CHAPTER FOUR

4.1 Theoretical framework

The ambiguities in the empirical analysis concerning standardizing patent protection among nations provide some room and opportunities for researchers, academicians and policymakers to continuously investigate other factors as to further developed and enhance the analysis.

International treaties (i.e TRIPS agreement) provide one standardize framework (i.e under Article 7) to harmonize cum minimize the residual gap for both north (well developed) and south (less developed) country's productivity and level of technological transfer.

4.2 Growth, FDI, Research and Development and IP Protection

Most empirical studies found that, economic growth (as a measure of productivity) are endogenously driven, inter alia through input factors (Solow,1956) and technology only assimilates through the process of capital accumulation and human capital creation exogenously to the model to indirectly measure productivity (Mankiw et.al.,1992; Miller and Upadhyay, 1997).

But nowadays the effect of technology to economic growth shared among nations at least by several channels inter-alia trading, licensing, and foreign investment. Maskus and Penubarti (1995), first uncover the (little) importance of patent protection framework to bilateral trading flow (especially imports) between developing nations as an increase of patent protection.

Moreover, Smith (1999, 2001) found the sensitivity of unidirectional evidence of exports flow to difference function of patent protection level. Due to the growing trade pattern of high technological product, trade opportunities have benefited nations especially to at least accumulate technological know-how as an alternative channel to energize growth's speed up process.

Stringent protection, among developing and less-developing countries has at least delaying the innovation creativity initiated from developed countries. Eaton and Kortum (1996), found evidence that 50% of growths in the OECD countries are facilitated by an invention and innovations originated from developed countries such as United Stated, Germany and Japan. Japan has experiencing an upward trend in technical progress (post war growth) due to an effort and progress of enhancing patent framework (Maskus and McDaniel, 1999). Liu and Wang (2003) link the mechanism possibility between foreign direct investments (FDI) to total factor productivity (TFP).

They believe that according to endogenous growth model theory, TFP is assumed to be synonymous to technological progress that assimilates through FDI flow. Markusen and Venables (1999) found evidence of some linkage effects in local industry development where FDI has shown formally as an industrial catalyst.

4.3 Internal and External of Negative Factors on FDI

Lack of transparency, less degree of openness, high country risk, black market activity, exchange rate distortion, high tariff rate and strong barrier and corruptions (widely blamed) have impediment power through various ways. Researchers, Gould and Gruber (1996), Smarzynska and Wei (2000), Wei and Wu (2001), Park and Lippoldt (2003), Gastanga et.al (1998), Paldam (2002) and MO, Pak Hung (2001) agreed that those factors are examples of self-created distortion instrument which silently retards the economic progress, especially in attracting foreign investors.

Good governance or institutions are measured by the efficiency of how one authority allocates resources efficiently from being exploited by legally private-interest agents. As purposed ideally by laissez faire system, allocations of factors are efficiently distributed through the pricing system mechanism. However, due a bureaucratic maze the effectiveness of economy delivery system in formalizing open macro economic policies becomes inefficient (Bai

and Wei, 2000) especially in attracting foreign investment (Gelos and Wei, 2002). Other studies conducted by Hines (1995) and Wei (1997a, 1997b and 2000), conclude with the same finding[22].

4.4 The Proposed Model

From the previous empirical studies, the expected sign for each coefficient can now be formalized. Both coefficients for IP protection level and ratio of R&D expenditure to GNP are expected to be positively correlated to FDI. However, BMP variables negatively affect the FDI.

To analyze the impact and magnitude of the said factors, this paper proceeds with the development of an econometrics model as describes below.

$$y_i = \alpha_0 + \alpha_i \chi_i' + u_i \qquad \text{(Eq.1)}$$

y_i = Inflow of FDI by foreign investors

χ_i = A sets of explanatory variables namely Patents protection index (IPRS), Black Market Index (BMI) and domestic R & D expenditure (RDEXP).

[22] However, Alesina and Weder (1999) did not found any empirical evidence when study about "Do Corrupt Governments receive less foreign aid".

By following the properties of Classical Linear Regression Model assumption (CLRM), it is worth to noted here that the conditional expected value for the error term are zero and follows the homoscedasticity distribution as shown by the respective equation $E(u_i \mid \chi_i) = 0$ and $var(u_i \mid \chi_i) = \sigma^2$.

The coefficients for IPRS and RDEXP are hypothesizing positively related to FDI, however BMI inversely related to FDI inflow to the host countries. We also look into the possibility of dummy interaction between the explanatory variables. Since the data set is involving a cross country sample, therefore another dummy variable to capture country specific development level will be constructed using the newly release World Bank income classification (as of July 2003) to find out the effect of FDI investment accordingly to the income development. The construction of dummy variable is explained in the next section.

