CORRUPTION AND TRADE IN GENERAL EQUILIBRIUM*

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ABSTRACT

We use the Heckscher – Ohlin – Samuelson- Vanek (HOSV) model of international trade to find out a link between corruption and the pattern of trade, not just its effect on the volume of trade, the usual point of query in the existing literature. We prove that greater corruption in labor-abundant countries will restrict the volume of world trade by working against the factor endowment bias. This is caused by a class of intermediaries who are engaged in mitigating the transaction cost of corruption. Corruption in capital-abundant countries reinforces the factor endowment bias and therefore should promote trade. For countries with similar factor endowments, relatively corrupt economy will export capital-intensive goods. We show that corruption does not necessarily reduce global volume of trade. Relatively capital-abundant country will be worse off with increasing degree of corruption at home and abroad, whereas the labor-abundant country, once engaged in trade may gain from corruption.

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SECTION I

This paper attempts to restructure the neo-classical theory of international trade in order to find a link between corruption and comparative advantage. Such a link in turn also leads to an interesting relationship between corruption and volume of trade. We argue that corruption in labor-abundant countries will counter the factor endowment bias and will reduce the volume of world trade. If a relatively capital abundant country exhibits greater degree of corruption, trade will in fact get a boost. Equal degrees of corruption in labor abundant and capital abundant countries will not affect the volume of trade.

In the beginning, corruption was considered as "grease in the wheels of commerce and trade" [Leff, N.H. (1964), Huntington, S.P. (1968)]. Some economists argued that corruption actually acts as signals for firms' competitive efficiency. But "grease theory" has lost much of its sheen as more and more evidence come to light showing that corruption is in fact like "sand" than "grease". Kaufman, D and Wei, S.J. (1999) tested the grease theory, empirically, but found no support in its favour. Subsequently, corruption has been regarded as harmful for trade, in particular and economic development, in general. In most of the cases corruption leads to an increase in transaction cost mainly through the problem of cross-border contract enforcement and naturally affects the volume of trade. Such arguments have been nicely elaborated and related papers have been surveyed in Anderson, J. (2000). Anderson, J and Marcouiller, D (2002) provide some evidence for the theory of corruption as an extra cost. They analyze insecurity in international trade related transactions and show that if the Latin

American countries were as transparent as the countries of European Union, Latin American imports would have increased by 30 percent. This hypothesis is further tested in Jansen, M and Nordas, H.K. (2004). They learn that better control of corruption is highly significantly associated with an increase in trade volume. It seems by and large that the detrimental effects of corruption on trade are unambiguously accepted in recent times. Recently De Jong, E and Udo, E (2006) provide new evidence reconfirming the hypothesis. Their paper has shown that nature of corruption has a significant role to play on trade flows. Trade is reduced the most if corruption is of chaotic type or arbitrary in nature. In this context Wei (1997) and Lavalle, E (2006) are also interesting papers where it is shown that corruption cuts back imports by the developing nations.[1] In a well known paper Trefler, D. (1995) convincingly demonstrates the case that the volume of world trade is much less than what is predicted by Heckscher-Ohlin-Samuelson-Vanek (hereafter HOSV) paradigm.

Hence, it is possible that some of the missing trade is due to institutional complexities involved in international trade with the less governed and less transparent economies. This hypothesis is repeatedly tested over the last few years. However, there is no such theoretical general equilibrium model which tries to incorporate corruption in the neo-classical framework and explains the missing trade mystery. In this paper we seek to fill-up this caveat.

In this paper we take a slightly different theoretical view of the problem. Usually corruption enters into the trade analysis in form of transaction costs when bribe is taken by government officials in the borders[2]. And it is easy to understand that if contracts are relatively difficult to enforce across borders than internally, volume of trade will suffer.

Suppose that this is not the case, such that relative costs of enforcement are the same internally or externally. In that case there is no special reason why international trade will suffer relative to the internal trade. However, if the traded sectors are affected more by corruption than the non-traded sector or if the exportable production is affected more than the import-competing good, trade will suffer. We abstract from all such examples of differential effect of corruption and focus on the neutral impact of corruption on two traded goods in a standard neo- classical model. This should be noted as a very natural extension of the standard general equilibrium trade theory. If a country, otherwise characterized by the attributes of a neo-classical world, is affected by corruption which eats away the output in each sector without any relative bias, will that affect the degree of comparative advantage and volume of trade?

Corruption in our framework diverts labor from productive to corruptive activities. This clue is taken from Bhagwati, J (1982) and Shleifer,A. and Vishny, R. (1993). Corruption is viewed in Bhagwati (1982) as DUP activity as many people engaged in corruption essentially avail of the arbitrage opportunities [Wei (1997)], acting as middlemen and intermediaries. Such diversion of human talent can be quite costly for the society and thus is related to the ideas of Shleifer and Vishny (1993). If relatively labor-abundant countries are those affected by corruption, an undeniable empirical fact given whatever data we have on inter-country measures of corruption [Mauro, P. (1995), Lavalle (2006) etc.] the volume of world trade will shrink. Very recently Roy, S. (2007) made an attempt to show whether corruption is anti-labor. Roy tried to examine the end product of corruption on trade-openness in both low and high-income countries. His paper, an empirical one, essentially corroborates our theoretical idea. We argue why corruption should affect comparative advantage and volume of trade simultaneously. It is beyond the notion of insecurity of transactions involving international trade or relative damage caused by corruption to the traded sectors. According the arguments developed in the paper, corruption in capital-abundant countries should promote trade. If in reality we do not observe much corruption in relatively capital abundant nations and we experience more of this in the labor-abundant countries, then our framework will predict lower volume of world trade.

