, et. al., 2001; Temple, 1999; Caselli, et. al., 1996; Islam 1995).

In a more recent interesting paper, Rogers (2008) has shown empirically more interesting set of causes/channels, which are theoretically intuitive. He has shown that corruption, black market premium and the extent of brain drain are the possible causes due to which education becomes unproductive and fails to produce the desired positive effect of human capital on growth in developing countries. He concludes that human capital matters in the sample of low corrupt countries while it does not have an effect on growth in the sample of high corrupt countries. We provide such a possible explanation on the link between human capital and growth by introducing the explicit role of corruption in a model of education, corruption and economic growth. To the best of our knowledge, there is little or no macro-theoretical explanation on this phenomenon[1].

[1] Eicher, *et.al.*, (2009) is an exception. But we differ from them in two accounts. First, they developed a model on the impact of education on income distribution due to corruption. Second, they relied on the arguments of increase in productivity due to human capital, which results in higher rental opportunity due to higher income of the economy. Whereas, in our model, we are looking into the interplay between human capital and corruption, along with the two opposing effects of human capital accumulation, due to which economy may end up with low growth trajectory along with the possibility of poverty trap.

In order to achieve the above, we utilize the literature on the detrimental effects of corruption on economic growth (Blackburn et. al., 2002; Mauro, 2004) along with the dual but opposing effects of education. While education makes an individual more productive in generating private sector output, at the same time it raises the efficiency of bureaucrats in stealing the public resources. According to this literature, the bureaucratic corruption may arise through different channels, for example, bribery and tax evasion (i.e., Blackburn, *et. al.*, 2006), embezzlement of government resources by public officials (Mauro, 2004) or by misinforming government about the costs and quality of public goods (Haque and Kneller 2009).

The detrimental effect of corruption on growth and development may take place through different channels, for example 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. Following the works of Ehrlic and Lui (1999) and Sarte (2000), the recent theoretical contribution is undertaken by Blackburn, *et.al.*, (2006). The study considers a dynamic general equilibrium model of growth for the joint determination of economic development and bureaucratic corruption. The similar mechanism was emphasized in Mauro (2004) and Blackburn, *et.al.*, (2002) through the existence of strategic complementarities where the corruption becomes inevitable. Another view is put forward by Haque and Kneller (2007) in their analysis that corruption may increase public investment but it lowers the returns to public investment and hence retarding the economic development.

We consider two period overlapping generations (OLG) model with human capital externality in the spirit of Lucas (1988) model and productive use of government expenditures in the spirit of Barro (1990). According to the theoretical predictions of the model, impact of human capital may be retarded by the bureaucratic stealing efficiency. Education has two opposing effects on growth; it may increase the bureaucratic stealing efficiency that reduces the cost of concealment of illegal income or it may have positive productivity effects. If the negative effect of bureaucratic stealing dominates the positive productivity effects, education may retard or even lower growth.

In the first period of life, individuals decide whether to acquire education or work for the home production, supply skilled or unskilled labour and consumes only when they are old. With more human capital the bureaucrats become efficient in reducing the cost of hiding their money as well as their corrupt identity. The concealment costs are the costs associated with hiding the illegal money earned through stealing of government resources. Because if caught the money will be confiscated by the government. In this manner human capital may have harmful effects on economic growth through increased bureaucratic stealing efficiency.

For example, higher human capital leads to higher bureaucratic efficiency which can be used to misappropriate government resources (e.g. stealing) 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 exerts positive effect on growth by raising 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 create 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 retard or even have negative effects on growth.

The remaining of the paper is organized as follows. The section 2 presents the basic framework of the model economy that is prone to bureaucratic corruption. In section 3, we consider the economy with no education while introducing education in section 4. In section 5, we study in details how corruption might affect the development of the economy with education as compared to the case of no education. In section 6, we make few concluding remarks.

2. Basic Framework

Time is discrete and indexed by t = 0…∞. All the agents live for two-periods with constant population and belong to overlapping generations (OLG) 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 all individuals are born with one unit of labour endowment, and among them bureaucrats and unskilled workers 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 misappropriate (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) and consuming when old. All markets are perfectly competitive.

2.1. 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 labour to receive a non-taxable income equal to the market wage paid to households. Any bureaucrat who is willing to accept a salary less than this wage must be expecting to gain through misappropriation (stealing) of public resources and is immediately identified as being corrupt. As in other analyses (e.g., Acemoglu and Verdier 1998; Blackburn et al. 2006; 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 $\tilde{G} = (1 - v\theta)ng$, where '$\theta$' 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 the 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 behaviour 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 being caught, and a probability, $1 - p$, of avoiding detection. 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 possess more stealing efficiency than the less or uneducated bureaucrats and hence the monitoring costs to the government increases with education of bureaucrats.

2.2. Households

Each household of generation *t* saves all of its income to acquire a final wealth of x_{t+1} 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, $U_t = x_{t+1} - b_{t+1} + u(b_{t+1})$, where $x_{t+1} - b_{t+1}$ is consumption, $b_{t+1}$is the bequest and $u(.)$ is a strictly concave function that satisfies the usual Inada conditions. The utility is maximized by setting $u'(.) = 1$, implying an optimal fixed size of bequest from one generation to the next that is $b_{t+1} = b$ 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 acquire education and supply skilled labour (i.e., $H_{t+1} = (1 + h_{t+1})l_{t+1}$) when old. Alternatively they may engage in home production and supply raw labour in the old age of his life. Every household receives bequest b_t and is liable to pay lump-sum taxes of τ_{t+1}. Households consume and leave bequest when old.

