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Mukherjee, Vivekananda and Mitra, Siddhartha and Banerjee, Swapnendu

Jadavpur University, Kolkata, INDIA, Jadavpur University, Kolkata, INDIA, Jadavpur University, Kolkata, INDIA

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Vivekananda Mukherjee♣

Siddhartha Mitra♦

Swapnendu Banerjee♠

Department of Economics, Jadavpur University, Kolkata 700032, India

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♠ Corresponding author: Department of Economics, Jadavpur University, Kolkata-700032, INDIA.
E-mail: swapnendu@hotmail.com

♣ Email: mukherjeevivek@hotmail.com

♦ Email: mitsid@yahoo.com

Abstract

The paper presents a theoretical model with bureaucratic corruption where bribe income can leak out of an economy. In such an economy given its perception about the extent of leakage the government sets the price of public services required for entrepreneurship by maximizing the welfare of the economy. We show that the corruption persists at the equilibrium. The government prices its services at a level higher than their unit cost of provision in high leakage economies. However, the price falls to unit cost level in more prosperous economies. We also find that the number of entrepreneurs starting business and the total income received as bribe are non-increasing functions of the prosperity level and the extent of leakage from the economy. The predictions of the model generate interesting policy implications: for example it clearly shows that in low prosperity economies the control of leakage may induce higher level of corruption, while the opposite is true in the high prosperity economies.

Keywords: Corruption, Leakage, Entrepreneurship, Pricing of Public Services

JEL Classification: D73; C72; H 57; O17

1. Introduction

In a recent report Kar and Freitas (2012) estimates that in the period 2001-2010 the illicit financial outflow from developing countries of the world had been around US$ 859 billion. They found 61.2% of this outflow had been from Asian countries except the Middle-East (five of the ten countries with largest outflow China, Malaysia, the Philippines, India and Indonesia are in Asia). The growth of illicit financial outflow however was the highest in the Middle-East and North Africa region at 26.3% per annum on average, followed by Africa at 23.8% and Asia at 7.8%. It is interesting to note, according to Corruption Perception Index published by Transparency International[1] these are also perceived to be the more corrupt countries of the World. This paper with the help of a theoretical model primarily explores the way the level of illicit outflow interacts with the prosperity of an economy to explain its level of corruption. In the process it also explains why the governments in the 'high leakage-low income' economies often charge higher price for the official services than their unit cost of production. The entry of firms and the average entrepreneurial efficiency levels of different economies classified on the dimensions of their income-leakage and prosperity have been compared too.

The corruption in the theoretical model we present in the paper takes the form of bureaucratic corruption as in Shleifer and Vishny (1993): the government officials sell various services complementary to each other to the entrepreneurs at higher-than-official prices and the government is unable to control the official's corrupt act[2]. Shleifer and Vishny claimed this 'second best equilibrium' to be typical feature of organization of corruption in some African countries, India and post-communist Russia. We generalize the framework described above in

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[1] www.transparency.org

[2] It is difficult to control bureaucratic corruption by designing state contingent contracts (Tirole, 1994). The efficiency wage argument forwarded by Becker and Stigler (1974) turns out to be costly for the governments starving off sufficient resources. Moreover, the punishment schemes often do not work either because of regulatory lag or because of unionism.

three different ways: (1) by introducing the possibility of leakage so that the bribe income earned by the bureaucrats can either be spent in the economy itself or can be taken out of the economy to a foreign destination; (2) by allowing the government to optimally choose the prices of its services; and (3) by bringing in the entrepreneurial choice as in Jovanovic (1982), Murphy, Shleifer and Vishny (1991), Lazear (2005) to endogenize the demand for the government services. The prices are chosen by the government to maximize the welfare of the economy and the calculation is affected by its perception of leakage from the economy. The choice of prices along with the level of prosperity of the economy on the other hand influences the choice of entrepreneurship by the individuals: the entry and the average entrepreneurial efficiency observed in the economy therefore get affected. More entrepreneurs entering the industry helps the corrupt bureaucrats to charge higher amount of bribe for selling the government services: corruption rises in the economy. As we derive the equilibrium of the model it turns out that no government is expected to choose the prices in such a way that corruption cease to exist in the economy because at such prices entrepreneurs do not enter the industry and the welfare falls: 'the first best' equilibrium without any corruption is not implemented. From the results of the model it appears the situation described in Shlifer and Vishny (*op cit.*) that the government always prices its services at its unit cost of production is true only in an equilibrium where the leakage from the economy is below a certain threshold. As such an economy prospers the official prices are not expected to deviate from their unit cost level. But the model also provides an additional insight as it claims that in high-leakage economies with low prosperity the official price of the licenses may exceed their unit cost of provision. The comparative static results offer following ranking of the economies on the basis of their corruption levels with the lowest corruption economy getting rank 1 as: 'low leakage-high prosperity' < 'high leakage-high prosperity' =

