Is Corruption Detrimental or Beneficial for Trade? A Case Study of Pakistan

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Dedicated to My Father

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ABSTRACT

Corruption generates dual impact on trade represented by sand wheel and grease wheel hypothesis. This study, by using corruption in the custom's department, provides evidence in favor of the validity of both the hypothesis in Pakistan, implying that corruption encourages as well as discourages trade. We find that when tariffs are high, corruption boosts the trade by avoiding tariffs. On the other hand when tariffs are low, corruption discourages trade by adding to cost. This proves that the impact of corruption on trade is non-linear. The implication of the findings is that tariff rates should be set at a moderate level.

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CHAPTER 1

INTRODUCTION

Trade is considered to be a strong determinant of economic growth. Hence the significant attention which trade related subjects drawn in relevant literature. Various factors affect trade in different ways. Trade depends upon terms of trade, GDP and many other factors like common border, language, exchange rate etc. As trade increases in a country it moves towards more prosperity and growth. But trade doesn't always increase. There are many hurdles to it, like transportation cost, cultural differences, membership in international organization, WTO sanctions and corruption etc. Numerous studies suggests measures required to remove the barriersto trade.

Corruption is defined as the improper use of authority for private gain (Wireman, 2012). After the introduction of Institutional Economics, governance and culture has gained central attention in the literature on growth. Authors like Acemoglu (2000), Williamson (2005) and Tanzi (1997) have discussed harmful effects of corruption on growth of a country. Corruption doesn't only affects growth butit also makes the government ineffective (Anechiarico, 1996).Therefore it is very important to incorporate the effects of corruption on overall economy. This study aims to evaluate the effect of corruption on trade. The study looks at both the positive and the negative effects of corruption. Various proxies of corruption are used in the literature. This study uses the 'Under invoicing in Trade' introduced by Zafar *et al.* (1993).

By and large, effect of corruption in literature is negative on economic growth, governmental expenditures and foreign direct investment (Tanzi and Davoodi, 1997; Habib and Zurawicki, 2002). These results conflict with the findings of Leff (1964) that corruption may increase efficiency by bypassing the government imposed rigiditiesto attract more

investment and hence cause growth. This view is referred to as "corruption greases the wheels" (Rose Ackerman 1997).

The literature offers different theories and concepts regarding the impact of corruption on trade, it has gone beyond the "moralistic view" which exclusively criticizes the role of corruption. The views based on morality might misrepresent our understanding about the corruption and its consequences. (Meon and Sekkat, 2003). This study examines two hypothesis; sand wheel hypothesis and greases the wheel hypothesis. In plain words the study respectively examines whether corruption encourages trade or discourages it.

The study examines the effects of custom officials' corruption on trade, by stressing the dichotomy of *evasion* and *extortion*[1] of corruption in trade perspective.By*Extortion* we mean that corruption by the customs authorities impedes trade and *evasion* means that corruption facilitates trade by relaxing the government imposed rigidities. Zafar*et al.* (1993) explains how custom officials 'scale down statistics for their own gain.

Greasing wheel perspective (Evasion):

The magnitude of the effect of corruption on trade is affected by the level of tariffs. Corruption can enhance efficiency; it removes the government imposed rigidities (tariffs) and greases the wheel of trade. For a given level of corruption, marginal effect of corruption on trade is affected by the level of tariffs. With low level of corruption; if the tariffs are high, a marginal increase in corruption will decrease the government imposed rigiditiesand thetrade volumewill increase due to evasion. (Dutt and Traca, 2010)

[1] Extortion implies Corruption is Detrimental for trade, Evasion implies Corruption Beneficial for trade

Sand wheel perspective (Extortion):

This perspective suggests that the impact of tariffs on trade volume is affected by the level of corruption; increase in corruption can decrease the trade flow because of extortion. This perspective suggests that corruption will impede the involvement of importer/exporter in trade. Thus for a given level of tariffs, a marginal increase in corruption will result in lowering the trade flow.

Our investigation shows thatboth the negative and positive impact of corruption is evident in Pakistan. Corruption reduces bilateral trade in Pakistan but at the same time it has positive impact if trade tariff are high. Countries are trying to reduce corruption because it is considered as curse for the economic growth, but they are not trying to address the reasons of corruption. Corruption is underpinned by certain reasons, which encourage officials to engage in corruption. This study shows that reducing the degree of openness i.e. increasing trade tariff, will eventually create incentives for the customs officials' to engage in corruption depending upon degree of supervision and risk of getting caught.

1.1. OBJECTIVE

The Study is focused on Pakistan. The objectives are given below:

- Whether corruption is detrimental to trade or beneficial for trade?
- How corruption behaves with the fluctuation in average tariff?
- Does corruption exhibits non-linear behavior against trade?

1.2. SIGNIFICANCE OF STUDY

Most of studies available on the subject use cross country panel data, but this approach does not give us the country specific results and therefore do not help in policy formulation. This study is exclusively focused on Pakistan. Though for Pakistan sufficient

literature is available for the effect of corruption on trade (Gatti (1999), Younas (2000), S. Knack and O. Azfar (2003)), however none of these studies have considered the possibility of dual impact of corruption. This study specifically examines whether corruption encourages or discourages international trade in Pakistan.

1.3. PLAN OF STUDY

Rest of the study is organized as follows; chapter two reviews the literature on trade and specifically discusses the impact of corruption on trade. Chapter three discusses the theoretical framework. In chapter four data formulation and econometric issues are discussed. Chapter five presents the results of econometric investigation. Chapter 6 concludes the study.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews trade theories and relevant literature regarding trade. Keeping in view the study objectives, the chapter is divided into three sections to have better understanding of the problem. Trade theories have been discussed in section one, the impact of corruption on trade has been discussed in section two and three. Finally the influence of conventional variables on trade is discussed in section four.

2.1. TRADE THEORIES

We are at the edge of globalization. International markets are now more interlinked and easily accessible to producers and consumers. All of this happens after huge bunch of theories and evidence available. This myopic view gives us ideas about prevailing international trade theories.

2.1.1 Theory of Absolute advantage

Mercantilist's view was that every country should export the good and services to increase the wealth and hence the economic growth. But later on it became evident that the mercantilist view is in favor of producers only and neglects the consumers. Therefore mercantilist policies came to be regarded as an impediment to economic growth. At that time Hla (1977) argued that a nation should export on the basis of absolute advantage and should export the commodity that use the factor which is available in abundance and should import the commodity the intensive factor of which is less abundant.

