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Corruption, Tax Evasion and Economic Development in Economies With Hierarchial Tax Administrative System

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Preface

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Since the second half of 2018 we have had issues with our regular editing services, as a result of which there has been a growing backlog of working papers that had been approved by the editorial committee. To avoid further delays in dissemination of the ongoing research, we decided to publish approved but unedited working papers online. Working paper No 03-18, December 2018 was the first such paper.

ABSTRACT

The paper looks into joint determination of corruption and development where there is hierarchial bureaucratic setup; tier one-bureaucrat and tier two bureaucrats. Corruption happens at two level once when tier one bureaucrat collude with households for tax evasion and another when tier one and tier two bureaucrats collude to hide corruption.. The paper determines that at high level of corruption, there is low development and at low incidence of corruption, there is high development.

Key words: Corruption, Tax Evasion, Economics Growth

JEL Classification: E02, E26, E42

1. Introduction

There has been consistent focus on the effect of corruption economic growth and development. The evidence in theoretical paper shows that there is negative relationship between corruption and growth through multiple channels, (Shleifer & Vishny, 1993; Barreto & Alm, 2003; and Wadho, 2013). The empirical literature shows that economies with high incidence of corruption have low economic growth and development figures, (Mauro, 1995; Mo, 2001). The paper tries to explore corruption in tax compliance problem under hierarchical bureaucratic setup where tax collectors can collude with tier two bureaucrats (superiors tax officers) and taxpayers, and its repercussions for economic growth and development.

Corruption is defined as misuse of public office for private gains, (Barreto, 2000; Banerjee, Mullainathan & Hanna, 2012). According to Barreto and Alm (2003), these public officials are repeatedly found self seeking, and they abuse there public position for personal gains. Their actions like demanding bribe to issue license, exchange of money for awarding contracts, stealing from public treasury and selling government_ owned commodities in black.

A corrupt economy has inefficient institutions that appear in the form of weak legislative and judicial systems along with bureaucratic red tape dampen the economic growth, (Mo, 2001; Aidt, 2009). Corruption through misallocation od resources and unequal distribution of wealth in economy slowdowns growth and lowers living standards of the economy, (Blackburn, Bose & Haque, 2010).

Shleifer and Vishny (1993) elaborates that corruption is expensive. The demand for secrecy shifts country's investment away from highest value project (health and education) towards potentially useless projects (infrastructure). Mauro (1995) finds that corruption lowers private investment, thereby reducing economic growth. Mo

(2001) established that economic growth decreases by 0.72% when corruption increases by 1%. Corruption reduces sustainable development in the form of reduced growth in genuine wealth, (Aidt, 2009).

Corruption in economy leads to tax evasion, as Barro (1991) states tax financed government services (utility and production) enhance growth. Tax revenue is utilized for public and physical capital investment, which converts raw material into output. Romer (1994) states that as physical capital increases economy moves towards high growth. Increased physical capital leads to spillovers, leading to economic growth and development, (Solow, 1994).

Tax evasion is a form of corruption, which has varied impact on economic growth. Lin and Yang (2001) in static model analysis shows that at low level of taxes, the extent of tax evasion was small and the growth was decreasing. Furthermore, the dynamic model showed that increase in the level of taxes allows tax evasion lading to increased saving, investment and growth in economy. Eichhorn (2001) show that tax evasion is beneficial for growth as households evade taxes only if it is profitable only if it leads to increased savings. The poor provision of public goods does not have an impact on growth.

Fiscal decentralization classifies the government into tiers where the local government acts as a subordinate tier in a multi-tiered system, the principle defining the roles and responsibility of each tier are clearly defined, (Shah & Shah, 2007; Bjedov & Madies, 2010). According to Amagoh and Amin (2012) such classification of the government into tiers improves the efficiency level along with economic growth and output. Hierarchical tax administrative system if fiscal decentralization of federal bureau department where superiors delegate the task of tax revenue collection to tax inspectors but also monitors them. Although in corrupt economy the advantages

are overshadowed by disadvantage of poor accountability and efficiency. Shleifer and Vishny (1993) points out that delegation of power results in dispersion of government decision making, which leads to lack of coordination and thus rent extraction.

Enikolopov and Zhuraasvkaya (2003) find that strong party system is beneficial for decentralization in less developed economies for better provision of public goods and government quality and economics growth. Fan, Lin and Triesman (2009) find that increased government tiers leads to bribery in government contracts and public services (utilities and customs).

Blackburn, Bose and Haque (2010) (hereafter BBH) model employs bureaucrats as agents of the government for tax collection. Corruption as bribery takes place among tax collectors and households. Wadho (2009) (hereafter W-model) models uses the endogenous monitoring where corruption of tax collectors can be caught. Corruption happens wen corrupt tax collector matches corrupt household. The model setting combines aspects of BBH model W- model. The population setup and external monitoring is taken from W-model. The tax collectors and household setup is same in but my model adds in another player, tier two bureaucrat. Tax administrative department is two tiered; tier one bureaucrats are tax collectors hired by the government and government for monitoring of tax collection and maintaining a corrupt free environment hires tier two bureaucrats know as effective auditors. Taxes are collected from high-income household on the tax rete determined by the government.

Tier one and tier two bureaucrats have opportunity to be corrupt. Two levels of corruption are: 1) bribery that tier on bureaucrats receive from households to be reported as low income. 2) pay off to tier two bureaucrats by tier on bureaucrats during audit if they are caught. The payoffs among the bureaucrats are decide through

Nash bargaining, (Cerqueti & Coppier, 2009). The focus of the model is not just tax collection but also the saving of the economy as it leads to economic growth. The model shows that investment in equilibrium with corruption is low compared to investment in equilibrium with no corruption. In addition, public goods are rival and non excludable and the agents in the economy luv for two time periods and two generation.

