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Can Equality and Growth Be Simultaneously Achieved?

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Abstract

This paper attempts to examine whether equal income distribution and steady economic growth can be achieved at the same time. Unlike previous studies that investigated either direct or reverse relationships between income inequality and per capita GDP growth independently of one another, this paper combines two links together and tries to explain any causal relationships between them. Using a cross-country dataset, it finds that income distribution and economic growth are not only directly correlated, but they also indirectly interact with each other simultaneously through other economic, political, and social factors such as education, health, investment, credit market, fiscal policies, and cultural diversity. Through these underlying factors, the possible trade-offs between improving income distribution and good economic performance might occur.

Keywords: Income Distribution, Inequality, Growth, Gini Coefficient

1. Introduction

The relationship between income distribution and economic growth has been one of the most active topics in development economics. The evolution and pattern of income distribution in the course of economic growth are the main concern for many development researchers. According to Kuznets (1955), the relationship between the level of economic development and income inequality has been hypothesized to take a form of an inverted U-shaped, that is, income inequality initially rises, stabilizes for a while, but eventually falls as a country develops. It was not until recently that the functional aspect of income distribution and its role in a country's economic development have been deeply focused. Persistent inequality implies that some unfortunate groups of a society tend to have consistently inferior opportunities than their fellow citizens and this is most likely to lead to wasted human potential and missed development opportunities (World Development Report, 2006).

Until now, different analytical methodologies as well as various types of income inequality indicators, across time and across countries, have been used to investigate both causal links between growth and income distribution. However, for the most part, the literature has progressed independently of one another. Therefore, the main purpose of this study is to investigate whether there are any simultaneous relationships between income distribution and economic growth. Furthermore, it also tries to determine the potential channels through which income distribution may affect economic growth, as well as those channels through which economic growth may affect income distribution.

2. Theoretical Background

The relationship between economic growth and income distribution is not a simple one; rather, it is quite complicated in that both factors can interact with one another through other factors. Therefore, one should be clear about the channels through which growth might affect inequality along with those through which inequality might affect growth.

2.1 Credit Market

Credit markets play an important part in governing the distribution of income as well as the growth rate since it involves the level of capital stock available in a country. In a case where the market works perfectly, investment decisions would be determined by the prospective returns on investment and the market price of capital, adjusted for the risk it entails. Unfortunately, credit markets in all countries are not perfect. Productive opportunities vary along with wealth distribution in the sense that individuals at the lower end of the scale do not have the same chances in life as those at the upper end. This is also the case for worthwhile investments such as education, good nutrition, farm production, self-employment, owner-occupied housing, and innovation implementation, all of which initially require some large fixed costs or minimum lumpy investments. Therefore, wealth obviously needs to be sufficiently concentrated in order for individuals or families to be able to cover such large sunk costs, and thereby initiate new industrial activities (Aghion and Williamson, 1998). Individuals who do not have initial wealth have to borrow to start investments. This is the point at which a credit market starts its essential role.

Possibilities of defaults and difficulties in enforcing contracts in developing countries lead to collateral requirements and differentiated interest rates. To the extent that wealth matters in the ability to put up collateral, it matters in determining the credibility of repayment, and access to the credit market. In worse case scenarios, individuals who are unable to provide sufficient collateral will have no

access to credit at any interest rate. Taken together, an inability to provide collateral and the higher interest rates charged prevent individuals with inadequate wealth from the most productive sector of the economy, even if they are as efficient as anyone else. Thus, unequal distributed investment opportunities lead to underinvestment by those who have good productive potential, a misuse of resources for some less productive purposes and a reduction in overall productivity (Ferreira, 1999; World Development Report, 2006).

2.2 Globalization

Another potential factor that shapes economic development and the pattern of distribution is the degree to which a country integrates with the rest of the world. Over the past few decades, global integration has evolved rapidly as a result of human innovation and technological advances. Money, commodities and ideas move around the world more freely than ever, enabling people to have access to cheaper imports, larger export markets, more capital flows and modern technology. Globalization has different dimensions; however, this study focuses mainly on economic globalization as a form of international trade.

The link between international trade and income distribution can be primarily explained by the Heckscher-Ohlin theory. According to this theory, the patterns of trade reflect differences in the distribution of factor endowments across countries. That is, every country will export commodities that use intensively those factors of production with which they are most well-endowed. In developing countries, where abundant unskilled labor is cheap and scarce skilled labor is expensive, the trade boom leads to an increase in the demand for unskilled labor and a decrease in the demand for skilled labor. Thus, factor prices of the former rise whereas those of the latter fall and as a result improve existing wage distribution. On the contrary, in developed countries, where unskilled labor is relatively expensive and skilled labor is relatively cheap, the trade boom, causes widened wage inequalities.

