What the Data Says About Capital Accumulation, Inequality, and Growth

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Abstract

The influence of capital accumulation on income inequality and the economic development process is examined in a dynamic panel of countries. Semiparametric estimates support the theory that the relationship between inequality and growth is influenced by capital-skill complementarities. Specifically, inequality is growth promoting in nations with small capital stocks, but appears to have little influence in nations with large capital stocks.

Keywords: Capital-Skill Complementarity, Economic Growth, Income Inequality

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1 Introduction

Macroeconomic theory has long suggested that the influence of income inequality on economic growth depends critically upon the level of physical capital accumulation (see Kaldor (1957) among others). Recently, Galor and Moav (2004) re-ignited debate on this issue by proposing a 'unified' growth and inequality theory. They hypothesize that during the initial stages of development (when capital is relatively scarce), income inequality promotes growth because income is channeled to households more apt to save and promote domestic capital formation (i.e. the 'classical' approach). As this process continues, capital-skill complementarities elevate the importance of human capital in the growth process, thereby eroding the benefits of inequality due to the obstacles it creates in the financing and affordability of education (i.e. 'credit market imperfection' approach). Finally, in the later stages of development, easy access to education and converging savings rates neutralize the affect of inequality on growth.

Despite the interesting implications of this theory, it has not been empirically tested. Consequently, this paper uses the latest inequality dataset to investigate the relationship between capital accumulation, income inequality, and economic growth in a panel countries. Extending the semiparametric inequality and growth model of Banerjee and Duflo (2003) to account for physical capital accumulation, inequality is found to promote growth in nations with small capital stocks, but has little overall effect on growth in nations with large capital stocks. Therefore, the 'classical' approach appears to dominate during the early stages of development, giving way to the 'credit market imperfection' approach as capital accumulates.

These results are particularly important given that most of the work in the inequality-growth literature has focused on singular mechanisms through which the distribution of income affects economic growth. In particular, empirical work has focused on whether greater inequality is 'good' or 'bad' for growth, but not enough effort has been made to condition that estimated relationship for differences in the level of development. Several papers has investigated whether differences in per capita income affect the empirical relationship between inequality and growth (see for example Barro (2000), and Bleaney and Nishiyama (2004)), but I am not aware of any examining the capital stock's affect on this relationship.

The remainder of the paper is organized as follows: section 2 describes the empirical model, while section 3 describes the data and estimation procedure. Section 4 discusses the results, while section 5 reports the results of robustness tests. Finally, section 6 concludes.

2 Semiparametric Model

The model of interest in this paper is an extension of the Perotti-based growth model used in Banerjee and Duflo (2003):

$$gr_{it+5} = \alpha y_{it} + X_{it}B + h(\Delta gini_{it}) + v_i + \varepsilon_{it} \tag{2.1}$$

where gr_{it+5} is the annualized rate of growth of real per capita GDP in nation i between periods t and t+5, y_{it} is log per capita real GDP, X_{it} consists of control variables from Perotti (1996), (i.e. the price level of investment, and average years of secondary school attainment among males and females (aged 25 and above) respectively), $h()$ is a smooth function, $\Delta gini_{it}$ is the change in the gini coefficient over the previous five years, v_i is a nation-specific effect, and ε_{it} is an i.i.d. stochastic shock.

Extending model (2.1) to incorporate the effects of physical capital accumulation yields:

$$gr_{it+5} = \alpha y_{it} + X_{it}B + m(\Delta gini_{it}, k_{it}) + \eta_t + u_{it} \tag{2.2}$$

where k_{it} is the log of the per capita capital stock, $m()$ is a smooth function, η_t captures time period effects, $u_{it} = \mu_i + \varepsilon_{it}$ is a one-way error term (whereby μ_i is i.i.d. $(0, \sigma^2_\mu)$ and ε_{it} is i.i.d. $(0, \sigma^2_\varepsilon)$, and uncorrelated with μ_i), and the remaining variables are defined identically as in model (2.1).[1]

Equation (2.2) uses the *change* in the gini coefficient ($\Delta gini$) rather than the *level* of the gini coefficient for a number of reasons. First, the WIID dataset, from which gini coefficients are obtained, contains many disparate and overlapping

[1] It is assumed that the time-period effects are mean zero and uncorrelated with the error term or any regressor.