The remaining of the paper is organized in the following manner, section 2 gives a description of the economy along with model setup, section 3 analyze the incentive to be corrupt in society. The next section elaborates on equilibriums' of the model, then in section 5 I explain the two way relationship between corruption and economic growth and development. Section 6 gives comparative statistics a and last section concludes the findings.

2. Framework

2.1. The Environment- Economy

There is overlapping generation model where each generation consists of constant population *N*, who live for two time periods and are risk neutral. A proportion □ ϵ (0,1) of agents are corruptible, i.e. they will be corrupt if it pays them to be corrupt and the remaining fraction *(1-□)* is not corruptible, who irrespective of the monetary gains will stay honest. Agents of each generation, are divided into three sets; private individuals referred to as *households* of which there is a fixed measure *n*, for the purpose of collecting taxes there is a fixed mass of *m* tax collectors classified as *tier one bureaucrats* and the hiring and overseeing of the tier one bureaucrats is done by a fixed mass *s* of *tier two bureaucrats* (known as super auditors) where $n<m<s$ and $n+m+s=N$. In the economy, households are differentiated on the basis of their labor endowment, which determines their relative income and their propensity to

be taxed. A fraction □ ϵ (0,1), of households are endowed with □ >1 units of labor (high income bracket) who are liable to pay a proportional tax □ ϵ (0,1) which is decided by the government, while the remaining fraction *(1-* □*)* have labor endowment □ =1(low income bracket) and they are not liable to pay any taxes. The government is aware of the total □ without knowing the individual taxes due by households. I assume that both tier one and tier two bureaucrats are not liable to pay taxes, i.e. they are low type, whereas tier two gets a premium $\upsilon < \varepsilon$.[1] The tax is collected by the tier one bureaucrats from $\frac{2n}{2m}$ households. At the first level, corruption takes place when tax collector conspires with households to conceal their information about their true income. In this scenario, the tax collector expects a gain in the form of bribe and households expect gains in the form of tax evasion. There is a fraction $\lambda \epsilon (0, 1)$ of tax collectors, which are corrupt in this way and the remaining fraction *(1-* □*)* are honest (non-corrupt). At the second level, corruption happens when during the audit this misreporting is revealed to tier two bureaucrats. I assume that when superior is honest, then, corrupt tier one bureaucrat is reported and punished. When corrupt tier one bureaucrat matches with corruptible tier two bureaucrat, then, later does not reveal this misreporting, and former pays him share out of total bribes determined through Nash bargaining.

All agents in the society work (save) during the 1st time period and consume in the 2nd time period. The firms are responsible for the output production, of which there is continuum of unit mass. The households provide the labor for hiring to the firms and the firms hire the rent capital from all agents of the society. All markets are perfectly competitive.

[1] *This is to simplify the model and I believe it does not affect the qualitative results of this model. .*

2.2. Households

Households of generation $i = (1,2)$ at time period t earn income $I_{i,t}$ by supplying their labor to firms in the private market and earn wages, $w_{i,t}$. Each household faces a linear utility function of its expected income. A household which have labor endowment □ =1 earns labor income w_i in each time period and are exempt from taxes. Households with labor endowment □ >1 earns labor income □w_i and pay proportional tax □ to the government. Both the high income and the low-income household save their current wages at the prevailing market interest rate for the next time period r_{t+1}, which, is received in the next period to be consumed with the next period wages. For the time period *t+1* the income for the household is I_{it+1} and the wages are $w_{i,t+1}$, as I will show in the steady state where $w_{i,t} = w_{i,t+1}$.I focus only on high-income households, as they are the ones who are liable for taxes and could collude with the tax collectors (tier one bureaucrats) for tax evasion. Honest households do not evade taxes such that their net income equal to $\varepsilon w_{i,t}\ (1-\tau) + r_{t+1}\varepsilon w_{i,t}(1-\tau) + \varepsilon w_{i,t+1}(1-\tau)$. Since in the steady state $w_{i,t} = w_{i,t+1}$, for the next section onwards I use *w* without the subscript. For corruptible households, there income is uncertain and depends on the bribe that they pay to bureaucrat and the probability of being caught. With probability p their corruption is detected through audit. I assume that the effective probability depends on the type of tier two bureaucrats. With probability θ, tax collector matches with a corruptible tier two bureaucrat. In this case, tier two bureaucrat does not reveal this corruption and they bargain on the share of bribes that each of them receive.Given this the effective probability of being caught $p(1-\theta)\ \epsilon\ (0,1)$. I assume that when detected, a corrupt household is asked to pay its taxes. Given this, the net income of corruptible household is

$$E(I;b,r) = \begin{cases} \varepsilon w(1-\tau)(2+r_{t+1}), & if\ \ b=0 \\ \varepsilon w(2+r_{t+1})(1-b_t-p(1-\theta)\tau), & if b>0 \end{cases} \quad (1)$$

Where b >0 implies that the household is involved in corruption.

2.3. Tax Collectors- Tier One Bureaucrats

Tax collectors differ in their behavior in public offices. They supply inelastically their unit endowment of labor to government and earn wages equal to, w_g in each time period. Any bureaucrat (corruptible or non-corruptible) working for a firm, while supplying one labor unit to receive a non-taxable wage equal to the wage paid to households. Therefore, any bureaucrat who is willing to accept a wage less than the stated wage must be expecting to receive recompense through bribery and hence is identified as being corrupt.[2] Each bureaucrat has $\frac{2\mu n}{2m}$ households under his jurisdiction. Honest bureaucrats do not indulge in corruption and earn a lifetime income, $w_g(2+r_{t+1})$. Whereas, corruptible tax inspectors can be corrupt if it pays them to be corrupt. Only the households, which are corrupt pays $\frac{2\theta\mu n}{2m}$ to the corrupt tax collector. Further, I assume that an honest household even when he encounters corrupt bureaucrat, he refuses to collude and declares his true income. Thus, with probability θ, a corruptible tax collector matches with a corruptible household who pays him bribe (b) and collude to hide his true income.