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 labour is given as, $u_t^{h,e} = (1 + r^e)b + \lambda(1 + h_{t+1})w_{t+1}^e - \tau_{t+1}^e - b + v(b)$ while the lifetime utility for the household who do not acquire education and supply raw labour is, $u_t^{h,ne} = (1 + r^{ne})(b + \lambda\overline{w}) + \lambda w_{t+1}^{ne} - \tau_{t+1}^{ne} - b + v(b)$, the utility is maximized by setting $v'(.) = 1$, implying an optimal fixed size of bequest from one generation to the next: that is $b_{t+1} = b$ for all t, where $v(.)$ is strictly concave function that satisfies the usual Inada conditions.

2.3. Bureaucrats

Each bureaucrat of generation t saves all of its income to acquire a final wealth of x_{t+1} 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 $V_t = x_{t+1}$. 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 labour, which he uses either to acquire education and accumulate human capital, $H_{t+1} = (1 + h_{t+1})l_{t+1}$ or works for the home production when young and supplies raw labour when old. The bureaucrats are designated as the agents 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 corruption might occur as the bureaucrat may be interested to mismisappropriate (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 misappropriation (stealing) of public funds. The final wealth of such a bureaucrat is $(1 + h_{t+1})w_{t+1}^{e}$if educated and $(1 + r^{ne})\overline{w} + w_{t+1}^{ne}$ 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 $(1 + h_{t+1})w_{t+1}^{e}$ if educated and $(1 + r^{ne})\overline{w} + w_{t+1}^{ne}$ if not educated, as before. If he does not, then his income is uncertain and depends on the amount of fund he misappropriates, the chances of being caught and the penalties incurred if he is exposed. Such a bureaucrat engages in misappropriation 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 misappropriate. The corrupt individuals may try to remain unobtrusive by concealing their illegal income in hiding if he is not caught. In this way, the bureaucrat is assured of retaining illegal income whether he is caught or not and loses only his legal income when 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 manages to save the amount $(1-p)(1+h_{t+1})w_{t+1}^{e}+\theta\mathrm{g}-C^{e}$ if educated and $(1+r^{ne})\overline{w}+(1-p)w_{t+1}^{ne}+\theta\mathrm{g}-C^{\mathrm{ne}}$ if not educated, where '*C*' is the cost of concealment a corrupt bureaucrat has to incur for hiding the amount he misappropriated from public funds. Here 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 misappropriated fund and inversely related to the level of human capital, which can be captured by the following simple function for cost of concealment to the corrupt bureaucrat $C^{e}=[1-\phi(1+h_{t+1})]\theta\mathrm{g}$ if educated (i.e., $h>0$)and $C^{ne}=[1-\phi]\theta\mathrm{g}$ if not educated (i.e., $h=0$). Accordingly, his income when he is educated but non-corruptible is $(1+h_{t+1})w_{t+1}^{e}$ while that of a corruptible bureaucrat is $\theta\mathrm{g}-C^{e}$ with probability *p*, and $[(1+h_{t+1})w_{t+1}^{e}+\theta\mathrm{g}-C^{e}]$ with probability$(1-p)$, implying an expected income of $[(1-p)(1+h_{t+1})w_{t+1}^{e}+\theta\mathrm{g}-C^{e}]$. Similarly, the income of non-corruptible bureaucrat when not educated is $(1+r)\overline{w}+w_{t+1}^{ne}$ while that of corruptible is $(1+r^{ne})\overline{w}+\theta\mathrm{g}-C^{\mathrm{ne}}$ with probability *p*, and $[(1+r^{ne})\overline{w}+w_{t+1}^{ne}+\theta\mathrm{g}-C^{\mathrm{ne}}]$ with probability$(1-p)$, implying an expected income $[(1+r^{ne})\overline{w}+(1-p)w_{t+1}^{ne}+\theta\mathrm{g}-C^{\mathrm{ne}}]$.

So, the expected lifetime income for bureaucrats under different scenario can be written as[2]

$$E\left(z_{t+1}^{b}\right)=\begin{cases}E\left(\hat{z}_{t+1}^{b,e}\right)=E\left(z_{t+1}^{b}\middle|\theta=0,h>0\right)=(1+h_{t+1})w_{t+1}^{e}\\ E\left(\hat{z}_{t+1}^{b,ne}\right)=E\left(z_{t+1}^{b}\middle|\theta=0,h=0\right)=(1+r)\overline{w}+w_{t+1}^{ne}\\ E\left(\tilde{z}_{t+1}^{b,e}\right)=E\left(z_{t+1}^{b}\middle|\theta>0,h>0\right)=[(1-p)(1+h_{t+1})w_{t+1}^{e}+\phi(1+h_{t+1})\theta\mathrm{g}]\\ E\left(\tilde{z}_{t+1}^{b,ne}\right)=E\left(z_{t+1}^{b}\middle|\theta>0,h=0\right)=[(1+r^{ne})\overline{w}+(1-p)w_{t+1}^{ne}+\phi\theta\mathrm{g}]\end{cases}\tag{1}$$

2.4. Firms

The representative firm combines $(1+h_{t+1})l_{t+1}$units of skilled labour when all agents in the economy are educate, with k_{t+1} units of capital to produce y_{t+1}^{e} units of output according to

$$y_{t+1}^{e}=A[(1+h_{t+1})l_{t+1}]^{\alpha}k_{t+1}^{1-\alpha}K_{t+1}^{\alpha}G^{\alpha}\tag{2}$$