Nevertheless, as Stewart and Berry (2000) reason, the theoretical expected effects of trade on income distribution in developing countries are far from uniform; rather, they vary with the structure of the economy. Whereas manufacturing-goods and primary-goods export producers tend to experience an improvement in income distribution from international trade as labor-intensive commodities and thus the demand for unskilled labor used intensively in producing such commodities expand, mineral exporters and import-substituter's tend to face a deteriorated income distribution

Openness to international trade not only affects income inequality within a country, it also has significant implications on a country's growth. Increased trade openness is generally believed to accelerate economic growth through various mechanisms. This is because openness not only leads to more efficient resource allocation by allowing imports of goods and services at a lower cost than producing them domestically, but it also increases the efficiency of investment, especially in developing countries, by enabling them to import sophisticated capital and intermediate inputs that are crucial to economic growth, but which would be expensive or impossible to produce at home (World Bank, 2004). Besides, the process tends to reduce monopoly power and rent-seeking behavior which arise from trade restrictions (Berg and Krueger, 2003). Such improvements may even induce higher rates of domestic savings and attract foreign capital inflows. With a specialization in activities so that a country has a comparative advantage, economies of scale as well as benefits from learning-by-doing practice can easily be achieved. This is why some researchers suggest that exposure to intense international competition in the global market is one of the best ways by which to drive innovative activities, enhance productivity and boost economic growth.

2.3 Redistribution Policy

A government is likely to be pressured by the majority of people to redistribute in a country in which income is unequally distributed among the population. Good policy should aim to diffuse existing

resources while distorting incentives and growth as little as possible. Government policies which aim to redistribute existing wealth to a broader population create different avenues such as land reform, lump-sum taxation, public schooling, or other progressive subsidies and transfers. The benefits of redistribution which target low-income individuals who are in a position to effectively make use of them should be utilized more in countries where the credit market is imperfect. As previously mentioned, credit constraints prevent low-income individuals from undertaking efficient amounts of investment. These redistribution policies are likely to help those unfortunate groups out of the inequality trap, increase investment opportunities, consecutively raise aggregate productivity, and stimulate the overall growth rate (e.g. Easterly and Rebelo, 1993; Perotti, 1996).

On the other hand, if redistribution policies aim to tax an increase in the stock of wealth; rather than the existing wealth base, they are likely to distort incentives and incur efficiency costs. This is because tax system such as income taxation and consumption taxation, imposed on the margins, tends to bring down savings, discourage investments, and ultimately lower economic growth (e.g. Alesina and Rodrik, 1994). Nevertheless, to avoid such large efficiency costs, a government can exempt taxes on basic foodstuffs and concentrate more on property taxation in order to achieve an overall tax system that is moderately progressive (World Development Report, 2006). With an imperfect credit market, when redistribution is financed through taxes, there exists two incentive effects that conflict with each other: the negative incentive effect of the lenders and the positive incentive effect of the borrowers. While taxation reduces net returns and lenders' incentive to invest, it increases the effort exerted by borrowers (Aghion *et al.,* 1999). That is, redistribution can either raise or reduce the growth rate, depending on whether the negative effect is smaller or greater than the positive effect.

2.4 Institutional Environment

Decisions on government policies such as public expenditures, transfers, and taxes, are not designed by a benevolent government aiming merely to maximize some social welfare function; rather, they are the results of political and social interactions of the population in a society. If income and wealth inequalities do not translate into unequal political power and influence, policy decisions can be partly modeled as votes on the values that certain policy variables are to take (Ferreira, 1999). This so-called median voter theorem states that if preferences for some policy variables vary monotonically across the distribution of income, and if each individual has one vote, then the preference of the median voter of that distribution would be the outcome of the voting process (Grandmont, 1978). If a proportional tax rate is to be chosen, preferences for such tax rates would decline as income levels rise: the poorer the median voter in relation to the voter with average income, the higher the tax rate that would be chosen by the voting process.

Nevertheless, the median voter theorem might not be useful in explaining the determinants of government policies if political institutions are of poor quality. In a country with highly unequal income distribution, high-income individuals tend to have more political power and more influence on institutions. Policies implemented by a government may not truly reflect national economic goals; instead, they are distorted by bribery, political contributions, and lobbying pressures of the high-income elite intended to secure their wealth, or even by politicians' own self-interest in order to accumulate wealth. For example, policies may favor a particular elite group by granting them rents and monopolies, while most people are being excluded from profitable lines of business.