There is a fraction □ ϵ (0,1) of corruptible tax collector who are corrupt and demand bribes to conceal information about households' income. For corrupt bureaucrats, their income is uncertain and depends on chances of being caught, bribe they receive, penalty associated with being corrupt, and the return they get on their investment from bribe income. They face a effective probability $p(1-\theta)$ of being caught through audit. Particularly, with probability *(1-□)* tax inspector matches with

[2] *See Blackburn, Bose and Haque, 2010 for more discussion.*

honest tier two superior who reports his corruption. With probability tax inspector matches with corruptible tier two bureaucrats, who demands a share ϵ (0,1) from bribe income to conceal his corruption. I assume that tax inspector is willing to pay this share and its value is determined through Nash bargaining. Since, corruption is illegal, tax inspector invests bribe income differently from wage income, i.e. he invests it in black market. We assume that black market rate of return is smaller and is equal to $r_{t+1} - \rho$, where $\rho > 0$.

I assume that when tax inspectors are caught through the audit, their entire income is confiscated which constitute of their earnings along with the bribe they have received form household. Given this the expected net income of a corruptible tax inspector is

$$E(I; b, r) = \begin{cases} w_g(2 + r_{t+1}) & b = 0 \\ [1 - p(1-\theta)]\left\{w_g(2 + r_{t+1}) + (2 + r_{t+1} - \rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon w b_t(1-\varphi)\right\}, & b > 0 \end{cases} \quad (2)$$

2.4. Super Auditors- Tier Two Bureaucrats

Tier two bureaucrats supply their labor to government and earn wage equal to υw_g, where 1< $\upsilon < \varepsilon$. This implies that tier two bureaucrats are paid a higher wage than tier one bureaucrat whereas for simplicity I assume that they do not pay taxes. Honest tier two bureaucrats do not collude with tax inspectors and they earn only wage income, whereas corruptible tier two bureaucrats collude with corrupt tax inspectors and their income is uncertain. The bribe income of tier two bureaucrats depends upon the bribe paid by the corrupt households and the corrupt tax collectors $\left(\frac{2\theta\mu n}{2m}\right)\left(\frac{2\theta m}{2s}\right)$ since $m < s$ there would $\frac{m}{s}$ tax collectors under tier two bureaucrats. Symmetric to tier one bureaucrat, I assume that when tier two bureaucrats are caught being corrupt, their entire income is confiscated, and they invest their bribe income in

black market that earns smaller return. Given this, the expected net income of tier two bureaucrats is

$$E(I;b,r)=\begin{cases} \upsilon w_g(2+r_{t+1}), & \varphi = 0, b = 0 \\ (1-p)\left[\upsilon w_g(2+r_{t+1})+(2+r_{t+1}-\rho)\left(\frac{\theta\mu n}{s}\right)\varepsilon w b\varphi\right], & \varphi > 0, b > 0 \end{cases} \quad (3)$$

2.5. Government

Government provides public goods through revenues which are collected through levying a proportional tax on high-income households, along with the fine that is collected from tier one and tier two bureaucrats when they are caught being corrupt. Government audits the conduct of bureaucrats that costs it resources. For simplicity, I assume that cost of auditing is equal to revenues collected through successful auditing. Government assigns a fixed proportion, □ □ (0, 1) of tax revenue generated on public goods, G_t and the remaining portion to the payment of wages to tier one and tier two bureaucrats. Given that no corruptible bureaucrat would ever reveal himself in the way described above. Therefore, to minimize the labor costs the government set the wages of all bureaucrats equal to the wages households receive from the private firms to ensure complete bureaucratic participation, (Blackburn et.al, 2010).

2.6. Firms

The representative firm produces output according to following Cobb-Douglas production function

$$Y_t = AL_t^{\beta}K_t^{1-\beta}G_t^{\alpha} \quad (4)$$

When there is congestion of the public services (Barro & Sala-I-Martin, 1992), such that $G_t={}^{G}/_{K}$, where *G* is the quantity of the public services and *K* is the private capital available to the private firms. Public good are rival and non-excludable i.e.

there is congestion[3]. Given there is congestion of public goods the production function becomes

$$Y = AL_t^{\beta} K_t^{1-\beta} \left(\frac{G_t}{K_t}\right)^{\alpha} \tag{5}$$

Where A>0, □ ,□ □ (0, 1), □ + □ < 1. Also L_t is the labor of the economy and K_t is the capital of the economy. The firms hire the labor from the households at competitive wage rate w_t and rents capital at competitive rental rate r_t. Profit maximization implies that

$$w_t = \beta A L_t^{\beta-1} K_t^{1-\alpha-\beta} G_t^{\alpha} \tag{6}$$

$$r_t = (1-\alpha-\beta) A L_t^{\beta} K_t^{-\alpha-\beta} G_t^{\alpha} \tag{7}$$

3. The Incentive to be Corrupt

I look into the behavior of households, tax collectors and tier two bureaucrats in the environment of tax evasion and bribery[4]. In two-dimensional problem where tier one bureaucrats decide whether to be corrupt or not and later to decide on the minimum bribe that is acceptable to them while considering the share the φ that they would have to give to tier two bureaucrats in order to evade being caught through the effective auditing. The share of bribe □ is decided between tax collector and tier two bureaucrats through the Nash bargaining. The point where they will both agree will decide the share. By including in this bargaining, a tax collector maximizes the net benefits from this collusion. If he colludes, the effective probability of being caught is smaller. It is equal to $p(1-\theta)$ because his corruption can only be revealed if he

[3] *Relative congestion: you benefit from the public good if you utilize it, otherwise there is no impact on the non-user utility.*