2.1.2 Theory of Comparative Advantage

The Smith's Theory of absolute advantage was later replaced by the Ricardo's comparative advantage theory. Ricardo's comparative advantage theory extended the scope

of trade by emphasizing on the fact that gain from trade is far more than envisioned by Smith. The modelbegan with two goods and one factor of production and later on incorporates two goods and two factor of production (also known as two-by-two model). In this model Ricardo shows how the technological difference can make both the economics better off through trade. The basic idea of the model is that countries should import what is comparatively expensive for them to produce and specialize in what producing is comparatively in-expensive. The model suggests that trade decisions are made on the basis of comparative advantage and wage rate is determined on the basis of absolute advantage. The model makes certain strong assumptions. Ricardo's analysis was further extended by Semulson (1949) by relaxing the assumption of factor immobility used by Ricardian model and came up with a theorem of Factor Price Equalization. It states that if the factors are mobile across trading partners then factor prices will be equalized in both countries. Yet anotherRicardian extension was mobilizing both the factor of production (known as Hechscher-Ohlin Model).

Rybczynski was concerned with the question "what if a specific factor endowment is increased?" to answer he put forth Rybczynski theorem (1955). Rybczynski (1955) theorem states that if there is an increase in endowment of any factor of production this will eventually increase the output of the industry using that particular factor intensively, and decrease the output of others. For example Dutch Disease – Netherland discovered oil which led to in an increase output of industries using oil intensively and at the same time the output of traditional export industries of Netherlands decreased.

2.2. Corruption as sands the wheel phenomenon (Extortion)

Conventional wisdom considers corruption as an obstacle to economic growth. Negative impact of corruption is highly discussed in the literature; showing that it shrinks the economic growth (Keefer and Knack, 1995), reduces the domestic investment and FDI (PSRA, 2003) and also contributes to leakages in government expenditures (Tanzi and

Dawoodi, 2003). Most of the corruption consists at bureaucratic level. Bureaucratic corruption occurs due to the discretionary powers over the distribution and regulation of benefits to the private sector (Rose-Ackerman, 1997), hence discouraging the private investor to participate in transaction. As a result county's trade volume is reduced. Younas (2000) empirically evaluates corruption behavior for multiple countries and highlights bribe procedures at different levels ofinternational transaction in Pakistan[2].It is argued that bureaucrats responding to preserve incentives ration public services to secure maximum rent. All this rent seeking results an increase in transaction cost and act as a barrier to trade (Kurer, 1993)[3].

2.3. Corruption as greasing the wheel phenomenon (Evasion)

Literature provides different theories and concepts regarding the impact of corruption on trade, it has gone beyond the "moralistic view" that exclusively criticizes the role of corruption. Leff (1964) argues that the view based on morality might misapprehend our understanding about corruption and its consequences[4]. Corruption can overcome the non-functionality of the bureaucracy. Huntington (1968) states that "In terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy, is one with a rigid, over-centralized, honest bureaucracy". In a country with restrictive trade regulation, opportunity to give bribe will allow the firm owners to bypass the trade regulation and involve in trade. Therefore corruption increases the trade volume by reducing the intensity of trade barriers between the countries. (Rose-Ackerman 1997)

[2] Arduz (2000) describes customs clearing criteria in the same way where most of the custom officials levied their own taxes besides official tax. And discourage individual to participate.
[3] Bardhan 2006 and Rose-Ackerman (1997) also gave the rational for the behavior of official when they are having discretionary powers over the regulations.
[4] The study also highlights how bureaucratic corruption circumvents inefficient institutional structure.

2.4. CONVENTIONAL TRADE LITERATURE

This section briefly discusses the role of major variables that influence trade. A number of studies identify terms of trade as a basic and core phenomena which effect the transactions. Trade is influenced by the nature of terms of trade, favorable or unfavorable especially in context of trade between developing and developed nations (Fatima N. 2010).Dutt and Traca (2010) among others conclude that tariff as transportation cost is one of the major impediments to trade. More transportation cost lesser will be the trade between the nation. Moreover besides distance, cultural, linguistic, religious heterogeneity also supposedly hinders trade (Dutt and Traca, 2010).

Review of literature suggests that almost all the studies on corruption are focused on aggregate level of corruption rather at the level of officials of the custom department. None of the studies specify the exact coefficient of corruption for a single country which can be helpful in designing the trade policy. This study seeks to cover this gap in literature and is therefore mainly focused on corruption in trade by custom officials'. Whenever the official has discretionary power, they try to use them for rent seeking. Corruption enhances trade because the firm wants to avoid the trade barriers which are mostly in the shape of tariffs, and eventually the rent is shared between the producer and custom officials (Rose-Ackerman, 1997). The same relation is discussed by Bardhan (2006). He argues that the official allows producers to avoid regulation so that they can share rent with the producer which gives incentive to both parties to engage in rent seeking. Thus the producer is facilitated who can increase the transaction volumefor a given bribe.

CHAPTER 3

THEORATICAL FRAMEWORK

This study follows a variant of augmented gravity model used by Pash and Dutt (2010). This model introduces the corruption in gravity equation in three phases. Starting with utility maximization and concluding equilibrium at macroeconomic level the firm equilibrium. To have a better understanding of micro foundation of this study, the model is explained below.

3.1. MODEL

The model begins with the consumer preferences in a specific country. Assume country *d* with consumer preferences as follows:

$$U = \int_l \; x_l^{1-\frac{1}{\varepsilon}}$$

Where x_l is the demand of good l and $\varepsilon > 1$ denotes the elasticity of substitution. Letting Y_d denote the income / expenditure and $p_l$is the price of *l* in country *d*. Country *d's* demand for *l* is given by:

$$x_l = p_l^{-\varepsilon} P_d^{\varepsilon-1} Y_d$$

$$with P_d^{1-\varepsilon} = \int_l \; p_l^{1-\varepsilon}$$

Where;

P_l is the price of commodity x_l in country *d*, Y_d is the level of income in country *d* and $P_d^{\varepsilon-1}$ price of domestically produced goods.

