CHAPTER 3 – DATA AND METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the data, sources of data and definitions and measurements of variables that will be used in the analysis of growth-poverty relationship. It also presents the hypothesis and the methodology to be adopted in the study.

3.2 DATA

This study uses secondary data on economic growth, poverty, and income inequality for analysis. It is collected on an annual basis for the period of 1970 to 2002. The data are by means a longitudinal or panel study. Due to the fact that official data on poverty and income inequality are limited to a selection of years, annual series means is obtained by using statistical estimation technique as shown in Appendix A. Estimation of data is used because the practice of taking several observations for analysis can produce highly misleading results and subsequently, will misrepresent the dynamic patterns of the data.

3.1.1 SOURCES OF DATA

The sources of data for this study include reports, plans and publication of government departments as listed below: -

i) *Yearbook of Statistics (various issues), Department of Statistics, Malaysia* that contains data, such as nominal GDP, real GDP, GDP by strata and GDP by sector.

ii) *Malaysian Plan (various issues), Kuala Lumpur* that provides data such as IP and number of poor households.

iii) *Economic Reports (various issues), Kuala Lumpur* that contains data such as basic socio-economic indicators, employment share and macroeconomic indicators.

iv) *Economic Planning Unit (EPU) of Prime Minister's Department, Malaysia* that provides published and unpublished data on mean and median monthly household income, GC, proportion of income shares of different income-groups, IP and number of poor households.

3.3 THE VARIABLES

3.3.1 DEFINITION OF VARIABLES

3.3.1.1 Economic Growth

Economic growth is defined as the rate of "change" in the level of production of goods and services in Malaysia over a calendar year. It is the increase or decrease of total goods and services produced rather than the factor of changes in prices. Therefore, it is, known as the amount of "real" growth in the economy, which is an amount that allows people to survive and prosper. In evaluating well-being or standard of living of the Malaysia's people, population is an important factor to be considered. Since labour productivity is the output per person in the work force, an increase in the labour productivity in Malaysia is a positive indication of economic growth and a direct determinant of the standard of living. Thus, economic growth can be defined as the "change" in the level of per capita production of Malaysia's economy, which is the amount of real growth per capita.

3.3.1.2 Poverty

Poverty is defined in absolute terms and conceptualised in terms of the ability of an average Malaysian household to consume "sufficient" goods and services. It is

appropriate since the primary concern of Malaysia as a developing country is pure survival, which is the ability of a household to afford a nationally defined basic standard of living. Thus, PLI is used as a basic determinant for the amount of "sufficient" goods and services to be consumed by Malaysian households. The PLI in Malaysia is computed based on the minimum requirements for 1) a minimum food basket to maintain a household in food nutritional health and 2) conventional needs in respect to clothing and footwear, rent and power, transportation and communications, health, education, and recreation.[74] It is a line that defines the minimum acceptable standard of living for the Malaysia's society. Thus, households of a population in Malaysia whose incomes or consumption fall below the PLI will be considered as poor or in poverty.

3.3.1.3 Income Inequality

Income inequality is defined as the unequal distribution of disposable annual income (money)[75] among households in Malaysia with total household income being adjusted for household size. It refers to income-gap among households or different categories of income-groups in Malaysia. The percentage of income recipients, therefore, is seen with respect to the total income they received in a year. If a small percentage of income recipients has a tendency of receiving a large share of income in a society, inequality is high. Inequality is lower when a large percentage of income recipients share the large share of income. Thus, the degree of inequality or income-gap in Malaysia differs and the magnitude lies between perfectly unequal to perfectly equal.

[74] See, *Fifth Malaysian Plan, 1986-1990, p.83* for information on Malaysia's PLI. This PLI is updated annually using Consumer Price Index (CPI) to give a better representation of the amount spent on consuming "sufficient" goods and services to maintain a decent standard of living in a society.
[75] It is the amount of income after direct taxes and including transfer payments and refundable tax credits.