[4] *My model looks at the economy in equilibrium such that w_g= □ as stated wage to private and public agents is same.*

matches with honest auditor. However, he will have to share bribe income with corrupt auditor. Moreover, if he does not collude, he is going to be caught with probability (p) irrespective of who is the auditor. Given this the net gains of colluding for tax collector with tier two bureaucrat are

$$\Delta B_1 = \left\{[1-p(1-\theta)]\left[w(2+\ r_{t+1}) + (2+\ r_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon w b(1-\varphi)\right] - (1-p)\left[w(2+\ r_{t+1}) + (2+\ r_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon w b\right]\right\}^{0_1}$$

$$\Delta B_1 = \left\{p\theta w(2+\ r_{t+1}) + (2+\ r_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon w b([1-p(1-\theta)] - [1-p])\right\}^{0_1} \quad (8)$$

Similarly, net gains of tier two bureaucrats from this collusion is

$$\Delta B_2 = \left\{\left[\upsilon w(2+\ r_{t+1}) + (2+\ r_{t+1}-\rho)\left(\frac{\theta\mu n}{s}\right)\varepsilon w b\varphi\right] - \upsilon w(2+\ r_{t+1})\right\}^{O_2} \quad (9)$$

$$\varphi^{NB} = \Delta B_2 . \Delta B_1$$

Keeping this in mind following share of bribe is given as

$$\varphi^{NB} = \left[\frac{O_2}{0_1+O_2}\right].\left[\frac{p\theta}{[1-p(1-\theta)]}\right]\left[1+\frac{(2+\ r_{t+1})}{(2+\ r_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon b}\right] \quad (10)$$

From the above expression, I establish the share of bribe tier two bureaucrats demand of the tax collectors. The comparative statistics $\frac{\partial(\varphi^{NB})}{\partial O_2} > 0$, which explains that increase in bargaining power of tier two bureaucrats, increases their share in bribe, by $\frac{\partial(\varphi^{NB})}{\partial 0_1} < 0$ we see that if the bargaining power of the tax collectors increases the share in bribe of tier two collectors would decrease. The increase in the rate of interest, the bribe and the proportion of corruptible agents have a negative impact on the share of tier two bureaucrats on bribe, ($\frac{\partial(\varphi^{NB})}{\partial\ r_{t+1}} < 0$, $\frac{\partial(\varphi^{NB})}{\partial b_t} <$

$0, \frac{\partial(\varphi^{NB})}{\partial\theta} < 0$). If the probability of being caught were to increases the share would also increases to cover the risk associated with it, $\frac{\partial(\varphi^{NB})}{\partial p} > 0$.

The tax collectors are corrupt only when the expected utility from being corrupt leaves no worse than not getting a bribe. The bribe would be large enough to cover the risk and share of tier two bureaucrats. I find that corruptible tax collector will be corrupt if

$$b_t^* \geq \frac{p(1-\theta)(2+\mathrm{r}_{t+1})}{[1-p(1-\theta)](2+\mathrm{r}_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon(1-\varphi)} \tag{11}$$

The second incidence of the corruption happens when the tax collectors and the households collude together to hide the true extent household's income. The corrupt high-income households will be willing to pay a bribe as long as it feasible for them, such that expected utility of from paying the bribe and the expected utility from not paying is at least equal. Keeping this in mind the optimum bribe rate for the households is calculated through equation (1) and is estimated to be

$$b_t^* = [1-p(1-\theta)]\tau_t \tag{12}$$

Equation 12 states that the households will not pay the tax collectors more than they expect to save from tax evasion. In my model incidence of corruption happens only when the tax collectors and the households concur on the same bribe such that they are simultaneously satisfy one another, this is seen when equation (11) and (12) are solved together

$$[1-p(1-\theta)]\tau_t \geq \frac{p(1-\theta)(2+\mathrm{r}_{t+1})}{[1-p(1-\theta)](2+\mathrm{r}_{t+1}-\rho)\left(\frac{\theta\mu n}{m}\right)\varepsilon(1-\varphi)} \tag{13}$$

The above condition relies on the economy wide variable τ and r_{t+1}. The current tax rate and the future market interest rate are of interest; determined by the

current economic situation in the economy. The prevalent economic condition in the economy accounts for corruption in my model. The current statistics show the presence of corruption will provide incentive to the upcoming bureaucrats. The current time period *t* corruption will determine the future corruption, which in return determines the future market interest rate.

The behavior of the economy is analyzed under two scenarios 1) economy where there is no corruption, 2) economy where there is corruption. Furthermore, the model looks into the behavior of capital in steady state alone such that $Y_{1,t} = Y_{1,t+1}$ *and* $Y_{2,t} = Y_{2,t+1}$ *and* $Y_{1,t} = Y_{1,t+1} = Y_{2,t} = Y_{2,t+1} = Y$ and $K_{1,t} = K_{1,t+1}$ *and* $K_{2,t} = K_{2,t+1}$ *and* $K_{1,t} = K_{1,t+1} = K_{2,t} = K_{2,t+1} = K$. From here onwards, I do not use subscript. Solving the equation (3), (4) and (5) I find the current market interest rate and the current wage in the market. Where $w = \beta L^{-1} \Psi K^{\chi}$ and $r = (1 - \alpha - \beta) \Psi K^{\chi - 1}$this shows that economy wide variable rely on the labor force in the market along with the labor and capital share in the output function. Furthermore, the presence of K show that the current level of the capital in the economy plays a dominant role for the determination of current wage, current market interest rate. Seeing this relation, I can conclude that the presence of future capital K_{t+1} would determine the future market interest rate r_{t+1} that would be accounted as the investment of the economy for the economic growth. In my model there fixed proportion for the government services such that $G_t = \Phi Y_t$, thus when in equilibrium I see that that the total labor supply $L = [(1 - \mu) + \varepsilon\mu]n$, which is the sum of total labor supply of high income households $\varepsilon\mu n$ and labor supply of low income

households $(1-\mu)n$.[5] I find the government share in the economy through $G = \Psi K^{\chi}\Phi$ where $\Psi = \left[A(\Phi)^{\alpha}L^{\beta}\right]^{1/1-\alpha}$ and $\chi = \frac{1-\alpha-\beta}{1-\alpha}$.