Assume now that *l* is produced by a single firm in origin country *o*, and the country *o* at least produces to satisfy the demand of commodity *l* in country *d*, so that x_l is the export of

country *o*to country *d*. Unit cost of production of *l* is given by *c* for country *o*. While exporting *l* the country *o*incurred transport and border cost. Transportation cost is represented by λ and border cost mainly consists of nominal tariff of country *d* to import form *o* denoted by T_{od} and set by the trade policy of the country *d*.

Consider a variable *z* defined as the *zeal* of custom officials to make sure that exporter or importer has been compiling all the regulatory barriers. There are several possibilities regarding this variable. Official may engage in under-invoicing or misclassification of imports into the low tariff category. So we can define a term as *zT* and call it as effective tariff, where$0 < z \leq 1$. $z < 1$ Implies there is tariff evasion. The *zeal* is influenced by the level of supervision δ– high supervision grater will be the *zeal* and vice versa. On the other hand officials can increase their import-rent by lowering *z* which eventually increases the pie of their bargain (getting away paying fewer tariffs then required as per rules).

The above mentioned behavior can be captured by the following utility function. (Dutt and Traca, 2010)

$$U = b^{\psi} \exp \delta(1 - \mathrm{z}^{-1} - \ln \mathrm{z}) \qquad (0 < \psi < 1)^{5}$$

Where

b is bribe taken by custom officials, ψ level of corruption and δ is level of supervision in custom department. Greater the level of supervision there will be more will be the chances for custom official to get caught.

[5] This utility functions assumes bribe as only source of income and ignores other determinant of corruption (like low salary). This model only focus on trade variables.

If$\psi = 0$this implies a corruption free environment and$z = 1$, there is no utility for the custom officials' to bribe.

Exporting commodity*l* to country d takes three phases to complete. In phase-I country*o* decides the quantity of export. In phase-II the merchandise has to go through the custom clearance procedure. In this phase, the custom clearing officer decides how much regulation to follow, depending on his *zeal*, and in the final phase, phenomenon of extortion and evasion comes in. (Extortion impedes trade and evasion facilitates trade by relaxing government imposed rigidities).

So the profit of firm *l* in country *d* is given as follows:

$$\Pi = \pi - \lambda c x_l$$

$$\pi = p_l x_l (1 - zT) - b$$

Where π is the revenue received by the firm *l*.

Equilibrium:

Starting from negotiation between exporter and custom officials, the result of negotiation is represented as competitive equilibrium which is achieved through Nash Bargaining Game (Rose-Acerman, 1997). We assume that the custom official has the absolute control as a gatekeeper. So if official refuses to clear shipment, he has to send back the shipment. We take value of shipment $\overline{p_l x_l}$ asgiven.

Solution to the Nash Bargaining is as follows:

$$\max_b \ln U + \ln \pi$$

$$\max_b \ln[\, b^{\psi} \exp \delta(1 - \mathrm{z}^{-1} - \ln \mathrm{z})] + \ln[\overline{p_l x_l}(1 - zT) - b]$$

$$\max_{b}[\psi \ln b + \delta(1 - z^{-1} - \ln z)] + \ln[\overline{p_l x_l}(1 - zT) - b]$$

Usingthe first order condition we can see how net revenue of effective tariff is shared between exporter and the custom official.

$$b = \frac{\psi}{1+\psi}[\overline{p_l x_l}(1 - zT)] \qquad (3.1)$$

$$\pi = (1 + \psi)^{-1}[\overline{p_l x_l}(1 - zT)] \qquad (3.2)$$

From equation (3.1) we can infer that an increase in corruption level will enhance the chances of asking high bribes. Whereas an increase in corruption carry negative effect on firms' revenue i.e. see equation (3.2).

Phase-II

In this stage we determine how much *zeal*of the customs officials is developed. To see this consider following maximization problem:

$$\max_{z}[\psi \ln b + \delta(1 - z^{-1} - \ln z)]$$

$$\max_{z}[\psi \ln\{\frac{\psi}{1+\psi}\overline{p_l x_l}(1 - zT)\}] + \delta(1 - z^{-1} - \ln z)]$$

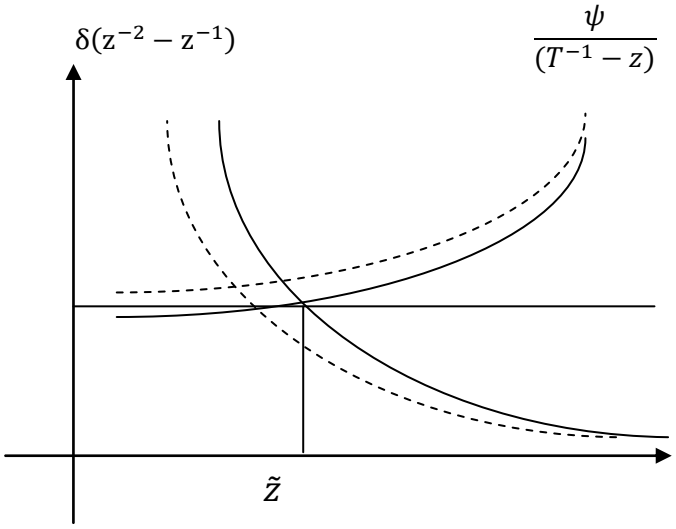
Using first order condition with respect to z will lead us to following inequality:

$$\delta(z^{-2} - z^{-1}) \geq \frac{\psi T}{1-zT} (= 0 \; if z < 1) \qquad (3.3)$$

Equation (3.3) has crucial importance in this model. Graphical representation of equation (3.3) gives us solution for the*zeal* ($\tilde{z}$). Left hand side of equation (3.3) shows marginal gain of custom official from rising z, which is decreasing in z. The right hand side shows marginal cost in rising z, which is increasing in z. Here we can see that if $\psi = 0$ then $z = 1$which implies that there is no evasion.

Equation (3.3) can be written as:

$$\delta(\mathrm{z}^{-2} - \mathrm{z}^{-1}) \geq \frac{\psi}{(T^{-1} - z)}$$



(Figure 1)

Figure 1 shows that an increase in the level of corruption (ψ) decrease the equilibrium level of (z). An increase in supervision (δ) will raise the equilibrium level of z.

Phase-III

In this phase exporter takes decision about volume of goods to be exported. The exporter maximizes profit by selecting the optimal output of commodity *l*.