The role of institutions in defining and enforcing political and economic rights is also crucial to a country's economic development. Every individual, rich or poor, should, ideally, have rights in order to protect their physical assets, talents and ideas. But, with poor institutions, there are difficulties in enforcing contracts and a risk of

expropriation, which tends to discourage incentives and drive away potential investments. Therefore, in order to promote growth, a good institutional environment should be developed so that it can generate equality of opportunity for individuals.

2.5 Cultural Diversity

Cultural diversity is one of the most interesting and active research areas in the twentieth-first century. Attempts to achieve equality economically, socially, and politically are not enough in that expanding human freedoms and human rights are also crucial. Like education, health, and political freedom, cultural liberty is another feature of human capital development that should have more focus. Individuals must be able to freely express their identities without being discriminated against in other aspects of their lives. In reality, however, diverse ethnicities, languages, religions, and values are likely to cause differences in opportunities which are opened up to them. For instance, particular ethnic groups or members of minority religions may find it difficult to take part in social interactions. These social interactions might take the form of lack of participating in education, employment, or political activities, all of which tend to worsen development outcomes. And, if such diversities are not managed properly, these problems can turn into instability, conflicts, and tensions within a society that further deteriorate economic growth. Nonetheless, cultural identities, even though they have been increasingly recognized, have been suppressed in national policy, not only through the everyday exclusion of economic, social, and political discrimination, but also through religious persecutions and ethnic cleansing (Human Development Report, 2004).

Without taking these diversities into account, government's effort to alleviate inequality problems may not be fulfilled. Therefore, policies such as redistribution should be formulated in a way that explicitly respects and promotes cultural differences. The interests of particular groups, whether minorities or majorities, should not be ignored and overridden by the majority or dominant groups. It is also

important that these multicultural policies should not contradict other national goals and other strategies of human development.

The above mentioned underlying factors that evolve in the relationship between income inequality and economic growth can be clearly shown in Figure 1.

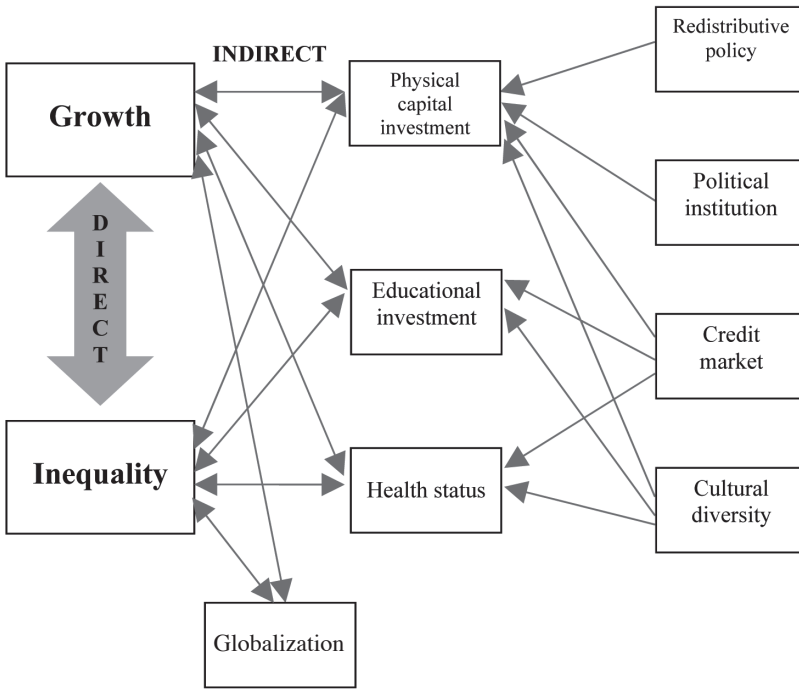

Figure 1 Inequality-growth Diagrammatic Framework

3. Data and Methodology

It was not until recently that researchers attempted to test whether growth and inequality are actually the joint outcomes of other variables and processes. Lundberg and Squire (2003) are among the earliest researchers in this area. They constructed the standard equations of growth and income distribution by allowing growth to enter the inequality

equation and reversely, the inequality equation to enter the growth equation. Then, they estimated both equations simultaneously by using a panel dataset of 125 countries. On the other hand, Fielding and Torres (2006) used per capita income as development measure and include two more equations, namely education and health, into the equation system. Instead of using a panel dataset, they utilized cross-sectional data in the estimation.