Our argument is drawn from a reasonable assumption that economic agents often have to comply with the undesired forces of regulation, intervention, rent-seeking and corruption. Such activities lead to the emergence of a sector represented by a group of people which takes care of such institutional hazards. Greater is institutional deficiency, bigger is the chunk of people who are there to benefit from the arbitrage opportunities, be it in the tax-office or at customs. These are the people who negotiate for political / bureaucratic special favors, arrange to jump the "queue" and engage in many other intermediations.[3] The transaction costs due to corruption are essentially spending to sustain this non-traded sector. Even without explicit taxes, tiding over regulatory complexities implies employing people who will take care of the institutional problems. This is typically a labor-intensive sector and in our paper it employs only labor. The lost value of output in each sector goes towards paying the wage bill in this non-traded sector. If the entire workforce absorbed in the non-traded sector were unemployed had there been no such sector, it would not have mattered much for the traded sectors. But this may not be the case. Such highly labor-intensive non-traded sector draws resources away from the labor-intensive component of the traded sector, strengthening the capital intensive component via the Rybczynski effect, thus affecting the extent of comparative advantage and volume of trade. We assume zero international trading costs associated with corruption, so that the adverse impact, if any, on the volume of trade is generated through restricting the factor endowment bias. We also assume away any intersectoral asymmetry involving the impact of corruption.

The arrangement of the paper is as follows. Introduction is followed by the benchmark model in section II. Section III introduces the government sector explicitly and generalizes the results derived in the benchmark model. The last section concludes. However, the mathematical details and proofs of propositions are relegated to Appendix.

SECTION II

The Benchmark Model

With this backdrop let us consider a world economy consisting of two economies: a home and a foreign economy. The variables of the foreign economy are denoted by asterisk. Foreign economy is considered in order to gauge the difference in relative price of foreign with that of home when degree of corruption changes in the home front. Our main focus is on the home economy.

Home economy is considered to be a perfectly competitive one producing two tradeable goods, capital-intensive good *X* and labor-intensive good *Y*. The major portion of the total labor force is absorbed in *X* and *Y* production, and others get employment due to institutional complexities involved in licensing and international trade. These institutional complexities give rise to corruption. Nevertheless, this service is not free of cost. α is the fraction of each good *X* and *Y* lost due to corruption. Therefore, $\alpha\ [P_X X +$

$P_Y Y$] represents the maximum total value of the goods that can be spent on those who are in a position to manipulate the system and recover the booty. Let Z represent the sector and L_Z, the people who are exclusively engaged in such operations. We assume competitive market for corruption to be consistent with the otherwise standard specifications of the competitive general equilibrium model.

Foreign economy is characterized by similar variables. However, it is corruption free. Perfect competition prevails in all markets in both the countries and production functions for X and Y are assumed to exhibit constant returns to scale and diminishing marginal productivity.

So the structure we have, here, is the standard Jonesian [Jones (1965)] specification of 2x2 neo-classical general equilibrium model. The symbols and basic equations are in consistence with Jones (1965).

To build the system of equations, we use following notations:

P_i = Price of ith good, $i = X,Y$

w = Return to labour

r = Return to capital, K

a_{ij} = Technological co-efficient

$\overline{K}$ = Total supply of capital

$\overline{L}$ = Total supply of labour

L_z = Labor engaged in corruption activities

Therefore, the general equilibrium structure is like the following one:

(1) $\alpha\left(P_X X + P_Y Y\right) = wL_z$

where, $\alpha \in [0,1]$; α depends on the strength of institutional regime. A low α will mean low corruption/ strong institution and conversely.

Competitive price conditions are:

(2) $w.a_{LX} + r.a_{KX} = P_X(1-\alpha)$

(3) $w.a_{LY} + r.a_{KY} = P_Y(1-\alpha)$

Full employment conditions are:

(4) $a_{LX}.X + a_{LY}.Y = \overline{L} - L_z$

(5) $a_{KX}.X + a_{KY}.Y = K$

Thus the structure of the model is over. Now let us try to solve for the unknown variables. Factor endowments of labour and capital are constant at $\overline{L}, \overline{K}$. Given ($\alpha$, P_X, P_Y) w and r can be determined from equation (2) and (3). Now, let us start from some L_z such that $(\overline{L} - Lz) > 0$. Then, given (w, r) and hence a_{ij}s (a_{ij} is constant because of CRS) and with a given value of L_z we can solve for X and Y from equation (4) and (5). If we increase L_z, because of Rybczynski effect production of X will expand while that of Y will contract.

Let us consider Y as the numeraire commodity and set $P_X = P$. So, equation (1) becomes,

(6) $\alpha(P.X + Y) = w L_z$

We can close the model by incorporating a homothetic demand function. This is,

(7) $\frac{X_D}{Y_D} = f(P); f'(P) < 0$

Here X_D and Y_D signifies demand for respective commodities.

Note that, given P with an increase in L_z, $(P.X+Y)$ does not change due to familiar envelope property.

(8) $$(P.dX + dY) = w.d\bar{L} + rd\bar{K} = 0$$

Hence, LHS in (1) is constant. With w determined, the RHS is linear in L_Z. Hence, we have figure -1 where L_{Z0} is determined. Now with L_{Z0} we can determine everything else in the system, in particular X and Y or $\left(\frac{X}{Y}\right)$. Note that sector Z enters as non-traded sector along with 2X2 HOS system. Activity in sector Z becomes "complementary" to X, the capital-intensive sector as Z turns out to be the most labor-intensive one.

SECTION II.A

Change in Price

With a rise in P, w will fall and r will go up as per the Stolper-Samuelson theorem. Given L_Z, this will make the labor constraint more and capital constraint less binding. Hence due to Rybczynski theorem X will go up and Y will go down [4].

Now, let us look at (6). RHS in figure-1 will rotate downward since w is lower and L_z is given. Note that due to the envelope property and also for the fact that 'α' is the same for both sectors, change in $(PX+Y)$ will be approximated by $dP.X$ which is greater than zero since P rises (as $PdX + dY = 0$) . Hence, the LHS in figure-1 will move upward. Therefore L_Z will increase further curtailing Y and increasing X. Thus a rise in P will raise $\left(\frac{X}{Y}\right)$, the usual supply-side response in this extended HOSV model. By using the homothetic demand function we can close the model and can determine the equilibrium value of *P*.

Figure-2 gives us the equilibrium autarkic price P_A.

Our motive is to verify the impact of α on effective factor abundance and ultimately on autarkic price which in turn affects the volume of trade. For that purpose let us introduce a foreign economy, represented by '*'. Say both domestic and foreign economies are similar in technology and preference. But the difference lies in factor endowments. Let the foreign economy be capital abundant. Hence,

(9) $$(K/L)^* > (K/L)$$

For simplicity let us assume the foreign economy to be corruption free, i.e. $\alpha^* = 0$. When both the nations are corruption free, according to HOSV prediction, for a given *P*,

$$(X/Y)^* > (X/Y).$$

This implies, $P_A^* < P_A$ ('A' denotes autarkic situation). It is apparent that greater is the difference between $(K/L)^*$ and (K/L) bigger will be the volume of trade or the size of so called "trade triangle".