inequality surveys. While the United Nations goes to great pains to enumerate the methodologies underlying each survey reported, it is extremely difficult to adequately adjust inequality measures across surveys so as to eliminate idiosyncratic differences in methodology. Indeed, the methodological details provided with each survey observation (i.e. income measure (gross/net income, monetary income, expenditures, etc.), recipient units (households, families, family equivalents, individuals, etc.), area coverage (urban, rural, metro, etc.), and population coverage (all, employed, economically active, taxpayers, etc.), only begin to scratch the surface of describing how these surveys were conducted. For example, even if one accepts that the above survey information adequately identifies the target population for a given study, crucial details regarding the actual sampling methodologies are not provided. Reflective of these hidden differences, one can find many overlapping surveys of the same nation, with relatively similar reported survey characteristics, but very different measures of the level of inequality. Rather than trying to combine different inequality data together using ad hoc rules, as suggested for example by Deininger and Squire (1996), this paper chooses to use changes in inequality instead.[2] To see the benefits of this approach, suppose that income inequality is measured in nation i during time period t, using study methodology j:

$$gini_{it}^{j} = gini_{it} + v_j + e_{it} \tag{2.3}$$

where each study method is *ex ante* unbiased (i.e. v_j is i.i.d. $(0, \sigma_v^2)$), but subject to a consistent *ex post* measurement error and idiosyncratic noise (e_{it} is white noise). Taking the first difference of equation (2.3) eliminates the *ex post* study-specific errors:

$$\Delta gini_{it}^{j} = \Delta gini_{it} + \Delta e_{it} \tag{2.4}$$

The second reason for using changes in inequality stems from the findings of Banerjee and Duflo (2003), who find little empirical evidence of a relationship between contemporaneous income inequality and economic growth. Using semiparametric methods, they do find an inverted "U" shaped relationship between *changes* in inequality and subsequent growth. Because their findings suggest that this empirical relationship is robust to differences in model specification (i.e. they

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[2] For example, Deininger and Squire (1996) suggest adding 6.6 to expenditure based gini coefficients to make them more comparable to income based gini coefficients.

used the control variables from Perotti (1996) and Barro (2000), and found virtually no difference in their results), the model of interest in this paper uses Perotti's specification and focuses on changes in income inequality.

Finally, it is important to note that while Galor and Moav (2004) discuss the relationship between the aggregate factors of production, income inequality, and economic growth, their fundamental story is consistent with (and can be re-cast into) a *marginal* argument (i.e. how *changes* in inequality affect growth). The following passage from their paper makes this clear:

> *Inequality therefore stimulates economic growth in stages of development in which physical capital accumulation is the prime engine of growth, whereas equality enhances economic growth in stages of development in which human capital accumulation is the dominating engine of economic growth and credit constraints are still largely binding.*

In other words, this implies:

$$\left.\frac{\partial growth_{it+5}}{\partial gini_{it}}\right|_{y^{*}<y_{it}<y^{**}} < 0 < \left.\frac{\partial growth_{it+5}}{\partial gini_{it}}\right|_{y_{it}<y^{*}} \tag{2.5}$$

where y^{*} is some critical level of development (e.g. per capita GDP or per capita capital stock) beyond which point human capital accumulation is the engine of growth, and y^{**} is a threshold level of development beyond which point credit market constraints are no longer binding. Thus, equation (2.2) is an appropriate model to investigate the capital skill complementarity growth theory of Galor and Moav (2004), as it models how changes in inequality affect the rate of economic growth.

3 Data and Estimation Procedure

3.1 Data

The data consist of an unbalanced panel of 139 observations covering 33 countries and spanning seven, 5-year time periods (1960 to 1990).[3] The rate of economic growth (gr_{it+5}), log per capita GDP (y_{it}), and the price level of investment are from the Penn World Table 6.1 (i.e. Heston, et. al. (2002)). The male and female education measures are from the Barro and Lee (1993) dataset. Capital stock data

[3] See Table 1 for a list of nations used in the sample.

(k_{it}) are from Duffy *et. al.* (2004). Finally, the gini coefficients are from the United Nation's World Income Inequality Database (WIID) (2000).

To construct a $\Delta gini_{it}$ panel that maximizes temporal and cross-sectional consistency, special care is taken to select consecutive observations that are as similar as possible with regard to area coverage, income definition, reference unit, and underlying survey methodology. As a result, preference is given to consecutive observations from the same studies (as discussed above in Section 2). Only observations labeled as 'reliable' by the U.N. are used, and missing observations are replaced by the closest observation in the previous 5-year period.[4] Because only very homogenous consecutive measures of inequality are used in the $\Delta gini_{it}$ panel, *ad hoc* corrections (e.g. adding 6.6 to expenditure-based gini coefficients) are unnecessary. See table 1 for a listing of the $\Delta gini_{it}$ values used in the paper.

3.1 Estimation Procedure

To ensure the robustness of the estimation results, two alternative procedures are used to estimate model (2.2): Berg, Li, and Ullah (2000), and Li and Stengos (1996).