The economy follows balanced budget condition *tax revenues = G+(mw+s□w)* and replacing the values of *G* and *w* gives the following relation

$$Tax\ revenue = \Psi[\Phi + \beta(m + s\upsilon)]K^{\chi}$$

According to growth theory, the presence of physical capital translates into investment of the economy; accumulation physical capital comes from saving of the economy. The savings in an economy comes from low-income households $(1-\mu)nw$ and the high-income honest and dishonest households $\mu n\varepsilon w(1-\theta)(1-\tau), \theta\lambda\mu n\varepsilon w(1-b-p(1-\theta)\tau)$ and $(1-\lambda)\theta\mu n\varepsilon w(1-\tau)$ respectively. The saving of tier one bureaucrats are $[(1-\theta)+\theta(1-\lambda)]mw$ and $\theta\lambda\mu mw\left\{[1-p(1-\theta)][w(2+r_{t+1})+(2+r_{t+1}-\rho)(\frac{\theta\mu n}{m})\varepsilon wb(1-\varphi)]\right\}$ and savings of tier two bureaucrats constitute of $(1-\theta)s\upsilon w, \theta(1-\lambda)s\upsilon w\ and\ \lambda\theta s\left\{(1-p)\left[\upsilon w+\left(\frac{\mu n}{s}\right)\theta\varepsilon wb\varphi\right]\right\}$. Where saving equal future capital

$$s_t = K_{t+1}$$

4. General Equilibrium

4.1. Equilibrium with No Corruption

In equilibrium with no corruption, total tax revenue collected in the economy is $\hat{\tau}\mu n\varepsilon w$. To cover the wages of the tier one and tier two bureaucrats $mw\ and\ s\upsilon w$ respectively and to provide public good and services G, which is utilized by the private firms. Given that the government runs a balanced budget , tax rate without corruption is

$$\hat{\tau}_t = \frac{G + \mathrm{w}(m + s\upsilon)}{\mu n\varepsilon w} \tag{14}$$

[5] *This holds true when there is equilibrium in the labor market.*

$$\hat{\tau}_t = \left[\frac{L\Phi + \beta(m + s\upsilon)}{\beta\mu n\varepsilon}\right] \equiv \hat{\tau} \tag{15}$$

Looking at this tax level the optimum tax rate, household's willingness to pay the bribe would be $\widehat{b_t} = [1 - p(1-\theta)]\hat{\tau}_t$ (from equation (12)).

In equilibrium with no corruption □=*0* total savings of the economy come from the honest low-income individuals $(1-\mu)nw$ and honest high-income households $\mu n\varepsilon w(1-\hat{\tau})$.The savings of the tier one and tier two bureaucrats is $mw$and $s\upsilon w$ respectively. Combining all these expressions together, I get

$$(1-\mu)nw + \mu n\varepsilon w(1-\hat{\tau}) + mw + s\upsilon w = \widehat{K}_{t+1}$$

Replacing the values of $\hat{\tau}$ and algebraic manipulation gives

$$wL - G = \widehat{K}_{t+1} \tag{16}$$

Using equation (16) and replacing $G = \Psi K^{\chi}\Phi$ and $w = \beta L^{-1}\Psi K^{\chi}$ I get the following expression for the future accumulation of the physical capital

$$\widehat{K}_{t+1} = \Psi K_t^{\chi}[\beta - \Phi] \equiv \widehat{K}(K_t) \tag{17}$$

As already established that $\hat{r}_t = (1-\alpha-\beta)\Psi\widehat{K}_t^{\chi-1}$, then from this I can conclude $\hat{r}_{t+1} = (1-\alpha-\beta)\Psi\widehat{K}_{t+1}^{\chi-1}$, combing this relationship with equation (17) I get the following relation

$$\hat{R}_{t+1} = (1-\alpha-\beta)\Psi\,[\beta-\Phi]^{\chi-1}.\widehat{K}_{t+1}^{\chi(\chi-1)} \equiv \hat{R}(K) \tag{18}$$

From ICC constraint, I get the following relation for R_t

$$\hat{R}(K_t) \geq \frac{2\,\bar{Z} - (2-\rho)\hat{\tau}}{(\hat{\tau} - \bar{Z})} \equiv \widehat{W} \tag{19}$$

4.2. Equilibrium with Corruption

In equilibrium with corruption, □=*1*. The total tax receipts come only d=from honest high-income households. Corruption happens when corrupt household meet with a corrupt tax collector. With probability $(1-\theta)[(1-\theta)+\theta(1-\lambda)]$ honest

households meet up with honest tax collectors, with probability $(1-\theta)\lambda\theta$ honest households meet up with corrupt tax collectors, corrupt households match with honest tax collector with probability $\theta[(1-\theta)+\theta(1-\lambda)]$. Combing all these three cases the total tax receipts submitted to the government equals $\tilde{\tau}\mu n\varepsilon w((1-\theta^2)$. When a corrupt household meets with corrupt tax collector with probability θ^2 and no tax receipt are submitted.

A corrupt tax collector is caught with probability *p(1-□)* he loses his corrupt income and is fined the amount that he has gained as illegal income. Once caught the corrupt tax collector has to pay the tax difference. Thus the revenues for the government coming from tax collector being caught is $p\tilde{\tau}\mu n\theta^2\lambda$ and $(p(1-\theta))[w(2+r_{t+1})+(2+r_{t+1}-\rho)(\frac{\mu n}{m})\theta\varepsilon wb]$. The cost of the effective audit is $c\eta\tilde{\tau}\mu n$ and for external audit is $c\sigma\tilde{\tau}\mu n$. The cost is covered by the fine collected. For the purpose of my analyses, I take the total cost and the fine to be equal such that the government spends no extra. Keeping all this in view, I find the following expression

$$\tilde{\tau}_t = \frac{G + \mathrm{w}(m + s\upsilon)}{(1-\theta^2)\mu n\varepsilon w} \tag{20}$$

$$\tilde{\tau}_t = \left[\frac{\Phi L + \beta(m + s\upsilon)}{(1-\theta^2)\mu n\varepsilon\beta}\right] \equiv \tilde{\tau} \tag{21}$$

The optimum level of bribe that households are willing to pay and the tax collectors are willing to accept is $\tilde{b}_t = [1 - p(1-\theta)]\tilde{\tau}_t$ (from equation (13)). The total saving in such economy comes from the corrupt as well as the honest agents.

