CHAPTER III

METHODOLOGY AND MODEL

3.1. Methodology

The methodology of the study takes both qualitative and quantitative approaches. The study focuses on the bilateral trade of Bhutan with its major trading partners and sees the impact of factors considered in the study on the trade flow of Bhutan. Further study investigates the bilateral trade potential of Bhutan and economic development in the light of international trade and examines trade polices.

3.1.1. Descriptive Method/ Qualitative Method

The descriptive analysis investigates the development of economy of Bhutan in the light of international trade growth and analyzes international trade policy of Bhutan and examines the structure and direction of trade flow of Bhutan.

The objective of this is to provide an overview of Bhutan's economy and development of international trade and trade policies over the decade, to shed lights on importance of carrying out the quantitative analysis.

3.1.2. The Model

The main objective of this study is to develop a methodology for analyzing international trade flows, based on the annual bilateral trade volume of Bhutan. The gravity model is used to explain trade patterns and to determine trade potential of Bhutan. This paper would examine the trade flow of Bhutan with the main trading partners in the following manner:

First, the study uses data from 1981 to 2003 for modelling gravity model using the Bhutan trade. Then use the parameters estimated for independent variable to identify the major factors that contributed to the direction of trade flows. Secondly, the regional differences that emerge from the analysis would be examined and finally, using the coefficient estimated from export and import equation will find the trade potential of Bhutan.

The gravity model to examine international trade flow is analogous to Newton's law, relating the gravity between two objects to their masses and the distance between them. According to the gravity approach, bilateral trade between two regions (countries) is directly related to their incomes (GDP, GNP) and inversely related to the distance between them.

In its simplest form, the gravity model of bilateral trade used by Tinbergen and Poyhonen relates trade between country i and country j to the proportion of the product of both countries GDP (Y_i Y_j) which are national income of respective countries and the distance or resistance between them (Dij) as a proxy for transaction costs. That is

$$X_{ij} = \alpha \frac{Y_i Y_j}{D_{ij}} \qquad \text{(a)}$$

Where α is a constant of proportionality.

They concluded that incomes of trading partners and the distances between them are statistically significant and of the expected positive and negative signs, respectively. Regressions of equation in logarithms of bilateral trade volumes on the GDP's of trading partners and the distance between them typically yield R^2 s (in the range of 0.65 to0.95) (Vancauteren). This has led many researchers to use variants of the gravity equation as a benchmark for the volumes of trade. These foundations were subsequently developed by many authors.

A common consensus among researchers is that the log-linear form of the gravity equation is the correct specification. This has an important implication since the microeconomic foundation of the gravity model is directed towards the application of a log-linear functional form. In accordance with the statement of *Mark Vancauteren*, the finding of Sanso *et al.* (1993) who questioned the log-linearity of the gravity equation found that, the log-linear specification although not optimal, represents the best functional form among those tested.

Taking logarithms of the gravity model equation stated above, we get the linear form of the model and the corresponding estimable equation as:

$$\log(TRADE_{ij}) = \alpha_0 + \beta_1 \log(GDP_{it} * GDP_{jt}) + \beta_2 \log(DISTANCE_{ij}) + U_{ijt} \quad \text{(b)}$$

Further, Classical gravity model generally uses cross-section data to estimate trade effects and trade relationships for a particular time period, for example one year. In reality, however, cross-section data observed over several time periods (panel data methodology) have been proven to result in more useful information than cross-section data alone. The advantages of this method are: first, panels can capture the relevant relationships among variables over time; second, panels can monitor unobservable trading-partner-pairs' individual effects. If individual effects are correlated with the regressors, OLS estimates omitting individual effects will be biased. Therefore, we have used panel data methodology for our empirical gravity model of trade.