($A>0$, $\alpha\in(0,1)$) 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 along with $l_{t+1}=l=\lambda m$ and $k_{t+1}=K_{t+1}$ in the equilibrium implies that wage, and rate of return to capital are as follows:

[2] For brevity, we shall not use the time subscripts for *h* and *w* while describing the respective scenario, as they are from the same time period, t+1.

$$w_{t+1}^{e} = \alpha\left(\frac{a}{l}\right)(1 + h_{t+1})^{\alpha} G^{\alpha} k_{t+1} \quad (3)$$

$$r_{t+1}^{e} = (1 - \alpha)a(1 + h_{t+1})^{\alpha} G^{\alpha} \quad (4)$$

Where, $a = A(\lambda m)^{\alpha}$. On the other hand, following (3) and (4), the representative firm of an economy where no agent is educated combines l_{t+1} units of raw labour with k_{t+1}units of capital to produce y_{t+1}^{ne}units of output according to

$$y_{t+1}^{ne} = Al_{t+1}^{\alpha} k_{t+1}^{1-\alpha} K_{t+1}^{\alpha} G^{\alpha} \quad (5)$$

Profit maximization implies that the wage rate and interest rate are

$$w_{t+1}^{ne} = \alpha\left(\frac{a}{l}\right) G^{\alpha} k_{t+1} \quad (6)$$

$$r_{t+1}^{ne} = (1 - \alpha)aG^{\alpha} \quad (7)$$

2.5. The Incentive to be Corrupt

A corruptible bureaucrat will misappropriate 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 $E\left(\tilde{z}_{t+1}^{b,e}\right) \geq E\left(\hat{z}_{t+1}^{b,e}\right)$ and without education as $E\left(\tilde{z}_{t+1}^{b,ne}\right) \geq E\left(\hat{z}_{t+1}^{b,ne}\right)$. Given the market-determined wage and interest rates in the economy, the above conditions reduce to the following single inequality with respective wage rates

$$pw_{t+1} \leq \phi\theta \mathrm{g} \quad (8)$$

Intuitively, a bureaucrat is more likely to be corrupt the more he expects to gain in illegal income if he evades the detection, and less likely to be corrupt the more expects to lose in legal income if he gets caught. Also, the decision to be corrupt is independent of individual's possession of human capital, h_{t+1}. This result is quite intuitive: as the human capital increases, both potential punishment in terms of loss of salary if caught and potential gain in terms of higher ability to extract net gain due to reduction in concealment cost rise.

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 levels of corruption and human capital accumulation. This reflects that higher wages of the agents imply higher costs to bureaucrats if they are caught, while the expected gain on the right hand side is a constant. 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 decisionmaking 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 which all other corruptible bureaucrats are corrupt. Recall in equilibrium, $l_{t+1} = l = \lambda m$ and from (3), we have $w^e_{t+1} = \alpha a(1 + h_{t+1})^\alpha G^\alpha k_{t+1}$. Thus as mentioned earlier, w_{t+1} is not only determined by the level of human capital stock, h_{t+1}, if the people are educated in the economy, but also by physical capital stock, k_{t+1}, and the total public services, G, both of which are determined by the aggregate level of corruption. On the contrary, w_{t+1} is determined only by physical capital stock, k_{t+1}, and the total public services, G, if the people are not educated in the economy. This can be shown clearly by substituting the values of respective w_{t+1}, with no corruption or the existence of corruption. Given this, the equation (8) can be used to determine the critical levels of capital for an economy with and without education respectively as

$$k^e_{t+1} \leq \frac{\phi\lambda m\theta g}{pa(1+h)^\alpha G^\alpha} \cong \kappa^e \tag{9}$$

$$k^{ne}_{t+1} \leq \frac{\phi\lambda m\theta g}{paG^\alpha} \cong \kappa^{ne} \tag{10}$$