Since all data were obtained from various sources, countries involved in the sample set were different in historical records, intensity and development levels, therefore heteroscedasticity problem might be suspected exist in the model. The heteroscedasticity problem moreover will limit the validity (biased) of the variance of each coefficient in the model and so the usual reported statistics produced by the usual OLS procedure unfortunately no longer distribute accordingly to the CLRM assumption.

In short, the statistics methodology used to test hypothesis under the Gauss-Markov assumption are less valid in the presence of heteroscedasticity[23]. This problem usually reported by many researchers when dealing with cross sectional and cross country data. As an alleviate measure, we will perform White Heteroscedasticity-Consistent Standard Error and Covariance.

Moreover, since heteroscedasticity problem suspected exist in the model and it is also seen as a minor problem indicating the existence of misspecification functional form of any model, therefore regression specification error test (RESET) developed by Ramsey's (1969) will be conducted to detect and correct such problem. Although the RESET test only can detect and identify such misspecification but the heteroscedasticity problem occurred in the model still not corrected.

Therefore to deal with the problem, White (1980) heteroscedasticity methodology test came into practice. We will also performed autocorrelation test to detect some space correlation of the residual in the model.

[23] Wooldridge, J.M (2003)

4.5 Model Calibration and hypothesis development

In this section we will discuss the empirical model suggested in the previous section. The suggested equation will be estimated for each cross country denoted by subscript i. The model is as follow:

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 RDEXP_i + \alpha_3 BMI_i \qquad \text{(Eq.1.1)}$$

Each of the variables transformed into its logarithm form to allow for percentage impacts to the estimated coefficients. FDI_i[24] is the inflow of FDI in the reporting (host) economy comprises capital provided (either directly or through other related enterprises) by a foreign direct investor to an FDI enterprise resident in the economy. $IPRS_i$ is the patents protection strength framework which was developed by Park and Ginarte (1997) using standard patent book of law and BMI_i[25] is the black market index as a proxy to transparency and efficiency of the domestic market.

Both $IPRS_i$ and BMI_i are the example of designed institutional factors that govern and control by the government of each receiving countries. Although the black markets in reality are sometimes beyond the government's control,

[24] For explanation of FDI inflow used in this paper, refer to UNCTAD Handbook of statistics which are available online at http://stats.unctad.org/

[25] BMI value is actually adapted by the authors from survey conducted on the Transparency International's Corruption Perception Index which taking ordinal value 1 through 5.

but with strong enforcement, regulation and continuous monitoring process it will reduce such activity.

The hypothesize sign derived in Eq.1.1 are as follows:

$$\alpha_1 > 0,\ \alpha_2 > 0,\ \alpha_3 < 0$$

To examine the interaction term and its effect to inflow of FDI, we developed eleven extended models to the equation Eq (1.1).

For the interaction term between the dummy variables with other explanatory variables is depicted by sets of equations below;

$$FDI_i = \alpha_0 + \alpha_1 RDEXP_i + \alpha_2 BMI_i + \alpha_{gi} \sum_{g=1}^{5} DIPRS * IPRS_i \qquad \text{(Eq.1.2)}$$

The above equation examines the effect of level of FDI inflow for each group given the level of IPRS and assuming other explanatory variables unchanged. The coefficient β_{gi} denotes the effect level of FDI received by the countries.

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 BMI_i + \alpha_{gi} \sum_{g=1}^{5} DIPRS * RDEXP_i \qquad \text{(Eq.1.3)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 RDEXP_i + \alpha_{gi} \sum_{g=1}^{5} DIPRS * BMI_i \qquad \text{(Eq.1.4)}$$

The interactions of Dummy IPRS with other explanatory variables are represented by (Eq.1.2), (Eq.1.3) and (Eq.1.4).

$$FDI_i = \alpha_0 + \alpha_1 RDEXP_i + \alpha_{gi} \sum_{g=1}^{5} DBMI * IPRS_i \qquad \text{(Eq.1.5)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_{gi} \sum_{g=1}^{5} DBMI * RDEXP_i \qquad \text{(EQ.1.6)}$$

The interactions of dummy BMI with other explanatory variables are represented by (Eq.1.5) and (Eq.1.6).

$$FDI_i = \alpha_0 + \alpha_1 RDEXP_i + \alpha_2 BMI + \alpha_{gi} \sum_{g=1}^{5} DRND * IPRS_i \qquad \text{(Eq.1.7)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 BMI + \alpha_{gi} \sum_{g=1}^{5} DRND * RDEXP_i \qquad \text{(Eq.1.8)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 RDEXP_i + \alpha_{gi} \sum_{g=1}^{5} DRND * BMI_i \qquad \text{(Eq.1.9)}$$