Consider following maximization problem:

$$\max_{x_l} \Pi = \pi - \lambda c x_l$$

$$\max_{x_l} \Pi = (1 + \psi)^{-1}[p_l x_l(1 - \tilde{z}T)] - \lambda c x_l \qquad (3.4)$$

Where $\tilde{z}$in equation (3.4) represents the optimal level of custom officials'*zeal* derived in equation (3.3). Given the demand function, we can derive the optimal price levelas:

$$p_l = p = \lambda c\left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\left(\frac{1+\psi}{1-zT}\right)$$

Furtheralgebraic manipulation yields the following:

$$p_l = \lambda c\left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta)}{(1-\mathrm{T})} \qquad (3.5)$$

Where;

$$(1+\Delta) = (1-\mathrm{T})(1-zT)^{-1}(1+\psi)^{6}$$

In equation (3.5),Δ represents the corruption tax that captures the fluctuation in price level due to behavior of the custom officials of country *d*. Here, we can also see the extreme case $(\psi = 0; z = 1)$ in which corruption tax is zero. By putting the pricep_l of commodity *l*, in demand function we can get the level of export ofgood l:

$$x_l = \left[\lambda c\left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta)}{(1-\mathrm{T})}\right]^{-\mathcal{E}} P_d^{\mathcal{E}-1}Y_d$$

Here the impact of corruption on export is captured by the term Δ (corruption tax). An increase in corruption tax leads to decrease in export level and profit for firm *l*.

$$\Pi = \left[\left(\frac{1+\Delta}{1-\mathrm{T}}\right)^{-\mathcal{E}}\right](\lambda c)^{1-\mathcal{E}}P_d^{\mathcal{E}-1}Y_d(\mathcal{E}-1)^{\mathcal{E}-1}(\mathcal{E})^{-\mathcal{E}} \qquad (3.6)$$

Equation (3.6) explains the effect of corruption on firm's profit thorough corruption tax(Δ). As corruption tax increases, profit of the firm decreases.

[6] See detail derivation in appendix II

As mentioned earlier the objective of this study is to capture the effect of corruption on bilateral trade. As gravity model best captures the variation in bilateral trade, therefore to capture the effect of corruption on trade this study we initially incorporate the possibility of corruption in the gravity model.However we have estimated the model which is only partially similar to the gravity model.The reasons for deviating from the gravity model which are discussed in the next chapter. For better understanding of the micro foundation, the study follows the Dutt and Traca (2010) methodology. Dutt (2010) also incorporates corruption tax in the gravity model. Corruption tax includes two terms, explaining the role of corruption in the scene of extortion and evasion, andis defined as:

$$\Delta(corruptiontax) = \psi - F(\psi|\, \delta, T)^{7} \qquad (3.7)$$

$$\psi = Extortion$$

$$F(\psi|\, \delta, T) = evasion$$

These terms incorporate the dual role of corruption in determining the level of trade. Extortion and evasion are the two elements of corruption that reduce and encourage trade flow respectively. Both the terms are highly influenced by tariff$T$ which is tariff in country *d*. Dutt and Traca (2010) has derived and comprehensively explained the term in their model. In this modelwe observe that the effect of corruption tax can be negative or positive depending upon which effect is more dominant.

$$X_{od} = \left(\frac{1+\Delta_{od}}{1+T_{od}}\right)^{1-\varepsilon} \lambda^{1-\varepsilon} \frac{Y_d Y_o}{P_d^{1-\varepsilon} \gamma_o^{1-\varepsilon}}^{8} \qquad (3.7a)$$

Equation (3.7a) is the traditional gravity equation which includes the term corruption tax. It is noteworthy that ε>1 which implies thatthe effect of corruption tax isopposite to the effect of

[7] Detailed Derivation of expression is given in appendix I.
[8] Detailed derivation of expression is given in appendix II.

corruption and depicts inverted U-shaped relation between the trade flow and corruption. It is important to note here that corruption comprises extortion and evasion opposing effects on trade.

3.2. EMPERICAL MODEL

Our previous mathematical derivation till now gives us equation (3.7a) that we need to estimate. To develop empirical model for estimating this equation, we have usedTaylor approximation and log linearization.

$$X_{od} = \left(\frac{1+\Delta_{od}}{1+T_{od}}\right)^{1-\mathcal{E}} \lambda^{1-\mathcal{E}} \frac{Y_d Y_o}{P_d^{1-\mathcal{E}} \gamma_o^{1-\mathcal{E}}} \qquad (3.7a)$$

Log linearization of above expressionyields the equation to be estimated:

$$\ln X_{odt} = a_1\psi_{dt} + a_2\psi_{dt}T_{odt} + a_3\psi^2 T_{odt} + a_4 T_{odt} + \boldsymbol{\Theta Z}_{odt} + b_1(Y_{ot}Y_{dt}) + c_1\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \qquad (3.8)$$

Expected signs of the coefficients are:

$$a_1 = -\mathcal{E} < 0$$

$$a_2 = \mathcal{E}d_1 > 0$$

$$a_3 = -\mathcal{E}d_2 < 0$$

$$a_4 = -\mathcal{E} < 0$$

$$\boldsymbol{\Theta Z}_{odt} = (1-\mathcal{E}) \ln \lambda_{odt}$$

$$b_1 > 0$$

$$c_1 \leq 0$$

CHAPTER 4

DATA AND METHODOLOGY

This section contains detail discussion on data and methodology used to carry out the estimation. Generalized method of moment (GMM) is used because there existsendogeneityin the model. Our theoretical model contains the distance variable however in our empirical estimation we have drop this variable time series data in which the distance being static would have no variation.

4.1. DATA

Data span for the study is1972-2009. To estimate the model we need two trading countries. One country is off course Pakistan and for the trading partner we have chosen USA because USA is among the largest trading partners of Pakistan. All data is in US dollars. The data sources are discussed below.

4.1.1. Bilateral Trade

The Bilateral Trade data for USA and Pakistan is from IFS Direction of Trade statistics (DOTS).