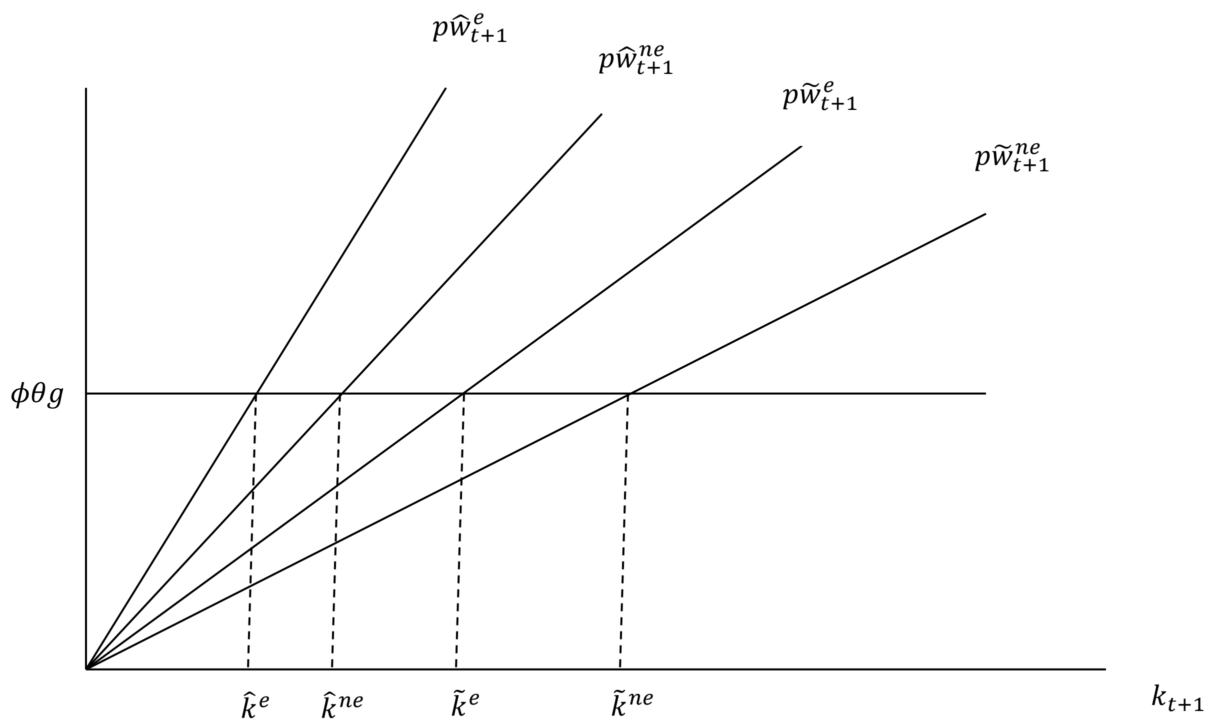

Figure 1: Incidence of corruption, education and development

Consider now the case of (9), where no corruptible bureaucrat is corrupt. Total government expenditure on public good is $G = ng$, while the total public service obtained from this spending is $\hat{G} = n$g.Under this situation, wage rate is $\widehat{w}_{t+1}^{e} = \alpha a(1 + h_{t+1})^{\alpha}(ng)^{\alpha}k_{t+1}$. For the case in which bureaucrats are corruptible, the total productive services in the economy will be, $\tilde{G} = n[v(1-\theta)\text{g} + (1-v)\text{g}] = (1-v\theta)n\text{g}$, under such situation, the wage rate in (9) is $\widetilde{w}_{t+1}^{e} = \alpha a(1+h_{t+1})^{\alpha}(1-v\theta)^{\alpha}(n\text{g})^{\alpha}k_{t+1}$. We may observe that as $\theta \in (0,1)$ and $v \in (0,1)$, it is easily verifiable that $\widetilde{w}_{t+1}^{e} < \widehat{w}_{t+1}^{e}$: that is, for any given stock of capital, k_{t+1} wages are lower under corruption than under non-corruption.

Therefore the incentive condition in (9) can be written below as (11) for the case of no corruption and (12) for the case where all corruptible bureaucrats are corrupt -

$$\hat{k}_{t+1}^{e} \leq \frac{\phi\lambda m\theta\text{g}}{p\alpha a(1+h)^{\alpha}(n\text{g})^{\alpha}} \cong \hat{\kappa}^{e} \tag{11}$$

$$\tilde{k}_{t+1}^{e} \leq \frac{\phi\lambda m\theta\text{g}}{p\alpha a(1+h)^{\alpha}(1-v\theta)^{\alpha}(n\text{g})^{\alpha}} \cong \tilde{\kappa}^{e} \tag{12}$$

Similarly, the incentive conditions under corruption and non-corruption in an economy with no education as given in (10) can be written as

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

$$\tilde{k}_{t+1}^{ne} \leq \frac{\phi\lambda m\theta\text{g}}{p\alpha a(1-v\theta)^{\alpha}(n\text{g})^{\alpha}} \cong \tilde{\kappa}^{ne} \tag{14}$$

2.6. Equilibrium

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 (11) – (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 that with education (i.e., $\hat{k}^{e} < \hat{k}^{ne}$ and $\tilde{k}^{e} < \tilde{k}^{ne}$ as $\widehat{w}_{t+1}^{e} > \widehat{w}_{t+1}^{ne}$ and $\widetilde{w}_{t+1}^{e} > \widetilde{w}_{t+1}^{ne}$). 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., $\hat{k}^{e} < \tilde{k}^{e}$ and $\hat{k}^{ne} < \tilde{k}^{ne}$ as $\widetilde{w}_{t+1}^{e} < \widehat{w}_{t+1}^{e}$and $\widetilde{w}_{t+1}^{ne} < \widehat{w}_{t+1}^{ne}$). Finally, it is revealed that the critical value of capital in a corrupt environment is higher than that in the non-corrupt environment when bureaucrats are educated as $\widehat{w}_{t+1}^{e} > \widetilde{w}_{t+1}^{e}$. 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.

In summary, the relationship between the alternative scenarios are $\widehat{w}_{t+1}^{e} > \widetilde{w}_{t+1}^{e} > \widetilde{w}_{t+1}^{ne}$ that corresponds with the critical values $\hat{k}^{e} < \tilde{k}^{e} < \tilde{k}^{ne}$, and $\widehat{w}_{t+1}^{e} > \widehat{w}_{t+1}^{ne} > \widetilde{w}_{t+1}^{ne}$ that corresponds with the critical values $\hat{k}^{e} < \hat{k}^{ne} < \tilde{k}^{ne}$. But the relationship between $\widehat{w}_{t+1}^{ne}$ and $\widetilde{w}_{t+1}^{e}$ is inconclusive. It is clear that if $h > \frac{v\theta}{(1-v\theta)}$, $\widetilde{w}_{t+1}^{e} > \widehat{w}_{t+1}^{ne}$, which results in $\tilde{k}^{e} < \hat{k}^{ne}$. This means that more corruptible bureaucrats will get incentive to be corrupt in an uneducated economy with no corruption compared to an educated economy with more corruptible corrupt bureaucrats. Accordingly, more bureaucrats will be corrupt in the economy that is non-corrupt but uneducated compared to the corrupt educated one. Our analysis takes the more interesting turn if we assume the reverse inequality[3]:

$$h < \frac{v\theta}{(1-v\theta)} \tag{15}$$

As it already indicates that $h < \frac{1-\phi}{\phi}$ from (1) and we shall see later that $h < \frac{1-\gamma}{\gamma}$ according to the government budget constraint in (18), it is more likely that (15) holds. It is possible that in some development regions the sample of countries may assume the values of the parameter that the inequality (15) holds indicating $\widehat{w}_{t+1}^{ne} > \widetilde{w}_{t+1}^{e}$, implying that in an economy with all educated and all corruptible corrupt bureaucrats the incentive for an individual to be corrupt may be more for an individual to be corrupt under the economy with all non-educated and all non-corrupt bureaucrats. If this is the case, then more education (i.e., higher human capital) in an economy with the widespread corruption would mean that more bureaucrats are attracted to misappropriate the public funds, which would damage productivity and economic growth more severely in that economy. For the rest of our analysis, this is the assumption we are considering.

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[3] $h < \frac{v\theta}{(1-v\theta)}$ is more realistic value compared to its reverse inequality, which interprets that the values of parameters are such that h is bounded up to $\frac{v\theta}{(1-v\theta)}$. The alternative option will result in such a value of h that it will be bounded from below $\frac{v\theta}{(1-v\theta)}$. As in our analysis, an individual without education (i.e., unskilled labourer) has λ units of labour endowment to supply inelastically, it is simply not possible to think that education would make so much of a difference that would make h to assume the values even higher than $\frac{v\theta}{(1-v\theta)}$. Because, just numerically $\frac{v\theta}{(1-v\theta)}$ can have the value as high as 99. So, it is justified to have sufficient condition for $\widehat{w}_{t+1}^{ne} > \widetilde{w}_{t+1}^{e}$ as $0 < h < \frac{v\theta}{1-v\theta}$.

2.7. Public Finance

So far we have discussed that 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 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 fail (succeed) in evading detection due to law of large numbers.

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 $(n\mathrm{g})$ and bureaucratic salaries$[n\widehat{w}^{e}_{t+1}]$.

$$m\hat{\tau}^{e}_{t+1} = n\mathrm{g} + n(1+h_{t+1})\widehat{w}^{e}_{t+1} \quad (16)$$

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

$$m\hat{\tau}^{ne}_{t+1} = n\mathrm{g} + n\widehat{w}^{ne}_{t+1} \quad (17)$$

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 bureaucrats by employing an imprecise monitoring technology that is an increasing function of the human capital accumulated by the bureaucrats and is defined as $d^{e} = \gamma(1+h)n\mathrm{g}$ under education and $d^{ne} = \gamma n\mathrm{g}$ 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 $(n\mathrm{g})$, the salaries of the fraction of non-corrupt bureaucrats $[n(1-v)w^{e}_{t+1}]$, the salaries of the corruptible bureaucrats who escape detection $[n(1-p)vw^{e}_{t+1}]$ and the monitoring cost (*d*). So, in an economy with education and corruption, the government budget is

$$m\tilde{\tau}^{e}_{t+1} = n(1-vp)(1+h_{t+1})\widetilde{w}^{e}_{t+1} + n\mathrm{g} + \gamma(1+h_{t+1})n\mathrm{g} \quad (18)$$

For the economy with no education but corruption, the budget is

$$m\tilde{\tau}_{t+1}^{ne} = n(1 - vp)\widetilde{w}_{t+1}^{ne} + n\mathrm{g} + \gamma n\mathrm{g} \tag{19}$$

A comparison between (16) and (18) under education, and (17) and (19) under no education reveals that for any given w_{t+1} and G, taxes are higher in a corrupt environment than in non-corrupt environment. This is true because corruption leads to a loss of public resources and increase in government (monitoring) expenditure.

3. Capital Accumulation Under no-education

The capital accumulation in the economy with no education, k_{t+1}^{ne}, is equal to the total savings of households plus total savings of bureaucrats which depends on whether corruption exists or not as discussed earlier. In the absence of corruption, each household saves $(1+\hat{r}^{ne})(b+\lambda\overline{w}) + \lambda\widehat{w}_{t+1}^{ne} - \hat{\tau}_{t+1}^{ne}$ and each bureaucrat saves $(1+\hat{r}^{ne})\overline{w} + \widehat{w}_{t+1}^{ne}$, implying total savings in an economy with no education and no corruption, $\hat{s}_{t+1}^{ne} = m(1+\hat{r}^{ne})(b+\lambda\overline{w}) + \lambda m\widehat{w}_{t+1}^{ne} - m\hat{\tau}_{t+1}^{ne} + n(1+\hat{r}^{ne})\overline{w} + n\widehat{w}_{t+1}^{ne}$.