SECTION II.B

Change in the degree of corruption in home front

Suppose there is a change in α , α rises in the home country owing to some institutional problems. Therefore $(1-\alpha)$ falls in the home, the labor-abundant country. Note that from (2) and (3) given *P* there will be symmetric response in both the price equations, $\hat{w} = \hat{r} < 0$ ['^' denotes proportional change as in Jones (1965)]. Hence, $\left(\frac{w}{r}\right)$ does not change. However, there are two effects on LHS in (6). Given $(P.X+Y)$, an increase in α has increased LHS. But as w and r fall, value of national income goes down. Hence given α, LHS should go down. The negative effect will vanish if we start from zero level of corruption. To keep things simple we shall assume that initially $\alpha=0$ [5]. Then the RHS falls at a given Lz as w falls. Therefore, L_z must increase lowering Y and increasing X. Subsequently a rise in α will lead to an increase in L_z and an increase in $\left(\frac{X}{Y}\right)$. This will reduce the gap between $\left(\frac{X}{Y}\right)^*$ and $\left(\frac{X}{Y}\right)$ for any given P. The autarkic price gap $(P_A - P_A^*)$ will also shrink and so will be the volume of trade. This is clearly demonstrated in figure-2.

Now, the degree of effective capital abundance in the labor-abundant country should be measured as $\left(\frac{K}{L-L_z}\right)$. Therefore $\left(\frac{K}{L}\right) < \left(\frac{K}{L-L_z}\right)$ and,

$$(10) \quad \left(\frac{K}{L}\right) < \left(\frac{K}{L-L_z}\right) < \left(\frac{K}{L}\right)^*$$

Therefore as α rises in a labor abundant country its effective capital abundance is strengthened. It is also to be noted that there is no presumption as to which sector is more affected by corruption with α being the same for both X and Y. But as corruption is a labor-intensive activity, the labor-abundant country suffers in terms of the good over which it has a comparative advantage. The message is that people, who could otherwise be involved in producing Y, are being engaged in illegal activities. Therefore, the corruption induced bias goes against the factor-endowment bias for a relatively labor-abundant country. Due to the same reason for a capital-abundant country corruption will reinforce the endowment bias. While many papers talk about how corruption can raise trading costs and hence adversely affect the volume of trade, it is not clear how corruption actually affects the pattern of comparative advantage. If corruption is a labor-intensive activity, it is definitely going to compete with other labor-intensive activities. That is how an increase in α affects the pattern of comparative advantage and volume of trade.

So we make the following propositions.

PROPOSITION I *: Labor-abundant country's natural endowment bias is countered by corruption bias whereas it is further strengthened in capital-abundant country. And if two countries have similar endowment trade will be determined by relative degree of corruption.*

(11) $$\hat{P} = (-)\frac{\psi\left[(\hat{K} - \hat{L}) + \lambda_{Lz}.d\alpha\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda + \theta\right]}$$

Proof: See appendix A for detailed mathematical proof.

PROPOSITION II *: An increase in the degree of corruption in a labor-abundant economy leads to lowering its volume of trade while it enhances the trade volume for capital-abundant country.*

(12) $$\Delta\hat{P} = (-)\frac{\psi\left[\lambda_{Lz}\Delta.d\alpha\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda + \theta\right]}$$

Proof: See appendix A.

So far we have not explicitly stated the welfare consequences of introducing corruption in the standard general equilibrium model. Having a leakage in the form of corruption entails inefficiency of some sort. Corruption acts as a tax on the labor-intensive sector. In the first best situation the economy should have produced more of the labor-intensive good. If the labor-abundant country wishes to engage in trade, corruption will restrict volume of trade and therefore the extent of the gains from trade will be affected. Thus the welfare loss is reinforced. Higher degree of corruption in a labor–abundant country will be harmful to the capital-abundant country since higher output of capital intensive good will depress world price of that good, causing a terms of trade loss for the capital-abundant country. In fact under free trade the capital-abundant economy will be worse off with increasing corruption at home and abroad. Interestingly once engaged in trade, the labor-abundant economy actually gains from further corruption, through an improvement in the terms of trade. But the inefficiency effect will also be strengthened. However, we may have a case where the labor-abundant country in the post-trade situation can gain from corruption with a strong enough terms of trade effect.[6]

In the next section we talk about a scenario where corruption may be considered as an endogenous factor. It is not insensible to think of endogenizing corruption because government bureaucracy has, in fact, some impact on the degree of corruption.

SECTION III

The Extended Model: Endogenous Corruption

The benchmark model we have discussed so far has one major restriction as α is exogenous. In this section, we treat α as a variable which depends on the size of the government or bureaucracy. L_g denotes the size of the government or bureaucracy which may facilitate productive activity through the proper provisioning of public services. But at the same time regulations and complex layers of decision making may increase transaction costs and induce corruption. Thus

L_g can affect α either way. We start from a situation where

(13) $\alpha = \alpha(L_g), \; \alpha' > 0$

We also assume that for $\alpha(L_g)$ lost in the process only $\beta\alpha(L_g)$ is recovered, $0<\beta<1$. Therefore, $(1-\beta)\alpha(L_g)$ is the cost due to corruption which cannot be recovered. $\beta\alpha(L_g)$ is recovered but is spent away towards payments to the bureaucrat and fees to the intermediaries. The *Z* sector's balancing condition looks as follows.

(14) $\beta\alpha(L_g)\,[PX+Y] = [w+w_b(L_z)]\,L_g + w.L_z, \;\; w_b' < 0$

Note that we now have w_b as the "rent" enjoyed by those powerful in the government to affect productive activities. One can interpret $\beta\alpha(L_g)\,[PX+Y]$ as tax revenue and bribe money. The bribe goes to pay the premium w_b which depends on L_z. Employing greater number as of intermediaries means economizing on paying the premium.