4.1.2. Corruption

As there is no direct measure of corruption by the officials of custom department, therefore this study uses the data on mis-invoicing as a measure of corruption. The data on mis-invoicing is from Zafar *et al.*(forth coming). The Zafar *et al.* (2001) and Zafar *et al.* (1993)explain that mis-invoicing is computed in the following manners. It uses the partner-countrytrade related datato compute mis-invoicing in trade. Thus cost, insurance and freight (c.i.f.) import value of the partner country are comparedwith the free on board (f.o.b.) export

value of the concerned country to findunexpected discrepancies in Trade. Using this approach, Trademis-invoicing isdefined in the following way:

*MIS = MIC – XP*AD*

Where,

MIS = Mis-invoicing

MIC = C.i.f. imports from Pakistan.

XP = F.o.b. exports of Pakistan.

AD = Adjustment factor defined as c.i.f. minus f.o.b.

The differencebetween c.i.f and f.o.b is quite common especiallyin the developing countries. The differences are purely due to engagement of custom official in manipulating the official statistics.

4.1.3. Trade Tariff

Average tariff rate is total collection of the customs department as a percentage of total import of Pakistan. The data on custom's collection is from Federal Board of Revenue (FBR)'s year book.This method of computing the average tariff is also used inDouglas (2002) and Halit(2002).The values are converted into dollars by dividing it with the exchange rate.

4.1.4. Price Indices

For price indices, study uses GDP-deflator, data is from International Financial Statistics (IFS).

4.1.5. GDP

The data on gross domestic product is from World Development Indicators (WDI).

4.2. METHODOLOGY

Cross country panel data studies yield mixed evidence regarding the impact of corruption on trade. As this study seeks to examine the country specific relationship therefore we use time series data to investigate our research questions. Our empirical model to be estimated has income and trade, which may have feedback relationship – increase in income causes trade and vice versa. Thus there exists a potential problem of endogeneity between trade and income (Cyrus 2002). To tackle endogeneity, Generalized Method of Moment (GMM) is used to estimate the model. The main benefit of GMM is that we need not worry about the data being homoscedastic and serially independent (Hansen, 1996). Besides these advantages the GMM maximizes the objective function by generating parameter through moment restrictions. These moment restrictions have no correlation with the error term.The tariff rate and import volumes, two variables in our equation to be estimated, affect each othertherefore OLS estimates will be biased and insignificant. To tackle the potentialendogeneitywe use instrumental variables.

Before explaining the empirical model to be estimated, we are listing below the objectives of the study once again. This will help the reader to understand how the empirical model will facilitate us in interpreting results with reference to objectives of the study.

The objectives are to investigate:

1- Whether corruption is detrimental to or beneficial for trade?
2- Whether there exist interaction between corruption by customs officials and tariffs?
3- Whether the impact of corruption on trade is linear or non-linear?

Our equation from previous chapter is:

$$\ln X_{odt} = a_1\psi_{dt} + a_2\psi_{dt}T_{odt} + a_3\psi^2 T_{odt} + a_4 T_{odt} + \boldsymbol{\Theta Z}_{odt} + b_1(Y_{ot}Y_{dt}) + c_1\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.1)$$

Where $X_{odt}$is the bilateral imports between Pakistan and USA, $\psi_{dt}$is the level of corruption, T_{odt} is the average tariff rate, $\boldsymbol{\Theta Z}_{odt}$ is cost proxy by distance between the trading partners, $\psi_{dt}T_{odt}$(corruption*tariff) is our interaction term, $\psi^2 T_{odt}$ (corruption^2*tariff) is another interaction terms representing non-linear behavior of corruption on bilateral trade, $Y_{ot}Y_{dt}$ is the product of economic volumes of Pakistan and USA and $P_d\ \gamma_o$ finally is the series of price indices product of both countries.

Cross country studies based on panel data seems to be the norm where gravity model is used. Cross country panel data studies yield mixed evidence regarding the impact of corruption on trade. To generate country specific effects we are using time series data while keeping the study exclusive for Pakistan. In gravity model distance between the trading partners is a crucial variable. As we are using time series data therefore the distance will appear as a constant in the entire series. There being no variation, there is no utility of using distance variable in our model. Therefore we have dropped this variable from the model and will be using only a variant of gravity model.

Including corruption, average tariff rates and interaction terms in a single equation will causes the singularity problem as both the interaction terms are product of corruption and tariff. To tackle this we have estimated two specifications; equation (4.2) and equation (4.3). Equation (4.2) includes corruption and tariff while equation (4.3) includes thetwo interaction terms i.e. corruption*tariff and corruption^2*tariff.

Following is the specification excluding the interaction terms:

$$\text{Log}(X_{odt}) = c + a_1 Log(\psi_{dt}) + a_4 \log(T_{odt}) + b_1 Log(Y_{ot}Y_{dt}) + c_1 Log\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.2)$$

Dropping corruption and tariff, including the two interaction termsyields:

$$\text{Log}(X_{odt}) = c + \ a_2 \text{Log}(\psi_{dt}T_{odt}) + a_3 \text{Log}(\psi^2 T_{odt}) + b_1 \text{Log}(Y_{ot}Y_{dt}) + c_1 \text{Log}\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.3)$$

Equation (4.2)shows the relationship between dependent variable i.e. bilateral trade and all independent variables used in the study.

The relationship between corruption and bilateral trade is ambiguous i.e. corruption may either encourage trade (evasion) or discourage it (extortion). We also hypothesize that the tariff ratesenhance trade cost and therefore has a negative impact on trade. The impact of the product of GDP of the two trading countries on trade is positive. Besides the inflation in the two countries, negatively impact bilateral trade.

Equation (4.3) shows the effect of corruption on bilateral trade while controlling for tariff. The interaction term corruption*tariffrepresents the effect of variation in corruption on bilateral trade. The expected sign of corruption*tariff is positive. This implies that as tariff increases corruption would increase to avoid tariff (evasion). The trader successfully avoids paying tariff and therefore the trade volume increases. The interaction term corruption^2*tariff shows the non-linear behavior of corruption on trade. The rational is that as corruption increases it ultimately becomes greater than the prevailing tariff. Once this happen the trade volume decreases.

