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Income Inequality in Developing Countries

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INCOME INEQUALITY IN DEVELOPING COUNTRIES

ABSTRACT

Globally, it is reported that the top 1 percent of income recipients receive about 15 percent of worldwide income, and the top 5 percent receive 40 percent of all income. Meanwhile, the poorest 20 percent receive only 1 percent of the global income. This paper attempts to unlock the significant factors that affect income inequality.

In 1963, Simon Kuznets derived the inverted U hypothesis from which he inferred that through the course of development, as per capita income increases, initially, income inequality will increase before it starts to improve. Hence he inferred that the trend of income inequality through a country's development takes the form of an inverted U. However, Kuznets' inverted U is a development pattern and not a theory. Therefore, the inverted U pattern does not explain income inequality.

In this study, using data on 61 countries, an inverted u pattern is found. The labor surplus model supports that the share of labor in industry and high population growth rates explain the inverted U. An explanation given by Arthur Lewis also supports that education explains the inverted U pattern. Using empirical tests, this paper addresses whether the share of labor, high population growth rates and education determine the inverted U pattern that was also found using data in this study.

Introduction

Economic growth refers to a rise in national per capita income and product (PCY). However, economic growth does not mean that there is improvement in mass living standards. It can be a result of increase of wealth for the rich while the poor have less or no improvement in their living standards (Gillis, 70). This uneven distribution of income is referred to as income inequality. There is much income inequality existing in individual countries as well as globally. Globally, it is reported that the top 1 percent of income recipients receive about 15 percent of worldwide income, and the top 5 percent receive 40 percent of all income. Meanwhile, the poorest 20 percent receive only 1 percent of the global income (Braun, 49). In this paper, I intend to unlock significant factors that affect the level of income inequality in developing nations.

There was much interest in income inequality in developing countries in the 1960's which diminished as these countries became faced with greater problems including declining growth rates and the debt problem (Gillis, 72). Today, income inequality remains an important issue because it concerns human welfare. Measures of income inequality give insights into the extent of poverty in countries and are guides for both local and international organizations concerned about the improvement of living standards of the very poor.

Theoretical Considerations and Hypothesis

Economic Growth and Income Inequality

Kuznets' Inverted U hypothesis

The foundation of most works on income inequality is provided by Simon Kuznets. In 1963, Kuznets suggested that the relationship between economic growth and income inequality takes the form of an inverted U. In his study, Kuznets used cross-section data of 18 countries. Using his data, he derived the inverted U hypothesis from which he inferred that through the course of development, as PCY increases, initially income inequality worsens, after which income inequality improves (Fields, 61). Diagram 1 illustrates this inverted U pattern. According to the pattern, moving from low-income economies ($0-500, World Bank (W.B) 1988) to lower-middle economies ($500-2200, W. B 1988), income inequality should increase. Starting from about upper middle-income ($2200-6000, W. B 1988) onwards, income inequality should decrease (Poulson, 150).

Kuznets' inverted U is a development pattern and not a theory. Chenery and Syrquin define development patterns to be changes in the structure of the economy associated with rising level of income (Chenery, 4). The main difference between a pattern and a theory is that a theory asserts causality and a pattern does not. A theory asserts that changes in one variable cause a change in another variable. A pattern on the other hand would show a relationship between variables but does not assert that a change in one variable is the cause of a change in another variable. Since every country develops in a unique way, patterns are often used in development economics, because they provide a basis for comparative analysis in order to make generalizations about the development process of a single country (Chenery, 3).

Kuznet's Inverted U Pattern

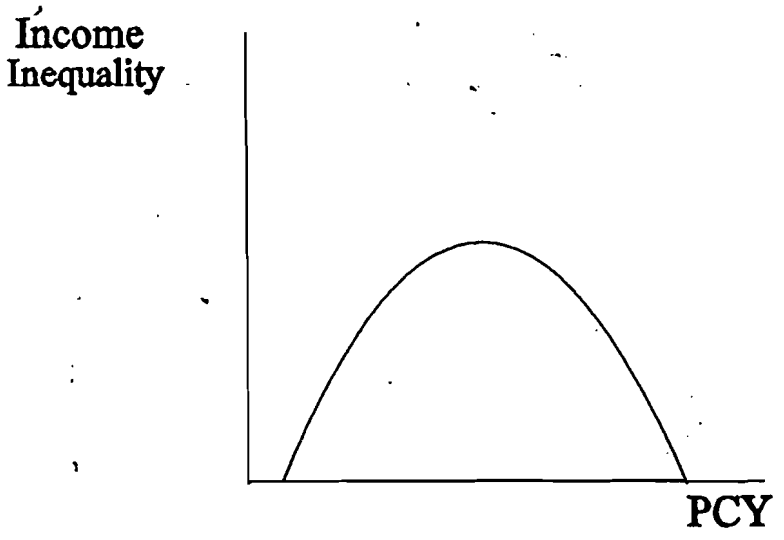

DIAGRAM 1

Since Kuznets inverted U is a pattern; it does not explain income inequality. That is, rising PCY does not cause the inverted U trend. Rather, there is a relationship between PCY and income inequality which is illustrated by the inverted U pattern. Thus the question becomes what factors affect the level of income inequality in a country. The rest of this paper attempts to disclose the explanatory variables of income inequality. It is found that two explanatory variables, the shares of labor in industry and education, support the inverted U. A third explanatory variable, population growth rate, is expected to affect the level of income inequality at any stage of development.

Effect of Increasing Share of Labor In The Industrial Sector

The migration of labor from the agricultural (rural) sector to the industrial (urban) sector plays an important role in the development of a country. Often when industrialization begins in a country, the industries require a significant amount of labor which must come from the rural sector. When labor migrates to the urban sector, production in this sector increases and the economy grows. Moreover, the urban sector has other benefits for workers who migrate, including access to services like public schools and health services, which enhance human capital and facilitate higher income. As will be discussed below, this rural to urban migration also affects income inequality. In this study, the share of labor in the industrial sector is used to account for the effect of rural to urban migration on income inequality.

The argument here is that initially the share of labor in the industrial sector would be positively related to the level of income inequality, and after some point in development, the share of labor in the industrial sector will be negatively related to the level of income inequality. Thus, this argument is consistent with the inverted U pattern. The support for this argument is provided by the two-sector labor surplus model. The two sectors in this model are the agricultural and industrial sectors. In this paper it is

assumed that if wages are rising, then income inequality is improving. This is because when workers earn higher wages, they take away more income from the wealthy and reduce wage differentials in the economy, causing the level of income inequality to decrease.

The Two-Sector Labor Surplus Model

It is assumed that before development takes place a nation is primarily agrarian and that surplus labor exists. Because land is fixed in supply and the supply of agricultural labor varies, as labor increases, initially agricultural output will increase until diminishing returns set in. Then, additional labor will not increase output, and the marginal productivity of labor will be zero. This situation indicates the existence of surplus labor. Since wage is a function of marginal productivity, wages will be constant whenever there is surplus labor. In a country that is at its early stages of development, this constant wage is the subsistence wage (Gillis, 54-59).

According to the two-sector model, the start of industrialization marks the start of development. Industries need workers, and given the initial surplus of labor in the agricultural sector, the industries attract workers from the agricultural sector by paying a constant wage which is slightly higher than the subsistence wage. The horizontal part of the labor supply curve, QR, in diagram 2 represents the period when there is surplus labor in agriculture, and the constant wage paid in the industrial sector is Q.