The interactions of dummy RDEXP with other explanatory variable are represented by (Eq.1.7), (Eq.1.8) and (Eq.1.9) below.

$$FDI_i = \alpha_0 + \alpha_1 RDEXP_i + \alpha_2 BMI + \alpha_{gi} \sum_{g=1}^{5} Dinc * IPRS_i \qquad \text{(Eq.2.0)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 BMI + \alpha_{gi} \sum_{g=1}^{5} Dinc * RDEXP_i \qquad \text{(Eq.2.1)}$$

$$FDI_i = \alpha_0 + \alpha_1 IPRS_i + \alpha_2 RDEXP_i + \alpha_{gi} \sum_{g=1}^{5} Dinc * BMI_i \qquad \text{(Eq.2.2)}$$

The interactions of dummy income classification with other explanatory variables are represented by (Eq.2.0), (Eq.2.1) and (Eq.2.1).

To avoid fall into dummy variable traps, usually one group will be selected as a base group. Therefore for any effect to FDI, each group has its own unique intercept in explaining the level of FDI inflow for each group. Instead of selecting one group as a basis of comparison, we include all interaction groups into each of equation as shown by Eq.1.2 to Eq.2.2 above.

Since the interaction of each dummy now gives different impact and magnitude to the FDI, therefore the discussion will in fact discuss mainly into the issues on how these interactions affect the investors' decision and how does it attracts the investment level into the group of countries given other factors fixed or unchanged. The signs of coefficients of α_{gi} for each dummy interactions group can be either positive or negative. The positive (negative) sign denotes the level of FDI higher (lower) compared to other group of countries in each analysis.

The suggested model above were developed after taking into account of various factors (i.e issues covered in the literature review section) and hopefully to reach the conclusion of what were actually the impact of FDI inflow as an impact from the TRIPS agreement for different sets and specific characteristic of countries that largely depends on FDI in assessing full potential of economic growth (Park and Ginarte, 1997)

Model developed in (Eq.1.1) is principally a benchmark model. Since the issues of impact of FDI inflow vary across countries, the set of equations which started from (Eq.1.2) through (Eq.2.2) were developed and the main concern is that, as the model developed, the complexity of FDI impact will be revealed. The interaction term for each equation will give the explanations of why some countries received massive FDI investment compared to other and what benchmark that investors look for when deciding to invest in certain counties given other factor unchanged as explained in (e.q.1.1).

4.6 Data and Measurement

This estimation involving cross-country data for 56 selected countries. The selection of countries is limited by the available information. The data are obtained from various sources. The data for inflow of FDI were obtained from United Nation Conference on Trade and Development (UNCTAD, 2003).

All data were quoted in $US million Dollars for the respective reported years. The R&D expenditure is obtained from UNESCO Institutes of Statistic which are also available online.

The R&D expenditure data are quoted as a percentage of Gross National Product (GNP) for each country set. The patent protections index value for the year of 2000 is obtained from Park and Wagh (2002)[26]. Since the selected countries taking periods from 1996 up to the year 2000, therefore indices for the year 1996, 1997, 1998 and 1999 for each country sample were calculated using the same framework used by the authors. The black market index is obtained from Gwartney et.al, Economic Freedom of the World (various issues).

For construction of dummy variables, levels of IPRS are divided into 5 groups taking interval value of [0, 1), [1, 2), [2, 3), [3, 4) and [4, 5). Each interval groups will denotes the different levels of IPRs protection for such countries. By taking two extreme interval group value [0, 1) and [4, 5), any countries falls into the former interval is classified with less IPRs protections compared to the latter.

[26] A detail of the original work by Ginarte and Park (1997) is based on the index calculated from five main categories of patents book of law. (1) Extent of coverage, (2) membership in international patent agreements, (3) provisions for loss of protection, (4) enforcement mechanism and (5) duration of protections. The details descriptions of each categories attached in the appendix 4.0. However, according to Park and Ginarte (1997), the indexes are sensitive to weighting. (Pp. 288).

For BMI, 5 group dummy variables constructed with ordinal group value of 1, 2, 3, 4 and 5. Value of 1 is classified with very low level of black market activity and countries falls under the ordinal value of 5 is classified with very high level of black market activity.

For RDEXP, the dummy variables classified into 4 groups taking interval value [0,1), [1,2), [2,3) and [3,4) also involving ordinal classifications.

Dummy variable for income group is divided into 5 classifications. Each of group is separated by it income level reported by the World Bank as of July 2003.

For each sets of dummy variables involved in this analysis, if the countries in the sample falls under the stipulated interval group, it will assigned by the value of 1 and zero otherwise[27].

[27] For details classifications of the ordinal value please refer to the attached appendix 4.1 and 4.2 respectively.