Berg, Li, and Ullah (2000) is loosely based on Robinson (1988), and thus the first step is to express the dependent variable (gr_{it+5}) and the linear explanatory variables (y_{it} and X_{it}) in deviations from their conditional means (conditioning on the corresponding in-sample values of $\Delta gini_{it}$ and k_{it} using kernel estimation), e.g. $y_{it} - \hat{E}(y_{it} | \Delta gini_{it}, k_{it})$.[5] This effectively 'linearizes' model (2.2) – i.e., the nonparametric function $m(\cdot)$ is eliminated. The resulting linearized model is a basic dynamic, one-way error component panel model (recall that the dependent variable (growth) is equal to the difference in log GDP in consecutive periods (i.e. $growth_{it+5} \equiv y_{it+5} - y_{it}$), and one of the right hand side (r.h.s.) regressors is current GDP (y_{it})), thus the y_{it} term on the r.h.s. of the model is correlated with the country-specific effect in the error term (μ_i). Using suitable instrumental

[4] This method for handling missing observations is also used in Forbes (2000) and Banerjee and Duflo (2003).
[5] Gaussian product kernels were used, with window widths obtained by minimizing asymptotic mean integrated square error (AMISE) (see Pagan and Ullah (1999), pg. 25 for more details).

variables, this linearized dynamic panel can be consistently estimated, however, to do so while ignoring the one-way error structure of the model yields an inefficient estimator. To overcome this deficiency, Berg, Li, and Ullah (2000) suggest a simple Feasible Generalized Least Squares (FGLS) procedure whereby a within transformation is performed (i.e. each country's observations are expressed in deviations from their country-specific means), thus eliminating μ_i. This, however, does not eliminate the need to use instrumental variable estimation, as the transformed GDP measure ($y_{it} - \bar{y}_i$) is now correlated with the transformed error term ($u_{it} - \bar{u}_i$) (i.e. the country-specific effect is eliminated, but the average idiosyncratic shock ($\bar{\varepsilon}_i$), which contains ε_{it}, is correlated with y_{it} by construction). Use of suitable instruments leads to an efficient, root-n consistent estimator of the coefficients in equation (2.2).[6] Lastly, the linear effects of $y, X,$ and η are removed from equation (2.2.), and estimates of $\hat{m}()$ are obtained by estimating $E\left[gr_{it+5} - \hat{\alpha} y_{it} - X_{it}\hat{B} - \hat{\eta}_t \middle| \Delta gini_{it}, k_{it}\right]$ using standard kernel methods. The Li and Stengos (1996) procedure is very similar to Berg, Li, and Ullah (2000), except that the one-way error component structure of the model is not exploited (i.e. no within transformation is performed prior to using instrumental variables to estimate the linearized, dynamic panel model), thus the Li and Stengos (1996) procedure is consistent, but not efficient.

4 Results

Following the procedure outlined in section 3.1, consistent estimates of the semiparametric function are obtained. In order to focus on economically interesting values of $\hat{m}()$, three fixed values of the capital stock are considered: 1) low capital stock (k^{low} equal to the bottom 20th percentile capital stock), 2) typical capital stock (k^{median} equal to the median capital stock), and 3) high capital stock (k^{high} equal to the top 20th percentile capital stock). Fixing the capital stock at each of the foregoing values, $\hat{m}()$ was calculated while the change in income inequality ($\Delta gini$) was varied in small, fixed increments. Plots of $\hat{m}()$, obtained

[6] Because the level of education, the price level of investment, and time period effects are predetermined when compared to the level of economic growth over the *next* five years, they are treated as exogenous variables. Thus, these regressors serve as their own instruments. One-period lags of education and the price level of investment are included in the instrument set to instrument for GDP.

using both the Berg, Li, and Ullah (2000) and Li and Stengos (1996) estimators are provided in Figure 1.[7] Remarkably, the estimates of $\hat{m}()$ differ very little between the estimators, and the overall findings, discussed below, are equally applicable to either plot.

In countries with low capital stocks, small increases in inequality (i.e. less than one, on a 100-point gini coefficient scale) raise the rate of economic growth, but only slightly. The Berg, Li, Ullah estimator predicts that annual growth would rise at most by 0.3 percentage points, while the Li and Stengos estimator predicts a more modest maximum increase of 0.06 percentage points. Clearly, these estimates are economically insignificant. On the other hand, reducing inequality has a much more significant affect on growth. Both estimators predict that a 2-point reduction in income inequality would lead to a 1.3 percentage point drop in annual growth, which is quite large. This finding provides limited support to the predictions of the 'classical' approach – inequality promotes growth in capital-scarce economies by channeling income to wealthier households who possess higher savings rates, thus raising domestic savings, investment, and capital formation. Clearly, if one believes the 'classical approach,' the prediction that growth would plummet as a result of modest reductions in inequality makes sense However, the asymmetry of this trade-off is puzzling: if falling inequality is bad for growth, then why does rising inequality not lead to significant increases in growth?