As long as there is surplus labor in the agricultural sector, the labor surplus model suggests that there will be rising income inequality in the economy as workers move to the industrial sector. This is because the increasing amount and low cost of labor in the industrial sector raises output in that sector, causing the owners of industries to realize huge profits, while wages cannot rise above point Q (diagram 2) until labor becomes a scarce factor (Gillis, 93). As illustrated in diagram 2, when there is surplus labor, an increase in demand for labor in the industrial sector from D_1 to D_2 does not force wages

Supply of Labor in the Industrial Sector
Using the Labor Surplus Model

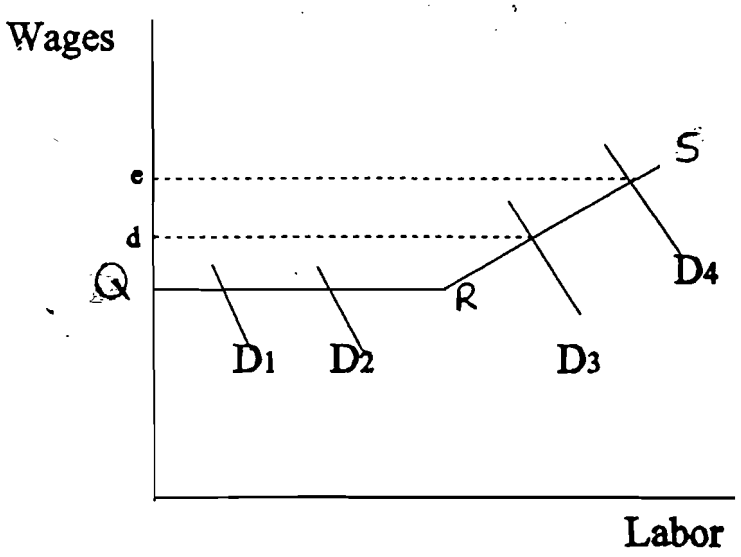

DIAGRAM 2

to rise. Thus although workers earn more than subsistence wage by moving to the industrial sector which should decrease the overall level of income inequality, the huge profit of capitalists rises faster and dominates the level of income inequality so that overall income inequality increases.

When surplus labor ceases to exist in agriculture, further increases in demand for labor by industries will lead to higher wages in the industrial sector and at the same time workers in the agricultural sector become better off since the supply of agricultural labor is decreasing. Thus there will be an improvement in the overall level of income inequality. The point at which labor becomes scarce is point R, and marks the start of a trend towards income equality. The supply curve facing the industrial sector becomes RS, an upward sloping curve, which indicates that labor is in scarce supply. Those remaining in agriculture are better off for the following reasons. Workers in the industrial sector are no longer producing their own food, causing the demand for agricultural products to increase and consequently the price of these products to be higher. Moreover, the available land per worker in the agricultural sector is rising and thus the marginal productivity of labor in the agricultural sector also rises. Increasing marginal productivity in the agricultural sector implies that wages in this sector are also rising. Thus to attract more workers from agriculture, industries must offer even higher wages than those existing in the agricultural sector (Gillis, 53). Thus in diagram 2, an increase in demand for labor in the industrial sector from D_3 to D_4 raises wages from d to e, which would mean a decrease in the overall level of income inequality.

The initial worsening followed by an improvement in the level of income inequality is consistent with Kuznets' inverted U hypothesis. That is, the labor surplus model supports the inverted U. Because the labor surplus model is based on the migration of labor to the industrial sector, it supports the argument that the share of labor in industry should first increase then decrease the level of income inequality.

The Effect of Population Growth Rates

It is stated that one reason why developing countries have high degrees of income inequality at relatively high levels of industrialization is because of rapid population growth in these countries (Dovring, 91). Countries like South Korea and Taiwan that have succeeded in improving income distribution adopted measures to control population growth as one of the necessary tools (Frank, 102). Moreover, other studies have shown a positive relationship between high population growth rates and income inequality (Chenery et al, 17).

These observations support the argument that high population growth rates will cause the level of income inequality to increase for any given level of PCY. Given that a country does not have perfect income equality at the start of its development process, the country's inverted U curve will intersect the income inequality axis at a point other than zero.

The argument given here is that high population growth rates will shift the country's inverted U curve upward so that the curve intersects the income inequality axis at a higher point than before, indicating an increase in the level of income inequality for any given PCY. This argument is illustrated in diagram 3. Higher population growth rates causes the curve to shift from A to B and the intercept of the curve to rise from 0.2 to 0.5 for example (measurement of income inequality is the gini coefficient - see appendix 2). Thus at PCY of 300, the level of income inequality also rises from 0.4 to 0.6. Therefore, population growth rates can be said to determine the intercept of the inverted U. An economy with a low population growth rate will have a lower intercept than a country with high population growth rates. That is, the higher the intercept of the inverted U curve of a country, the higher the level of income inequality for any given PCY.

Strong support for the argument that high population growth rates are positively related to the level of income inequality is provided by the two-sector labor surplus model and the theory of supply and demand. As previously discussed, the labor surplus model suggests that a country first has a period of worsening income inequality followed by a period of improvements in the level of income inequality. During the period of worsening income inequality, there is surplus labor in the agricultural sector and income inequality improves when labor becomes scarce. Using the labor surplus model and the theory of supply and demand, it will be shown that high population growth rates are positively related to the level of income inequality during the periods of abundant and scarce supplies of labor.

Diagram 4 shows the effect of rising population growth rates when there is surplus labor in agriculture. As discussed before, BC indicates the period when income inequality rises, because the owners of industries are realizing huge profits due to the growth of industries and low labor costs. At point C income inequality will take a downturn and further demand for labor by industries will cause wages to rise. If the population growth rate is not high, then the supply curve of labor S_{ind} should remain BCD.

However, if the supply of labor is increasing because of high population growth rates, then S_{ind} will be ABCD. The amount of surplus labor will become ABC which is greater than BC that represents surplus labor when population growth rates are very low. Therefore, when population growth rates are high, it will take a longer time for the economy to reach point C, where all surplus labor is absorbed by industries and the economy tends towards income equality. Also, labor costs will remain low for a longer time, causing the owners of industries to make greater profits than when population growth rates are low. This is because if population growth rates are relatively stable, then the time when labor becomes scarce comes sooner so that the owners of industries must cut profits at an earlier stage to increase wages in order to hire more workers.