We have estimated the following two additional specifications for bilateral trade:

$$\text{Log}(XM_{odt}) = c + a_1 Log(\psi_{dt}) + a_4 \log(T_{odt}) + b_1 Log(Y_{ot}Y_{dt}) + c_1 Log(P_d\ \gamma_o\ ) + \epsilon_{odt} \quad (4.4)$$

Dropping corruption and tariff, including the two interaction termsyields:

$$\text{Log}(XM_{odt}) = c + a_2 \text{Log}(\psi_{dt}T_{odt}) + a_3 \text{Log}(\psi^2 T_{odt}) + b_1 \text{Log}(Y_{ot}Y_{dt}) + c_1 \text{Log}(P_d\ \gamma_o\ ) + \epsilon_{odt} \quad (4.5)$$

The expected signs of variables along with notation used in the theoretical and empirical models are summarized in table (4.1).

Variable names and their respective notations:

TABLE (4.1)

Variable name	**Brief explanation**	**Theoretical model notations**	**Estimation notations**	**Expected signs**
Total bilateral trade	Total Trade between USA and Pakistan	$\text{Log}(XM_{odt})$	Xm	Dependent Variable
Imports	Imports of Pakistan from USA	$\text{Log}(X_{odt})$	Imports	Dependent Variable
Custom corruption	Mis-invoicing by the custom officials	$Log(\psi_{dt})$	corr	(Unknown)
Tariff in Pakistan	Average Tariff rate	$\log(T_{odt})$	Tariff_2	Negative
Countries Volume	Product of GDP	$Log(Y_{ot}Y_{dt})$	Cgdp	Positive
Price Indices	Product of CPI	$\text{Log}(P_d\ \gamma_o\ )$	prodef	Negative
Corr*Tariff	Interaction term	$\text{Log}(\psi_{dt}T_{odt})$	Int_2_1	Positive
Corr^2*Tariff	Non-linear interaction term	$\text{Log}(\psi^2 T_{odt})$	Int_2_2	Negative

This study uses time series data, ranging from 1972-2009. All thevariables are in log form. Table (4.2) shows the descriptive statistics for all the variables used in the model.

Descriptive Statistics:

Table (4.2)

	XM	X	Corr	Tariff	cgdp	prodef	Corr*Tariff	$Corr^2$*Tariff
Mean	9.16	8.87	8.66	-0.98	23.52	3.27	7.67	16.33
Median	9.22	8.88	8.72	-0.97	23.55	3.28	7.74	16.45
Max	9.76	9.35	9.13	-0.69	24.13	4.25	8.41	17.54
Min	8.24	8.15	8.01	-1.69	22.89	2.07	6.45	14.6
Std. Dev.	0.41	0.27	0.35	0.21	0.37	0.6	0.52	0.86
Skewness	-0.32	-0.3	-0.36	-1.09	-0.12	-0.22	-0.44	-0.39
Kurtosis	2.19	3.09	1.85	4.75	1.76	2.05	2.32	2.01
Obs	38	38	38	38	38	38	38	38

Stationarity of the variableshas been examined by applying Augmented Dickey Fuller (Dickey and Fuller, 1981). The results are presented in table (4.3):

TABLE (4.3)						
Augmented Dickey-Fuller (ADF) unit root test results:						
VARIABLES	**LEVEL**			**1ST DIFFERENCE**		
	No Trend	*With Trend*	*Results*	*No Trend*	*With Trend*	*Results*
Xm	-2.08	-3.60	S			
Imports	-2.53	-3.58	S			
Corr	-2.66	-2.60	NS	-7.95	-7.99	S
Tariff_2	-4.22	-4.10	S			
Cgdp	-0.58	-1.68	NS	-5.38	-5.28	S
Prodef	-3.09	-2.57	S			
Corr*Tariff	-2.64	-2.50	NS	-7.24	-7.75	S
$Corr^2$*Tariff	-2.55	-2.45	NS	-7.70	-7.99	S
NOTE: values are check at 5% level with and without trend. S and NS are abbreviation for Stationary and Non-Stationary respectively.						

The total trade volume (XM), Imports (imports), Price indices (prodef), and Tariffs are level stationary. While corruption (corr), country volumes (cgdp), interactionterm corruption*tariff (int_2_1) and interaction term $corruption^2$*tariff (int_2_2)are stationary at first difference.

CHAPTER 5

EMPIRICAL RESULTS

The estimation results are presented in this chapter. The estimation methodology used is Generalized Method of Moments (GMM). As mentioned earlier, the study has estimated two specificationsfor eachbilateral imports and bilateral trade (equation (4.2), equation (4.3) and equation (4.4), (4.5) in chapter 4). For convenience of the reader these equations are shown below:

$$\text{Log}(X_{odt}) = c + a_1 Log(\psi_{dt}) + a_4 \log(T_{odt}) + b_1 Log(Y_{ot}Y_{dt}) + c_1 Log\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.2)$$

$$\text{Log}(X_{odt}) = c + \ a_2 \text{Log}(\psi_{dt}T_{odt}) + a_3 \text{Log}(\psi^2 T_{odt}) + b_1 \text{Log}(Y_{ot}Y_{dt}) + c_1 \text{Log}\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.3)$$

And specification for bilateral trade: (equation (4.4) and equation (4.5)):

$$\text{Log}(XM_{odt}) = c + a_1 Log(\psi_{dt}) + a_4 \log(T_{odt}) + b_1 Log(Y_{ot}Y_{dt}) + c_1 Log\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.4)$$

$$\text{Log}(XM_{odt}) = c + \ a_2 \text{Log}(\psi_{dt}T_{odt}) + a_3 \text{Log}(\psi^2 T_{odt}) + b_1 \text{Log}(Y_{ot}Y_{dt}) + c_1 \text{Log}\left(P_d\ \gamma_o\ \right) + \epsilon_{odt} \quad (4.5)$$

The estimation results for bilateral trade are shown in table (5.1).Column one and two respectively shows the results for specification given by equation (4.4) and equation(4.5).

Table (5.2) shows empirical results by taking bilateral imports as dependent variable (equation (4.2) and (4.3)). This table also consists of three columns. The second column

shows estimation results of equation (4.2) and third column shows estimation results of equation (4.3). The results for each independent variable are discussed below:

Corruption:

Corruption carries negative association with both bilateral trade and bilateral imports. The negative coefficient shows that bilateral tradewill decrease if there is an increase in corruption by custom officials, which implies corruption in detrimental to trade.The coefficient shows that if there is one percent increase in corruption bilateral trade will be reduced by 0.08 percent (table 5.1). For imports the impact is 0.22 percent (table 5.2).