This empirical tradeoff between inequality and growth also holds in nations with median levels of capital. Specifically, both estimators predict that a 1-point increase in inequality increases economic growth by approximately 0.3 percentage points. On the other hand, both estimators predict between a 0.5 and 0.6 percentage point drop in growth in response to a 2-point drop in the gini coefficient. The growth-penalty for greater equality is approximately half of that faced by nations with low capital stocks. This supports the theory that capital-skill complementarities increase the relative importance of human capital over physical capital, thus diminishing the benefits of greater inequality, and the costs of greater equality. Again, the same puzzling asymmetry between greater/lesser inequality and growth is present in nations with median levels of capital.

On the other end of the development spectrum, nations with high capital stocks exhibit a very different inequality and growth pattern. In particular, both

[7] Due to the intercept identification problem (as described in Robinson (1988)), the plots in Figures 1 to 4 were re-centered at zero.

estimators predict that growth initially declines with small increases in inequality, but that larger increases in inequality (between 0.25 and 0.5) lead to rising growth. Overall, both models predict that an increase in the gini coefficient of about 1.5 leads to an increase in the annual rate of economic growth of about 0.2 percentage points. Clearly, the upside growth potential of higher inequality is very limited. In nations with large capital stocks, lower inequality also leads to higher rates of economic growth. Both estimators predict that the annual growth rate will rise between 0.2 and 0.4 percentage points in response to a 2-point reduction in the gini coefficient. These results run counter to the lesser-developed countries already examined, in that greater equality is good for growth, and that growth initially declines with higher inequality. In addition, the overall magnitude of inequality's affect on growth is much smaller in more highly developed nations. While not perfect, these findings also provide limited support for the capital-skill complementarity theory advanced by Galor and Moav. Specifically, lower inequality is not harmful to growth, nor is higher inequality especially growth enhancing, suggesting that the 'classical' benefits of channeling income to wealthier households in order to stimulate domestic capital formation are limited. At this phase of development, capital-skill complementarity would hold that human capital is relatively more important to maintaining sustained economic growth (hence the benefits of lower inequality), but that the magnitude of the benefits will be low overall (as credit market constraints (e.g. collateral requirements) are largely not binding).

These results are also somewhat similar to Banerjee and Duflo (2003), in so far as there appears to be an inverted U-shaped relationship between changes in income inequality and economic growth (at least in the low to medium capital cases). The major differences between this paper and theirs are two-fold: 1) Banerjee and Duflo do not use the level of economic development to condition their nonparametric relationship between growth and changing inequality (see Model (2.1) above), and 2) the apex of their U-shaped relationship was centered roughly at $\Delta gini = 0$, implying that *any* change in inequality is harmful to subsequent growth. The underlying theory that they advanced to explain this phenomena is that political processes help to shape the distribution of income, and that the negotiation process is costly. Thus, any change in the distribution of income is the result of costly bargaining, leading to a lower rate of growth than would have occurred in the absence of bargaining. While this theory does not fit the findings of this paper, it is still likely that nations experience political-economy undercurrents, which may skew the affects of inequality on growth. In other words, the empirical departures from the theory of Galor and Moav may be due in-part to costly political bargaining. To say anything definitive on this point is beyond the scope of this paper, but could potentially prove a fertile avenue for future research.

To date, several papers have examined how differences in income affect the tradeoff between inequality and growth, including Barro (2000) and Bleaney and Nishiyama (2004). In short, Barro finds that greater inequality is harmful to growth in nations with per capita income less than $2,070 (1985 U.S. dollars), and beneficial to growth in nations with incomes above this threshold. Contrary to Barro, Bleaney and Nishiyama (2004) find that the affect of inequality on growth is very similar in both high and low income countries. Contrary to Bleaney and Nishiyama (2004), this paper suggests that development does influence the inequality-growth relationship. With regard to Barro, the present findings indicate that higher inequality is beneficial to growth (or alternatively that greater equality is harmful to growth) in less-developed and developing nations, while in developed nations greater equality increases growth, while greater inequality can be either beneficial or harmful to growth depending on how much inequality rises (i.e. small increases in inequality reduce growth, while larger increase lead to slight increases in the growth rate).

5 Robustness

In order to test the robustness of the results discussed above, alternative control variables, measures of development, and inequality are used. Specifically, the semiparametric growth model is re-estimated using Barro's (2000) control variables. In separate robustness checks, an alternative measure of development, log income, is used to control for economic development in the nonparametric regressions, while in a final robustness check, the level of inequality is used instead of changes in inequality.