‘high leakage- low prosperity’ < ‘low leakage-low prosperity’. The average entrepreneurial efficiency level rank comparison of the economies are: ‘low leakage-high prosperity’ ≈ ‘high leakage-high prosperity’ ≈ ‘high leakage- low prosperity’ < ‘low leakage-low prosperity’ with the highest average entrepreneurial efficiency economy getting rank 1. The predictions of the model generate interesting policy implications: for example it clearly shows that in low prosperity economies the control of leakage may induce higher level of corruption, while the opposite is true in the high prosperity economies. The insight is helpful in a country like India where the recent popular upsurge against corruption demanded control of leakages from the country.

By now it is widely established that corruption is an important factor influencing performance of an economy. On the one hand it retards growth (Mauro (1995)) and on the other it induces income inequality in an economy (Gupta, Davoodi and Alonso-Terme (2002)). An extensive literature has already developed to explain different levels of corruption observed in different economies[3]. It has been argued broadly that the level of political and economic freedom in the economies, which in turn depends on factors like education, democracy, ethno-lingual diversity, religious dominance, colonial or transitional history, trade openness, regulation of start-ups etc. explain the difference: since the high income countries generally enjoy greater political and economic freedom, they are observed to have lower corruption level compared to low income countries around the world. However the illicit financial outflow so far has not been discussed in this literature though it may have an impact on the level of corruption of the economies as discussed above. In this sense the paper adds a new dimension in the economics of corruption literature. As Bardhan (2006) points out: “though it is widely accepted now that the low income economies have higher level of corruption than the high income economies, the

[3] See Svensson (2005) for a survey.

challenge remains to explain why similar income economies have different levels of corruption", the present paper adds an explanation to such a query in terms of extent of illicit outflow from the economies.

The paper is also related to the literature on entry of firms in markets. In this literature cross-country difference in number of entrepreneurs in total labor force of a country is explained in terms differences in the prosperity levels, governance structure and entrepreneurial culture (Freytag and Thurik (2007), Aidis, Estrin and Mickiewicz (2009), Klapper, Amit, Gullien and Quesada (2010)). The theoretical results presented in this paper that entry is a non-increasing function of prosperity of the economy is consistent with empirical findings in the literature in the case low income economies. It also provides an additional insight about how the extent of leakage from the economies is related to entry. As leakage from the economy rises, the government reacts by increasing the prices of its services above the unit cost of provision. As the cost of entrepreneurship rises, the number of entrants falls. The prediction is consistent with the literature in the sense that it was empirically confirmed that higher taxation leads to fall in the number of entrepreneurs. The higher leakage leads the benevolent government to choose higher price for its services: the number of entrepreneurship falls as result.

The organization of the paper is as follows: Section 2 presents and analyses the model. Section 3 concludes the paper.

2. The Model

Consider the decision of an individual in an economy with population size 1 about starting or not starting a business. To start the business he has to get two licenses, each one from a different bureaucrat.