Note that each member in the group L_g earns $(w+w_b)$. Therefore, everyone would like a government job since it pays a premium on top of *w*. To motivate on comparative static results we assume L_g is determined by a government quota. We have stated earlier, L_g can negatively affect α when public services help reduce transaction costs. Higher L_g may intensify the transaction cost as well. In both cases, one can justify a premium w_b. In the former case public officials are paid so that they get added incentive for helping the production process. When higher L_g increases α, bribe needs to be paid for avoiding harassment.

Given L_g, one can determine all the variables. We proceed exactly in the same fashion as in the benchmark model. Let us start from a given *P*, we can determine *w*, *r* from the competitive cost conditions. Then equation (14) determines L_z. Note that given *P*, *(PX+Y)* is independent of L_z. Then given L_z , we can solve for *X* and *Y*. As earlier we assume initially L_g is zero and β is unity so that the inefficiency effect on the payment towards L_g is ignored. Now as *P* increases, given L_g and L_z , *X* must increase and *Y* must go down.

From (14) by differentiating w.r.t. *P* and using the envelope condition we get,

(15) $$\frac{dL_z}{dP} = \frac{\left[\beta\alpha(L_g).X - \frac{dw}{dP}(L_z + L_g)\right]}{\Delta}$$

Note that, due to Stolper-Samuelson argument, $\left(\frac{dw}{dP}\right) < 0$ and Δ = $[w+ L_{g.} w_b'(L_z)] >0$ implies that the RHS in (14) is increasing in $L_{z.}$ Δ guarantees the stability of equilibrium $L_{z.}$ As *P* goes up and consequently $L_{z,}$ *X* goes up further and *Y* shrinks due to Rybczynski argument. Thus relative supply of *X* increases with *P* and we close the system with homothetic demand to find out the equilibrium relative price in autarky.

SECTION III.A

Comparative Statics

Now we need to chalk out how L_z may get affected in order to understand the role of government bureaucracy in enhancing the volume of trade when corruption is being endogenous. Higher "unproductive expenditure" incurred due to corruption or regulatory control are reflected through a higher β or L_g. In case, greater L_g implies positive pro-active influence on productive activity, $\alpha\ (L_g)$ should be decreasing in L_g. But the possibility is always there that regulations and complex layers of decision making may increase transaction costs and induce corruption, $\alpha\ (L_g)$ should be increasing in L_g .

Let us derive the effect of a change in β and L_g on L_z from (14).

Differentiating (14) with respect to β and L_g for a given P and using envelope condition we get,

(16) $$\frac{dL_z}{d\beta} = \frac{[\alpha(L_g)(P.X+Y)]}{\Delta} > 0$$

and

(17) $$\frac{dL_z}{dL_g} = \frac{\left[\beta\alpha'(L_g)(P.X+Y) - [w + w_b(L_z)] - (L_z + L_g)\frac{dw}{dL_g}\right]}{\Delta}$$

Here the value of $\frac{dL_z}{dL_g}$ may be either positive or negative, i.e. $\frac{dL_z}{dL_g} > 0$ or $\frac{dL_z}{dL_g} < 0$. We discuss both the possibilities now. When L_g increases, α can go up or down.

Suppose, α goes down i.e. $\alpha' < 0$. The RHS in (14) will increase for a given *w*, reducing L_z in order to balance both sides. But with more productive activity factor returns improve. Therefore as w increases, L_z needs to fall further. This is captured in (17). If α' *<0*, then $\left(\frac{dw}{dLg}\right) > 0$. Therefore the numerator in (17) is negative implying $\frac{dL_z}{dL_g} < 0$. This suggests that a more productive bureaucracy must imply a smaller size of corruption related activities.

If α' *>0,* $\left(\frac{dw}{dLg}\right) < 0$. But still $\frac{dL_z}{dL_g}$ can be negative. This happens iff $\left|(w + w_b)\right| > \left|\left\{\beta.\alpha'(\mathrm{Lg})(P.X + Y) - (Lg + Lz)\frac{dw}{dLg}\right\}\right|$. Because an increase in L_g, ceteris *paribus,* increases the cost of sustaining bureaucracy. A sufficiently strong α' and/ or $\left(\frac{dw}{dLg}\right)$ will make $\frac{dL_z}{dL_g} > 0$.

Therefore, we can write down the following proposition.

PROPOSITION III:

a) *Higher β will increase L_z for a given P and L_g*

b) *Higher L_g will reduce L_z for a given P and β provided α' <0*

c) *Higher L_g may increase L_z for a given P and β provided α' >0*

Proof: see the discussion above and see Appendix C for mathematical details.

Note that whenever both L_g and L_z go up for a given *P*, *X* must go up and *Y* should decline. Therefore, for a given *P*, relative supply of *X* increases driving down the autarkic relative price. Thus a relatively corrupt economy will have an export bias in favor of the capital intensive good. Hence as we have shown in the benchamark model, if a labor abundant economy has a greater β or L_g , its autarkic relative price of the labor intensive good will be higher compared to no-corruption case. Hence, corruption bias will go against the factor-endowment bias curtailing the volume of trade.

If $\alpha' < 0$ and $\frac{dw}{dLg}$ are strong enough L_z will fall when L_g goes up. In this case, there is a possibility that when L_g goes up, (L_z+L_g) may go down increasing relative supply of Y and hence increasing P. This is a case where more productive bureaucracy promotes export in labor-intensive good and increases the volume of trade.

It is possible that as L_g goes beyond a level, α responds positively to increasing L_g. Therefore, the relative price of the labor intensive good may go down following the initial rise in L_g and then will go up eventually. For a relatively labor abundant economy, a relatively productive bureaucracy will promote trade, but eventually trade gets restricted with bulging bureaucracy.

Figure 3 captures the possibility. D denotes the difference between the world and local (autarkic) relative price of the labor-intensive good. Let $\bar{L}_g$ denote that level of L_g which borderlines the case when bureaucracy starts having an unproductive influence on the autarkic production bundle. Increase in D represents greater volume of trade. Hence volume of trade for the labor-abundant economy increases with L_g initially and then drops.

The analysis in this section corroborates our earlier claim with a constant α. Corruption led transaction costs either in terms of a higher β or rising L_g will generally lead to a higher L_z. This will work against the factor-endowment bias in a typical labor-abundant country, restricting the volume of trade. For a capital-abundant country the result will be exactly opposite.