In the presence of corruption, households save $(1+\tilde{r}^{ne})(b+\lambda\overline{w}) + \lambda\widetilde{w}_{t+1}^{ne} - \tilde{\tau}_{t+1}^{ne}$ while each non-corruptible bureaucrat saves $[(1+\tilde{r}^{ne})\overline{w} + \widetilde{w}_{t+1}^{ne}]$ and corruptible bureaucrat saves either $[(1+\tilde{r}^{ne})\overline{w} + \theta\mathrm{g} - C^{\mathrm{ne}}]$ with probability p of being detected or $[(1+\tilde{r}^{ne})\overline{w} + \widetilde{w}_{t+1}^{ne} + \theta\mathrm{g} - C^{\mathrm{ne}}]$ with probability $(1-p)$ of avoiding the detection, the total savings of each of these bureaucrats equals $(1+\tilde{r}^{ne})\overline{w} + (1-vp)\widetilde{w}_{t+1}^{ne} + v\phi\theta\mathrm{g}$. Combining the savings of households and bureaucrats the total savings in an economy with no education and corruption ($i.e.$, $\tilde{s}_{t+1}^{ne}$) are given as $m(1+\tilde{r}^{ne})(b+\lambda\overline{w}) + \lambda m\widetilde{w}_{t+1}^{ne} - m\tilde{\tau}_{t+1}^{ne} + n(1+\tilde{r}^{ne})\overline{w} + n(1-vp)\widetilde{w}_{t+1}^{ne} + nv\phi\theta\mathrm{g}$.

These results can be used to determine two alternative paths of capital accumulation. Using the expressions for $\widehat{w}_{t+1}^{ne}, \hat{r}^{ne}$, and $m\hat{\tau}_{t+1}^{ne}$ from (6), (7) and (17), the capital accumulation in the absence of corruption and education is described by

$$\hat{k}_{t+2}^{ne} = \hat{I}^{ne} + \widehat{\Omega}^{ne} k_{t+1} \tag{20}$$

Where $B = A(\lambda m)^{\alpha}(n\mathrm{g})^{\alpha}$; $\widehat{\Omega}^{ne} = \alpha B$; $\hat{I}^{ne} = [1 + (1-\alpha)B][mb + (\lambda m + n)\overline{w}] - n\mathrm{g}$

Using the expressions for $\widetilde{w}_{t+1}^{ne}, \tilde{r}^{ne}$, and $m\tilde{\tau}_{t+1}^{ne}$ from (6), (7) and (19) along with the expression for B, the capital accumulation in the presence of corruption and no education is obtained by combining the savings of households and bureaucrats as given below

$$\tilde{k}_{t+2}^{ne} = \tilde{I}^{ne} + \widetilde{\Omega}^{ne} k_{t+1} \tag{21}$$

Where, $\widetilde{\Omega}^{ne} = \alpha(1 - v\theta)^{\alpha} B$;

$\tilde{I}^{ne} = [1 + (1 - \alpha)(1 - v\theta)^{\alpha} B][mb + (\lambda m + n)\overline{w}] - [1 + (\gamma - v\phi\theta)]ng$

The equations (20) and (21) exhibit the stationary points associated with the steady state levels of capital as

$$\hat{k}^{ne^*} = \frac{\hat{I}^{ne}}{(1 - \hat{\Omega}^{ne})} \quad (22)$$

and

$$\tilde{k}^{ne^*} = \frac{\tilde{I}^{ne}}{[1 - \tilde{\Omega}^{ne}]} \quad (23)$$

It is quite obvious that $\tilde{k}^{ne^*} < \hat{k}^{ne^*}$ for any given k_{t+1}. The capital accumulation is lower when corruption is widespread in an economy with no-education. 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 equilibrium. The incentive condition to be corrupt defines that 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 figures (2) and (3). Assume that $\kappa^{ne} < \tilde{k}^{ne^*}$then the economy evolves along $\tilde{k}^{ne}_{t+1}$ until it reaches κ^{ne} and then it approaches $\hat{k}^{ne}_{t+2}$ and reaches $\hat{k}^{ne^*}$. This process describes the process of transition from the low development regime with high corruption to the high development regime with low corruption. Now consider $\kappa^{ne} > \tilde{k}^{ne^*}$, the economy is locked forever on $\tilde{k}^{ne}_{t+1}$, converging forever towards to $\tilde{k}^{ne^*}$. In this case there is no transition and the economy remains poor and corrupt forever.

4. Capital Accumulation with education

Like before, the capital accumulation in the economy, k^e_{t+1}, is equal to the total savings of households plus total savings of bureaucrats which depends on whether corruption exists or not. In the absence of corruption, each household saves $(1 + \hat{r}^e)b + \lambda(1 + h_{t+1})\widehat{w}^e_{t+1} - \hat{\tau}^e_{t+1}$ and each bureaucrat saves $\widehat{w}^e_{t+1}$, implying total savings in an economy with education and no corruption, $\hat{k}^e_{t+1} = m(1 + \hat{r}^e)b + \lambda m(1 + h_{t+1})\widehat{w}^e_{t+1} - m\hat{\tau}^e_{t+1} + n(1 + h_{t+1})\widehat{w}^e_{t+1}$.

In the presence of corruption, savings of households are $(1 + \tilde{r}^e)b + \lambda(1 + h_{t+1})\widetilde{w}^e_{t+1} - \tilde{\tau}^e_{t+1}$ while each non-corruptible bureaucrat saves $(1 + h_{t+1})\widetilde{w}^e_{t+1}$ and corruptible bureaucrat saves either

$\theta g - C^e$ with probability p of being detected or $(1 + h_{t+1})\widetilde{w}_{t+1}^e + \theta g - C^e$ with probability $(1 - p)$of avoiding the detection, implying total savings in an economy with education, $\tilde{s}_{t+1}^e = m(1 + \tilde{r}^e)b + \lambda m(1 + h_{t+1})\widetilde{w}_{t+1}^e - m\tilde{\tau}_{t+1}^e + n(1 - vp)(1 + h_{t+1})\widetilde{w}_{t+1}^e + nv\phi(1 + h_{t+1})\theta g$.