Households

1) Low-income HH = $(1-\mu)nw$
2) High-income HH (honest) = $\mu n\varepsilon w(1-\tilde{\tau}_t)(1-\theta)$
3) High-income (HH) (dishonest) = $\theta\mu n\varepsilon w(1-\widetilde{b_t}-p(1-\theta)\tilde{\tau}_t)$

Tax Collectors

B_1 Honest = $(1-\theta)mw$

B_1 Dishonest/ Corruptible = $\theta\mu m\left\{[1-p(1-\theta)]\left[w+\left(\frac{\theta\mu n}{m}\right)\varepsilon w\tilde{b_t}(1-\varphi)\right]\right\}$

Tier two Bureaucrats

B_2 Honest = $(1-\theta)s\upsilon w$

B_2 Dishonest/ Corruptible = $(1-\lambda)s\upsilon w+\theta s\left\{(1-p)\left[\upsilon w+\left(\frac{\theta\mu n}{m}\right)\varepsilon w\tilde{b}_t\varphi\right]\right\}$

Combing all these expression together, I get the following relation

$$\begin{aligned}(1-\mu)nw+\ &\mu n\varepsilon w(1-\tilde{\tau}_t)(1-\theta)+\ \theta\mu n\varepsilon w\left(1-\tilde{b_t}-p(1-\theta)\tilde{\tau}_t\right)+\ (1-\theta)\\ &+\ \theta m\left\{[1\ -\ p(1\ -\ \theta)]\left[w\ +\ \left(\frac{\theta\mu n}{m}\right)\ \varepsilon w\tilde{b_t}(1\ -\ \varphi)\right]\right\}\\ &+\ (1\ -\ \theta)s\upsilon w\ +\ \theta\ s\ (\ 1\ -\ p\ )\ [\ \upsilon\ w\ +\ \left(\frac{\theta\mu n}{s}\right)\varepsilon\ w\ \tilde{b_t}\varphi\ ]\ =\ \tilde{K}_{\ t+1}\end{aligned}$$

Replacing the value of $\hat{\tau}$ and algebraic manipulation gives

$$\begin{aligned}Lw+mw[1-p\theta(1-\theta)]+s\upsilon w\frac{(1-\theta)}{(1-\theta^2)}[G+\mathrm{w}(m+s\upsilon)][1+\theta p]\\ -\theta\mu n\varepsilon\mathrm{w}\tilde{b_t}\{1-\theta\varphi-[1-p(1-\theta)\theta(1-\varphi)]\}=\tilde{K}_{t+1}\end{aligned}\qquad(22)$$

Working with equation (22) and replacing $\widehat{b_t}=[1-p(1-\theta)]\hat{\tau}_t$, $G=\Psi K^{\chi}\Phi$ and $w=\beta L^{-1}\Psi K^{\chi}$ following capital accumulation exist in equilibrium with corruption

$$\begin{aligned}\tilde{K}_{t+1}=\Psi K_t^{\chi}\Bigg[&\beta+\frac{\beta}{L}m[1-p\theta(1-\theta)]+\frac{\beta}{L}s\upsilon(1-\theta p)\\ &-\frac{(1-\theta)}{(1-\theta^2)}\left[\Phi+\frac{\beta}{L}(m+s\upsilon)\right][1+\theta p]\\ &-\frac{\theta\mu n\varepsilon\beta\tilde{\tau}}{L}[1-p(1-\theta)]\{1-\theta\varphi-[1-p(1-\theta)\theta(1-\varphi)]\}\Bigg]\end{aligned}\qquad(23)$$

I know that $\tilde{r_t}=(1-\alpha-\beta)\Psi\tilde{K}_t^{\chi-1}$, then from this we can conclude $\tilde{r}_{t+1}=(1-\alpha-\beta)\Psi\tilde{K}_{t+1}^{\chi-1}$, combing this relationship with equation (23) I get the following relation

$$\tilde{R}_{t+1} = (1-\alpha-\beta)\Psi\left[\Psi\left[\beta + \frac{\beta}{L}m[1-p\theta(1-\theta)] + \frac{\beta}{L}s\upsilon - \frac{(1-\theta)}{\left(1-\theta^2\right)}\left[\Phi + \frac{\beta}{L}(m+s\upsilon)\right][1+\theta p]\right.\right.$$
$$\left.\left. - \frac{\theta\mu n\varepsilon\beta\tilde{\tau}}{L}[1-p(1-\theta)]\{1-\theta\varphi-[1-p(1-\theta)\theta(1-\varphi)]\}\right]\right]^{\chi-1} . K_{t+1}^{\chi(\chi-1)} \equiv \tilde{R}(K_t) \quad (24)$$

From my ICC constraint I get the following relation of R_t

$$\hat{R}(K) \geq \frac{2\,\bar{Z} - (2-\rho)\tilde{\tau}}{\left(\tilde{\tau} - \bar{Z}\right)} \equiv \widetilde{W} \quad (25)$$

5. Corruption and Development

5.1. From low development to Corruption

To see whether at the equilibrium level there is corruption or not, at what level of capital there is high growth and what level there is low growth in economy and if these level are same for both the equilibrium with corruption and with no corruption.