Assume that all individuals have equal labour endowment which they either sell in the labour market or use in business[4]. We assume that the value of individual's labour endowment in the labour market is $w > 1$ which essentially is his outside option. As an economy prospers w is expected to rise. Business is assumed to yield an income A_i to individual i, which one can interpret as entrepreneurial ability. While A_i is not observable as such, it is common knowledge that A_i is uniformly distributed over $[\underline{A}, \bar{A}]$. Thus, the probability density function takes the value of $1/[\bar{A} - \underline{A}]$ at each level of A_i in $[\underline{A}, \bar{A}]$. But in order to start a business an individual has to pay prices p_1 and p_2 for the licenses which might be different from the official prices c_1 and c_2 where $p_1 \geq c_1$ and $p_2 \geq c_2$. The amount $p_i - c_i > 0$ will be the bribe received by the i^{th} bureaucrat per license. For simplicity we assume for the government the unit cost of providing the licenses is 0. The bureaucrats have the option of spending their income from corruption within the domestic economy or outside of it. To keep things general we assume the perception in the economy about the corrupt bureaucrats' behavior is that they spend λ fraction of their income within the domestic economy. The rest is leaked out of the economy. The lower is the value of $\lambda \in [0, 1]$ the higher is the extent of leakage from the economy. To focus on interior solution (partial market coverage) we make the following assumption:

[4] One can conceive of a situation where the outside labour market requires less skill (unskilled labour market) and therefore abilities hardly differentiate each individual's outside option. Alternatively one can assume that a person with higher entrepreneurial ability might have higher return to labour endowment in the outside market. Since we already capture heterogeneity in terms of entrepreneurial ability adding an additional dimension in the complete information structure might complicate things without adding much to our analysis. In an incomplete information structure one can extend this model to variable returns to labour endowment in the outside market but that is beyond the scope of this current analysis.

Assumption 1: $\bar{A} > w > 3\underline{A} - 2\bar{A} > 0$.

Now the i^th individual would start a business if

$$A_i - (p_1 + p_2) \geq w \Rightarrow A_i \geq w + (p_1 + p_2) = A^* \text{ let.}$$

(1)

Therefore individuals belonging to $[A^*, \bar{A}]$ will start a business and individuals belonging to $[\underline{A}, A^*)$ will not start the business.

Given (1) the demand for each type of license is derived as

$$\begin{aligned} x(p_1 + p_2) &= 0 \text{ } if \text{ } w + (p_1 + p_2) \geq \bar{A} \\ &= \frac{\bar{A} - w - (p_1 + p_2)}{(\bar{A} - \underline{A})} \epsilon [0,1] \text{ } if \text{ } \bar{A} \geq w + (p_1 + p_2) \geq \underline{A} \\ &= 1 \text{ } if \text{ } w + (p_1 + p_2) \leq \underline{A} \end{aligned} \quad (2)$$

Thus, to start with for very high values of $p_1 + p_2$, the demand for each type of license $x(p_1 + p_2)$ is 0. As $p_1 + p_2$ falls below $\bar{A} - w$ the demand attains a positive magnitude and increases with a decrease in $p_1 + p_2$ till it reaches 1 at $p_1 + p_2 = \underline{A} - w$. Thereafter, demand remains constant at 1 with a fall in $p_1 + p_2$. With this we proceed to analyze the following two stage game:

Stage 1: The Government chooses $\{c_1, c_2\}$.

Stage 2: An individual needs to procure the licenses from the bureaucrats. The prices of the licenses are simultaneously chosen by the bureaucrats[5].

We solve for the Subgame Perfect Nash equilibrium of this entire game. We start with the stage 2 solutions where the bureaucrats compete in prices. For simplicity we assume the discount factor to be equal to 1 between stages.

[5] One can alternatively consider sequential pricing of licenses at stage 2. But the results qualitatively remains the same as in the simultaneous pricing situation as has been analyzed here.

Stage 2: Procurement of Licenses

We conceive of a situation where the prices of the licenses are simultaneously chosen by the bureaucrats. Given (c_1, c_2) this leads to Nash interaction between the two license providing bureaucrats in stage-2 on the basis of information about the demand given above: bureaucrat 1 chooses p_1 to maximise his profits taking p_2 as given and bureaucrat 2 behaves similarly. The Nash equilibrium in stage 2 is thus a price tuple, the i^{th} component of which is the price charged by bureaucrat i (i = 1, 2), with the property that each component price is a best response to the other. In what follows we derive this Nash equilibrium in stage 2.