The generalized gravity model of trade states that the volume of trade or exports or imports between pairs of countries, Xij, is a function of their incomes (GNPs or GDPs), their populations, their distance (proxy of transportation costs) and a set of dummy variables either facilitating or restricting trade between pairs of countries. In its simplest form, the gravity model takes the form that is,

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} N_i^{\beta_3} N_j^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} U_{ij} \quad (1)$$

Where;

Y_i (Yj) indicates the GDP or GNP of the country i (j) measure size of economies of country i and j; Ni (Nj) are populations of the country i (j), measures of the economies' physical size; Dij measures the distance between the two countries' capitals (or economic centers); Aij represents dummy variables; Uij is the log normally distribute error term with E(ln U_{ijk}) = 0 and βs are parameters of the model that is coefficients to be estimated.

The error term captures any other shocks and chance events that may affect bilateral trade between two countries. This is the core gravity model equation where bilateral trade is predicted to be positive function of income and negative function of distance.

Using per capita income instead of population, an alternative formulation of equation (1) can be written as

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} y_i^{\beta_3} y_j^{\beta_4} D_{ij}^{\beta_5} A_{ij}^{\beta_6} U_{ij} \quad (2)$$

Where yi(yj) are per capita income of country i(j). As the gravity model is originally formulated in multiplicative form we can linearize the model by taking the natural logarithm of all variables. So for estimation purpose, model (2) in log-linear form in year t, is expressed as,

$$\ln X_{ij} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln y_{it} + \beta_4 \ln y_{jt} + \beta_5 \ln D_{ijt} + \sum \delta_n P_{ijnt} + U_{ijt} \ (3)$$

Where ln denotes variables in natural logs. P_{ijh} is a sum of preferential trade dummy variables. Dummy variable takes the value one when a certain condition is satisfied, zero otherwise. It is common to augment the gravity model by variables that either increase or reduce trade through their impact on transaction costs or the overall institutional environment (e.g. trade policy proxies, binary variables for participation in regionally trading agreements, for sharing a common commercial language, for sharing a common border, and for common colonial heritage).

Our study have employed augmented gravity model like existing literatures. The general gravity approach is used to determine factors that contributed to the trade flow of Bhutan and quantify Bhutan's trade variation in terms of economic mass (gross domestic products-GDP), distance, openness and per-capita income and a set of dummy variables either facilitating or impeding trade between the countries. Similar to Rahman (2003) three separate equations are estimated in this study to delineate the effects of the selected variables on total trade, exports and imports separately. [a)] The gravity model of Bhutan's trade (exports + imports), [b)] the gravity model of Bhutan's exports, and [c)]the gravity model of Bhutan's imports. Thus, we have basically followed Rahman (2003) by re-specifying some variables that would best suit the Bhutanese trade. But in fact the model could have taken from one of any number of papers as it is a standard gravity estimating equation with dummies included to capture integration effects.

Since the dependent variable in the gravity model is bilateral trade (sum of exports and imports) between the pairs of countries, the product of GDP and product of GDP per capita have been used as independent variables. Based on these considerations following specification of the gravity model is used in this paper:

$$X_{ij} = \beta_0 Y_i^{\beta 1} Y_j^{\beta 2} y_i^{\beta 3} y_j^{\beta 4} D_{ij}^{\beta 5} O_{ij}^{\beta 6} A_{ij}^{\beta 7} A_{ij}^{\beta 8} U_{ij} \quad (4)$$

Where

X_{ij} - total trade flows between Bhutan (country i) and country j,

Y_i (Y_j) - Gross Domestic Product of country i(j),

yi(yj) - Per capita GDP

D_{ij} - distance between country i and country j,

O_{ij} - trade openness

U_{ij} - error term

Dummy variable (Aij) indicate whether country share a border and existence of bilateral agreement.

A_{j1} - Land border between country i, and country j,

A_{j2} - bilateral or regional trade agreement or free trade agreement,

B_s - parameters of the model.