5.1 Barro Growth Model

To demonstrate that estimates of the affects of changing inequality on growth are not due to Perotti's (1996) control variables, the following model, based on Barro (2000) is estimated:

$$gr_{it+5} = X_{it}B + m(\Delta gini_{it}, k_{it}) + \eta_t + v_i + \varepsilon_{it} \qquad (5.1)$$

where gr_{it+5} is the annualized rate of growth of real per capita GDP in nation i between periods t and t+5, X_{it} consists of log per capita real GDP, log per capita GDP squared, government's share of output, the rate of inflation, years of male schooling, the log of the total fertility rate, investment's share of output, and the growth rate of trade, $m()$ is a smooth function, $\Delta gini_{it}$ is the change in the gini coefficient over the previous five years, k_{it} is the log of the per capita capital stock, v_i is a nation-specific effect, and ε_{it} is an i.i.d. stochastic shock.[8] The data on the rate of economic growth, real chain-weighted GDP per capita, government's share of output, investment's share of output, and changes in trade (measured by changes in 'openness' (i.e. imports plus exports as a fraction of output)) are from the Penn World Tables (v 6.1). The education series, defined as the average years of male secondary and higher instruction, is from the Barro and Lee (1993) dataset. Finally, the fertility rate and the inflation rate are from the World Bank Development Indicators database.[9]

Estimation follows the Berg, Li, and Ullah (2000) procedure outlined in Section (3.1) above. A plot of $\hat{m}(\cdot)$ is provided in Figure 2. The results are very similar to those from the Perotti growth model (see Section 4): reduced inequality in nations with low to median levels of capital per worker leads to reduced economic growth. On the other hand, small increases in inequality (i.e. between 0.25 and 0.5-point increase in the gini coefficient) raise growth, while larger increases in inequality actually reduce the growth rate. Overall, the inverted U-shaped relationship between changes in the gini coefficient and economic growth is more fully formed and symmetric (as compared to the Perotti model). With regard to highly developed nations (i.e. nations with large per capita capital stocks), the Barro model predicts that reduced inequality raises the rate of economic growth, which is consistent with the findings from the Perotti model. Both models agree that small increases in inequality reduce economic growth in highly developed

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[8] Barro (2000) examines growth over 10-year periods, while the present model only considers 5-year growth spells. Because the motivation to use Barro's control variables is simply to verify the robustness of the affects of inequality on 5-year growth, there is no reason to consider 10-year growth horizons.

[9] Model (5.1) does not include the democracy index because it varies very little within countries, thus the Berg, Li, Ullah (2000) FGLS procedure will eliminate any country-specific heterogeneity. The rule-of-law index used in Barro (2000) was also omitted because of limited time-coverage.

nations, but the Barro specification differs in that growth monotonically declines with inequality, while the Perotti model predicts that large increases in inequality (increases in the gini coefficient in excess of one) lead to higher growth. Thus, the estimated impact of changing inequality and growth is very consistent, despite differences in control variables.

5.2 Alternative Measures of Development: GDP

To verify that economies at varying stages of development respond differently to changes in the distribution of income, and that the proceeding results are not sensitive to how development is measured (i.e. using capital stocks), Model (2.2) is re-specified using per capita GDP as an alternative measure of development:

$$gr_{it+5} = X_{it}B + m(\Delta gini_{it}, y_{it}) + \eta_t + u_{it} \tag{5.2}$$

Following the Berg, Li, and Ullah (2000) procedure, a plot of $\hat{m}(\cdot)$ is provided in Figure 3. The estimated curves for nations with high to median levels of per capita GDP are virtually identical to the Berg, Li, and Ullah estimates of Model (2.2). Only the estimated relationship between inequality and growth for nations with low levels of per capita GDP differ, and very little overall. In particular, estimates of Model (5.2) for low-GDP nations predict: 1) lower inequality leads to reduced growth (which is consistent with estimates from Model (2.2)), and 2) higher inequality (regardless of the magnitude) leads to lower economic growth. The general shape of $\hat{m}(\cdot)$ - an inverted "U"-shaped curve - is similar for lesser developed nations (regardless of whether capital or GDP are used to measure development), the only difference being that the apexes are centered at different values of $\Delta gini$.