Using different methods and datasets, both of the researchers found that income distribution and economic growth are simultaneously correlated. Thus, research on growth and inequality should focus on joint determinants. In a situation where the distribution of income is likely to be indirectly determined by the growth rate, and the growth rate is in turn indirectly determined by the distribution of income, investigating these two causalities entirely independent of each other might not be appropriated and intuitive, since it does not take into account information provided by other equations in the system. This means that conventional analysis, investigating the impact of policy on growth or inequality independently, fails, in that it ignores the evidence that policies designed to improve outcome will more than likely to influence the other, and to the extent that an independent model is under- identified, it cannot be entirely certain what is being estimated (Lundberg and Squire, 2003).

3.1 Data

Many recent studies on the inequality-growth relationship exploit the panel data method in the analyses. A panel data set combines both a time-series and a cross-sectional component and provides insightful information about the dynamics of the economy. However, panel data sets used in most studies are large in the number of observations but small in time periods because of a lack of long time-series data on the distribution of income for individual countries. Also, while there may be considerable variation in income distribution across countries, there is less variation in distribution across short time periods. Such limited variation over time suggests that the long-run impact on economic

growth is best explored using the cross-section variation. Therefore, the analysis in this study is based upon cross-country data in 2000-2004.

While the real growth rate of Gross Domestic Product (GDP) per capita is used as an indicator of a country's level of economic development, the Gini coefficients for income distribution are used as indicators of the degree of inequality. The data used in this study is comprised of 188 countries gathered from different sources, but are largely obtained from the Penn World Table version 6.2 in Heston, Summers and Aten (2006) and the World Bank's World Development Indicators. They are the main average values for each county from 2000 to 2004.

Table 1 Data Categorized by Region

Region	Per capita GDP growth	Income Gini coefficient	Physical capital investment	Secondary schooling years	Healthy life expectancy
East Asia and Pacific	1.5949	41.12	12.68	1.52	56.14
Europe and Central Asia	5.2996	32.49	14.15	1.66	59.97
Latin America and the Caribbean	1.3730	52.02	13.55	1.68	60.03
Middle East and North Africa	-0.9590	37.58	8.88	1.71	56.37
South Asia	3.2135	34.24	13.47	1.27	50.71
Sub-Saharan Africa	1.4378	46.79	9.05	0.73	41.32
High-income OECD	1.5973	31.96	23.97	3.63	70.64
Other high income	1.9552	37.92	15.69	2.94	65.11
Total	**1.9844**	**40.35**	**13.60**	**1.10**	**55.72**

3.2 Simultaneous-Equation Modeling Framework

This study not only focuses on economic factors as done previously by Lundberg and Squire (2003) and Fielding and Torres (2006), but it also looks closely into the political as well as social factors in determining the interconnection between income distribution and economic growth. A two-way relationship between two such factors can be modeled simultaneously as:

$$Growth = \beta_{10} + \beta_{11}\, Gini + \beta_{12}\, I/GDP + \beta_{13}\ln(Edu) + \beta_{14}\ln(Health) + \gamma_{11}\ln(InitialGDP) + \gamma_{12}\, Trade/GDP + \gamma_{13}\, R\&D/GDP + u_1 \quad (1)$$

$$Gini = \beta_{20} + \beta_{21} Growth + \beta_{22}\, I/GDP + \beta_{23}\ln(Edu) + \beta_{24}\ln(Health) + \gamma_{21}\, Trade/GDP + \gamma_{22}\, LandGini + \gamma_{23}\, Unemploy + u_2 \quad (2)$$

$$I/GDP = \beta_{30} + \beta_{31}\, Growth + \beta_{32}\, Gini + \gamma_{31} M2/GDP + \gamma_{32}\, IncomeTax/GDP + \gamma_{33}\, Polity + \gamma_{34}\, Language + u_3 \quad (3)$$

$$\ln(Edu) = \beta_{40} + \beta_{41}\, Growth + \beta_{42}\, Gini + \gamma_{41}\, M2/GDP + \gamma_{42}\, Language + u_4 \quad (4)$$

$$\ln(Health) = \beta_{50} + \beta_{51}\, Growth + \beta_{52}\, Gini + \beta_{53}\ln(Edu) + \gamma_{51}\, M2/GDP + \gamma_{52}\, Language + u_5 \quad (5)$$