3.3.2 MEASUREMENT OF VARIABLES

3.3.2.1 Real Gross Domestic Product Per capita Growth (RGDPCG)

Economic growth is measured in terms of changes in GDP per capita or GDP per capita growth at constant prices[76]. It comprises of changes in the growth of real production per person in the Malaysia's economy. It is obtained using the nominal growth minus inflation (changes in CPI) and divided among the Malaysia's people. The Equation 3.1 expressing this growth measure is:

$$RGDPCG = (\Delta RGDPC/RGDPC)/Mid\text{-}year\ Populations \qquad (3.1)$$

which is the real gross domestic per capita growth for Malaysia in a particular year as a proportion of the production at the beginning of that year.

3.3.2.2 Incidence of Poverty (IP)

Poverty is measured in terms of IP, which is also known as "Headcount Index." It is determined by the number of poor households in Malaysia, in a particular locality, either state or district, over the total number of households. The poor households refer to those whose incomes or consumption fall below the Malaysia's PLI. The Equation 3.2 representing this index is:

$$IP = p/n \qquad (3.2)$$

where p is the number of poor units and n is the total population in Malaysia.

[76] "Constant Price" is the price adjusted for inflation, which means the purchasing power of one monetary unit does not vary.

3.3.2.3 Gini Coefficient (GC)

Income inequality is measured in terms of GC, which is an index constructed using the Lorenz curve.[77] It is given by the ratio of the area between the theoretical line of equality (or diagonal) and Lorenz curve to the total area under the line of equality. The whole distribution of income in Malaysia is reduced to a single number, between zero and one. If there were perfect equality, the value of the GC would be zero, while perfect inequality would give a value of one. The GC, thus, can be interpreted as the proportion of total income that must be transferred from the rich to the poor in order to make all incomes equal in Malaysia (Sundrum, 1990). It can be measured using deciles,[78] which is the conventional way of presenting income distribution data as:

$$GC = \{\sum_{i=1}^{10} (i-[1.5]\ \mu_i\} / 5 \sum_{i=1}^{10} \mu_i \qquad (3.3)$$

where i is the number of deciles and μ_i is the average or mean income of i.

3.4 HYPOTHESIS FOR ANALYSIS

3.4.1 ECONOMIC GROWTH CAN EFFECTIVELY REDUCE POVERTY

The relationship between economic growth and poverty is based on theoretical generalisations. "Trickle Down Theory" states that benefits of overall economic growth would automatically filter down to the poor from the process of overall development. Poverty would eventually disappear when rapid economic growth can be sustained.

---

[77] Lorenz curve is a curve constructed by Lorenz, which is fitted to percentile shares to measure the percentage of income going to income recipients. Income recipients are arranged from the poorest to the richest, moving from left to right. Complete equality would occur only if x per cent of the population received x per cent of the income, as indicated by the 45 degree line. Perfect inequality would occur if one person has 100 per cent of the income, as represented by the horizontal axis. See, Meier, Gerald M. 1995. *Leading Issues in Economic Development*, (6th Edition). New York: Oxford University Press.

[78] Barba, Ricardo C. 1996. *Poverty and Income Inequality in the Philippines. Master Thesis.* National University of Singapore.

Based on this theory, the first hypothesis is derived by assuming that poverty will reduce linearly as economy continues to grow. Equation 3.4 gives the function that will be used to test this hypothesis.

$$\textit{Hypothesis 1:} \qquad IP = f(RGDPC) \qquad (3.4)$$

where IP is the dependent variable that represents the rate of poverty and $RGDPC$ is the independent variable that represents real per capita growth. The rate of poverty is seen as directly disproportionate to the rate of growth.

Another assumption based on the theory is that the change in poverty rate increases linearly as economic growth rate continues to increase. The derived hypothesis function to be tested is given by Equation 3.5.

$$\textit{Hypothesis 2:} \qquad CIP = f(\overset{+}{RGDPCG}) \qquad (3.5)$$

where CIP is the dependent variable that represents change in the rate of poverty and $RGDPG$ is the independent variable that represents change in the of rate of real per capita growth. The change (increase) in the rate of poverty reduction is seen as directly proportionate to the change (increase) in the rate of growth.