5.2 Alternative Measures of Inequality: Gini Coefficients in Levels

As a final robustness check, Model (2.2) is modified by replacing changes in inequality ($\Delta gini_{it}$) as an argument in $m(\cdot)$, with levels of inequality:

$$gr_{it+5} = \alpha y_{it} + X_{it}B + m(gini_{it}, k_{it}) + \eta_t + u_{it} \tag{5.3}$$

Following the Berg, Li, and Ullah (2000) procedure, a plot of $\hat{m}(gini_{it}, k_{it})$ is provided in Figure 4. As compared with the plots of $\hat{m}(\Delta gini_{it}, k_{it})$ in Figure 1, there are strong similarities. First, higher inequality is generally good for growth in nations with low to median capital stocks. These advantages, however, are most pronounced in nations with low initial inequality. Thus lesser developed nations with more egalitarian distributions of income stand to gain the most from increased inequality. Alternatively, in nations with higher levels of inequality (the threshold appears to equal a gini coefficient of 36), greater inequality either leads to reduced growth (in the case of low-capital nations) or little-to-no additional growth (in the case of median-capital nations). Mirroring the relationship between developing versus developed nations represented in Figure 1, the plot of $\hat{m}(gini_{it}, k_{it})$ for high-capital nations is the inverse of the low to median-capital plots. In particular, growth declines with greater inequality in nations with very equal income distributions, but rises with inequality in nations with higher levels of inequality. Overall, the magnitude of the affect on growth (due to higher inequality) is small as compared to lesser-developed nations.

These findings are generally consistent with this paper's previous results, and also provide some support to the findings of Galor and Moav (2004) and Barro (2000). With regard to Galor and Moav, greater inequality leads to greater rates of growth in lesser-to-moderately developed nations, but has little overall affect on growth in developed nations. This supports the general thesis that capital-skill complementarities drive a nation's growth cycle, whereby physical capital is more important to growth in the early stages of development (hence the benefit of inequality: it channels income to households with higher savings rates, which increases domestic capital formation), and human capital becomes more important in the latter stages of development, by which time the high level of income and diminished credit-market constraints marginalize the impact of inequality on human capital accumulation. Figure 4 also provides conditional support for Barro (2000), which predicts that inequality is good for growth in wealthier nations and constrains growth in poorer nations. Examining figure 4, it is clear that inequality is bad from growth in poor nations, so long as their level of inequality is very high to begin with. If instead, a poor nation has low-to-moderate inequality, the opposite finding holds (i.e. higher inequality increases growth). In developed nations with gini coefficients in excess of 32, higher inequality raises the growth rate. Thus, in nations with moderate-to-high levels of inequality, Barro's basic findings hold true, while the findings of Bleaney and Nishiyama (2004) do not.

5 Conclusion

One of the primary topics of interest in the income inequality and growth literature has been to determine the nature of the linkage between these two variables. More specifically, investigators have sought to determine whether capital market imperfections, political economy or 'classical' resource channeling mechanisms were responsible for the empirical findings in the literature. The chief drawback of these investigations is the implicit assumption that the *same* mechanism is responsible for the relationship between inequality and growth across *all* nations.

This paper finds that in underdeveloped and moderately developed nations, greater equality is harmful to growth, while greater inequality generally has a small but positive impact on growth. In developed nations, reducing inequality is generally beneficial to economic growth, while greater inequality leads to either very small increases or decreases in the growth rate. Overall, underdeveloped and developing nations experience the largest growth effects (measured by the magnitude change in the growth rate) in response to changing inequality. In developed nations, by comparison, the magnitude of growth rate changes is relatively small. These results are robust to differences in the estimation methods (i.e. Berg, Li, and Ullah (2000) versus Li and Stengos (1996)), control variables (Perotti (1996) versus Barro (2000)), measures of development (per capita capital stock versus per capita GDP), and measures of inequality (changes in the gini coefficient versus the level of the gini coefficient). These findings strongly support the predictions of the inequality and growth model suggested by Galor and Moav (2004), and suggests that future theoretical models should incorporate inequality-growth mechanisms that vary with input factor intensities. Moreover, future empirical research should condition the relationship between inequality and growth on a nation's aggregate factors of production.

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Table 1 – Dataset on Changing Inequality