One important characteristic of trade between two countries, identical in every respect except differing in terms of L_g and β is that under free trade factor prices do not equalize. β or L_g acts as a productivity parameter and under free trade both w and r are likely to be lower in a country with higher β and/or L_g. As opportunity for international factor mobility arises, both labor and capital will be inclined to flow out of the more corrupt economy. Also to be noted is the fact that as a labor-abundant country engages in trade, the relative price of the labor-intensive good increases, leading to a lower L_z and a smaller size of the Z sector or a cut back in activities involving the corrupt segment of the economy. But at the same time the earning of a typical bureaucrat increases with an increase in w as well as an increase in $w_b(L_z)$. However, as long as the elasticity of w_b with respect to L_z is not too strong, one could expect a tilt of wage distribution in favor of the non-bureaucrats.

SECTION IV

Conclusion

The purpose of this paper is to model corruption as a labor-intensive activity within a simple general equilibrium framework and then explain the relationship between international trade and corruption. We argue that the standard HOSV framework provides some insights regarding such a relationship. Corruption is a labor-intensive activity. Hence, as more labor is attracted to this sector, labor-intensive traded good suffers, so does the volume of trade for the labor-abundant economy. This shows that even if corruption does not directly affect trading costs, we can still have lower volume of trade. The scenario in the paper is one where the labor-abundant economy suffers from corruption, but not the capital –abundant one. A corrupt capital-abundant nation is likely to trade more than under the usual "non-corruption" case. Thus corruption leading to greater volume of trade is a distinct possibility. Moreover, our results indicate that there may be a case when in a labor-abundant economy exports are really capital intensive and a large chunk of the labor force is absorbed in the extra-legal non-traded activities.

However, if labor is assumed to be immobile between production and corruption activities volume of trade as well as the natural endowment bias will remain unaffected due to a change in the degree of corruption. Labor immobility insulates the production sector from any shock stemming from corruption. This phenomenon is explained in Appendix D.

If corruption leads to the relative global abundance of capital-intensive good it hurts welfare of a capital-abundant economy. Therefore, such a nation will always despise corruption, a reason grounded in economic reality without much of a moral connotation. Once engaged in trade the labor-abundant country may not mind being more corrupt. Since corruption leads to improvement of its terms of trade. In the extended model the welfare loss due to greater corruption has to be weighed against the terms of trade gain due to greater production of capital-intensive good. We may also have a critical level of government bureaucracy for which it is optimum in raising the volume of trade. An excessive bureaucracy itself may instigate more people to be engaged in corruption activities.

End note

1. Chan (2006) looks at the role of property rights and comparative advantage. Although similar in spirit, he does not deal with the factor-endowment approach.
2. Analysis of corruption and related distortion in open economies starts with Krueger (1974) and Bhagwati (1982). Later papers by Hillman and Ursprung (1988, 1996) introduced explicit political economy angle to the trade related problems. Hillman (2003) summarizes research in this area. More recently Marjit, Ghosh and Biswas (2007), bring in the issue of corruption and trade reform in the context of a developing economy.
3. A paper by Lui (1985) is an interesting reference on this.
4. Interested readers may look into Jones (1965) for more detailed analysis and mathematical calculations.
5. Initial α may not be necessarily 0. Without losing the essence of the model we can think of any positive value of α to start with. In that case the value of $\hat{P}$ would be

$$\hat{P} = (-)\frac{\psi\left[(\hat{K}-\hat{L}) + \lambda_{Lz}(1-a)\hat{\alpha}\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda+\theta\right]}$$

and that of $\Delta\hat{P}$ would be $$\Delta\hat{P} = (-)\frac{\psi\left[\lambda_{Lz}(1-a)\Delta\hat{\alpha}\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda+\theta\right]}$$

Here***, " a"*** captures the effect that as α increases more payment goes to corrupt sector. Note that $0 \leq a \leq 1$. If we start from no-corruption level, *a=0****.*** One can check that this will provide us with the same result.

6. Welfare implication of a change in the degree of corruption in our benchmark model is provided in Appendix B.

<u>Appendix A</u>

Differentiating and manipulating equation (2) and (3) we get,

(1.A) $$\hat{w}(-|\theta|) + \hat{r}|\theta| = \hat{P}$$

Where, $|\theta| = \begin{pmatrix} \theta_{LY} & \theta_{KY} \\ \theta_{LX} & \theta_{KX} \end{pmatrix} = (\theta_{KX} - \theta_{KY}) = (\theta_{LY} - \theta_{LX})$

And, $\theta_{Li} \Rightarrow$ value share of L in i[th] commodity, i= X and Y

$\theta_{Ki} \Rightarrow$ value share of K in i[th] commodity, i= X and Y

Therefore,

(2.A) $$(\hat{r} - \hat{w}) = \frac{\hat{P}}{|\theta|}$$

Here, $|\theta| > 0$ because commodity X is K-intensive.

Solving for $\hat{w}$ we get,

$$\hat{w} = \hat{P}\left[1 - \frac{\theta_{KX}}{|\theta|}\right] \text{ where, } \left(1 - \frac{\theta_{KX}}{|\theta|}\right) < 0$$

Therefore,

(3.A) $$\hat{w} = -\theta\hat{P}$$

$$\text{where, } (-\theta) = \left[1 - \frac{\theta_{KX}}{|\theta|}\right]$$

here, $\theta > 0$ (Stolper-Samuelson result)

Differentiating equation (4) and (5) and manipulating them one gets,

(4.A) $$(\hat{X} - \hat{Y}) = \psi(\hat{K} - \hat{L}) + \psi\hat{L}_z\lambda_{Lz}$$

here, $\psi > 0$, due to Rybczynski's effect.

From equation (6)

(5.A) $$d\alpha + \hat{V} = -\theta\hat{P} + \hat{L}_z$$

Here, $\hat{V} = \lambda\hat{P}$ and λ is the share of X in national income.

Therefore,

(6.A) $$\hat{L}_z = d\alpha + \hat{P}(\lambda + \theta)$$

From homothetic demand function, (6.A) and (4.A) what we have,

(7.A) $$\hat{P} = (-)\frac{\psi\left[(\hat{K} - \hat{L}) + \lambda_{Lz} d\alpha\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda + \theta\right]}$$

where, σ_D implies demand elasticity.

- Hence proposition I is proved.