3.4.2 INCOME INEQUALITY INHIBITS GROWTH IMPACT ON POVERTY

Kuznets 'Inverted-U Hypothesis' relates economic growth with income inequality. It claims that as a country develops, its income distribution changes in which income inequality increases in the early stages of development, reaches its peak and, then, declines in the later stages of development.[79] The changes of income inequality with

[79] Kuznets' Inverted U-Hypothesis" (1955) – A hypothesis formed based on the observation of long-term transition in developing countries from mainly rurally-based economies toward urban-based ones. When

respect to economic growth, therefore, vary across time; positive correlations in the beginning, then, zero correlations and finally, negative correlations as represented by Equation 3.6.

$$GC = f(RGDPC)^{-/+} \tag{3.6}$$

On the other hand, two types of arguments, the 'Induce Growth Argument' and the 'Growth-Elasticity Argument,' explain the correlation between poverty and income inequality. The former states that higher income inequality may reduce growth rates and, hence, makes it more difficult for growth to reduce poverty. The latter states that higher income inequality would cause the poor to receive a smaller share of income by assuming that growth benefits all levels of income in similar proportions. This makes the reduction of poverty slower (Martini, 1999).[80] Both arguments explain the existence of a close relationship between poverty and income inequality; the higher the rate of income inequality in a society, the higher the rate of poverty as shown by Equation 3.7.

$$IP = f(GC)^{+} \tag{3.7}$$

Based on the theoretical generalisations relationship between growth and inequality and the data-consistent empirical generalisations relationship between inequality and poverty, the level of IP is depends on the amount of real per capita growth and the changes in the underlying income distribution (Datt & Ravallion, 1992). Either an increase in income or improvement in its distribution should reduce poverty.

---

the process of industrialisation starts and the first workers migrate to the cities, inequality increases. Until most workers are in the urban sector, the traditional migration tends to decrease inequality rather than increasing it. In other words, income inequality is a by-product of growth and structural change. See: Pablo Rodas-Martini. 1999. "Income Inequality Within and Between Countries: Main Issues in the Literature", *Human Development Report 1999* – "Globalisation with a Human Face", pp.370. Also see: Simon Kuznets, "Economic Growth and Income Inequality", *American Economic Review 45* (March 1955): 1-28 and "Quantitative Aspects of the Economic Growth of Nations: VIII. Distribution of Income by Size", *Economic Development and Cultural Change 11* (March 1963): 1-80.

[80] See: Pablo Rodas-Martini. 1999. "Income Inequality Within and Between Countries: Main Issues in the Literature", *Human Development Report 1999* – "Globalisation with a Human Face", pp.380-381.

Assuming that poverty rate reduces linearly in the period of economic growth where inequality is increasing, the derived hypothesis function to be tested, thus, is given by Equation 3.8.

Hypothesis 3: $$IP = f(\overset{+}{GC}, \overset{-}{RGDPC}) \quad (3.8)$$

where GC is a measure of initial inequality in income distribution. Poverty rate is seen as directly proportionate to the change in the rate of per capita growth and directly disproportionate to the change in the rate of inequality. Thus, total change in poverty is due to the change in growth component and change in distribution component. The growth component tends to have greater impact on poverty that will reduce poverty. However, inequality in distribution will reduce the impact of growth on poverty. If growth is as sufficiently strong to outweigh the distributional effect, poverty will fall. On the contrary, if the effect of distribution component is greater, poverty will rise.