The profits made by bureaucrat i through sale of licenses as a function of the price charged by him, given the price charged by the other bureaucrat ($j \neq i$) would be given by:

$$\pi_i(p_i, p_j) = (p_i - c_i)\frac{(\bar{A} - w - (p_i + p_j))}{(\bar{A} - \underline{A})}$$

And the best response functions will be given by

$$p_i = \frac{(\bar{A} - w) - (p_j - c_i)}{2} \quad \forall i = \{1,2\},\ j = \{1,2\}, i \neq j\ . \tag{3}$$

The Nash equilibrium prices as a function of official prices in this simultaneous move game will be $p_1^* = \frac{\bar{A} - w + (2c_1 - c_2)}{3}$ and $p_2^* = \frac{\bar{A} - w + (2c_2 - c_1)}{3}$ and therefore the total price paid for the licenses is given by $p_1^* + p_2^* = \frac{2(\bar{A} - w) + c}{3}$ where $c = c_1 + c_2$. Note that the total price paid by an entrant for licenses (cost of entry to the potential entrant) is not a function of either c_1 or c_2 individually, but is a function of the sum of official prices given by $c_1 + c_2 = c$. It is increasing in c as well as $\bar{A}$ and is decreasing in the outside option. The number of entrants at the equilibrium is $\frac{(\bar{A} - w) - c}{3(\bar{A} - \underline{A})}$ and the total number of licenses issued is $\frac{2[(\bar{A} - w) - c]}{3(\bar{A} - \underline{A})}$ both of which are decreasing in the total official price of the licenses. The bribe paid per entrant $B = \frac{2[(\bar{A} - w) - c]}{3}$ is increasing in $\bar{A}$ but decreasing in the sum of official prices. The total amount of bribe income $\frac{2[\bar{A}-w-c]^2}{9(\bar{A}-\underline{A})}$ is decreasing in the sum of official prices of the licenses. However, the decrease tapers off with an increase in *c* while the number of entrants into the industry declines with an increase in *c* at a constant rate.

Observation 1: ***An increase in official prices leads to fewer entrepreneurs starting business. The total income received as bribe also falls.***

As c increases the total price $p_1^* + p_2^*$ increases by $\frac{1}{3}$ of c. Consequently A^* rises and therefore the number of entrepreneurs earning profits more than their outside option from labour endowment falls. Since both the number of entrants and the bribe from corruption per business entry $(p_1^* + p_2^* - c)$ falls total income received as bribe also falls.

Given this price interaction between the bureaucrats in period 2 we now solve for the optimal level of c chosen by the government in stage 1.

Stage 1: Optimal choice of *c*

Since $(p_1^* + p_2^*)$ depends not on c_1 or c_2 individually but on $c = c_1 + c_2$, in stage 1 the government chooses the optimal level of c such that the social welfare in the form of total surplus is maximized. The total surplus from this Nash interaction in prices between license providers can be defined as the sum of Entrepreneurs' net Surplus (ES), Government Revenue (GR) from the sale of licenses and λ fraction of the bureaucrats' income (from corruption) where λ signifies the amount of corrupt income spent in the domestic economy and thus $1 - \lambda$ is the leakage from the economy. The Entrepreneurs' net Surplus is nothing but the aggregate net income earned by operating entrepreneurs which in this case consists of all entrepreneurs in the range $[A^*, \bar{A}]$ and can be calculated as

$$\frac{1}{(\bar{A}-\underline{A})}\int_{A^*}^{\bar{A}}[A_i-(p_1^*+p_2^*)]\,dA_i=\frac{(\bar{A}+2w-c)^2-9w^2}{18(\bar{A}-\underline{A})}. \quad (4)$$

The total government revenue is given by the total demand for licenses multiplied by the official prices, i.e. $\frac{(\bar{A}-A^*)}{(\bar{A}-\underline{A})}c=\frac{(\bar{A}-w)c-c^2}{3(\bar{A}-\underline{A})}$. Therefore the total welfare is given by

$$W=\frac{(\bar{A}+2w-c)^2-9w^2}{18(\bar{A}-\underline{A})}+\frac{(\bar{A}-w)c-c^2}{3(\bar{A}-\underline{A})}+\lambda\frac{2[\bar{A}-w-c]^2}{9(\bar{A}-\underline{A})}. \quad (5)$$

The government will choose $c^* \geq 0$ to maximize W.