So the difference in autarkic price level relative to benchmark no-corruption level is given by,

(8.A) $$\Delta\hat{P} = (-)\frac{\psi\left[\lambda_{Lz}\Delta d\alpha\right]}{\sigma_D + \psi\lambda_{Lz}\left[\lambda + \theta\right]}$$

- Hence proposition II is proved.

<u>Appendix B</u>

The utility that a consumer gets depends on consumption demand for X and Y.

(1.B) $$U = U\left(X_D, Y_D\right)$$

Differentiating and dividing both sides by $\frac{\partial U}{\partial Y_D}$ we get,

(2.B) $$dU \Big/ \frac{\partial U}{\partial Y_D} = \frac{\partial U / \partial X_D}{\partial U / \partial Y_D} dX_D + dY_D$$

LHS of the previous equation is the change in utility expressed in terms of units of Y. We can call it change in real income or welfare in Y units. Let us denote it by $d\Omega$. Therefore we can write,

$$d\Omega = \frac{P_X}{P_Y} dX_D + dY_D$$

Hence,

(3.B) $$d\Omega = dY_D + PdX_D$$

We also know that the budget constraint is,

(4.B) $$Y_D + PX_D = Y + PX$$

Differentiating we have,

$$dY_D + PdX_D + X_D.dP = dY + PdX + X.dP$$

Or, $dY_D + PdX_D = dY + PdX + X.dP - X_D.dP$

Or, $dY_D + PdX_D = dY + PdX - .dP(X_D - X)$

Therefore,

(5.B) $$d\Omega = -.dP(X_D - X) + (dY + PdX)$$

The first term of the RHS represents Terms of Trade (TOT) effect whereas the second term signifies the change in the value of total production or change in production bundle.

Any change in welfare due to change in the degree of corruption comes through TOT change and change in the production bundle.

(6.B) $$\frac{d\Omega}{d\alpha} = -\frac{dP}{d\alpha}(X_D - X) + \left(\frac{dY}{d\alpha} + P\frac{dX}{d\alpha}\right)$$

We know that $\frac{dP}{d\alpha} < 0$ for a labor-abundant economy whereas the second term $\left(\frac{dY}{d\alpha} + P\frac{dX}{d\alpha}\right)$ is also negative as a rise in the degree of corruption leads to lowering the value of total production in labor-abundant country. An increase in α reduces both w and r.

Therefore TOT effect is positive for a labor-abundant country when degree of corruption increases. However, there is an inefficiency effect since greater corruption reduces value of production and retained earnings of the factor owners. Such a trade-off is absent in the capital-abundant country. An increase in corruption worsens its terms of trade and also leads to direct income loss.

APPENDIX C

Differentiating equation (14) w.r.t. P

$$\beta\alpha(L_g)\left[P\frac{dX}{dL_z} + \frac{dY}{dL_z}\right]\frac{dL_z}{dP} + \beta\alpha(L_g).X = w'_b(L_z).\frac{dL_z}{dP}.L_g + w.\frac{dL_z}{dP} + \frac{dw}{dP}(L_z + L_g)$$

(1.C)
$$\frac{dL_z}{dP} = \frac{\left[\beta\alpha(L_g).X - \frac{dw}{dP}(L_z + L_g)\right]}{w'_b.L_g + w - \beta\alpha(L_g)\left\{P.\frac{dX}{dL_z} + \frac{dY}{dL_z}\right\}}$$

here, $\frac{dw}{dP} < 0$ and $w + L_g.\, w_b'(L_z) = \Delta > 0$ for stability of equilibrium L_z.

Setting $(PdX+dY) = 0$ from envelope condition we get, (2.C) $$\frac{dL_z}{dP} = \frac{\left[\beta\alpha(L_g).X - \frac{dw}{dP}(L_z + L_g)\right]}{\Delta} > 0$$

Differentiating equation (14) w.r.t. β, for a given P and using envelope condition one gets,

$$\alpha(L_g).P.X + \alpha(L_g)Y = \frac{dw_b(L_z)}{dL_z}.\frac{dL_z}{d\beta}.Lg + w.\frac{dL_z}{d\beta}$$

(3.C) $$\frac{dL_z}{d\beta} = \frac{[\alpha(L_g)(P.X + Y)]}{\Delta} > 0$$

Differentiating equation (14) w.r.t. β, for a given P and using envelope condition one we have,

$$\beta\frac{d\alpha(L_g)}{dL_g}.PX + \beta\frac{d\alpha(L_g)}{dL_g}.Y = w + L_g\frac{dw}{dL_g} + \frac{dw_b(L_z)}{dL_z}\frac{dL_z}{dL_g}.L_g + w_b(L_z). + w.\frac{dL_z}{dL_g} + L_z\frac{dw}{dL_g}$$

(4.C) $$\frac{dL_z}{dL_g} = \frac{\left[\beta\alpha'(L_g)(P.X + Y) - [w + w_b(L_z)] - (L_z + L_g)\frac{dw}{dL_g}\right]}{\Delta}$$

APPENDIX D

Without losing generality we can make following changes in the benchmark model. There are two types of labor in the economy, say, L_1 and L_z. L_z is different from L_1 . L_1 is absorbed in the production of X and Y and return to L_1 is w_1 but L_z get employment due to institutional complexities involved in licensing and international trade and thses laborers get w_z as wage.

Solving for $\hat{w}_1$ we get, $\hat{w}_1 = \hat{P}(1-\alpha)\left[1-\frac{\theta_{KX}}{|\theta|}\right]$ where, $\left(1-\frac{\theta_{KX}}{|\theta|}\right) < 0$

Therefore,

(1.D) $\hat{w}_1 = (-\theta)\hat{P}$

Equation (5.A) of Appendix A will become

(2.D) $d\alpha + \hat{V} = \hat{w}_z + \hat{L}_z$

Therefore,

(3.D) $\hat{L}_z = d\alpha + \lambda\hat{P} - \hat{w}_z$

Let us introduce the labor mobility function $\frac{L_1}{L_Z} = g\left(\frac{w_1}{w_z}\right)$; $g' > o$ to capture the effect of mobility.

Therefore,

(4.D) $\hat{w}_z = (-\theta)\hat{P} - \frac{\hat{L}_1 - \hat{L}_z}{\phi}$

where ϕ is the elasticity of labor-mobility function.