Another derived hypothesis function, proposed by Ravallion (1997) based on the generalised relationships, is that as inequality increases, the rate of poverty reduction becomes less responsive to growth in real growth per capita and reaches zero at sufficiently high inequality. Assuming that the elasticity of changes in poverty reduction to changes in growth falls as inequality increases and reaches zero when the richest person has all of the income, the rate of change in poverty reduction can be written as:

Hypothesis 4: $$CIP = f(\overset{-/+}{(1 - GC)}\ \overset{+}{RGDPCG})^{81} \quad (3.9)$$

where $(1 - GC)RGDPG$ is the "distribution-corrected" rate of growth. The rate of change in poverty reduction is directly proportionate to the rate of $(1 - GC)RGDPG$. Thus, the

[81] An hypothesis suggested by Ravallion, M. (1997) in the paper, "*Can High-Inequality Developing Countries Escape Absolute Poverty?*" Poverty and Human Resources Division, Policy Research Department, June. Copies available free from World Bank, 1818H Street NW, Washington DC 20433.

effectiveness of changes in growth rate to reduce changes in poverty reduction is affected by the rate of inequality that varies over time. If the effect of inequality is relatively larger than the effect of growth, the rate of poverty reduction will reduce and vice versa.

3.4.3 THE PATTERNS OF GROWTH MATTERS FOR POVERTY

Sectoral patterns (compositions) of growth effects on poverty reduction explained 'how' growth actually benefited the poor, through different sectors, such as, rural or urban, manufacturing or agriculture, and primary, secondary or tertiary. According to Danielson (2001), growth in agriculture (or rural sectors) is usually more poverty-reducing than growth in manufacturing (or urban sectors). However, in the middle-income and low-income Asian countries, manufacturing growth (urban sectors growth) has proved to be an important source of poverty reduction since manufacturing sector is growing more rapidly than the agriculture sector.

Based on these generalised empirical evidences, Malaysia as a middle-income developing country, therefore, would expect manufacturing growth to play a greater role in reducing poverty. The derived hypothesis to be tested is given by Equation 3.10. The assumption is that growth in the manufacturing and agriculture sectors, both, reduces poverty with relatively larger effects coming from the manufacturing growth.

$$\textit{Hypothesis 5:} \qquad IP = f(\bar{RGDPmg}, \bar{RGDPag}) \qquad (3.10)$$

where *RGDPmf*, and *RGDPag* are independent variables that represent 'real growth' in the manufacturing sector and agriculture sector respectively. The rate of poverty is seen as directly disproportionate to the rate of growth of these two-sectors. Manufacturing

growth is expected to have larger effect on poverty reduction as compare to agriculture growth.

3.5 METHODOLOGY

To test the hypotheses described in the previous sections, time-series analysis or historical type of analysis will be used. The number of observations that will be included in the study are 32 due to the research period of 32 years from 1970-2002. Results of the econometric analysis using 'Ordinary Least Square' (OLS) estimation will be interpreted and presented descriptively using tables, graphs and charts in the following chapters accordingly. All rates of change are compound annual rates (annual differences in logs gave similar results).

3.5.1 TESTS OF HYPOTHESES – ECONOMIC GROWTH IMPACT ON POVERTY

The hypotheses of the effectiveness of economic growth in reducing poverty will be tested using the following regression models of IP on real GDP per capita growth expressed.

3.5.1.1 Basic Specification Analysis of Growth and Poverty

Simple level regression will be employed to test *Hypothesis 1*. The logarithm of IP is regressed on the logarithm of real GDP per capita.

$$Ln\ IP_t = \alpha_0 + \beta_0\ ln\ RGDPC_t + e_t \qquad (3.11)$$

where β_0 is the "growth elasticity" of poverty with respect to real GDP per capita given by $RGDPC_t$ at time t, α_0 is the fixed effect reflecting time differences in distribution and

e_t is a white-noise error term. If β_0 is negative, this implies that poverty will reduce as the economy continues to grow.

To test *Hypothesis 2,* the basic specification of simple growth regression will be used. The change in the rate of poverty reduction is regressed on the change in the rate of real per capita growth.

$$CIP_t = \gamma_0 + \delta_0 RGDPCG_t + \varepsilon_t \qquad (3.12)$$

where CIP measures the change in the rate of IP at time t, γ_0 is the constant, δ_0 is the change of poverty rate with respect to the change of real per capita growth given by $RGDPCG_t$ and ε_t is an error term. If δ_0 is negative, this means that the change in the rate of poverty will reduce as the rate of growth increases.