Note from equation (5) lower is the value of λ i.e. higher is the leakage from the economy lower is the welfare of the economy. However, in the 'first best' equilibrium where the government successfully controls the corrupt act of the bureaucrats and no bribe rent is generated, W becomes independent of λ. So dependence of W on λ is a typical feature of the 'second best equilibrium' situation addressed in this model where the government fails to control bureaucratic corruption[6].

Proposition 1:

(i). The optimal subgame perfect choice of official price of licenses will be $c^*=\frac{(2\bar{A}-5w+4\lambda w-4\lambda\bar{A})}{(5-4\lambda)}>0$ ***if and only if*** $\lambda<\frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$; $c^*=0$ ***otherwise. There will be multiple equilibria with respect to the choices of*** c_1^* ***and*** c_2^*.

(ii). If $\lambda<\frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$, ***an increased leakage from the economy raises the optimal official price. No such effect exists if*** $\lambda\geq\frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$.

(iii). If $\lambda<\frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$, ***an increased outside option leads to a fall in the optimal official price. No such effect exists if*** $\lambda\geq\frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$.

[6] In the 'first best' situation the government being successfully able to prevent bureaucratic corruption maximizes $[\frac{(\bar{A}-c)^2-w^2}{2(\bar{A}-\underline{A})}+\frac{(\bar{A}-w)c-c^2}{(\bar{A}-\underline{A})}]$ by choosing $c^*=0$.

Proof:

(i). Calculation is straightforward and follows from the above discussion and assumption 1 made above.

(ii). Since $(5 - 4\lambda) > 0$, an increase in w leads to a fall in c^*.

(iii). Calculation is straightforward and follows from the above discussion. **QED**

To understand the first part of proposition 1 note that an increased c unambiguously leads to a fall in the Entrepreneurs' Surplus. This is due to the fact that an increase in c leads to an increase in $p_1^* + p_2^*$ and therefore the number of entrepreneurs starting business (i.e. the market coverage) and also each entrepreneur's net income from starting a business falls. Also income from corruption unambiguously falls with increased c due to the previously stated negative 'market coverage effect'. On the other hand the effect of an increase in c on government surplus depends on two opposing effects. First is the same 'market coverage effect' which is negative, but an increased c will lead to an increase in revenue per unit license sold. It is optimum for the government to choose that c where the marginal negative effects are exactly offset by an increase in the direct government revenue from the sale of licenses. A point worth mentioning is that in this structure one can only solve for $\mathrm{c}_1^* + \mathrm{c}_2^*$ and any combination of $\{\mathrm{c}_1^*, \mathrm{c}_2^* | \mathrm{c}_1^* + \mathrm{c}_2^* = \mathrm{c}^*\}$ will be optimal for the government. As λ increases more corrupt income is spent within the domestic economy and thus the marginal cost of choosing a higher value of c^* rises. So it is optimal for the government to reduce the optimal official prices $(\mathrm{c}_1^* + \mathrm{c}_2^*)$ to their unit cost of provision which is assumed to be 0. Such a pricing of official services would attract more entrepreneurs into the business and the surplus of the operating entrepreneurs as well as income of the corrupt officials would increase. Finally, as the outside option becomes more attractive the government needs to reduce the official prices to attract prospective entrepreneurs to enter business. If the leakage is substantial since at the initial equilibrium the government was choosing $c^* > 0$, it reacts by lowering c^*. But if the leakage is not substantial, it has no room for lowering c^* below the unit cost of production of licenses. Therefore it sticks to $c^* = 0$.

The proposition explains why public services may be charged with a price above their unit cost of provision in the economies where the leakage is substantial. However with economic prosperity in such economies the official prices are expected to fall to their unit cost of provision. The economy as perceived in Shleifer and Vishny (1993) does not suffer from any leakage (the case of $\lambda = 1 \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ in our context) and therefore it charges unit cost prices for the official services: as such economies prosper, the official prices are not expected to deviate from their unit cost level. But Proposition 1 also offers an additional insight as it claims that when Shleifer-Vishny framework is generalized to take into account the possibility of leakage, their assumption of official price of the licenses is equal to their unit cost of provision may not always hold true: in high-leakage economies with low prosperity the official price of the licenses may exceed their unit cost of provision. However we should also remember that in the 'first best' equilibrium the government always chooses $c^* = 0$. So although the governments in the 'high leakage - low prosperity' economies deviate from the 'first-best' choice of c^* but the 'low leakage – high prosperity' economies continue to charge the 'first-best' price for the licenses.