Country	1960	1965	1970	1975	1980	1985	1990
Austria					-0.20	0.50	0.50
Bangladesh			-3.11	1.80	-0.83	0.83	1.00
Belgium				5.50	-1.31	-5.75	0.90
Brazil				3.39	-3.22	-2.36	0.76
Canada			0.69	-0.68	-0.62	1.81	-0.90
Chile				0.36		1.70	-1.73
China				-1.30		-0.60	3.20
Denmark				-2.42		-0.27	-2.00
Finland				-4.80	-5.40	-1.60	0.40
France		-2.00	-3.00	-1.00	-2.00	0.06	
Germany			1.20	-2.60	0.00	-1.40	0.00
Hong Kong					-2.50	7.88	-3.18
Hungary			-3.02	-0.11	-1.26	-0.57	2.37
India	-2.77	-1.45	-0.76	-1.21	2.97	-0.65	-1.80
Indonesia			-2.60			-1.00	1.20
Italy				1.00	-2.00	-6.00	2.90
Japan			0.70	-1.10	-1.00	2.50	-0.90
Korea, Republic of			-1.04	1.85	0.99	-4.09	-0.90
Malaysia				1.80	-0.80	-3.00	0.35
Mexico		0.40	2.20	0.20			4.00
Netherlands				-5.60	-0.46	0.96	0.50
New Zealand					4.75	1.03	4.39
Norway			-1.48	1.44	-6.33	0.46	1.70
Pakistan			-2.40	3.19	0.18	-0.50	-2.78
Singapore				-4.99		5.09	-1.32
Spain					-2.40	-1.60	0.72
Sri Lanka			3.68	0.94	8.20	1.80	1.40
Sweden			-1.08	-6.48	-1.90	1.10	1.40
Taiwan			-2.82	-1.33	-0.13	1.24	0.91
Thailand			1.35	-0.89			5.70
United Kingdom			0.80	-1.80	1.60	2.20	5.20
United States		-0.24	-0.58	0.36	0.78	2.06	0.54
Venezuela					-4.02	4.81	-7.44

Values are equal to the change in the gini coefficient (measured on a 100-point scale) over the previous 5 years (i.e. $gini_{it}$ - $gini_{it-5}$)