These results can be used to determine two alternative paths of capital accumulation. Using equations (6), (7), and (16), the capital accumulation in the absence of corruption in the economy with education is described by

$$\hat{k}_{t+2}^e = \hat{I}^e + \widehat{\Omega}^e k_{t+1} \tag{24}$$

Where, $\widehat{\Omega}^e = [\alpha(1 + h_{t+1})^{1+\alpha}B]$; and $\hat{I}^e = [1 + (1 - \alpha)(1 + h_{t+1})^{\alpha}B]mb - ng$

Using equations (6), (7), and (18), the capital accumulation in the presence of corruption in the economy with education is described by

$$\tilde{k}_{t+2}^e = \tilde{I}^e + \widetilde{\Omega}^e k_{t+1} \tag{25}$$

Where, $\widetilde{\Omega}^e = [\alpha(1 + h_{t+1})^{1+\alpha}(1 - v\theta)^{\alpha}B]$; and

$\tilde{I}^e = [1 + (1 - \alpha)B(1 + h_{t+1})^{\alpha}(1 - v\theta)^{\alpha}]mb - [1 + (1 + h_{t+1})(\gamma - v\phi\theta)]ng;$

The equations (24) and (25) exhibit the stationary points associated with the steady state levels of capital

$$\hat{k}^{e^*} = \frac{\hat{I}^e}{[1 - \widehat{\Omega}^e]} \tag{26}$$

and

$$\tilde{k}^{e^*} = \frac{\tilde{I}^e}{[1 - \widetilde{\Omega}^e]} \tag{27}$$

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 and 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 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 determine the outcome defined as the poverty trap equilibrium.

5. Education, Corruption and Growth: An Evaluation

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

Since $(1+h)^{1+\alpha} > 1$ and $(1-v\theta) < 1$, the capital accumulation in (20) – (21) and (24) – (25) suggests $\hat{\Omega}^e > \hat{\Omega}^{ne}$, $\hat{\Omega}^e > \tilde{\Omega}^e$, $\tilde{\Omega}^e > \tilde{\Omega}^{ne}$, $\hat{\Omega}^{ne} > \tilde{\Omega}^{ne}$ and $\hat{\Omega}^e > \tilde{\Omega}^{ne}$. Ambiguity arises for comparison between $\hat{\Omega}^{ne}$ and $\tilde{\Omega}^e$, where we see that education increases the productivity of the individual while the associated corruption dampens it. But as $(1+h)^{1+\alpha}$ is the expression of the effects of both individual's acquired skill and economy-wide human capital, it is more likely that the positive effect due to $(1+h)^{1+\alpha}$would be higher than the negative effect of corruption. Therefore, $\hat{\Omega}^{ne} < \tilde{\Omega}^e$. It suggests that $\hat{\Omega}^e > \tilde{\Omega}^e > \hat{\Omega}^{ne} > \tilde{\Omega}^{ne}$. As under no education scenario the households will start earning from quite early in their life, automatically this would mean that uneducated households would start their life with higher income when capital is very low (i.e., near zero). This would cause the intercepts under non-education scenario to be higher than that under education scenario. Therefore, the comparison of intercepts would reflect it as $\hat{I}^e < \hat{I}^{ne}$ and $\tilde{I}^e < \tilde{I}^{ne}$. Also $\hat{I}^e > \tilde{I}^e$ (as $(1-v\theta) < 1$ and $(\gamma - v\phi\theta) > 0$), $\hat{I}^{ne} > \tilde{I}^e$ (as $\hat{I}^{ne} > \hat{I}^e > \tilde{I}^e$), $\hat{I}^{ne} > \tilde{I}^{ne}$, $\tilde{I}^{ne} > \tilde{I}^e$, $\hat{I}^e > \tilde{I}^{ne}$ (as $\hat{I}^e < \hat{I}^{ne}$, $\hat{I}^{ne} > \tilde{I}^e$ and $\tilde{I}^{ne} > \tilde{I}^e$). The comparison of intercepts reveals that $\hat{I}^{ne} > \hat{I}^e > \tilde{I}^{ne} > \tilde{I}^e$.

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 (2) we suppose that $\kappa^{ne} < \tilde{k}^{ne^*}$ implies that transition between development regimes is feasible in an economy under no education and $\tilde{k}^{e^*} < \tilde{k}^{ne^*}$ in figure (1.2) 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 of the change in the incentive condition. In an economy with education, the bureaucrats now engage 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) shows that corruption dampens the effect of education such that it causes the economy to reach at a steady-state which is lower than what the economy could reach at even without education while there is no corruption.