Where β's = structural coefficients for endogenous variables

γ's = structural coefficients for exogenous variables

u's = disturbance terms

Growth = annual growth rate of real GDP per capita

Gini = Gini coefficient for income distribution

I/GDP = real gross domestic investment as a percentage share of real GDP

ln(*Edu*) = log of average years of secondary schooling in the population aged over 15

ln(*Health*) = log of healthy life expectancy

ln(*InitialGDP*) = log of real GDP per capita in year 2000

Trade/GDP = real trade volume as a percentage share of real GDP

R&D/GDP = gross domestic expenditure on R&D as a percentage share of GDP

LandGini = Gini coefficient for land distribution

Unemploy = total unemployment as a percentage share of total labour force

M2/GDP	=	money and quasi-money as a percentage share of GDP
IncomeTax/GDP	=	taxes on income, profits, and capital gains as a percentage share of GDP
Polity	=	political regime indicator
Language	=	linguistic fractionalisation,

(see Appendix 1 for data definitions and sources).

The first equation represents the standard growth equation in which the growth rate of real GDP per capita is determined by various factors. Most important, it includes the Gini coefficient which is supposed to account for any direct link between income inequality and economic growth. In addition, the physical and human capital levels measured in schooling, health status, and research and development expenditures should also influence a country's rate of growth and enter into the equation. Also, in order to capture the significance of international trade in economic growth, especially in this globalization age, openness to trade is also included. Furthermore, the level of real GDP per capita in the initial period is added in order to capture the conditional convergence hypothesis. The convergence phenomenon, if it exists, is a conditional one in that it predicts higher growth in a country with lower starting per capita GDP, only if the other explanatory variables are held constant.

The second equation represents potential sources of inequality in the distribution of income. It states that income inequality depends on the level of economic performance and the levels of capital stock a country exhibits for the reason that these factors tend to have a major impact on an individual's ability to earn income. Another determinant that should be included in the equation is the level of unemployed labor in the market since it should directly worsen income distribution. Besides, as far as the role of globalization is concerned, an expansion of trading activities should also have a significant implication on income distribution. And, to account for the effect of the initial distribution among the population on the existing distribution,

the way in which land is distributed is included.

The next three equations stand for the accumulation of physical capital, educational capital and health capital, respectively. They are supposed to act as the potential channels that transmit any underlying causalities from income distribution to growth or from growth to income distribution. Other than the growth rate of GDP per capita and an inequality measure, the extent to which these three factors are accumulated is in turn governed by a country's level of financial development, that is, whether greater financial depth lessens credit constraints by which to borrow and helps provide efficient individuals with sufficient credit to start up prospective investments. Such investments should also be partly influenced by cultural diversity in that diversities are sometime claimed to hamper some minority groups from effective activities. The role of political factors, such as the quality of political institution and tax policies also affect investors' incentives to invest, especially in the case of physical capital, hence, they are added into the third equation.

One advantage of this study over previous ones lies in the fact that this study investigates more closely the potential factors underlying the inequality-growth relationship as postulated by equations (3) – (5). It also takes into account the issue of globalization, and political and social issues, which have been overlooked in the literature. In this respect, effective policies can be developed which would help alleviate development problems successfully.

In addition, in a situation where there exists potential endogeneity arising from reverse causality, instrumental variables are needed. In this modeling framework, instrumental variables include all exogenous and predetermined variables as well as the log of GDP per capita in the year 1995 and the initial values of physical capital investment ratio, trade volume, research and development (R&D) expenditure, unemployment rate, money and quasi-money (M2), and political regime indicators, all of which are averaged from 1995 to 1999.

3.3 Estimation Results

There are two fundamental approaches commonly used to estimate a simultaneous-equation model, namely the single-equation methods of estimation and the system methods of estimation. The single-equation method is designed to estimate any identified structural equation that is the focus of interests individually, taking into account any restrictions placed on that equation without concern of the restrictions on other equations in the system. Due to limited reference in the rest of the system, this is also known as the limited information method. One of the most well-known single-equation methods is that of the two-stage least squares (2SLS).

Although it produces estimates that are consistent, in general, the single-equation estimation method is not asymptotically efficient because it does not take into account the correlation of the structural disturbances across equations. To deal with this problem properly, one has to resort to the system methods. The three-stage least squares (3SLS) method is the simplest system method used in order to estimate a simultaneous-equation system. Its underlying idea is to improve the efficiency of the estimators by taking into account the contemporaneous correlation of the disturbances across equations, as suggested by the seemingly unrelated regressions (SUR) method, and hence treating all equations in the system as a set of seemingly unrelated equations.