3.1.3. Gravity Model of Bhutan's Trade

Thus based on the specification of the gravity model (4) the gravity model of trade in this study is:

$$\log TR_{ijt} = \alpha_0 + \alpha_1 \log(GDP_{it} * GDP_{jt}) + \alpha_2 \log(GDP/pop_{it} * GDP/pop_{jt}) + \alpha_3 \log(PCGDPd_{ijt}) + \alpha_4 \log(Distance_{ij}) + \alpha_5 \log(TR_w/GDP_{it}) + \alpha_6 \log(TR_w/GDP_{jt}) + \alpha_7 (Border_{ij}) + \alpha_8 (TA_{ij}) + \alpha_9 (TB_{ij}) + \alpha_{10} (SAPTA) + \alpha_{11} \Delta(\alpha_1 \log(GDP_{it} * GDP_{jt})) + \alpha_{12} \Delta(\alpha_2 (\log(GDP/pop_{it} * GDP/pop_{jt})) + (U_{ij}) \quad (5)$$

Where;

TR_{ij} = Total trade (export + import) between Bhutan (country i) and country j, represent bilateral trade.

GDP_i (GDP_j) = Gross Domestic Product of country i (j),

GDP/Pop_{it}*GDP/Pop_{jt} = GDP per capita of country i and j.

$PCGDPd_{ijt}$ = GDP Per capita differential between country i and j.

$Distance_{ij}$ = geographic distance in miles between their capitals of $country_i$ and $country_j$,

TR_w/GDP_{ijt} = Trade to GDP ratio of country $_{i\ (j)}$, represents trade openness. TR_w is total trade of country i and j to world.

$Border_{ij}$ = Land border between $country_i$ and $_j$.

$T\ A_{ij}$ = bilateral free trade agreement between India and Bhutan.

TB_{ij} = bilateral preferential trade agreement between Bhutan and Bangladesh.

$SAPTA_{ij}$ = whether country j is a member of SAPTA.

U_{ijt} = error term; t = time period, αs = parameters.

The dependent variable TR_{ij} *is* total trade (exports plus imports) between pairs of countries in a given year at time *t* (measured in US$ millions). The first four independent variables are standard gravity terms; other explanatory variables that are typically included in the model are trade openness and dummy variables reflecting contiguity; geographical and cultural proximity such as common boarders and participation in various bilateral and regional trading arrangements intended to test for the effects of bilateral and regional membership. In addition (last two variables) the change in GDP and per capita GDP over the years are included in this model to find the significance of their impact on the trade flow.

Basic gravity model of international trade postulates that the trade between country $_i$ and country $_j$ is proportional to the product of GDP_i and GDP_j (proxies for income and size) *and* inversely related to the distance (captures transport cost) between two countries. Further, the standard gravity model predicts that countries with similar levels of output per capita will trade more than countries with dissimilar levels. This is

true of the Helpman-Krugman sort of theory also, as it predicts that the volume of trade should increase with increasingly equal distribution of national income. This however contradicts the traditional Hecksher-Ohlin theories of trade that predicts that countries with dissimilar levels of output will trade more than countries with similar levels. In addition, the Linder hypothesis says that countries with similar levels of per capita income will have similar preferences and similar but differentiated products, and thus will trade more with each other. This hypothesis is often viewed as similar to the Krugman-Helpman theory in its predictions. Thus $PCGDPd_{ijt}$ is used to test this hypothesis.

Hypothesis

According to the basic assumptions of the gravity model, the following hypotheses could be tested in this study (ceteris paribus):

- The product of GDPs are considered as the income and size of the economy that captures the idea that larger and richer countries trade more than small and poor countries. Because the larger and the richer countries have more advanced an infrastructure that facilitates trade and have more liberal trade policies, etc. Thus there will be more trade between the two countries bigger the GDP.

- GDP Per capita provides proxy for the level of development and infrastructures that are essential to conduct trade and as such the more developed the countries are the more would be the trade between the pairs of countries (Frankel). So we expect a positive sign for the coefficient of GDP/pop.

- According to the H-O theory, the sign of the coefficient differential of GDP per capita would be positive. On the other hand as per the Linder hypothesis the sign would be negative. Thus the absolute difference in per capita income (PCGDPd) to test Linder hypothesis i.e. countries with similar levels of per capita income will have similar tastes, they will produce similar but differentiated products and trade more among themselves.

- Distance indicates that geographical proximity promotes bilateral trade flows as it reduces transport and information costs. Obviously higher transport costs reduce trade so the effect is expected to be negative sign for the coefficient of this variable. Distance negatively influences trade flows.