From the equations (18 and 26) I find that $\tilde{R}(K)$ and $\hat{R}(K)$ have monotonically downward function with respect to K. From equation (18), (19), (24) and (25) we establish that $\tilde{R}(K_t) > \hat{R}(K_t)$ and $\widetilde{W} < \widehat{W}$ for all values of K_t. I find the optimum level of K would define a point in economy there is high growth. We define K_1^C and K_2^C around which we can define K at which where they may be growth, low growth or multiple growth level. For all $K_t < K_1^C$, $\hat{R}(K_t) > \widehat{W}$ and for all $K_t > K_1^C$, $\hat{R}(K_t) < \widehat{W}$. Similarly, for all $K_t < K_2^C$, $\tilde{R}(K_t) > \widetilde{W}$ and for all $K_t > K_2^C$, $\tilde{R}(K_t) < \widetilde{W}$. Where $K_1^C < K_2^C$.[6]

Proposition 1: For $\forall\, K_t < K_1^C$, there is a unique equilibrium where all corruptible bureaucrat is corrupt. For $\forall\, K_t > K_2^C$, there is a unique equilibrium where

[6] *See Figure 2*

no corruptible bureaucrat is corrupt. For $\forall K_1^C < K_t \leq K_2^C$ there is multiple equilibrium.

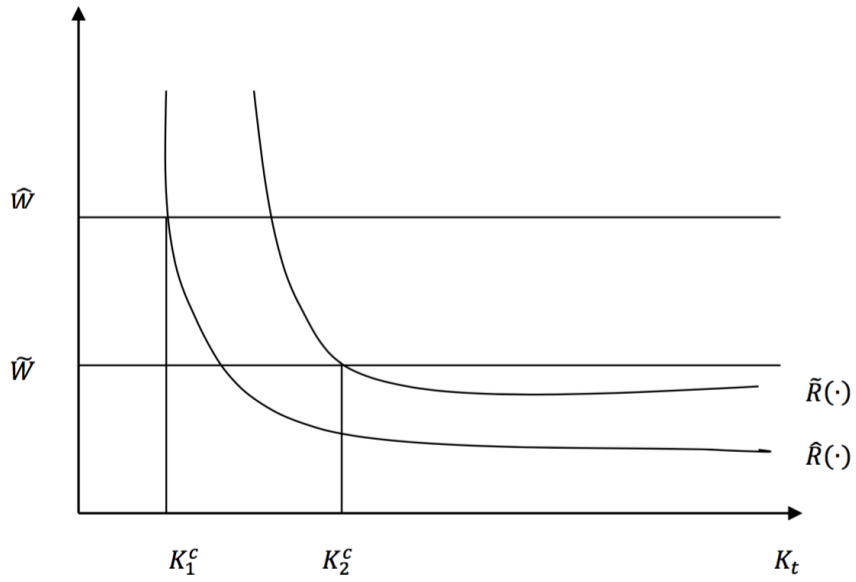

FIGURE 1: Corruption equilibrium

Where[7]

$$K_1^C \geq \left[\frac{\bar{S}(\tilde{\tau}_t - \bar{Z})}{2\bar{Z} - (2-\rho)\tilde{\tau}_t}\right]^{\chi(\chi-1)}$$

$$K_2^C \geq \left[\frac{\bar{V}(\tilde{\tau}_t - \bar{Z})}{2\bar{Z} - (2-\rho)\tilde{\tau}_t}\right]^{\chi(\chi-1)}$$

5.2. From Corruption to Low development

Two paths capital accumulation has been identified one for equilibrium where there is no corruption and one for there is corruption, $\widehat{K}^*$ and $\widetilde{K}^*$. In equilibrium where there is no corruption, the economy moves on higher development path $K(\cdot)$ and thus has a

[7] Where $\bar{S}$ and $\bar{V}$ are not the function of K.

high level of steady state equilibrium $\widehat{K}_H = \{\Psi[\beta - \phi]\}^{1-\chi}$ (from equation 17). Whereas in equilibrium where there is corruption the economy moves on lower development path $K(\cdot)$ so there is low level of steady state $\widetilde{K}_L = \left[\Psi\left[\beta + \frac{\beta}{L}m[1 - p\theta(1-\theta)] + \frac{\beta}{L}sv - \frac{(1-\theta)}{(1-\theta^2)}\left\{\phi + \frac{\beta}{L}(m + sv)\right\}(1 + \theta p) - \frac{\theta\mu n\varepsilon\beta\tilde{\tau}}{L}[1 - p(1-\theta)]\{1 - \theta\varphi - [1 - p(1-\theta)]\theta(1-\varphi)\}\right]\right]^{1-\chi}$ (from equation 23)