To preserve the spirit of this study, equations (1) – (5) are estimated simultaneously by using the three-stage least squares method and are presented in Table 2. The estimation results from the two-stage least squares (2SLS), are also provided in Appendix 2.

3.3.1 Direct Effect

Equations (1) and (2) show that income inequality, measured by the Gini coefficient, and economic growth, measured by annual per capita GDP growth rate, are directly correlated. However, it is more likely that income inequality has a significant impact on growth than the other way around. The results from the growth equation show that high

income inequality is harmful to economic growth: a one percentage point increase in the Gini coefficient tends to reduce per capita GDP growth by 0.14 percentage points.

The estimated coefficients on the investment ratio and the healthy life expectancy at birth show significant positive impacts on the growth rate as predicted. However, a striking finding lies in the average years of schooling that enters negatively in the growth equation, the relationship which is robust to the use of alternative educational attainment indicators such as the schooling attainment rates and the schooling completion rates. As surprising as these negative results may seem, they are similar to what other researchers have found in examining the relationship between education and growth (e.g. Benhabib and Spiegel, 1994; Pritchett, 2001; Lundberg and Squire, 2003; Fielding and Torres, 2006).

When analyzing the other side of the analysis, the estimates of the inequality equation also illustrate some important findings. Despite their decreasing ability to explain income inequality, higher growth and physical capital accumulation are found to help improve the distribution of income of the country to some extent. Educational capital accumulation, in particular, significantly contributes to a reduction in income inequality, contradicting to health capital that reveals a positive impact. Another important factor that poses a significant impact on income distribution is the distribution of agricultural land, which has been considered as a major asset in agrarian economies. The results show that inequality in land results in inequality in income correspondingly.

However, globalization, measured by trade volume (imports plus exports), enters equations (1) and (2) insignificantly. This seems to be consistent with the fact outlined previously that trade patterns should be taken into account when analyzing the impact on income distribution and economic growth. Also, this might be indicative of a period of coverage in this study does not truly reflect the nature of globalization.

Table 2 Three-stage Least Squares Estimates

Explanatory variable	**(1)** ***Growth***	**(2)** ***Gini***	**(3)** ***I/GDP***	**(4)** ***ln(Edu)***	**(5)** ***ln(Health)***
Constant	-26.0403* (-1.85)	5.6177 (0.21)	17.7624** (2.80)	2.2511** (5.34)	3.2874** (21.08)
Growth		-0.1600 (-0.54)	1.9292** (6.84)	-0.0064 (-0.30)	0.0203** (3.14)
Gini	-0.1430* (-1.67)		-0.2748* (-1.93)	-0.0409** (-4.16)	0.0109** (3.12)
I/GDP	0.3277** (7.44)	-0.1011 (-1.06)			
ln(*Edu*)	-5.7811** (-3.62)	-6.7370** (-2.11)			0.4905** (12.98)
ln(*Health*)	8.4708** (1.97)	5.4662 (0.75)			
ln(*initialGDP*)	-0.1747 (-0.24)				
Trade/GDP	0.0008 (0.19)	0.0039 (0.38)			
R&D/GDP	-0.3547 (-0.86)				
LandGini		0.2530** (3.92)			
Unemploy/GDP		0.0940 (0.94)			
M2/GDP			0.0353** (2.53)	0.0038** (3.25)	-0.0004 (-1.00)
IncomeTax/GDP			0.4785** (2.99)		
Polity			0.0801 (1.07)		
Language			-4.3117** (-2.11)	-0.7465** (-4.93)	0.0327 (0.57)

Note: Z-statistics in parentheses; ** significant at 5 percent level; * significant at 10 percent level

3.3.2 Indirect Effect

Apart from the direct effect, income distribution and economic growth also interact with each other indirectly through other channels. To begin with, causality runs from growth to income distribution, although economic growth does not significantly contribute to income distribution directly as shown in equation (2), the results from equations (3) – (5) suggest that it does so through three major factors: physical capital investment and human capital investment in forms of education and health. In the case of physical capital investment, measured by the

investment ratio, the higher growth rate tends to increase the investment rate which in turn helps lower income inequality: a one percentage point increase in the growth rate raises the investment ratio by 1.93 percentage points and thereby indirectly lowers the Gini coefficient by 0.10 percentage points, other things being constant.