- The more open the country is the more would be the trade. So we expect a positive sign for the openness variables (TR_w/GDP_{ijt}).
- Sharing boarders increase the trade flows between any given pair of countries so expected positive sign.
- In existence of bilateral trade agreement or regional trade agreement there will be more trade between the countries. So we expect positive signs for these coefficients. These dummy variables are included in an interest to measure the impact of Bhutan's bilateral free or preferential trade and regional trade agreements on the trade flow of Bhutan.

To find the regional differences the trading partners would be grouped into Asian countries and other developed countries and then run a two separate panel regression using same trade model equation (5) and then compare the difference in the significance of coefficients obtained from the each estimation.

3.1.4. Gravity model of Bhutan's Export

$$\log X_{ijt} = \beta_0 + \beta_1 \log(GDP_{it}) + \beta_2 \log(GDP_{jt}) + \beta_3 \log(GDP/pop_{it}) + \beta_4 \log(GDP/pop_{jt}) + \beta_5 \log(PCGDPd_{ijt}) + \beta_6 \log(Dis\tan ce_{ij}) + \beta_7 \log(TR_w/GDP_{it}) + \beta_8 \log(TR_w/GDP_{jt}) + \beta_9 \log(Ex_{ijt}) + \beta_{10}(TA_{ij}) + \beta_{11}(TB_{ij}) + \beta_{12}(SAPTA) + U_{ij} \quad (6)$$

X_{ijt} -export as dependent variable; Ex_{ij} –real exchange rate between country i and j.

Economic size, GDP or GDP per capita, of the exporting country measures their productive capacity and can be argued to be a proxy for the capita-labor ratio. The importer's GDP, or GDP per capita, serves as an indicator of what Thoumi (1989a and 1989b) refers to as an absorptive capacity of imported goods.

Real exchange rate is used as a proxy for relative prices. If there is a single issue that economists agree on, it's that trade should be as free and unfettered as possible. The two countries with different monies are separated by a monetary barrier to trade, otherwise known as exchange rate. That barrier might be small if exchange rate costs are small or easy to hedge; but the barrier might be large. After all one thing we know about the exchange rates is that they tend to change, usually in unpredictable ways. Thus

quantifying the impact of currency unions and exchange rate uncertainty on trade is thus an empirical exercise of importance.

Hypothesis

- Expect positive signs for β_1, β_2, β_7, β_8,
- Expect negative signs for β_6, β_9,
- Signs can be either positive or negative for β_3, β_4, β_5. The reason given is that with the higher per capita income if the country enjoys economies of scale effect, then β_3 would be positive; alternatively due to absorptive effect if the country exports less, then β_3 would be negative. Similarly if country j demands more country i's goods due to higher income, β_4 would be positive on the other hand due to economies of scale effect in country j, if more goods are produced in country j, then β_4 would be negative. β_5 would be positive if the H-O hypothesis holds and negative if the Linder hypothesis holds. (Rahman 2003).

3.1.5. Gravity model of Bhutan's Import

$$\log M_{ijt} = \delta_0 + \delta_1 \log(GDP_{it}) + \delta_2 \log(GDP_{jt}) + \delta_3 \log(GDP/pop_{it}) + \delta_4 \log(GDP/pop_{jt}) + \delta_5 \log(PCGDPD_{ijt}) + \delta_6 \log(Distance_{ij}) + \delta_7 \log(TR/GDP_{it}) + \delta_8 \log(TR/GDP_{jt}) + \delta_9 \log(Ex_{ijt}) + \delta_{10}(TA_{ij}) + \delta_{11}(TB_{ij}) + \delta_{12}(SAPTA) + U_{ij} \quad (7)$$

M_{ijt} is import as dependent variable. All the variables are same as defined in the export model.