Upward Shift of the Inverted U Curve

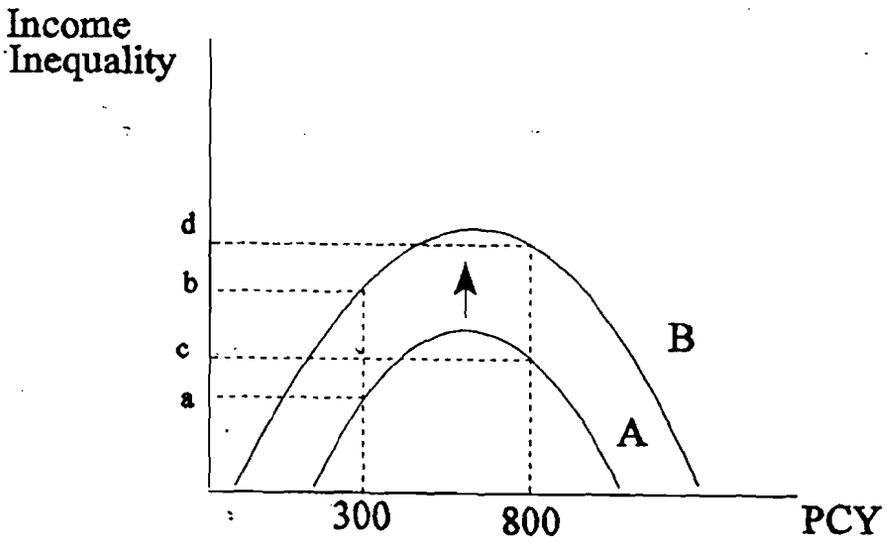

DIAGRAM 3

Effect of High Population Growth Rates with
Surplus Labor in the Economy

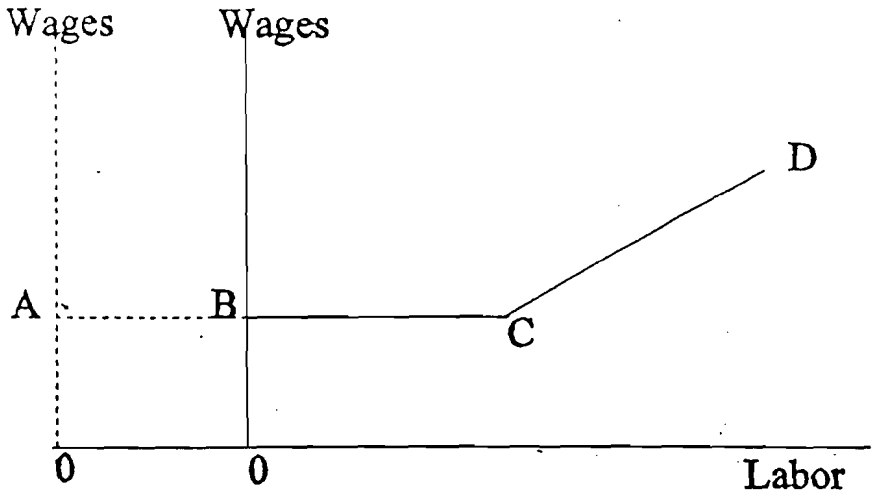

DIAGRAM 4

Effect of High Population Growth Rates with
Scarce Supply of Labor in the Economy

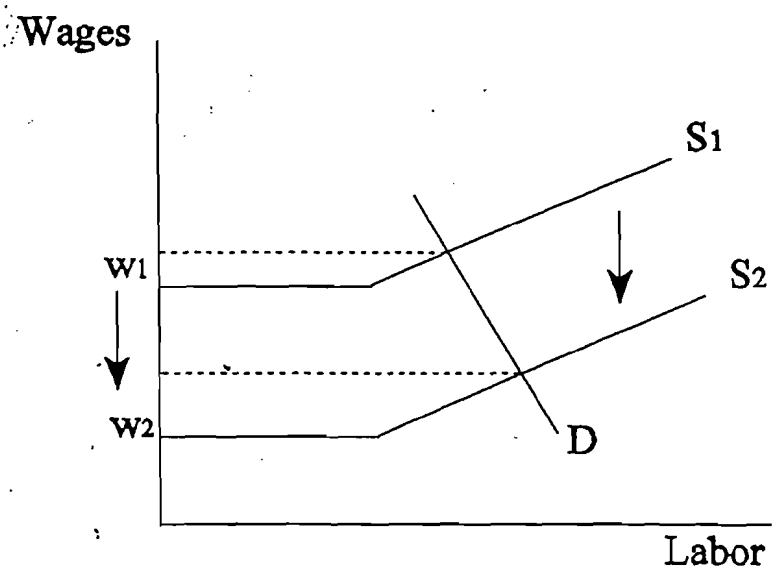

DIAGRAM 5

In summary, when surplus labor exists and a country finds itself along the upside of the inverted U when its level of income inequality is rising, high population growth rates would further increase the level of income inequality for each PCY along this part of the inverted U curve. This is due to the widening of income differentials between industrial owners and workers.

If the country is at the stage when labor is in scarce supply, then the supply curve facing industries will be upward sloping. Thus, there will be improvements in the level of income inequality because wages will increase whenever the demand for labor by industries increases. This is illustrated in diagram 5A, where S_1 is the supply curve of labor facing industries and an increase in their demand for labor from D1 to D2 raises wages from a to b.

An increase in the supply of labor at the stage of development when there is scarcity of labor causes labor to be less scarce and reduces wages. As shown in diagram 5B, an increase in the supply of labor due to high population growth rates will cause the supply curve to shift from S_1 to S_2, causing wages to fall from d to c. Since falling wages are linked with higher profits for industrial owners, there would be an increase in the level of income inequality. Thus, when labor is scarce and a country finds itself along the downside of the inverted U, high population growth rates will retard improvements in the level of income inequality. That is, the level of income inequality will increase for every PCY along the downside of the inverted U.

Since it has been shown that high population growth rates shift both the upside and downside of the inverted U curve upward, it is clear that high population growth rates shift the inverted U curve upward. When this upward shift occurs, the inverted U will intercept the income inequality axis at a higher point, implying that the level of income inequality will rise for any given level of PCY.

Effect of Education

Education is important because it allows people to contribute effectively towards the growth of the economy. Education also improves the level of income inequality by eliminating skill differentials which reduce wage differentials. This is because education facilitates higher labor productivity which leads to higher labor income.

The effect of education on income inequality is given by Lewis who focuses on the differentials between skilled and unskilled labor. As an economy grows, industries expand and they demand more skilled and unskilled labor. But at the early stages of development, there will be a scarce amount of literate people to carry out, for example, supervisory and administrative tasks. Because of this scarcity of skilled workers compared to the abundant supply of unskilled workers, wage differentials between the two groups of workers will widen. Skilled workers will see increases in their wages, while the wages of unskilled workers may even fall if the supply of unskilled workers increases (Lewis, 180-181) The initial widening of wage differentials that results between the two groups of workers causes a worsening of the level of income inequality in the economy.

However, as the economy grows and educational facilities spread to a larger proportion of the population, in the long run, skilled workers in the country will increase, causing the wages of skilled workers to fall (Lewis, 180-181). Thus, wage differentials between the skilled and unskilled workers will reduce, causing the level of income inequality to improve. The initial worsening followed by improvements in the level of income inequality that is caused by the widening and then narrowing of wage differentials, is consistent with the inverted U pattern. Thus, it is argued here that initially education is likely to be positively related, before it becomes negatively related to the level of income inequality.

More support for the fact that education affects the level of income inequality is shown by the need for expansion of education systems worldwide and in the studies of many economists. Compulsory education is widely accepted as an important public service, and every country has some form of compulsory education (Eckstein, 1992). Eckstein and Zilcha show empirically that human capital affects the quality of labor and that compulsory education will improve the distribution of income through generations (Eckstein, 1992). If education improves labor and causes higher wages, then compulsory education should improve the level of income inequality. Also, Chenery and Syrquin found that education removes income away from the richest 20% and increases income of the lowest 40% (Chenery, 63). More interestingly, where primary and secondary schooling were found to be positively related to income shares obtained by individuals, it was also shown that primarily schooling significantly explained variations in income for the lowest 40% and secondary education significantly explained those of the middle 40%(Chenery et al, 17). This finding helps explain why emphasis is often placed at least on compulsory primary schooling in many developing nations. It can be said that the aim is to improve the lot of the very poor.

Hypotheses

The discussions above generate four hypotheses:

I. The inverted U exists, supported by the fact that the labor surplus model predicts the inverted U pattern.

II. The share of labor in industry is initially positively related then negatively related to the level of income inequality.

III. Population growth rates are positively related to the level of income inequality at any stage of development. Higher population growth rates are associated with higher income inequality.