From (4.D) and (3.D) one gets,

(5.D) $\hat{L}_z = \frac{1}{\left(1+\frac{1}{\phi}\right)}\left[d\alpha + \frac{\hat{L}_1}{\phi} + \lambda\hat{P} + \theta\hat{P}\right]$

Using homothetic demand, labor mobility function and equation (5.D) and manipulating we get the value of $\hat{P}$ as

(6.D) $$\hat{P} = (-)\frac{\psi\left[\hat{K} - \hat{L}_1(\lambda_{L1X} + \lambda_{L1Y}) - \hat{L}_z\lambda_{Lz} + \frac{\lambda_{Lz}}{1+\frac{1}{\phi}}d\alpha + \frac{\lambda_{Lz}}{1+\frac{1}{\phi}}\frac{\hat{L}_1}{\phi}\right]}{\sigma_D + \frac{\psi\lambda_{Lz}}{1+\frac{1}{\phi}}[\lambda+\theta]}$$

where, λ_{L1Y} = share of labor engaged in *Y* production, λ_{L1X} = share of labor engaged in *X* production and λ_{Lz} = share of labor engaged in corruption acitivity.

Putting $\phi = 0$ we have the in difference autarkic price level relative to benchmark no-corruption level as,

(7.D) $$\Delta\,\hat{P} = 0$$

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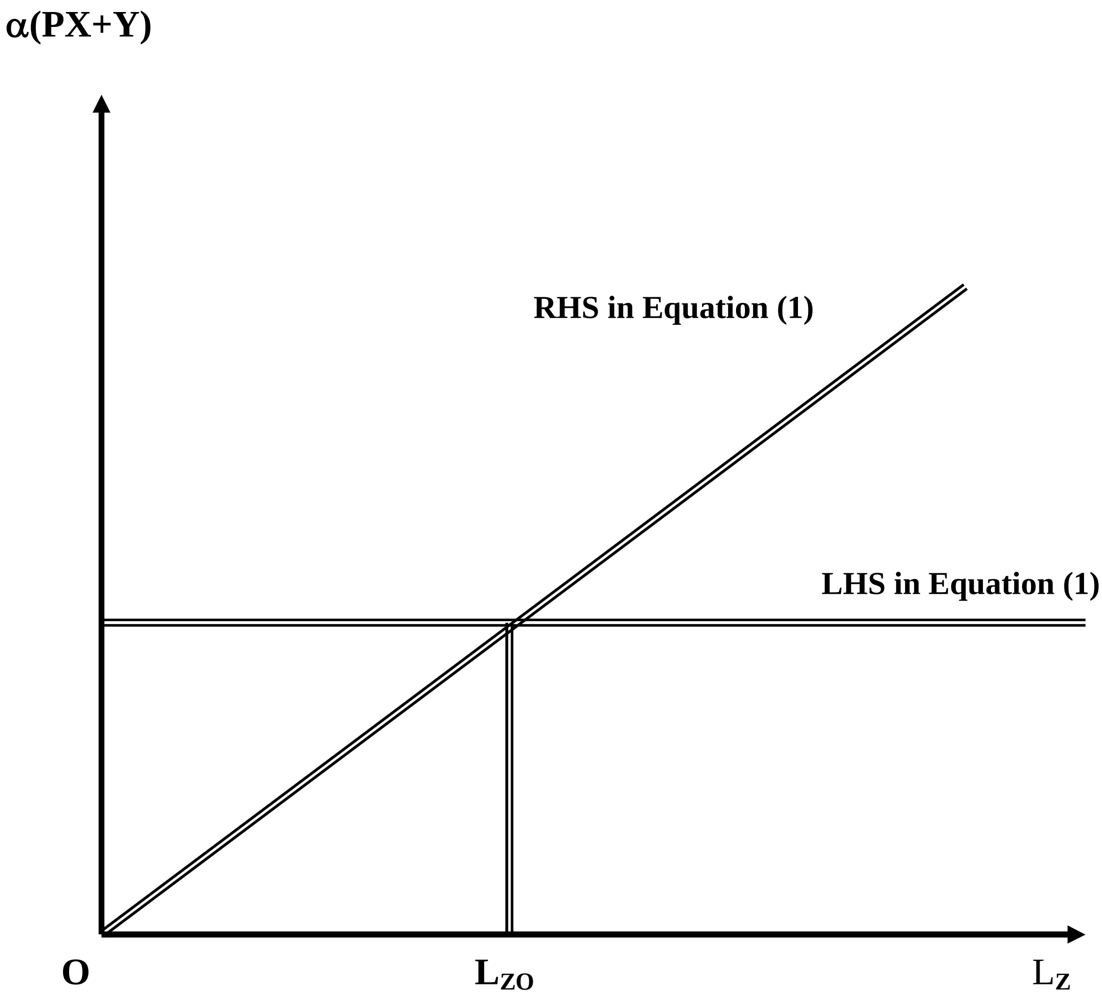