This finding is also applicable to the case of human capital, measured by healthy life expectancy in equation (5). The estimated coefficient on the growth variable of 0.02 implies that a one percentage point increase in the growth rate is likely to improve the healthy life expectancy by 2 percent which is equivalent to 1.11 years. But with a positive relationship between health and inequality found in equation (2), a rise in the growth rate indirectly transmits to greater income inequality via an improvement in health.

On the contrary, economic growth does not have a significant impact on the education variable, indicating that a higher growth in real per capita GDP fails to increase the accumulation of educational capital, measured by the average years of secondary schooling in the adult population.

As to the causality obtained from income distribution to economic growth, equations (3) – (5) also suggest the indirect effects of such a distribution on economic growth. Other things being equal, any improvement in the distribution of income would increase the investment ratio for physical capital: a one percentage point decrease in the Gini coefficient would increase the rate of physical accumulation by 0.27 percentage points and consecutively boost the rate of growth by 0.33 percentage points.

Similarly, for education, lowering the Gini index by one percentage point also helps raise secondary schooling years by 4.09 percent, equivalent to 0.08 years, which in turn, indirectly causes the rate of growth to diminish. On the other hand, income inequality is found to be positively related to health status. The estimated coefficient of 0.0109 on the inequality measure implies that a one percentage point decrease in income inequality significantly reduces the life expectancy by 1.09 percent, which correspondingly decreases

economic growth.

In addition to these three main factors, physical and human capital investments are governed by other important factors. Equations (3) – (5) suggests that any improvements in the credit market, measured by money and quasi-money as a share of GDP, have positive impacts on capital stocks, as predicted. However, it does not play any crucial role in health investment since it is possible that individuals normally perceive health as an asset that is far less tangible than physical capital or educational capital, therefore, borrowing to improve their health status is unlikely.

The results from equation (3) also show that income taxation is an appropriated redistributive tool by which to stimulate investment, thereby reducing inequality and contributing to higher growth. However, the political regime indicator does not have a significant role in the inequality-growth relationship. As Temple (1999) indicates, under authoritarian or democratic regimes, what is far more important is the nature of the political regime. The accountability of politicians to all should be of central concern - whether those who run the regime concentrate on self-interest, or they look after the interests of a nation as a whole. As for cultural diversity, measured by linguistic fractionalization, the results also show that diversity does hamper investment in physical capital and educational accumulation.

Another key factor that contributes largely to health is education. The estimated coefficient on schooling is significantly positive, implying that better education may improve standards of hygiene and may be associated with lower fertility and infant mortality, all of which help raise a child's life expectancy at birth.

4. Conclusion

Overall, the estimation results provide important implications. First, income distribution and economic growth are indeed simultaneously correlated. However, the negative relationship found between them does not imply that through varying one variable, this would automatically have a favorable impact on the other. This is because income inequality and growth can interact with one another through

underlying factors which may conflict in the end.

Second, the negative relationship between education and growth implies that higher schooling years does not necessarily imply higher educational quality and thus a higher growth rate. Therefore, government should improve the quality of schooling so that increased education might enhance individuals' abilities and cognitive skills so that they adhere to the prevailing capital level.

Third, the positive relationship between inequality and health lies in the fact that health services tend to be unequally distributed and benefit only a small group of people. Hence, a rise in health status exacerbates the already prevailing inequality. Therefore, public access to high-quality health facilities, either in forms of universal coverage services or health insurance should be encouraged.

Forth, government fiscal policy via direct taxation based on income, profits and capital gains can be an effective tool in redistribution in that it helps low-income individuals to engage in productive activities that raise overall investment and lower income inequality accordingly.

Cultural diversity is another factor that should not be neglected since it plays a crucial role in determining the extent to which capital is accumulated. Therefore, development policies should be formulated in a way that explicitly respects and promotes cultural differences.

Finally, rather than the distribution of income, what seems to be far more important is the distribution of available opportunities. That is, to promote an economy where income distribution is equally distributed and economic growth is enduring, policymakers should provide all individuals similar chances in which to attain higher education, acquire better health care, have access to credit markets, and to become politically and socially active, regardless of their predetermined background.