IV. It is likely that education is initially positively related before it becomes negatively related to the level of income inequality

Research Design

Data on 61 countries, mainly low-income and middle-income countries, are used in this study (see Appendix 1). The measure of income inequality used is the gini coefficient. This coefficient is calculated from a Lorenz curve that is constructed using data on income distribution of a given country. Appendix 2 gives an explanation of how gini coefficients are calculated. I created a program in Pascal to calculate this coefficient based on the Lorenz curve, the formula for the area of trapezoids, and the formula for the coefficient.

Data on income distribution, share of labor in industry and population growth rates were obtained from the World Bank's publication Social Indicators of Development 1991-92. Primary and secondary school enrollments are used as a measure of the expansion of education and the data for these variables were also obtained from the Social Indicators of Development. Data for all variables are not given annually but for periods of time. This is possibly due to the fact that data on variables such as the income distribution in a country are collected less frequently. The periods for which data are reported are 25-30 years ago, 15-20 years ago and the most recent period.

PCY Groups

When I plotted gini coefficients for the countries used in this study, all the points were crowded so that no pattern was observed. When I tried to observe patterns using PCY groups, I found an inverted U pattern. According to the inverted U pattern I found, the upside of the inverted U existed for countries with PCY up to $300 (dollar amounts are

1990 current market prices in US dollars). There was no clear trend for countries with PCY between $300 and $1000, but there was clear evidence of the downside of the inverted U starting with countries with PCY about $1000 and higher. Diagram 6 illustrates the inverted U pattern that I found using plotted graphs . **PCY Group I** will refer to countries with PCY less than or equal to $300. **PCY Group II** will refer to countries with PCY between $300 and $1000, and **PCY Group III** will refer to countries with PCY greater than $1000.

Table 1 which shows regression results for the PCY groups identified above verifies the inverted U pattern that was observed using plotted graphs. The PCY^2 term is included since the inverted U pattern is quadratic. According to Table 1, there is an initial worsening of income inequality for PCY Group I judging from the positive significant sign of the PCY variable. The results for PCY Group II does not indicate any significant pattern and confirms that a horizontal line best represents the trend of income inequality for this PCY group. For PCY Group III, there is strong evidence of decreasing income inequality, which is indicated by the negative significant sign of the PCY variable. Thus, the results shown in this table, confirm that the inverted U pattern exists. In Appendices 3, 4 and 5, the regression lines for PCY Group I, II and III, drawn against the plotted data for the PCY groups respectively are shown. Put together, the regression lines of the three PCY groups also show the inverted U pattern I found using plotted graphs. Later on we will see whether the labor surplus model supports that this inverted U pattern exists.

My findings using plotted graphs and regression models discussed above are good findings since they posit that the phase of worsening income inequality ends earlier than expected at PCY of about $300, and that the point at which income inequality starts it downward trend also occurs earlier at PCY of about $1000. As previously mentioned, according to the inverted U pattern, it is expected that income inequality worsens up to PCY of about $2200 before it starts to improve.

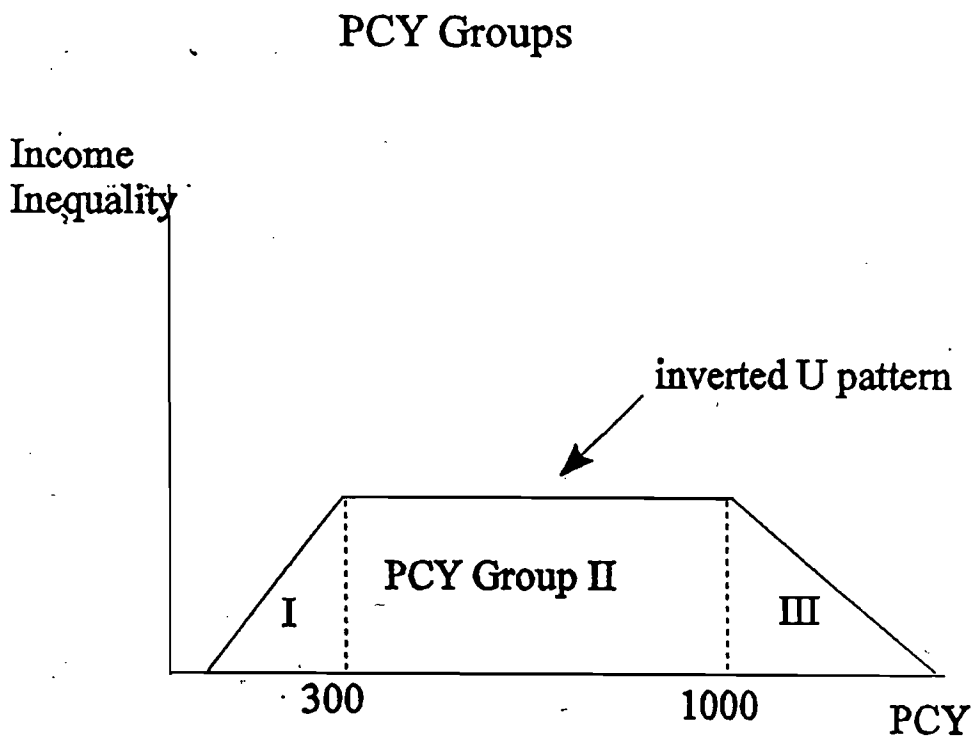

DIAGRAM 6

Table 1: INVERTED U PATTERN

VARIABLES	PCY <= 300	300<PCY<= 1000	PCY >1000
PCY	(+) +0.00262*	-0.00012	(-) -0.00003*
PCY^2	(-) -0.00001*	+0.00000	(+) +0.00000

* = significant at the 90% confidence level.
signs in parentheses are the hypothesized signs.

Models

To test the hypotheses in this paper, several regression models are created and tested for each PCY group. On an aggregate level, the regression results for all three PCY groups will test the four hypotheses. In these models, **Industry** represents the share of labor in industry, **PopRate** represents population growth rates, and **Primary and Secondary** represent primary and secondary school enrollments respectively. Table 2 clearly presents the variables used in this study and their definitions. OLS regressions were used to test the models.

For each PCY group, Model 1 includes all the variables and tests all four hypothesis. Models 2 and 3 attempt to improve Model1. The equation for Model 1 is:

$$\text{Gini} = \text{Constant} + \text{PCY} + \text{PCY}^2 + \text{Industry} + \text{Industry}^2 + \text{PopRate} + \text{Primary} + \text{Primary}^2 + \text{Secondary} + \text{Secondary}^2.$$

[Equation 1]

Again, the squared terms are included since the inverted U pattern is a quadratic curve. PopRate^2 is not included in the equation above because PopRate is hypothesized to always be positively related to the level of income inequality.

According to the hypothesis, for PCY Group I, it is expected that in the regression result for Model 1, the PCY term will be positive and significant. This result will confirm the upside of the inverted U. Industry is expected to be positive and significant to imply that during the early stages of development, rural to urban migration causes the economy to experience worsening levels of income inequality. High population growth rates should always worsen the level of income inequality and therefore a positive and significant sign is expected for PopRate. Primary and Secondary are also expected to be positive and significant since a country at its early stage of development is likely to have large wage differentials between the few literate people who receive high wages and the masses of illiterate people who receive very low wages.

TABLE 2: DEFINITION OF VARIABLES

VARIABLES	**DEFINITIONS**
PCY	*GNP per capita*. Estimates are for 1990 at current market prices in U.S dollars.
INDUSTRY	Labor force in mining, manufacturing, construction, electricity, water and gas, as a percentage of the total labor force.
POPRATE	*Population growth rate*. Annual growth rate calculated from mid year total and urban population.
PRIMARY	*Primary school enrollment*. Gross enrollment of all ages at primary level as a percentage of school age children as defined by each country and reported to UNESCO.
SECONDARY	*Secondary school enrollment*. Computed in the same manner as the primary school ratio.