3.5.1.2 Variants On The Basic Specification of Growth and Poverty

To determine variants on the basic specification analysis, a time trend is added to the Equations 3.11 and 3.12 to capture the possibility that there has been a secular increase or decrease over time in the share of the GDP accruing to the poor.

$$Ln\ IP_t = \alpha_1 + \beta_1 \ln RGDPC_t + \lambda T_t + e_t \qquad (3.13)$$

$$CIP_t = \gamma_1 + \delta_1 \ln RGDPCG_t + \rho T_t + \varepsilon_t \qquad (3.14)$$

where T is the time component that takes the value of 1,2,3...32 and λ and ρ are the trend rates that reflects changes in the logarithm of IP and CIP over time t respectively. If λ and ρ are both significant, poverty rate and changes in the poverty rate will tend to reduce over time due to the time factor and not the influence of any other factors.

To capture the possibility of whether the ability of growth in reducing poverty is getting stronger or weaker over time, the logarithm of IP and the CIP are regressed on the logarithm of real GDP per capita and the RGDPCG respectively for the period of 1970s, 1980s and 1990s. The estimated coefficients of RGDP and RGDPC for different periods allow for comparisons of the strength of growth-poverty relationship, whether it has reduce or increase.

Periods

1970s *(1970-1979)*: $Ln\ IP_t = \alpha_2 + \beta_2\ ln\ RGDPC_t + e_t$ (3.15)

(1971-1980): $CIP_t = \gamma_2 + \delta_2\ ln\ RGDPCG_t + \varepsilon_t$ (3.16)

1980s *(1980-1989)*: $Ln\ IP_t = \alpha_3 + \beta_3\ ln\ RGDPC_t + e_t$ (3.17)

(1981-1990): $CIP_t = \gamma_3 + \delta_3\ ln\ RGDPCG_t + \varepsilon_t$ (3.18)

1990s *(1990-1999)*: $Ln\ IP_t = \alpha_4 + \beta_4\ ln\ RGDPC_t + e_t$ (3.19)

(1991-2000): $CIP_t = \gamma_4 + \delta_4\ ln\ RGDPCG_t + \varepsilon_t$ (3.20)

where β_2, β_3 and β_4 are coefficients that represent the "growth elasticity" of poverty with respect to real GDP per capita and δ_2, δ_3 and δ_4 are coefficients that represent the changes in IP with respect to changes in real per capita growth for the period of 1970s, 1980s, and 1990s respectively. If the coefficients are getting stronger, ($\beta_2 < \beta_3 < \beta_4$) and ($\delta_4 < \delta_4 < \delta_4$) in each period of time, the ability of growth in reducing poverty is getting stronger for the entire period of 1970-2000, and vice versa.

To examine whether the relationship between growth in real GDP per capita and IP is different during the periods of negative and positive growth, an interaction term of RGDPC with a dummy variable is added in the simple level and growth equation.

$$Ln\ IP_t = \alpha_5 + \beta_5\ ln\ RGDPC_t + \pi D_t + e_t \quad (3.21)$$

$$CIP_t = \gamma_5 + \delta_5\ ln\ RGDPCG_t + \vartheta D_t + \varepsilon_t \quad (3.22)$$

where D is the dummy variable that takes the value one when growth in average RGDP is negative at time period t. It takes the value zero when growth in average RDPG is positive or zero. The coefficients, π and ϑ, represent the changes in logarithm of IP and CIP due to the effects of crisis on economic growth. If π and ϑ are significant respectively, this implies that economic crisis will affect the total performance of poverty reduction.

3.5.2 TESTS OF INEQUALITY'S IMPACT ON GROWTH-POVERTY RELATIONSHIP

To test the impact of (income) inequality on the ability of growth to reduce poverty, the following regression models are employed.