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Appendix 1 Definitions and Sources of Data

Variable	Period	Type	Definition	Source
Growth	2000-2004	Average	Annual growth rate of real GDP per capita	Alan Heston, Robert Summers and Bettina Aten (2006). Penn World Table Version 6.2. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
Gini	1993-2003	Average	Gini coefficient for income distribution (ranged from 0 to 100, 0 representing perfect equality and 100 representing perfect inequality).	World Bank (various years). World Development Indicators.
I/GDP	2000-2004	Average	Real gross domestic investment (private and public) as a percentage share of real GDP	Alan Heston, Robert Summers and Bettina Aten (2006). Penn World Table Version 6.2. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
Education	2000	Point	Average years of secondary schooling in the population aged over 15	Robert J. Barro and Jong-Wha Lee (2000). "International Data on Educational Attainment: Updates and Implications." *Center for International Development Working Paper No. 42*, Harvard University.
Health	2000-2002	Average	Healthy life expectancy: the equivalent number of years, adjusted for the time spent in poor health, that a newborn child can expect to live based on the current mortality rates and prevalence distribution of health states in the population.	World Health Organization, WHO Statistical Information System (WHOSIS). Available from *http://www3.who.int/whosis/hale/hale.cfm?path=whosis,hale&language=english* [2006, July 27].
InitialGDP	2000	Point	Real GDP per capita	Alan Heston, Robert Summers and Bettina Aten (2006). Penn World Table Version 6.2. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Appendix 1 Definitions and Sources of Data (continued)

Variable	Period	Type	Definition	Source
Trade/GDP	2000-2004	Average	Real trade volume (exports and imports) as a percentage share of real GDP	ibid.
R&D/GDP	2000-2004	Average	Gross domestic expenditure on research and experimental development as a percentage share of GDP	World Bank (various years). World Development Indicators.
LandGini	1960-1970	Average	Gini coefficient for land distribution (ranged from 0 to 100, 0 representing perfect equality and 100 representing perfect inequality).	Klaus Deininger and Pedro Olinto (1999). "Asset Distribution, Inequality, and Growth." *World Bank Policy Research Working Paper No. 2375*, World Bank.
Unemployment	2000-2003	Average	Total unemployment as a percentage share of total labor force	World Bank (various years). World Development Indicators.
M2/GDP	2000-2003	Average	Money and quasi-money as a percentage share of GDP	ibid.
IncomeTax/GDP	1998-2004	Average	Taxes on income, profits, and capital gains as a percentage share of GDP	International Monetary Fund (various years). Government Finance Statistics Yearbook.
Polity	2000-2003	Average	Political regime indicator: (ranged from -10 to +10, -10 representing full autocracy and +10 representing full democracy)	Polity IV Project (2006). Political Regime Characteristics and Transitions, 1800-2004. Center for International Development and Conflict Management (CIDCM), University of Maryland. Available from *http://www.cidcm.umd.edu/polity/* [2006, 22 September].
Language	2001	Point	Linguistic fractionalization: the probability that two randomly selected individuals from a population belonged to different linguistic groups.	Alberto Alesina, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat and Romain Wacziarg (2003). "Fractionalization." *Journal of Economic Growth* 8: 155-94.

Appendix 2 Two-stage Least Squares Estimates

Explanatory variable	**(1)** ***Growth***	**(2)** ***Gini***	**(3)** ***I/GDP***	**(4)** ***ln(Edu)***	**(5)** ***ln(Health)***
Constant	1.9318 (0.10)	36.4718 (1.25)	9.5005 (1.35)	1.7864** (4.06)	3.7097** (21.79)
Growth		0.0500 (0.16)	1.5899** (4.66)	0.0173 (0.78)	0.0098 (1.32)
Gini	-0.2374** (-2.36)		-0.1501 (-0.99)	-0.0308** (-3.02)	0.0032 (0.86)
I/GDP	0.1541** (2.49)	0.0022 (0.02)			
ln(*Edu*)	-3.5231 (-1.64)	-1.9306 (-0.56)			0.3270** (6.75)
ln(*Health*)	0.9376 (0.17)	-4.7495 (-0.60)			
ln(*initialGDP*)	0.7989 (0.89)				
Trade/GDP	0.0016 (0.23)	0.0005 (0.04)			
R&D/GDP	-1.5852** (-2.46)				
LandGini		0.3415** (4.92)			
Unemploy/GDP		0.1330 (1.18)			
M2/GDP			0.0529** (2.94)	0.0042** (3.34)	0.0004 (0.80)
IncomeTax/GDP			0.9028** (4.04)		
Polity			0.2395** (2.31)		
Language			-4.1521* (-1.78)	-0.7752** (-4.85)	-0.0933 (-1.43)

Note: *t*-statistics in parentheses; ** significant at 5 percent level; * significant at 10 percent level