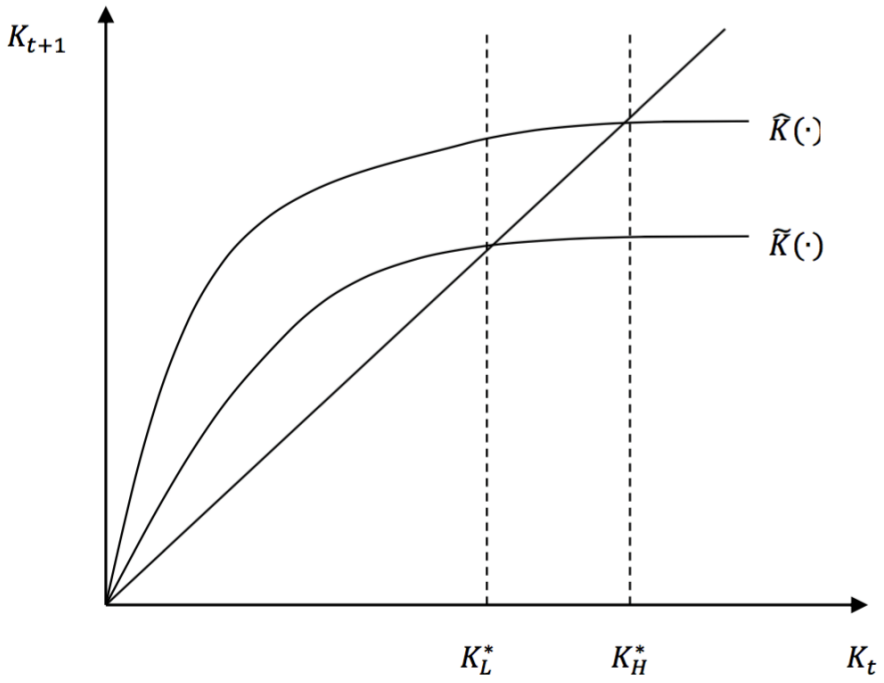

FIGURE 2: Capital Accumulation

Intuition

In an economy with equilibrium with corruption $\frac{\partial \widetilde{K}_L}{\partial p} > 0$, and $\frac{\partial \widetilde{K}_L}{\partial \theta} < 0$ which intuitively tells me that as the probability of being caught increases capital accumulation increases. As the proportion of the corrupt individual increases, capital

accumulation in a corrupt economy decreases.

6. Comparative Statics

For a given level of physical capital K_t in an equilibrium with or without corruption satisfy$\tilde{\tau} > \hat{\tau}$, $\tilde{r} > \hat{r}$.What I see is that for a given level of physical capital K the optimum tax rate of the corrupt economy is higher than that of the equilibrium with no corruption, $\tilde{\tau}_t > \hat{\tau}_t$as easily seen from equation (15) and (21), as of which $\tilde{b}_t > \hat{b}_t$ Intuitively, this holds true for government need to run a balanced budget, the revenues collected in equilibrium with corruption are lower than the expenditure. The government raises the taxes to overcome the shortage.

Similarly from equation (17) and (23) I see that $\widetilde{K}_{t+1} < \widehat{K}_{t+1}$and equation (18) and (24) clearly show that $\tilde{r}_{t+1} < \hat{r}_{t+1}$. Together this establishes that in equilibrium with corruption the level of taxes are high as of which the cost of concealment in the shape of bribe is also high, furthermore the accumulation of the physical capital is less as compared to the equilibrium with no corruption and the rate of interest is also high. What all this entails that in equilibrium with corruption the level of taxes is high due to which households pay a large bribe to evade taxes, which leads to low saving and capital accumulation. In equilibrium with no corruption, the taxes are not high such that all households pay the taxes. Their saving is high enough for the capital accumulation and economic growth. When the rate of capital accumulation is high the rate of interest associated with is low, this is due diminishing marginal returns to capital.

7. Conclusion

In the last decade there have been concern that how corruption that is prevalent in the

government seem to have a negative impact on economic growth and development. Economist throughout the world have been working on justifying the relation that how corruption affect growth through various channels. There has been abundant empirical literature on that but now theoretical strand of literature focuses on how corrupt government affects the growth through different channels.

Corruption creates unfavorable conditions for investment in physical capital and thus growth. I have modelled this by treating legal income differently from the corruption income. Corruption income is illegal and can only be invested in black market which offers smaller returns. FDI can help in diluting negative effect of corruption on investment. In my model corruption negatively affects savings that in turn affect investment, since FDI is savings of foreigners in a foreign country, corruption of destination country cannot affect the saving decisions of FDI of host countries. In this case if FDI is a bigger share of total investment then corruption might have negligible effect on investment. However, literature on FDI and corruption highlights that corrupt economies are not attractive destinations for FDI.

According to Wei (2000) the international investors do not find it worthwhile to invest in economies where the corruption index is high for then there is poor contractual enforcement, making it difficult for them to make profits. Country's investment environment is measured through the institutional quality, which is an indicator of political institutions, rule of law, property rights, non-transparency and instable economic policies, if these are poor in quality then FDI in that country would be low for it creates operational inefficiencies, (Globerman & Shapiro, 2002; Habib & Zurawicki, 2002). Corruption lowers the productivity of the public inputs as already shown in the model, this leads to decrease in the country's locational attractiveness

which is important factor for foreign investors, (Egger & Winner, 2005). The location plays an important role when the investor are deciding on the host countries from investment point of view.

Blackburn et.al (2010) and Wadho (2009) look at a single public office tier. My model is further extension of these model with two government tiers, which implies that the share of the bureaucrats have decreased for the proportion of the illegal income is same. There is fixed value of bribe that is shared among the bureaucrats. If the number of bureaucrats were to increase the each bureaucrat share would decrease for now the bribe would have to be split into more shares. This can easily be explained that if a pie was to be distributed among two individuals the share would more than if the same pie were to be distributed among large number of individuals. Increase in the number of the bureaucrats could lead to two effects; negative and positive. Taking the multiple tiers may also increase the size of the bribe (pie) this could be done when the tier two bureaucrats ask a particular percentage of bribe from tax collectors who in return will ask for higher bribe from households by framing them. If there were 'n' number of tiers the negative effect will appear in the form of small share in bribe, the positive affect will appear for when there are more corrupt bureaucrats there would be framing and extortion. There might be optimal level of 'n'. My paper does not focus on the number of tiers as I am not interested in so many tiers of government but rather on the how corruption effects economic development through savings and physical capital investment.

This paper adds to the growing literature of how corrupt government through tax evasion and capital accumulation effect economic growth and development. The basic setup for the corrupt bureaucrat is same but my model introduces the multi-level tax

administrative system. Where, tier two bureaucrats and the tax collectors are both involved in double incidence of corruption. Furthermore, my model shows that the households bribe the tax collector and then they in return offer bribe to their tier two bureaucrats. There is transfer of resources as of which illegal income is created that cannot be included in savings, which results in lower capital investment of economy. Low investment in capital becomes visible as low economic growth and development. My paper has explained how corruption accompanies low growth and development and how low development accompanies high corruption. My paper tries to explain the corruption and economic growth duos relationship through theoretical model but there remains scope for further research.

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