TABLE (5.1)		
GMM Estimation results for Total Bilateral Trade (XM)		
VARIABLES	**(1)**	**(2)**
Corruption	-0.08 (0.02)*	-
Average Tariff Rate	0.13 (0.06)**	-
Countries Volume	1.43 (0.18)*	1.41 (0.11)*
Price Indices	-0.29 (0.12)**	-0.25 (0.07)*
Corruption*tariff	-	0.34 (0.08)*
Corruption^2*Tariff	-	-0.21 (0.05)*
Constant	-23.09 (3.79)*	-22.28 (2.44)*
Observations	38	38
R-squared	0.97	0.97
D.W Test	1.80	1.89
J-statistic	0.35	0.34
Standard Errors in parentheses * Refers to 1 percent, ** to 5 percent, and *** to 10 percent significance level		

Corruption*Tariff:

Our interaction termcorruption*tariff carries a positive sign for both the bilateral trade and bilateral imports. This interaction term showsthe impact of corruption on total trade and imports by controlling the tariff. The positive association observed indicates that if the tariff is high, a marginal increase in corruption will increase trade. The results are highly significant. This result supports the greases the wheel hypothesis.

Corruption^2*Tariff

The interaction termcorruption^2*tariffwhich shows the non-linear behavior of corruption on bilateral trade and bilateral imports, bears negative correlation with bilateral trade. The negative correlation of corruption^2*tariff with the bilateral trade implies that the impact of corruption on bilateral trade and imports is non-linear – is inverted U-shaped as expected. The logic of this behavior is explained in our theoretical model (section 3). This non-linearity implies that for significant high level of corruption the trade decreases.

Average Tariff Rate:

The estimation of equation (4.3)shows positive association between tariff and bilateral trade. These results are not in accord with the theories of international trade i.e. Gravity Model, in which tariff has negative relation with bilateral trade. One possible reason for the positive relation between bilateral trade and imports is that as the imports of a country increase and start damaging the domestic industry, the firms' lobby for protectionist measures like increase in tariff. This explanation is in accord with Helpmen (1994). Another possible reason could be the inelasticity of imports e.g. machinery, Hi-tech commodities etc.

Gross Domestic Product:

The positive role of GDP to trade between two countries is often cited in trade literature. It is argued that bilateral trade between the nations is positively associated with the economic volume of these two nations (Feenstra, 2002). Our empirical results are significant and compatible with theory. Increase in economic volume of countries leads to increase in trade between respective countries. The estimated coefficient shows that there is respectively 1.43 and 1.30 percent increase in bilateral trade and imports if there is one percent increase in countries economic volumes.

TABLE (5.2)		
GMM Estimation results for Bilateral Imports		
VARIABLES	**(1)**	**(2)**
Corruption	-0.22 (0.05)*	-
Average Tariff Rate	0.577 (0.09)*	-
Countries Volume	1.30 (0.22)*	1.30 (0.22)*
Price Indices	-0.46 (0.14)*	-0.46 (0.14)*
Corruption*Tariff	-	1.38 (0.23)*
Corruption^2*Tariff	-	-0.80 (0.14)*
Constant	-17.81 (4.77)*	-17.81 (4.77)*
Observations	38	38
R-squared	0.81	0.82
D.W Test	1.71	1.84
J-statistic	0.39	0.41
Standard Errors in parentheses * Refers to 1 percent, ** to 5 percent, and *** to 10 percent significance level		

Price Indices:

The multilateral trade resistance represents linguistic, cultural barriers etc. Taking lead from Baier and Bergstrand (2001) price indices are used as a proxy of multilateral trade resistance. In both the estimations, these barriers have a negative association with the bilateral trade between the two countries. The coefficient shows a respective decrease of 0.29 and 0.46 in bilateral trade and bilateral imports if there is an increase of one percent in price indices.

The estimation showsthat almost all the variables are significant and have expected signs except tariff. The tariff has positive association with imports rather than negative. Pakistan is a developing country going through industrialization and is highly influenced by political environment. An increase in imports leads to an increase in demand for higher tariff.Theregression'sJ-statistics indicate the instruments used are valid.

CHAPTER 6

SUMMARY AND CONCLUSIONS

The impact of corruption on trade has recently gained much attention in the trade policy debate. This study has looked into the dual role of corruption – whether it encourages or discourages the bilateral trade. The impact of corruption on bilateral trade has been examined between Pakistan and USA. The time span is 1972-2009 and study uses GMM.

The results givestrong evidence in favor of the existence of non-linearity between corruption and bilateral trade. Given low protection i.e. low tariff, corruption reduces the bilateral trade and acts as a trade cost. Our interaction term corruption*tariffwhich shows the effect of corruption while controlling for tariff, shows that if there is an increase in tariff the marginal effect of corruption on trade is positive: thus corruption acts as a solution to the governmental rigidities and enhances the trade (evasion – grease wheel hypothesis).

Our main conclusions are; Corruption discourages bilateral trade, however, if tariff is higher, corruption encourages trade because corruption helps to avoid government imposed rigidities i.e. tariff. On the other hand if corruption is already high enough i.e. beyond a certain threshold level, then further increase in corruption discourages trade because now the level of corruption exceeds the tariff– sand wheel hypothesis. The study also shows that the trade volume and economic sizes of trading partners are directly related.

The positive impact of corruption on trade in some situation should not be taken to mean that we should allow corruption to encourage trade because the corruption on its own generates a number of negative impacts. For example tariff cannot be used as a policy variable to protect domestic industry, if corruption is allowed to determine the level of trade. Moreover corruption generates macro effects like inequality which could be detrimental to the growth of an economy. Furthermore corruption adversely effects perceptions regarding

state governance. This in turn negatively affects a number of economic variables like investment in the economy.