3.5.2.1 Multiple Regression Analysis of Growth, Poverty and Inequality

Multiple regression analysis is used to test *Hypothesis 3*. It quantifies the relative contributions of growth and inequality to changes in poverty through the rate of 'elasticity'. The 'growth elasticity' is defined as the change in poverty due to the change in RGDPC while holding the value of GC (at some reference level). The 'inequality elasticity', on the other hand, is the change due to a change in the GC while holding the growth constant. Either an increase in growth or an improvement in its distribution should reduce poverty. Thus, the regression analysis includes both the growth rate of RGDPC and changes in inequality as explanatory variables for poverty reduction.

$$Ln\ IP_t = \beta_6\ ln\ RGDPC_t + \eta\ ln\ GC_t^{82} + e_t \qquad (3.23)$$

[82] Although Gini Coefficient is in the form of ratio (0-100), logarithm of its value has been used for the regression analysis because its estimated 'elasticity' coefficient has to be used along with the estimated 'elasticity' coefficient of real per capita growth for the calculations of 'Inequality-Growth Trade-Off Index' (IGTI) and 'Pro-Poor Growth Index' (PPGI) in the following sections. Since real per capita growth has to be expressed in logarithm term, therefore, Gini Coefficient is also expressed in logarithm term for consistency.

where β_6 is the usual "growth elasticity" of poverty with respect to RGDPC and η is the "inequality elasticity" of poverty with respect to GC (or disparity in income) given by GC_t. e_t is the residual, which exists whenever the RGDPC and GC jointly determine the change in poverty.

If β_6 is negative, this indicates that increase in real GDP per capita reduces poverty. If η is positive, this implies that inequality has decreased the effect of poverty reduction. Poverty will reduce if 'growth elasticity' is larger than the 'inequality elasticity.' Economic growth is as sufficiently strong to outweigh the distributional effect. On the contrary, if 'inequality elasticity' is larger, there will be an increment in poverty. In short, changes in income distribution wipe out some of the effects of growth on poverty.

3.5.2.2 Inequality – Growth Trade Off Index (IGTI)

Based on the "inequality elasticity" of poverty and "growth elasticity" of poverty obtained using Equation 3.23, the trade-off between inequality and growth can be estimated. It is represented by the 'Inequality-Growth Trade-off Index' (IGTI) proposed by Kakwani (2000). According to Kakwani, total proportional change in poverty can be first written as:

$$\frac{d\theta}{\theta} = \eta_\theta \frac{d\mu}{\mu} + \varepsilon_\theta \frac{dG}{G} \quad (3.24)$$

where η_θ represents the "growth elasticity" of poverty and ε_θ represents the "inequality elasticity" of poverty. μ is mean income and G is GC. Thus, the first term in the right-hand side of the equation measures the impact of growth on poverty and the second

[83] Stated by Kakwani, Nanak. 2000. in "Growth and Poverty Reduction: An Empirical Analysis". *Asian Development Review*, Vol.18, no.2: 74-84.p79.

term in the same side of the equation measures the impact of change in GC. By equating the total proportionate change in poverty to zero, the inequality-growth trade-off index (IGTI) can be obtained as:

$$\text{IGTI} = \phi_\theta = \frac{\partial \mu}{\partial G} \times \frac{G}{\mu} = -\frac{\varepsilon_\theta}{\eta_\theta} \qquad (3.25)$$

Substituting the value of elasticity derived by Kakwani with the value obtained from this study, the derived IGTI will be:

$$\text{IGTI} = -\eta / \beta_6 \qquad (3.26)$$

Therefore, IGTI is the ratio of "inequality elasticity" with respect to "growth elasticity". It explains the required growth rate in order to offset the adverse impact of increase in inequality. It also means that reducing the GC is equivalent to having additional percentage of growth rates. Thus, the larger the IGTI, the greater will be the benefits of following pro-poor policies that would reduce inequality.