Source = Social Indicators of Development 1991 -92

For PCY Group II, the regression result for Model 1 will likely indicate nothing significant as is implicated by the results presented in Table 1.

For PCY Group III, a negative significant sign is expected for the PCY variable to confirm the downside of the inverted U. Industry is also expected to be negative and significant since countries in this group should have competitive labor markets so that higher demands of labor increase wages. PopRate is expected to be positive and significant. Primary and Secondary are expected to be negative and significant. This is because at the later stages of development there should be more literate people in the labor force which should cause wage differentials to reduce and income inequality to decrease.

Results, Conclusions and Policy Implications

Tables 3, 4 and 5 show the regression models for PCY Group I, II and III respectively.

PCY Group I (The early stage of development)

Results

Table 3 shows the results for this group. Model 1 which contains all the variables is a good model judging from its R^2 of 0.80. All the variables are significant except for Primary and Primary ^{2}. Secondary and Secondary^2 have unexpected signs. In Model 2, where the Secondary variables are excluded, the R^2 becomes 0.54 and only PopRate is significant. However, the Primary variables have the expected signs. Model 3 appears to be the best model in which the Primary variables are excluded. All the variables in this model are significant and the model has an R^2 of 0.80. However, the Secondary variables have the unexpected signs.

TABLE 3: GINI REGRESSIONS FOR PCY <=300

VARIABLE	MODEL 1	MODEL 2	MODEL 3
PCY	(+) +0.00428*	(+) +0.00110	(+) +0.00191*
PCY^2	(-) -0.00001*	(-) -0.00002	(-) -0.00001*
INDUSTRY	(+) +0.15718*	(+) +0.02127	(+) +0.08700*
$INDUSTRY^2$	(-) -0.00786*	(-) -0.00092	(-) -0.00414*
POPORATE	(+) +0.17821*	(+) +0.07699*	(+) +0.10363*
PRIMARY	(+) -0.00240	(+) +0.00247	
$PRIMARY^2$	(-) +0.00000	(-) -0.00002	
SECONDARY	(+) -0.01823*		(+) -0.01467*
$SECONDARY^2$	(-) +0.00047*		(-) +0.00030*
ADJUSTED R^2	0.80	0.54	0.80

* = significant at 90% confidence level (two-tail test).
Signs in parentheses are the hypothesized signs.

Given that Model 3 is the best model, it will be used to estimate the impact of each variable on income inequality. The equation for Model 3 is :

$$\text{Gini} = -0.2636 + 0.002\text{PCY} - 0.000\text{PCY}^2 + 0.087\text{Industry} - 0.004\text{Industry}^2 + 0.10363\text{PopRate} - 0.015\text{Secondary} + 0.000\text{Secondary}^2$$

[Equation 2]

The positive sign and significance of the PCY variable in Model 3 confirm the initial positive relationship between PCY and income inequality. The positive and significant sign of Industry is consistent with the labor surplus model's prediction that at the initial stages of development an increase of workers in the industrial sector worsens the level of income inequality. The result for PopRate supports that high population growth rates are positively related to the upside of the inverted U. This result is also consistent with the explanation provided by the labor surplus model that high population growth rates will increase the amount of surplus labor in this PCY group and worsen income inequality. The unexpected results for the Primary variables may be due to the fact that this variable is not lagged. The unexpected significant result for Secondary is an important finding and can be explained as follows.

At PCY less than $300, it is likely that secondary school enrollments are not high. However, an increase in secondary school enrollments implies that there is likely an increase in primary school enrollments. Since at the early stage of development most primary school graduates enter the labor force, an increase in secondary school enrollments also implies that more primary school graduates are entering the labor force. Therefore, secondary school enrollment may be proxying for more people in the labor force with primary school education, who because of their primary school education should be making higher wages. More people making higher wages reduces wage

differentials which improves income inequality. This explanation is consistent with the result obtained from the Secondary variable.

Conclusions and Policy Implications

As explained in Appendix 2 where the method of calculating gini coefficient is discussed, the value of the gini coefficient lies between 1 and 0. The closer the coefficient is to 0 the lower the level of income inequality. The closer the gini coefficient is to 1 the higher the level of income inequality. From Equation 2 above, it is deduced that an increase of PCY by $1 will cause the gini coefficient to rise by 0.002. This means that an increase of PCY by $50 causes the gini coefficient to rise by a tenth (0.1). This result is significant and posits that when a country begins its development process and PCY increases, the initial worsening of income inequality is inevitable. Thus for countries with PCY up to about $300, a worsening trend of income inequality can be accepted as an initial phase that accompanies development.

According to Equation 2 above, a percentage increase of labor in industry (the variable Industry) causes the gini coefficient to increase by 0.087. Thus a 1.15 percentage increase of labor in the industrial sector causes the gini coefficient to rise by about a tenth. This result is also significant and implies that about a 9 percent increase of labor in industry will cause the level of income inequality to be at the highest possible level. Therefore, the results suggest that developing countries within PCY Group I should not only concentrate on the developing the industrial sector but should simultaneously concentrate on developing the agricultural sector. That way, they may be able to reduce the amount of migrants from agriculture into industry.

How much income inequality exists at the early stages of development depends significantly on population growth rates. The higher the population growth rate, the

higher is the level of income inequality at each PCY. According to Equation 2, a 1 percentage increase in population growth rates causes the gini coefficient to rise by 0.104. This implies that an increase of population growth rate by 0.96 percent (approximately 1 percent), causes the gini coefficient to rise by a tenth. This result points out that it is necessary for developing countries to adopt measures to control population growth rates as early as possible in their development process. By maintaining low population growth rates, and as according to the labor surplus model, labor in the economy becomes a scarce factor earlier, and labor markets are competitive sooner. Then also, wages should increase and income inequality should improve.

If Secondary is accepted as a proxy for the amount of primary school graduates entering the labor force, then, as calculated from Equation 2, a 6.67 increase of primary school graduates entering the labor force (i.e. 6.67 increase in secondary school enrollment) should decrease the gini coefficient by a tenth. This is a significant and encouraging result because it emphasizes the universal benefits of education even at the early stages of development.

PCY Group II (The intermediate stage of development)

Results

All the models created for this PCY group show no significant result as noted in Table 4. None of the variables are significant, and the R^2s for all the models are very low. The results confirm that the curve is a straight line for this PCY group.

Conclusion

The results for PCY Group II does not allow one to make any generalizations applicable to countries in this PCY group today. Perhaps, conditions in these countries are complex and varied and therefore cannot be easily summarized.