Now replacing this optimal c^* at stage-2 equilibrium we get the equilibrium bribe paid per entrant, the total licenses issued and total amount of bribe received in corruption. If $\lambda \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ these amounts are calculated as: $\frac{2(\bar{A}-w)}{3}$, $\frac{2[(\bar{A}-w)]}{3(\bar{A}-\underline{A})}$, $\frac{2[\bar{A}-w]^2}{9(\bar{A}-\underline{A})}$. If $\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ the corresponding amounts will be $\frac{2\bar{A}}{(5-4\lambda)}$, $\frac{2\bar{A}}{(5-4\lambda)(\bar{A}-\underline{A})}$ and $\frac{2\bar{A}^2}{(5-4\lambda)^2(\bar{A}-\underline{A})}$ respectively**.** Comparing these amounts we arrive at the next proposition of the model.

Proposition 2:

(i). Under simultaneous purchase of licenses it is optimum for the government to allow for some amount of corruption.

(ii). The number of entrepreneurs starting business and the total income received as bribe are non-increasing functions of the extent of leakage of the bribe from the economy. If $\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ ***an increase in the leakage from the economy, reduces the number of entrepreneurs starting business; the total income received as bribe also falls. The average level of entrepreneurial efficiency rises in the economy. However if*** $\lambda \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ ***an increase in the leakage keeps the number of entrepreneurs starting business at a constant level and the total income received as bribe also remains constant. The average level of entrepreneurial efficiency in the economy remains unchanged.***

(iii). The number of entrepreneurs starting business and the total income received as bribe are non-increasing functions of the outside option available in the economy. If $\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ ***an increased outside option keeps the number of entrepreneurs starting business at a constant level; the total income received as bribe also remains constant. The average level of entrepreneurial efficiency in the economy remains unchanged. However if*** $\lambda \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$***, an increased outside option leads to less number of entrepreneurs starting business and the total income received as bribe falls; the average level of entrepreneurial efficiency rises in the economy.***

Proof:

(i) Independent of whether $\lambda \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$ or $\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$, it follows from the above discussion that in both the situations the total amount of bribe received in corruption is a positive amount. Therefore the statement follows.

(ii) and (iii). Calculation is straightforward and since $(5-4\lambda) > 0$ and $(\bar{A} - \underline{A}) > 0$ the statements easily follow from the above discussion. **QED**

To understand the intuition behind proposition 2 it is important to keep in mind the unique feature of the present model that a government adjusts its choice of c^* depending on its perception about leakage of bribe-income from the economy. Below we explain how the choice of c^* influences the results in a non-trivial way.

The result that it is optimum for the government to allow some amount of corruption in the economy although similar to the one found in the literature by papers like Mookherjee and Png (1995), the explanation we offer in the present model is new. In our case the government could easily implement a 'no corruption' equilibrium by choosing a high value of c^* at $c^* = \bar{A} - w$; but it refrains from doing so because such a policy choice would make entry in the industry unattractive and thus would reduce W from its optimum level.

From proposition 1 we know that as the leakage of bribe-income from the economy rises the choice of c^* does not fall: while above the threshold ($\lambda \geq \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$) it remains constant at the unit cost of provision, below the threshold ($\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$) it rises along with the leakage. The increase in c^* results in more costly entrepreneurship and less number of licenses are demanded. So less amount of bribe is demanded: corruption falls in the economy when higher average efficiency level of entrepreneurship is realized. The result predicts that if in an economy leakage could be reduced (i.e. λ could be increased) costlessly, below the threshold it would increase corruption, but the average efficiency of entrepreneurship would fall. Above this threshold nothing would change. So unlike the commonly held perception, reduction in leakage may not translate into lower corruption in economies: in a high leakage economy such a policy in fact turns out to be counterproductive increasing the level of corruption in the economy.