Hypothesis

- Expect positive signs for δ_1, δ_2, δ_7, δ_8, δ_9,
- Expect negative signs for δ_6,
- Signs can be positive or negative for δ_3, δ_4 and δ_5. The reason given is that with the higher per capita income if the country i enjoys economies of scale effect, then δ_3 would be negative; alternatively due to absorptive effect if the country i imports more, then δ_3 would be positive. Similarly if country j demands more country j's

goods due to higher income, δ_4 would be negative on the other hand due to economies of scale effect in country j, if more goods are produced in country j, then δ_4 would be positive. δ_5 would be positive if the H-O hypothesis holds and negative if the Linder hypothesis holds. (Rahman 2003).

3.1.6. Trade Potential

There exist several quantitative methods to estimate trade potential of a country. One of them is based on the commonly used in empirical analysis, the Gravity models. The main advantage of using Gravity models for this purpose is accessibility and reliability of data. Thus to find the trade potential of Bhutan, the coefficients obtained from the estimation of above exports and import functions are used to obtain predicted level of exports and imports of Bhutan. That is coefficient of gravity equation of export and import estimated would be used in simulation exercises to determine natural bilateral trade between two countries and such simulated bilateral export and import are compared with the actual exports and imports to assess bilateral export potential.

Conclusion is drawn from the sign of the difference between potential and actual trade flows. If the difference is positive then there is more room for trade (under trade) and if it is negative then the countries are high performing pairs (over trade). When two countries trade much less than in the theory get positive potential which indicates that there is more room to trade or untapped trade potential between the particular pair of countries. When two countries trade currently much more than the gravity models predicts there are negative potentials but this do not necessarily indicate too much export but should be viewed as high performing pair and indicate there is a very successful bilateral trade partnership.

3.2. Data Sources and Measurement of the Variables

This study covers a total of 17 countries and these countries are chosen on the basis of importance of trading partnership with Bhutan and availability of data. Among the Asian countries included in the study: three south Asian countries are India, Bangladesh and Nepal however trade with other south Asian countries are negligible thus those countries are excluded from the study. Other Asian countries included in the study are Thailand, Singapore, Malaysia and Japan. European countries considered in the study are United Kingdom, France, Germany, Italy, Netherlands, Switzerland, Austria and

Denmark and other country included is USA for the analysis of Bhutan's trade. The trade flows between Bhutan and these trading partners (countries) form more than 95% of Bhutan's total foreign trade volume.

The data are collected for the period of 1981 to 2003 for 23 years and total number of observation 391. It is not possible to go beyond this period because only since 1981 trade data were compiled and tabulated annually and first comprehensive information on Bhutan's Foreign Trade Statistics was published. All are annual data and converted in real terms.

i. **Export** (X_{ij}) **and Import** (M_{ij})

The bilateral trade data on Bhutan's export and import are obtained from Bhutan Trade Statistics Yearbook. The exports are valued at FOB (free on board) prices and imports at CIF (cost, insurance and freight) prices in native currency at the frontier check-posts by the Department of Revenue and Customs as per the Bhutan Customs law. These data are not available online or in a soft copy thus exports and imports data are complied and punched in manually by the author into the system for this study.

In our study both exports and imports are expressed in millions of US dollars using the annual period-average exchange rate for all years and are converted in to real terms by dividing by implicit GDP deflator prices. For some country pairs, data entry especially for export is zero in certain years, which could be due to levels of trade that are too small to be recorded or in that particular year no export and imports were made. Those pairs with zero trade values are taken as NA, thus we have unbalanced panel data. (To note goods imported and exported by the armed forces are not included in the trade statistics).

From 1981 to 1992 data are based on standard international trade classification revision 2 and from 1993 to 2003 data are based on Harmonized Commodity Description Coding System (HS). Data are obtained from Foreign Trade Statistics Year book of Bhutan & Bhutan Trade Statistic Yearbook published by different agencies. From 1981 to 1989, published by Ministry of Trade and Industry. From 1990 to 1992, published by Central Statistical Office, PlanningCommission. From 1993 to 2003 obtained from published by Revenue and Customs, Ministry of Finance.