TABLE 4: GINI REGRESSIONS FOR 300 < PCY <= 1000

VARIABLE	MODEL 1	MODEL 2	MODEL 3
PCY	0.00004	0.00005	0.00008
PCY^2	-0.00000	-0.00000	-0.00000
INDUSTRY	-0.00842	-0.00720	-0.00836
$INDUSTRY^2$	-0.00000	-0.00004	0.00002
POPRATE	-0.02217	-0.02602	-0.00794
PRIMARY	0.01063	0.01068	
$PRIMARY^2$	-0.00006	-0.00006	
SECONDARY	0.00171		0.00232
$SECONDARY^2$	-0.00002		-0.00002
ADJUSTED R^2	-0.07	0.05	0.02

TABLE 5: GINI REGRESSIONS FOR PCY > 1000

VARIABLES	MODEL 1	MODEL 2	MODEL 3
PCY	(-) -0.00002	(-) -0.00001	(-) -0.00002
PCY^2	(+) +0.00000	(+) +0.00000	(+) +0.00000
INDUSTRY	(-) -0.00460	(-) -0.01577	(-) -0.00720
$INDUSTRY^2$	(+) 0.00007	(+) +0.00024	(+) 0.00012
PORPORATE	(+) -0.01515	(+) +0.00806	(+) -0.01960
PRIMARY	(-) -0.01664	(-) -0.05207*	
$PRIMARY^2$	(+) +0.00008	(+) +0.00024*	
SECONDARY	(-) -0.00971*		(-) -0.00866*
$SECONDARY^2$	(+) +0.00006*		(+) +0.00005
ADJUSTED R^2	0.50		0.44

* = SIGNIFICANT AT THE 90% CONFINDENCE LEVEL (TWO-TAIL TEST.
SIGNS IN PARENTEHESES ARE THE HYPOTHESIZED SIGNS.

PCY Group III (The industrialized stage of development)

Results

Only the education variables have significant coefficients in the models in Table 5. The PCY variables in this table are not significant although they are in Table 1. This is possibly because the explanatory variables in the regression equations for the models in Table 5 (these explanatory variables are not included in the regression equation for Table 1), reduce the significance of the PCY variable. The significant and expected coefficient for Secondary in the models supports Lewis' explanation that as an economy develops, education facilities become available to more people so that in the long run education has a negative effect on the level of income inequality.

Conclusion

Since countries in PCY Group III are well industrialized, the increasing share of labor in industry may have little impact on the level of income inequality. Likewise, population growth rates which are relatively stable in these countries may have negligible effect on the level of income inequality. It is likely that there are other variables that may help explain the downward trend of income inequality that is expected for industrialized countries. Often, countries in the early stages of development experience political and social instabilities, conditions which improve as these countries develop. Thus, a measure of political and social conditions may for instance be a crucial determinant of the downward trend of income inequality. It is also likely that the existence of certain institutions in industrialized countries, like unions that function to improve wages, help improve the level of income inequality in these countries. Thus a measure of unionization may also improve the results for this group. Another variable that measures

the technological know-how in the various countries may also help explain the inverted U. This is because it is usual to find more advanced technological equipment and facilities in industrialized countries and not in developing countries. In summary, the share of labor in industry and population growth rates do not explain the downside of the inverted U.

General Conclusion

In this paper, four hypothesis were generated and tested to confirm that the inverted U exists, and that the share of labor in industry, population growth rates and education were explanatory variables of income inequality. Moreover, the labor surplus model predicts the inverted U pattern. Although the inverted U pattern was found as presented in Table 1 where only PCY variables were used in the regression equation, the explanatory variables failed to show the inverted U pattern in its entirety. The explanatory variables were able to explain the upside of the inverted U as shown in Table 3, but the same explanatory variables could not explain the downside of the inverted U as shown in Table 5.

Thus, this study also shows that the labor surplus model explains the upward trend for countries with very low PCY, and that high population growth rates worsen the level of income inequality for these countries. This study highlights that the labor surplus model is incapable of explaining any other part of the inverted U, especially the downside of the inverted U.

Suggestions For Future Research

Another explanation for the inverted U pattern can be given using labor market power as follows. At the early stages of development, firms have monosony power and can force

wages to be low which signifies a period of worsening income inequality. At the intermediate stage of development more firms may exist which may cause the initial monosony power of firms to reduce and at least prevent further worsening of income inequality. At the industrialized stage of development, workers are likely to organize into unions and counter the remaining monosony power of firms. This should increase wages and cause income inequality to improve. This brief discussion suggests an important area for future research. Perhaps a better explanation of the inverted U pattern or an important area to be considered along with the labor surplus model may be discovered.

Another area for future research will be to separate the countries in PCY Group III (countries that have PCY greater than $1000) into two categories: the newly industrialized and the well industrialized countries. This may help control for the wide range of PCY in PCY Group III and also the differences in institutions that exist in these countries.

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APPENDIX 1

countries	time	gini	PCY	PopRate	indus	primary
Banglade	25-30	0.30	70.00	2.6	4.8	31
India	25-30	0.36	90.00	2.3	11.9	74
Pakistan	25-30	0.34	110.00	2.6	18.3	40
Pakistan	15-20	0.294	130	3.1	17.2	12
Banglade	15-20	0.316	130	2.5	5.4	73
Thailand	25-30	0.39	140.00	3.1	5.2	78
Sri Lanka	25-30	0.41	160.00	2.5	13.9	93
India	15-20	0.37	170.00	2.3	12.9	79
Tanzania	15-20	0.38	170.00	2.8	3.8	53
Phillipine	25-30	0.45	180.00	3.1	15.8	113
Indonesia	15-20	0.38	210.00	2.4	11.7	86
Uganda	15-20	0.36	220.00	2.6	3.9	44
Sierra Le	15-20	0.40	220.00	2	13.2	39
Kenya	15-20	0.49	230.00	3.7	6.2	95
Sri Lanka	15-20	0.32	290.00	1.6	14.2	77
Mauritius	25-30	0.40	310.00	2.4	25.4	72
Egypt	15-20	0.38	320.00	2	18.4	71
Columbia	25-30	0.56	320.00	3	21.4	84
Phillipine	15-20	0.43	340.00	2.6	16.1	107
Botswana	15-20	0.50	350.00	3.8	8.4	72
Bolivia	15-20	0.46	360.00	2.5	19.9	85
Suriname	25-30	0.29	390.00	2.7	21.5	120
Costa Ric	25-30	0.45	400.00	3.2	19.2	106
Liberia	15-20	0.55	410.00	3	9.4	62
Mexico	25-30	0.49	460.00	3.3	21.9	92
Ecuador	15-20	0.59	540.00	3	20.2	104
Zambia	15-20	0.50	550.00	3	9.2	97
Columbia	15-20	0.47	550.00	2.1	23.4	118
Guatemal	15-20	0.46	570.00	2.8	17	61
Nicaragu	15-20	0.52	630.00	3	15.6	82
Spain	25-30	0.35	700.00	1	34.5	115
Tunisia	15-20	0.34	710.00	2.1	31.1	97
Mauritius	15-20	0.43	710.00	1.5	24.5	107
Libya	25-30	0.24	810.00	3.9	20.9	78
Malaysia	15-20	0.45	820.00	2.3	16.6	91
Argentina	25-30	0.38	870.00	1.5	34.2	101
Japan	25-30	0.37	900.00	1.1	32	100
Costa Ric	15-20	0.45	950.00	2.5	21.6	107
Peru	15-20	0.52	1000.00	2.7	18	113

Fiji	15-20	0.38	1030.00	1.9	16.8	115
Brazil	15-20	0.51	1070.00	2.4	24.3	88
Venezuel	25-30	0.48	1130.00	3.4	23.7	94
Israel	25-30	0.30	1300.00	3.5	35.4	95
Barbados	15-20	0.32	1520.00	0.4	23.3	103
Portugal	15-20	0.38	1540.00	3.8	34.7	113
Netherlan	25-30	0.39	1560.00	1.4	40.7	104
Trinidad	15-20	0.41	1720.00	0.9	37.2	99
Finland	25-30	0.42	1750.00	0.3	35.4	92
Norway	25-30	0.32	1840.00	0.8	36.8	97
France	25-30	0.46	2030.00	0.9	39	134
Denmark	25-30	0.35	2050.00	0.8	36.9	98
Venezuel	15-20	0.45	2380.00	3.6	26.7	97
Canada	25-30	0.30	2620.00	1.8	32.5	105
Ireland	15-20	0.29	2650.00	1.7	32.4	103
Sweden	25-30	0.36	2760.00	0.9	42.8	95
Spain	15-20	0.34	2780.00	1	37.4	111
Israel	15-20	0.28	3890.00	2.3	33.7	97
France	15-20	0.36	6000.00	0.5	37.3	109
Germany	15-20	0.33	6670.00	-0.4	47.6	103
Sweden	15-20	0.27	8320.00	0.4	36.5	101
Australia	Recent	0.34	16680.00	1.6	34.4	106