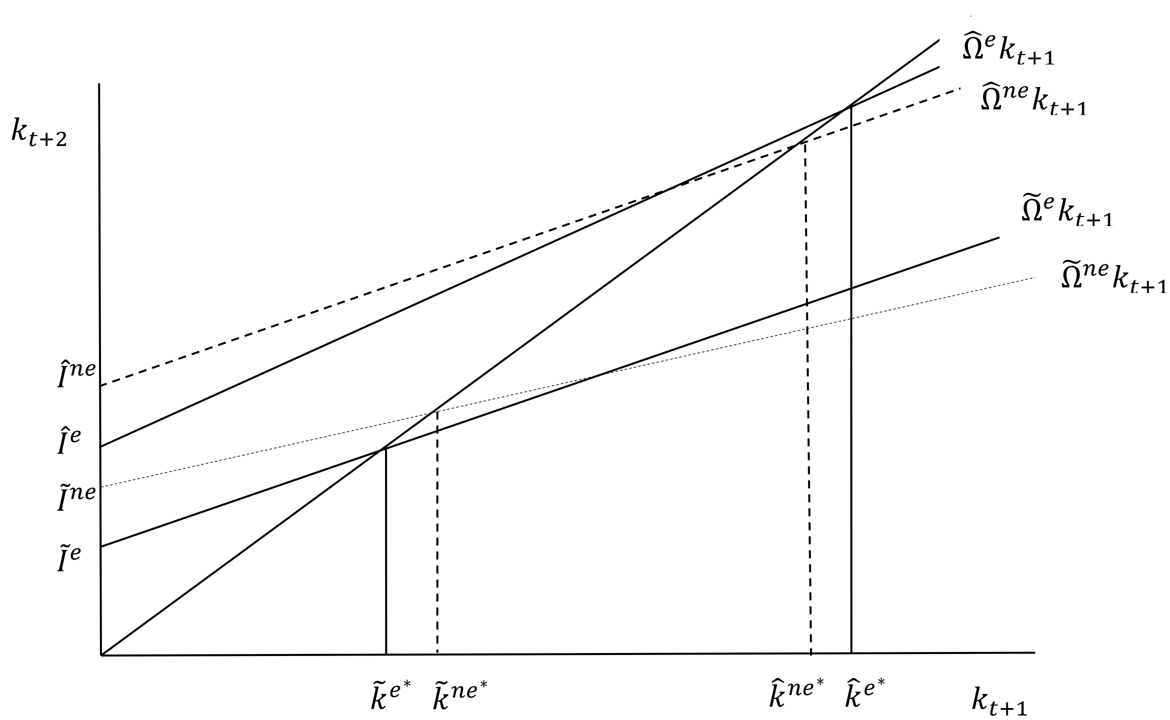

Figure (2): Capital Accumulation

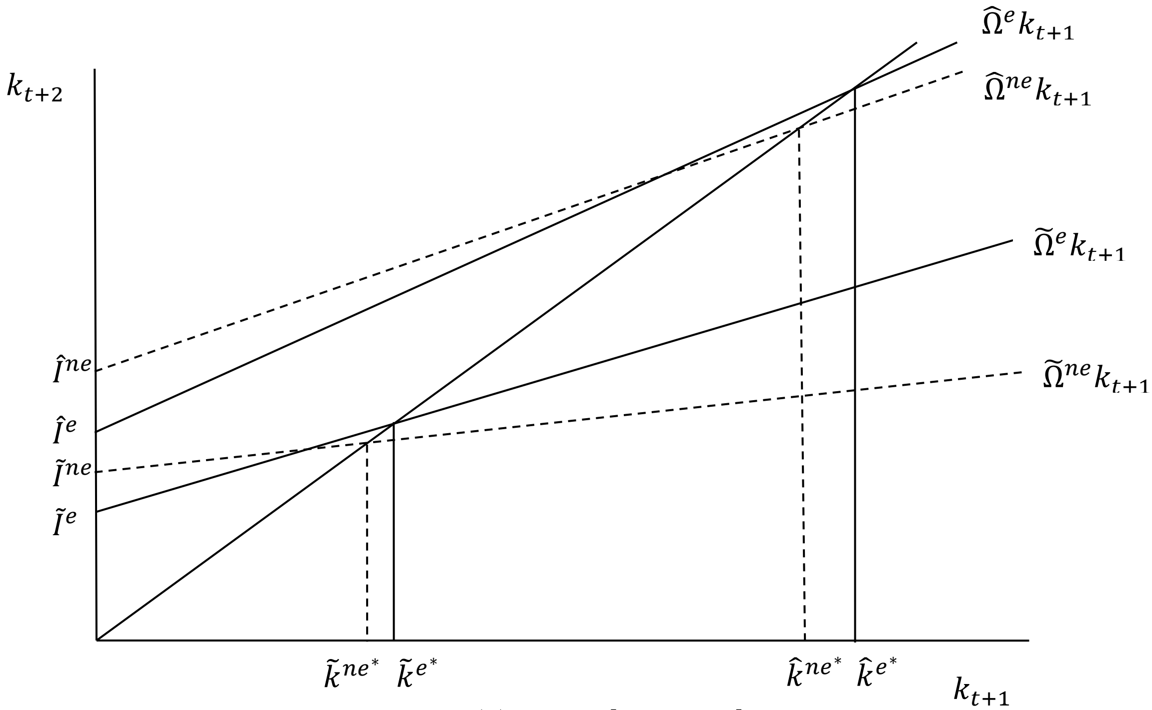

Figure (3): Capital Accumulation

6. Conclusion

While there is a consensus in the human capital theory regarding the important role of human capital in generating economic growth, along with a consensus on its impact on individuals' earnings according to micro-empirical literature, empirical growth literature seems to provide mixed results of human capital on economic growth. Most of the researchers blame this to the quality of data, and econometric techniques 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 paper we considered two period over-lapping generations 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 and provision of public services. Corruption arises through misappropriation (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 shown 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.

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