As the economy prospers and the outside option rises the less efficient entrepreneurs exit from the market and the average entrepreneurial efficiency rises in the economy. As the demand for licenses falls, the corruption in the economy also falls. But this mechanism gets obstructed if the perception about the economy is such that the most the bribe incomes are spent outside the economy (the case where $\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$). In such economies the optimal c^* falls with an increased w leading to a decrease in the cost of entrepreneurship and thus neutralizes the effect of better outside option: therefore an increased outside option keeps the number of entrepreneurs starting business at a constant level; the total income received as bribe and the average level of entrepreneurial efficiency also remain constant. The result ends up explaining why the prosperity of an economy may not bring in any change in the amount of corruption and the nature of entrepreneurship if the extent of leakage from the economy is above a threshold level ($\lambda < \frac{(2\bar{A}-5w)}{4(\bar{A}-w)}$.

The empirical evidence on cross-country corruption broadly suggests[7] that low income economies have higher level of corruption. But the challenge in the literature had been the explanation of the observed different corruption levels of similar income economies (Bardhan (2005)). Proposition 2 contributes to the literature by providing an explanation of different corruption levels observed in the economies with similar level of prosperity: it hypothesizes that

[7] See Svensson (2005) for a survey.

in the economies which are below the threshold level in terms of λ, at a given level of prosperity higher extent of leakage from the economy would imply lower level of corruption. In this group of economy the change in prosperity does not explain the change in corruption level. However for the economies which are above the threshold level in terms of λ, the traditional observation holds and the variation in the extent of leakage does not explain the variation in the observed level of corruption.

One of the limitations of Proposition 2 presented above is that its statements are derived on the basis of comparative static results. Comparative static results on the other hand are based on *ceteris paribus* assumption. Therefore it can compare corruption and average entrepreneurial efficiency level of a 'high leakage-high prosperity' economy with the same of a 'high leakage-low prosperity' economy on one hand and that of a 'low leakage-low prosperity' economy with a 'low leakage-high prosperity' economy on the other: however it cannot do the same for a 'high leakage-low prosperity' economy and a 'low leakage-high prosperity' economy.

One natural question of interest would be how do we compare the corruption level and average entrepreneurial efficiency level of the economies characterized as 'high leakage- low prosperity' and 'low leakage-high prosperity' economies? To answer such a question it is possible to simulate the present model with feasible values of the parameters $\bar{A}$, $\underline{A}$ and w satisfying assumption 1. Here we provide an overview of likely results to be obtained from such an exercise. Let us assume $\bar{A}$ = 1 and $\underline{A}$ = 0.7. While for the economies with low prosperity we take w = 0.1, for the economies with high prosperity we take w = 0.9. The economies with high and low degree of leakage take the respective values of λ as $\lambda = 0$ and $\lambda = 1$. The respective corruption level of a 'high leakage-low prosperity' economy and a 'low leakage-high prosperity' economy turns out to be 0.3 and 0.007. Similarly the respective average entrepreneurial efficiency level of a ‘high leakage-low prosperity’ economy and a ‘low leakage-high prosperity’ economy turns out to be 0.98 and 0.9. Clearly the ‘high leakage-low prosperity’ economy has higher corruption level compared to the ‘low leakage-high prosperity’ economy. But, their average entrepreneurial efficiency level turns out to be similar. The re-run of the simulation exercise with appropriate parameter values yields similar result. Therefore, by using the simulation results along with predictions of Proposition 2 we note the next observation of the model as follows:

Observation 2:

(i). The ranking of the economies according to their corruption level, with the lowest corruption economy getting rank 1, must be: ‘low leakage-high prosperity’ < ‘high leakage-high prosperity’ = ‘high leakage- low prosperity’ < ‘low leakage-low prosperity’.

(ii). The ranking of the economies according to their average entrepreneurial efficiency level, with the highest average entrepreneurial efficiency economy getting rank 1, must be: ‘low leakage-high prosperity’ ≈ ‘high leakage-high prosperity’ ≈ ‘high leakage- low prosperity’ < ‘low leakage-low prosperity’.

Note, observation 2 generate interesting policy implications: for example it clearly shows that in low prosperity economies the control of leakage may induce higher level of corruption, while the opposite is true in the high prosperity economies. The insight is helpful for policymakers in a country like India where the recent popular upsurge against corruption demanded control of leakages from the country. However, a similar demand should get its due justification in high prosperity economies.