Calculating Gini Coefficients

To convert the figures of an income distribution data into a measure of income inequality can be done by constructing a Lorenz curve for each country from which the Gini coefficient/concentration ratio(a measure of inequality) is calculated. "The Lorenz curve shows the total percentage of total income accounted for by any cumulative percentage of recipients. The shape of this curve indicates the degree of income inequality in the income distribution"(Gillis 1992, 74). To illustrate how a Lorenz curve is derived consider the following data for Brazil in 1983:

poorest 20% of households receive 2.4% of total income
second quintile receive 5.7%
third quintile receive 10.7%
fourth quintile receive 18.6%
richest 20% receive 62.6%

From these data it can be observed that Brazil has a high degree of inequality if 62.6% of its total income goes to the richest 20% of total households. Also, a total of 100% of households receive 100% of total income. To construct a Lorenz curve first the cumulative income share accruing to any given percentage of households is calculated. Thus for the data above we get the following calculations:

poorest 20% receive 2.4% of total income
poorest 40% receive 2.4 + 5.7 = 8.1% of total income
poorest 60% receive 8.1 + 10.7 = 18.8% of total income
poorest 80% receive 18.8 + 18.6 = 37.4% of total income
100% of households receive 100% of total income.

The Lorenz curve is a graph plotted from the data above with the horizontal axis measuring the cumulative percentage of recipient units and the vertical axis measuring the cumulative share of total income. Diagram2 below shows the Lorenz curve obtained from the data above:

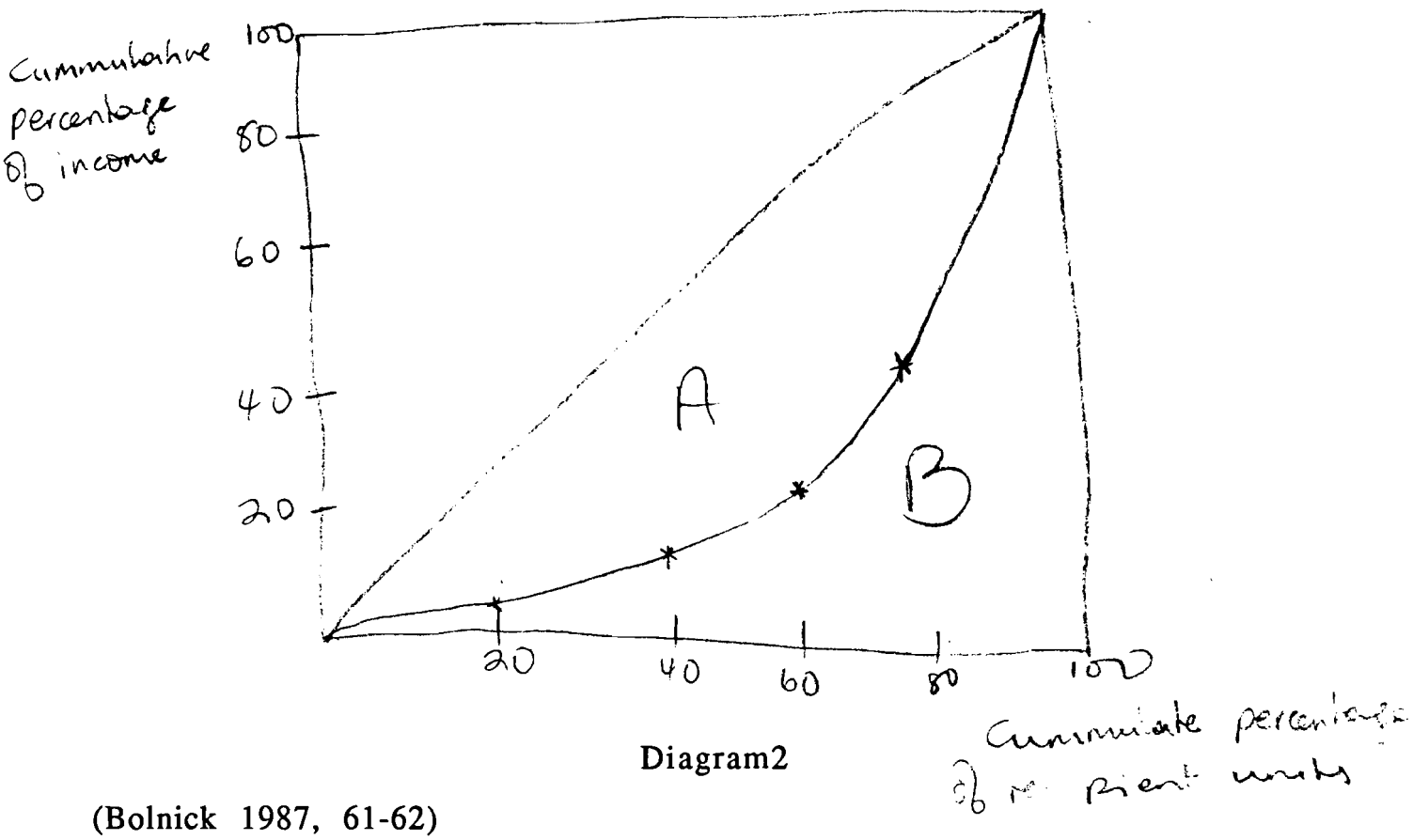


Diagram2

(Bolnick 1987, 61-62)

The diagonal line is a 45-degree line. The closer the curve is to this line the lesser is income inequality. The closer it is to the right hand borders the greater is income inequality(Gillis 1992, 74).