3.5.2.3 The Pro-Poor Growth Index (PPGI)

The "inequality elasticity" of poverty and "growth elasticity" of poverty obtained using Equation 3.23 can also be used to obtain the 'Pro-poor Growth Index' (PPGI) which explains whether economic growth is proportionally benefiting the poor in consideration of the income distribution factor. According to Kakwani and Pernia (2000), the degree of pro-poor growth can be measured by the index:

$$PPGI = \phi = \sigma / \sigma_g \qquad (\sigma = \sigma_g + \sigma_l)^{84} \qquad (3.27)$$

---

[84] Stated by Kakwani, Nanak and Pernia, Ernesto M. (2002) in the paper "*Pro-poor Growth and Income Inequality: with the assistance of Hyun Son*". Economics and Development Resource Center: Asian Development Bank (ADB), October.

where σ_g is the proportionate change in poverty when there is a positive growth rate of one per cent provided relative inequality does not change and σ is the proportional change in poverty caused by the sum of two factors: σ_g, which is the income effect on poverty and σ_I, which is the inequality effect on poverty.

Assume that income effect of growth on poverty, σ_g, is always negative, which implies that growth will always reduce poverty. The inequality effect, σ_I, however, can either be positive or negative. If σ_I is negative, it means that growth has led to a change in the distribution of income in favour of the poor thereby, reducing poverty unequivocally. Such a growth can be characterised as pro-poor. If σ_I is positive, the change in income distribution is pro-rich; the rich benefit proportionally more than poor.

In this study, σ_g is equivalent to β_6 and σ_I is represented by η. The PPGI, therefore, will be derived as:

$$\phi = (\beta_6 + \eta) / \beta_6 \qquad (3.28)$$

where ϕ will be greater than 1 if $\eta < 0$, which means that growth is strictly pro-poor. If $0 < \phi < 1$, it means that $\eta > 0$ but poverty still declines due to growth. This situation may be generally characterised as "trickle-down." If $\phi < 0$, economic growth will in fact badly hurt the poor and lead to an increase in poverty.

3.5.2.4 The 'Distribution-Corrected' Rate of Growth (DCRG)

To test *Hypothesis 4*, the rate of change in poverty reduction is regressed upon the "distributed-corrected" rate of change in per capita real growth. This rate of growth is

obtained by multiplying the conventional rate of growth, *RGDPG* with the value of one minus the rate of initial inequality, *(1-GC)*.

$$CIP_t = \delta_1 (1\text{-}GC)_t \, RGDPCG_t + \varepsilon_t \qquad (3.29)$$

where δ_1 is the "distributed-corrected" rate of growth (DCRG) and $\varepsilon_{1,t}$ is the unexplained variance, which consists of the measurement error. The coefficient δ_1 implies the possibility for the rate of change in growth to reduce the rate of change in poverty reduction when income inequality effects are taken into consideration. It can be smaller or greater than what the coefficient produces by using conventional rate of growth.

3.5.3 TESTS OF PATTERNS OF GROWTH EFFECTS ON POVERTY REDUCTION

Similarly, the hypotheses of the impact of patterns of growth on poverty reduction are tested using multiple regressions analysis as expressed.

3.5.3.1 Multiple Regression Analysis of Patterns of Growth and Poverty

To test *Hypothesis 5*, the logarithm of IP is regressed on the logarithm of real GDP of the manufacturing sector and agriculture sector.

$$Ln\, IP_t = \alpha_7 + \beta_7 \ln RGDPmf_t + \beta_8 \ln RGDPag_t + e_t \qquad (3.30)$$

where β_7 and β_8 are "growth elasticities" of poverty with respect to the real GDP of manufacturing and agriculture sectors respectively. These estimated coefficients allow for comparisons of the strength of growth-poverty relationship in the manufacturing sector and agriculture sector. If the coefficient, β_7 is larger, this implies that the manufacturing sector tends to play a greater role in reducing the poverty rate.