ii. Gross Domestic Product *(GDP)*

Gross domestic Product (GDP_{ij}) and per capita GDP ($PCGDP_{ij}$) data at 1990 constant prices are obtained from UN statistical division [online] available from website http://unstats.un.org/unsd/snaama/selectionbasicFast.asp GDP measures the economy size and income of the country and per capita GDP measures the level of development and infrastructure. The absolute value of Gross Domestic Per capita differential ($PCGDPd_{ij}$) is measured by difference between domestic per capita GDP of Bhutan (country i) and foreign per capita GDP (countryj).

$$PCGDPd_{ij} = PCGDP_i - PCGDP_j$$

iii. Distance *($Dist_{ij}$)*

Gravity analysis to model international trade flows incorporate the impact of infrastructure and geographical disadvantages on the transport costs and subsequent effect on bilateral trade flows. The distance between country i and country j is taken as a proxy for transportation cost.

Measure of the geographical distance between countries is defined as the distance between capitals cities measured in miles between their capitals. The distance between country i and country j measured "as the crow flies" technically called the great-circle distance measured between the two latitude and longitude combinations. The distance between Thimphu (capital of Bhutan) and other capital cities of country j are obtained from surface distance between two points of latitude and longitude and Great Circle Distance between cities [online] available from http://www.wcrl.ars.usda.gov/cec/java/lat_long.htm

The major proportion of trade today goes by air (and not by sea or land) and therefore the air routes provide the most convenient justification for using the straight – line or great circle measure of distance. The ultimate justification is of course given by the fact that this measure seems to be a reasonable measure of averaging across different modes of transportation and works well in practice (Batra 2004).

iv. Trade openness *($Open_{ij}$)*

Trade openness is measured by total trade (export + import) against the world to GDP ratio of country i(j), if this value is high shows existence of trade openness. According to the trade theory more open the country is more would be the trade between the countries and many empirical analysis have proved this. The total trade data of trading partners (country j) to world are obtained from WTO website, www.stat.wto.org. And total trade of Bhutan to world is obtained from Bhutan Trade Statistic year book.

v. Real Exchange rate *(Ex_{ij})*

Exchange rate is considered as one of the factors that do cause competitive advantages based on price levels, it will also be involved as an explanatory variable in the model. Exchange rate data are obtained in terms of national currency per US dollar from IMF data source. And this is converted to country j currency in terms of country i currency and is multiplied by country j GDP deflator and divided by country i GDP deflator.

$$Ex_{ij} = e_{ij} \frac{GDPdfla_{j}}{GDPdfla_{i}}$$

Further following dummy variables are included to capture the impact of geographical factors and historical ties between countries on bilateral trade are explained as follows:

Since the nature of agreements on preferential market access between developed countries and LDCs and between developing countries and LDCs, and also the nature of regional trade agreements are important issues. Thus incorporation of such variables would help in analyzing trade preferential agreements, forecasting potential trade between partners and the estimation of interregional and international trade (border effects).

vi. Border *(BOR_{ij})*

A dummy variable is used to identify a pair of countries that are adjacent or share a common border. This dummy is in addition to the inclusion of the distance variable to account for the possibility of centre to centre distance overstating the effective distance between neighboring countries that may often engage in large volume of border trade. If

country i and j, share a common border then the dummy variable takes the value of one otherwise 0.

vii. Preferential Trade agreements

TA_{ij} and TB_{ij} capture free trade agreement with India and preferential trade agreement with Bangladesh respectively. Free Trade Area promotes intra-regional trade through further dismantling of tariff and other non-tariff barriers to trade among members. Likewise existence of free trade area and preferential trade agreement facilitates bilateral trade between the countries and studies have found it to be trade enhancing and statistically significant. In existence of preferential trade agreements dummy variable value equals one otherwise 0.

Countries enter into regional trading agreements with the intention of facilitating bilateral trade. The dummy variable is equal to one when both countries belong to same regional group and zero otherwise. The estimated coefficient will then tell us how much of the trade can be attributed to a special regional effect that is $SAPTA_{ij}$. Bhutan is a member of SAARC since its formation in 1985 and in 1991 members agreed to form SAPTA which came in to force in December 1995.