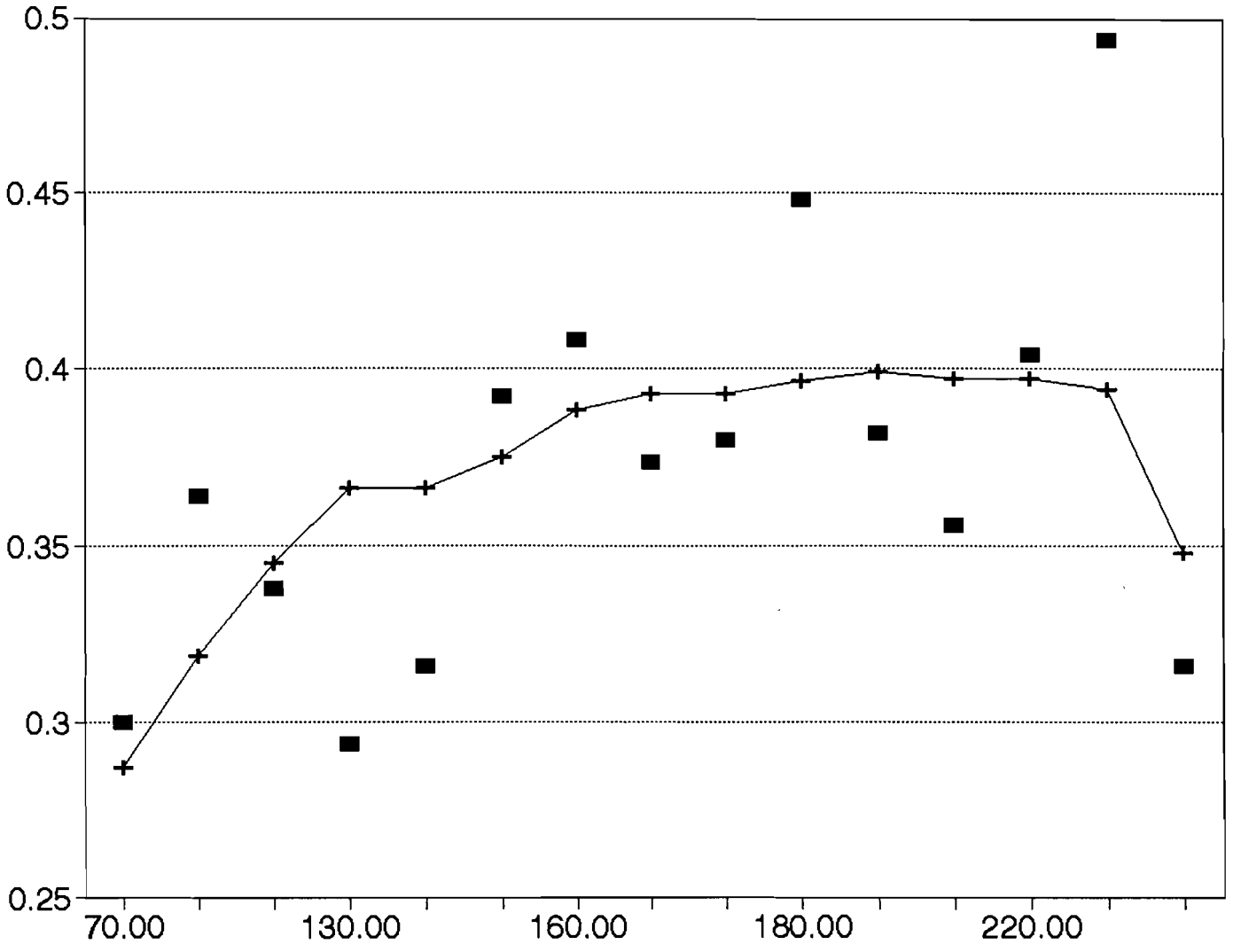
To calculate the Gini coefficient, let A be the area between the Lorenz curve and the diagonal line and let B be the area under the Lorenz curve as show in Figure 2. The formula to calculate the Gini coefficient is given as

A/(A + B). A + B will always be 0.5 because the box in which the Lorenz curve is drawn is a unit square especially seen if all percentages are taken as decimal units, e.g 20% as 0.2. Therefore the area of the square becomes 1x1 = 1.0, and half the area of the square (A + B) is 0.5.(Bolnick 1987, 62) Area B can be calculated geometrically using formulas for calculating areas of rectangles, triangles and trapezoids. The area of B was calculated geometrically to be 0.233. Since A + B = 0.5, A = 0.5 - 0.233 = 0.267. The Gini Coefficient A/A + B) = 0.267/0.5 = 0.534. The closer the Gini coefficient is to 0 the lesser is income inequality, and the closer it is to 1 the greater is income inequality.

I created a program in Pascal that calculates gini coefficients based on the Lorenz curve, the formula for the area of trapezoids and the formula for the gini coefficient.

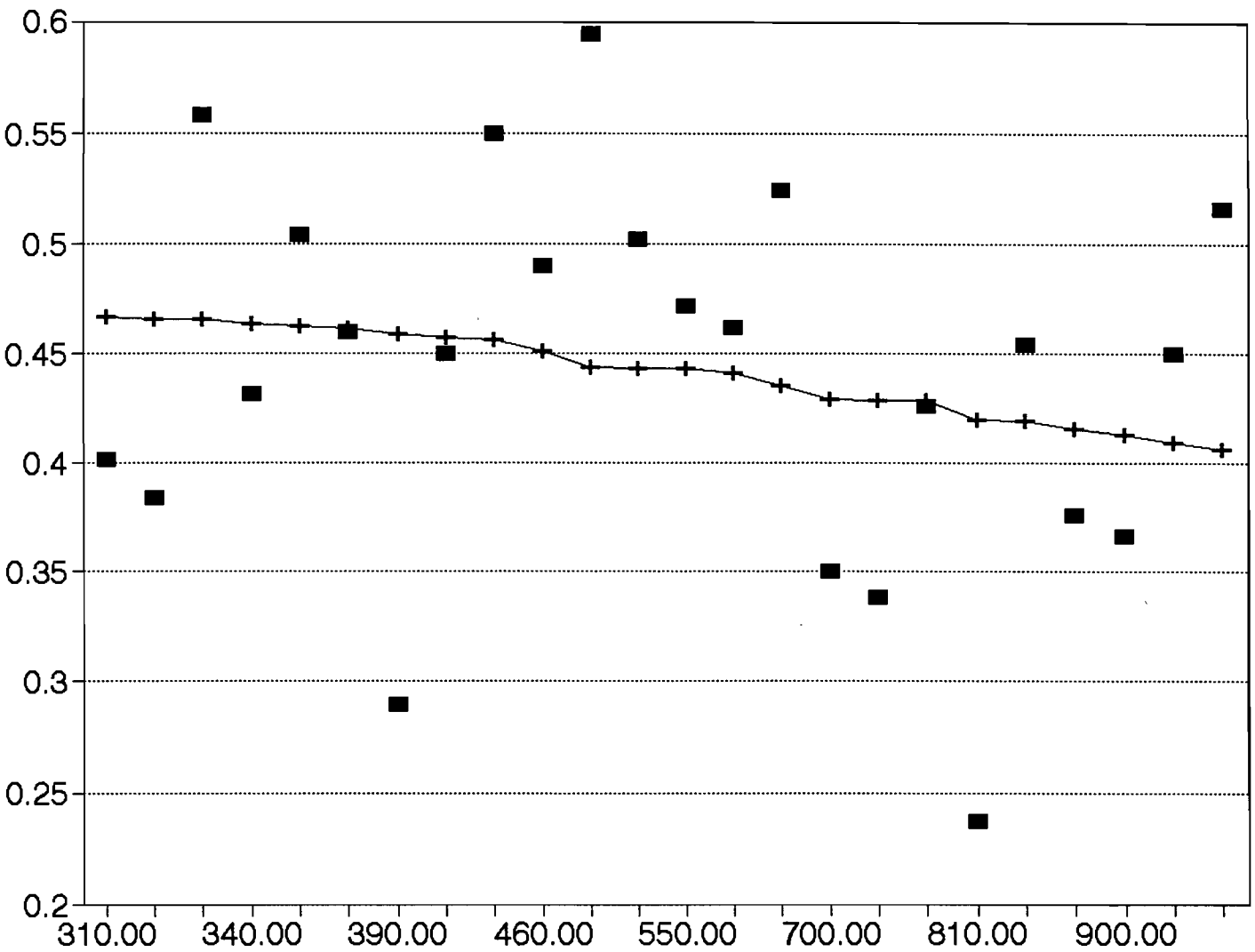
APPENDIX 3

REGRESSION LINE DRAWN AGAINST PLOTTED DATA FOR PCY GROUP I



APPENDIX 4

REGRESSION LINE DRAWN AGAINST PLOTTED DATA FOR PCY GROUP II



APPENDIX 5

REGRESSION LINE DRAWN AGAINST PLOTTED DATA FOR PCY GROUP III