FIGURE - 1

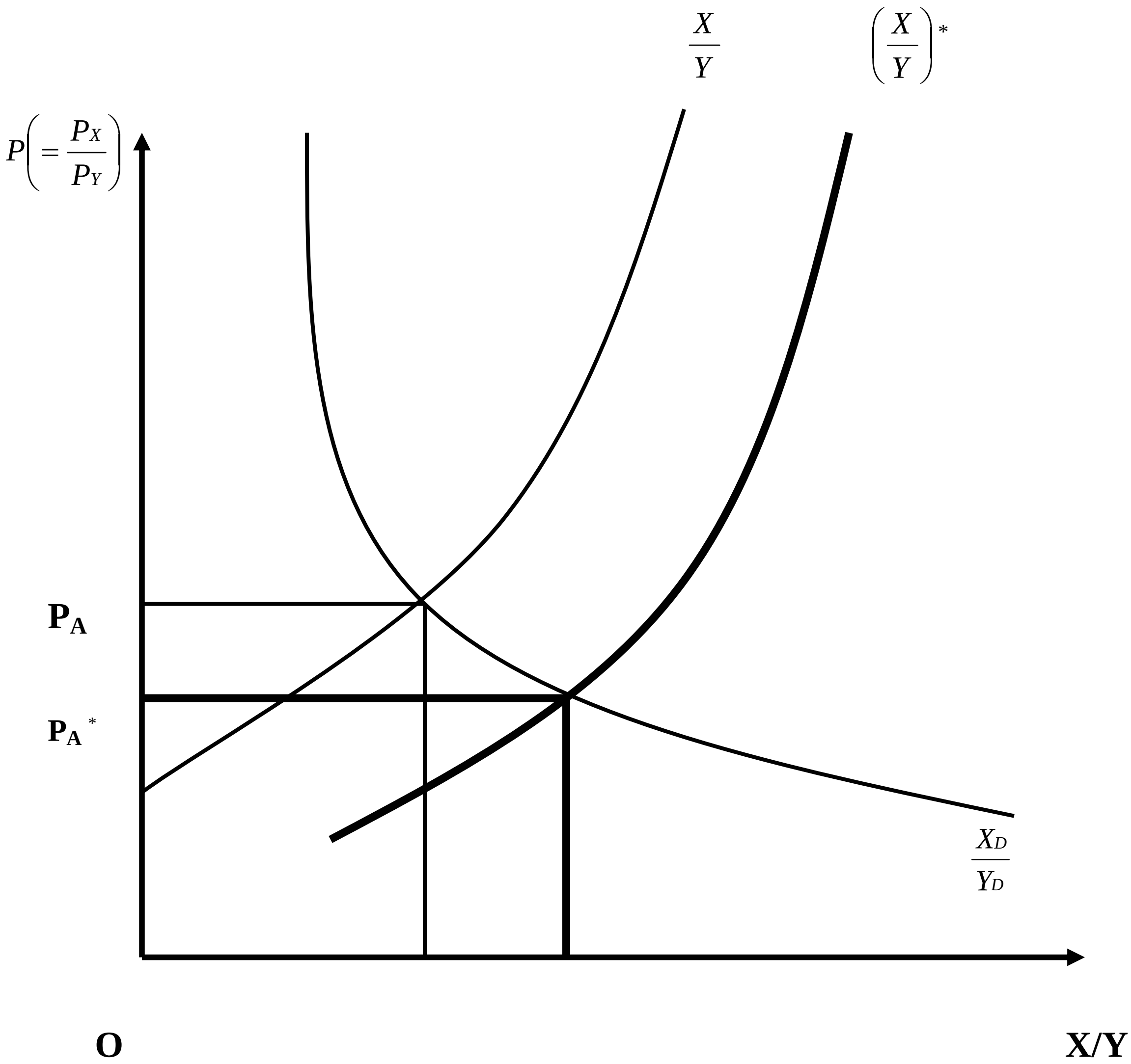
$\frac{X}{Y}$
$\left(\frac{X}{Y}\right)^*$
$P\left(=\frac{P_X}{P_Y}\right)$
P_A
P_A^*
$\frac{X_D}{Y_D}$
O
X/Y

FIGURE - 2

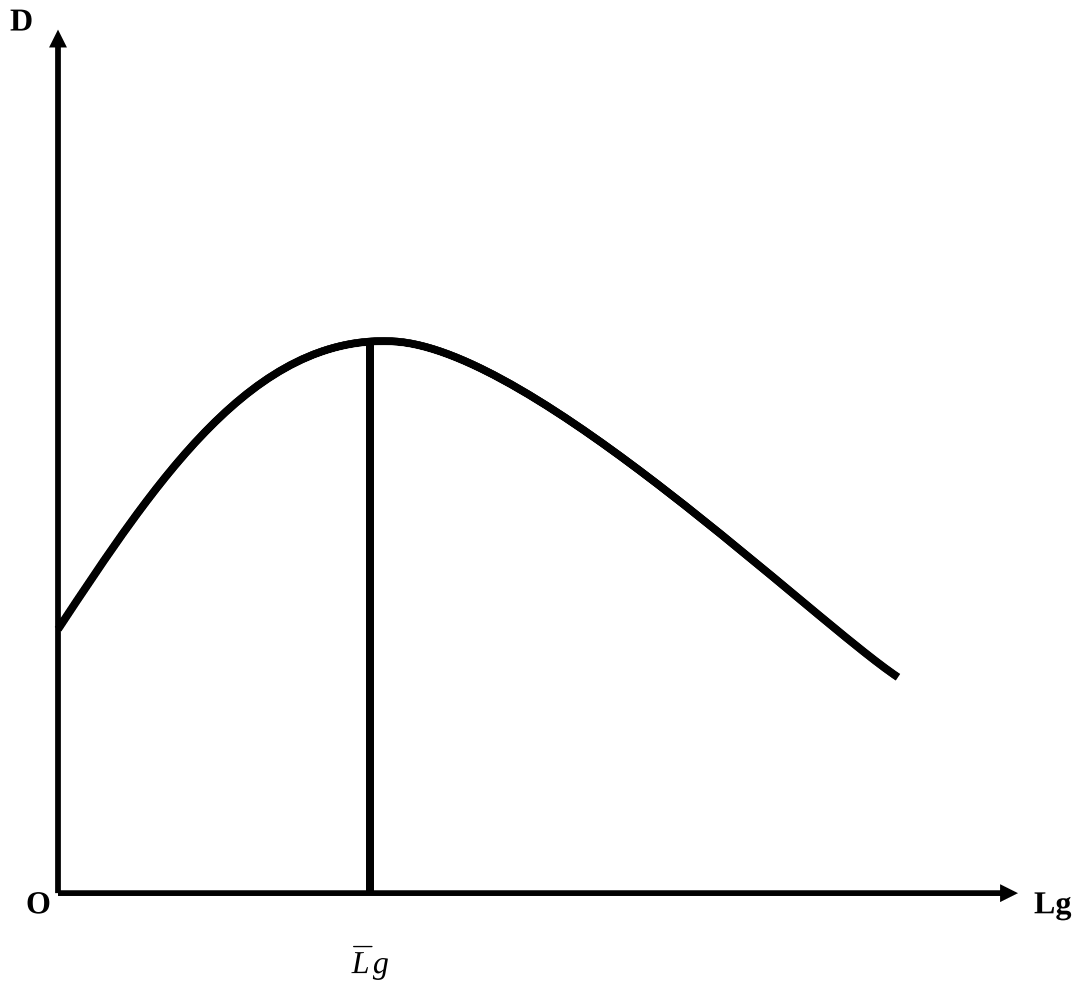

FIGURE - 3