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APPENDIXI:

Equation (3.7) shows the corruption tax. The detailed derivation for corruption tax is as follows:

$$\frac{\psi T}{1-zT} = \delta(z^{-2} - z^{-1})$$

$$(z^{-2} - z^{-1})(1-zT) = \psi T/\delta$$

$$\left(\frac{1}{z^2} + \frac{1}{z}\right)(1-zT) = \frac{\psi T}{\delta}$$

$$\frac{(1-z)}{z^2}(1-zT) = \frac{\psi T}{\delta}$$

$$(1-z)(1-zT) = \frac{z^2\psi T}{\delta}$$

$$1 - z - zT + z^2T - \frac{z^2\psi T}{\delta} = 0$$

$$1 - z(1+T) + z^2T(1-\psi/\delta) = 0$$

$$z^2T(1-\psi/\delta) - z(1+T) + 1 = 0$$

Using quadratic formula,

$$z = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$z = \frac{-[-(1+T)] \pm \sqrt{[-(1+T)]^2 - 4[T(1-\psi/\delta)](1)}}{2[T(1-\psi/\delta)]}$$

$$z = \frac{(1+T)}{2T}\left[\frac{1 \pm \left\{1-(1-\psi/\delta)\left[1-\left(\frac{1-T}{1+T}\right)^2\right]\right\}^{1/2}}{(1-\psi/\delta)}\right]$$

Take,

$$\frac{\psi T}{1-zT} = \delta(z^{-2}-z^{-1})$$

$$\frac{\psi T}{\delta(z^{-2}-z^{-1})} = 1-zT$$

$$1-zT = \frac{\psi T}{\delta z^{-1}(z^{-1}-1)}$$

$$1-zT = \frac{z\psi T}{\delta(z^{-1}-1)}$$

$$1 = zT + \frac{z\psi T}{\delta(z^{-1}-1)}$$

$$1 = zT[1+\psi/\delta(z^{-1}-1)]$$

$$zT = \frac{1}{1+\psi/[\delta(z^{-1}-1)]}$$

$$zT = [1+\psi(z^{-1}-1)^{-1}/\delta]^{-1}$$

$$T = \frac{\delta(z^{-1}-1)}{z[\delta(z^{-1}-1)+\psi]}$$

As,

$$(1+\Delta) = \left(1-\frac{\delta(z^{-1}-1)}{z[\delta(z^{-1}-1)+\psi]}\right)\left(1-\frac{z\delta(z^{-1}-1)}{z[\delta(z^{-1}-1)+\psi]}\right)^{-1}(1+\psi)$$

$$1+\Delta=\left[\frac{z[\delta(z^{-1}-1)+\psi]-\delta(z^{-1}-1)}{z[\delta(z^{-1}-1)+\psi]}\right]\left[\frac{[\delta(z^{-1}-1)+\psi]-\delta(z^{-1}-1)}{[\delta(z^{-1}-1)+\psi]}\right]^{-1}(1+\psi)$$

$$1+\Delta=\left[\frac{z[\delta(z^{-1}-1)+\psi-\delta(z^{-2}-z^{-1})]}{z[\delta(z^{-1}-1)+\psi]}\right]\left[\frac{[\delta(z^{-1}-1)+\psi]}{\psi}\right](1+\psi)$$

$$\Delta=[\delta(z^{-1}-1-z^{-2}+z^{-1})+\psi]\left(\frac{1+\psi}{\psi}\right)-1$$

$$\Delta=\left[\psi-\delta\left(\frac{1}{z^2}+1-\frac{2}{z}\right)\right]\left(\frac{1+\psi}{\psi}\right)-1$$

$$\Delta=\left[\psi-\delta\left(\frac{1}{z}-1\right)^2\right]\left(\frac{1+\psi}{\psi}\right)-1$$

$$\Delta=\psi-\delta\left(\frac{1+\psi}{\psi}\right)\left(\frac{1}{z}-1\right)^2$$

$$\Delta=\psi-F(\psi|\delta,T)$$

Appendix II:

The derivation of equation 3.5 is carried out in the following manners:

Take:

$$p_l = p = \lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\left(\frac{1+\psi}{1-zT}\right)$$

Multiplying and dividing by $(1 - \mathrm{T})$:

$$p_l = p = \lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\left(\frac{1+\psi}{1-zT}\right)\left(\frac{1-T}{1-T}\right)$$

$$p_l = p = \lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\left(\frac{1+\psi}{1-T}\right)(1-\mathrm{T})(1-z\mathrm{T})^{-1}$$

Let $(1 + \Delta) = (1 - \mathrm{T})(1 - zT)^{-1}(1 + \psi)$, so the above equation becomes:

$$p_l = \lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta)}{(1-\mathrm{T})}$$

APPENDIX III:

Extension of Gravity model by following the methodology of Anderson (2003) and Dutt (2010)

$$X_{od} = \int_{l} p_l x_l$$

As we know from previous calculations:

$$p_l = p_l = \lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta)}{(1-\mathrm{T})}$$

$$x_l = \left[\lambda c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta)}{(1-\mathrm{T})}\right]^{-\mathcal{E}} P_d^{\mathcal{E}-1} Y_d$$

Putting values in X_{od} we get:

$$X_{od} = \int_{l} \lambda_{od} c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta_{od}}{(1-\mathrm{T_{od}})}\left[\lambda_{od} c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta_{od})}{(1-\mathrm{T_{od}})}\right]^{-\mathcal{E}} P_d^{\mathcal{E}-1} Y_d$$

The subscript *od* represents country pair. There are *N* products of commodity *l* in country *o* and w is paid as a wage so after rearranging the above argument we get:

$$X_{od} = N_o w_o^{1-\mathcal{E}}\left[\lambda_{od} c \left(\frac{\mathcal{E}}{\mathcal{E}-1}\right)\frac{(1+\Delta_{od})}{(1-\mathrm{T_{od}})}\right]^{1-\mathcal{E}} P_d^{\mathcal{E}-1} Y_d$$

The income in country *o* is what she sells within the geographical boundary and outside, considering the price levels within the countries (*o* and *d*) and world income; an application of gravity model gives us the following final expression.

$$X_{od} = \left(\frac{1+\Delta_{od}}{1+T_{od}}\right)^{1-\mathcal{E}} \lambda^{1-\mathcal{E}} \frac{Y_d Y_o}{P_d^{1-\mathcal{E}} \gamma_o^{1-\mathcal{E}}}$$

APPENDIX IV:

Some basic definition for the terms used in this study:

Bilateral Trade:

The exchange of goods between two countries.

Tariffs:

Tax imposed on imports of goods and services.

Mis-invoicing

The difference between the export invoice and import invoice for the same product in exporting and importing country respectively.

Gross Domestic Product:

Sum of all the goods and services produces within the geographical boundaries of a country is called gross domestic product

Corruption:

Misuse of authorities for private gain is called corruption.