3. Conclusions

We present a model of bureaucratic corruption a la Shlifer and Vishny (1993) where corrupt government officials sell various services complementary to each other to entrepreneurs at higher-than-official prices, with the critical differences that bribe income can leak out of the economy and the government optimally chooses the prices of its services by maximizing social welfare given its perception about the extent of leakage. We show that in the 'second best' situation where the government cannot control bureaucratic corruption through incentive mechanisms, it prices its services at a level higher than their unit cost of provision in high leakage economies and the price falls to unit cost level in more prosperous economies. The paper also shows that the number of entrepreneurs starting business and the total income received as bribe are non-increasing functions of the prosperity level and the extent of leakage from the economy. In this respect the paper is a first in analyzing how the extent of illegal outflow (leakage) from an economy affects the degree of corruption in an economy. The paper also generates interesting policy implications. Our model predicts that in low prosperity economies the control of leakage may induce higher level of corruption, while the opposite is true in the high prosperity economies.

A couple of points are warranted at this juncture: in this model the extent of the leakage from the economy has been treated as exogenous. But it can be argued that the level of corruption of an economy can determine the extent of leakage. So in a more complete model the extent of leakage from the economy must be determined endogenously where both the level of corruption in an economy and the extent of leakage would be function of some exogenous factors. The model has further limitations. We have not considered any punishment scheme (or any incentive scheme for that matter) for corrupt officials. One can assume a probability of punishment along with fixed punishment costs but we conjecture that our results will continue to hold with this changed specification. One can also extend this analysis by considering punishment costs that is increasing with bribe income and we intend to do that in our future analysis. The third point is that the nature of corruption we address in the paper is petty corruption and not high level corruption. One can construct a model with high level corruption and analyze the impact of leakage on the level of corruption in an economy. Last but not the least, a cross-country analysis bringing out the interrelationship between leakage, prosperity of an economy and the degree of corruption based on the hypotheses developed in this paper constitute our future research agenda.

References

Aidis, R., S. Estrin and T. Mickiewicz (2009): Entrepreneurial Entry: Which Institutions Matter? Discussion Paper No. 4123, Bonn: IZA.

Bardhan, P. (2006): The Economist's Approach to the Problem of Corruption, *World Development* 34(2), 341 – 348.

Becker, G. and J. Stigler (1974): Law Enforcement, Malfeasance and the Compensation of the Enforcers, *Journal of Legal Studies* 3(1), 1 – 19.

Freytag, A. and R. Thurik (2007): Entrepreneurship and its Determinants in a Cross-country Setting, *Journal of Evolutionary Economics* 17(2), 117 – 131.

Gupta, S., H. Davoodi and R. Alonso-Terme (2002): Does Corruption Affect Income Inequality and Poverty? *Economics of Governance* 3, 23 – 45.

Jovanovic, B. (1982): Selection and the Evolution in Industry, *Econometrica* 50(3), 649 - 670.

Kar, D. and S. Freitas (2012): Illicit Financial Flows from Developing Countries 2001-2010, Global Financial Integrity: Washington. Available at http://iff.gfintegrity.org/iff2012/2012report.html.

Klapper, L., R. Amit, M. Gullien and J. Quesada (2010): Entrepreneurship and Firm Fomation Across Countries, Policy Research Working Paper 4313, World Bank, also published in *International Differences in Entrpreneurship*, NBER, 129 – 158.

Lazear, E. (2005): Entrepreneurship, *Journal of Labor Economics* 23(4), 649 – 680.

Mauro, P. (1995): Corruption and Growth, *Quarterly Journal of Economics* 110(3), 681 – 712.

Mookherjee, D. and I. Png (2005): Corruptible Law Enforcers: How Should They be Compensated?, *Economic Journal* 105, 145 – 159.

Murphy, K., A. Shleifer and R. Vishny (1991): The Allocation of Talent: Implications for Growth, *Quarterly Journal of Economics* 106(2), 503 – 530.

Shleifer, A. and R. Vishny (1993): Corruption, *Quarterly Journal of Economics* 108(3), 599 – 617.

Svensson, J. (2005): Eight Questions about Corruption, *Journal of Economic Perspective* 19 (3), 19 – 42.

Tirole, J. (1994): Internal Organization of Government, *Oxford Economic Papers* 46(1), 1 – 29.