Figure 1 – The Impact of Changing Inequality on Economic Growth

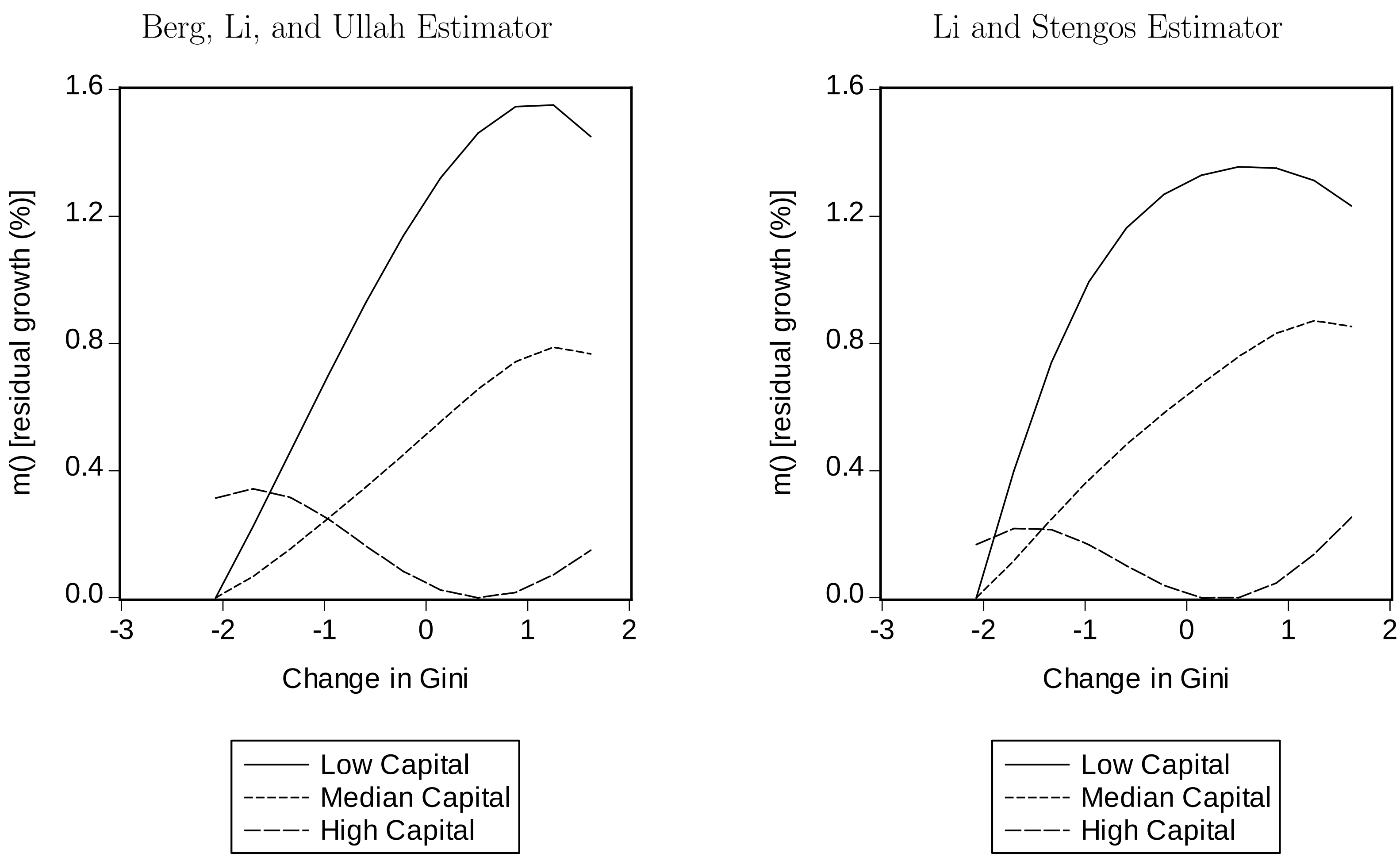

Figure 2 – Growth vs. Inequality using Barro's Control Variables

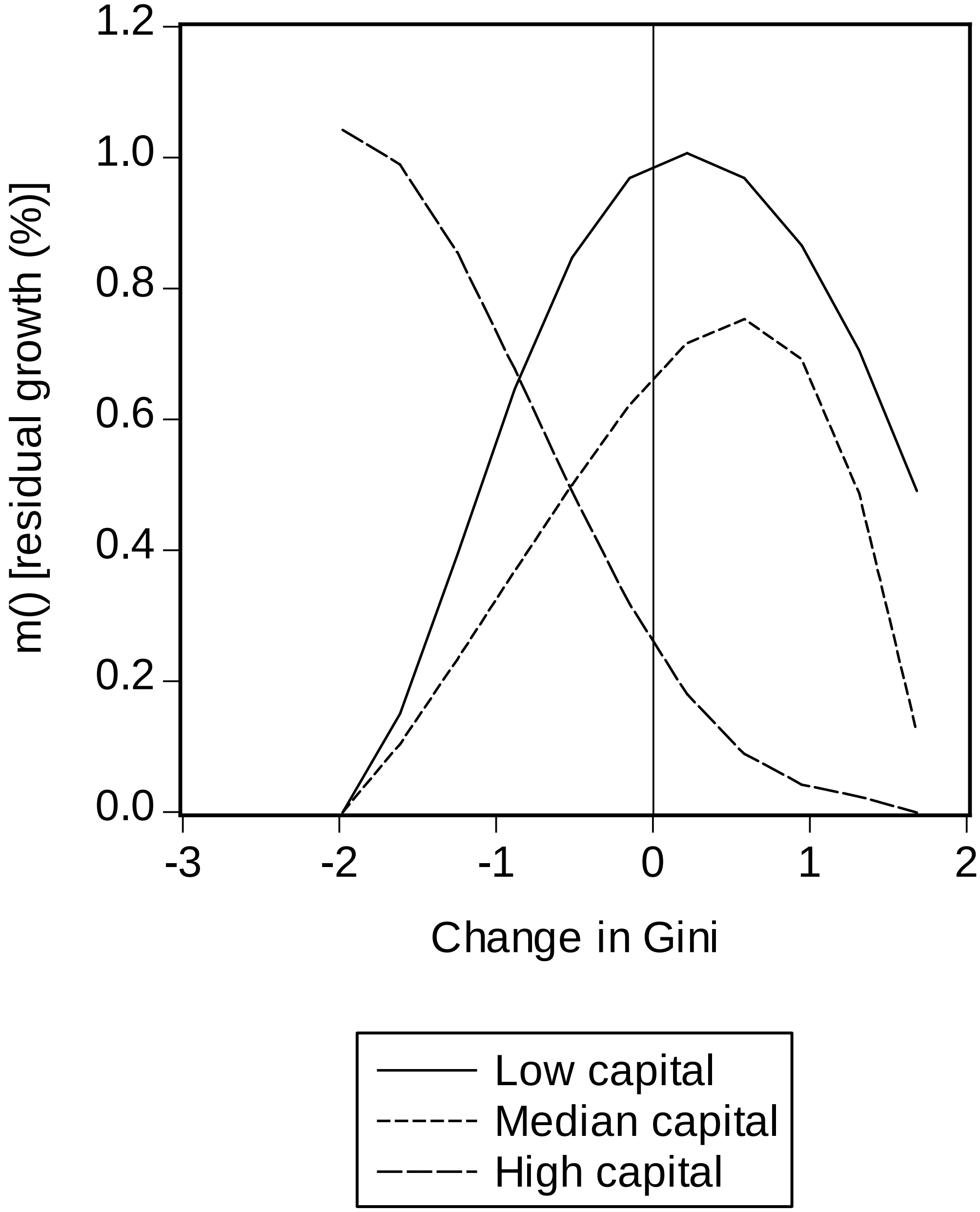

Figure 3 – Growth vs. Inequality using GDP as the Development Measure

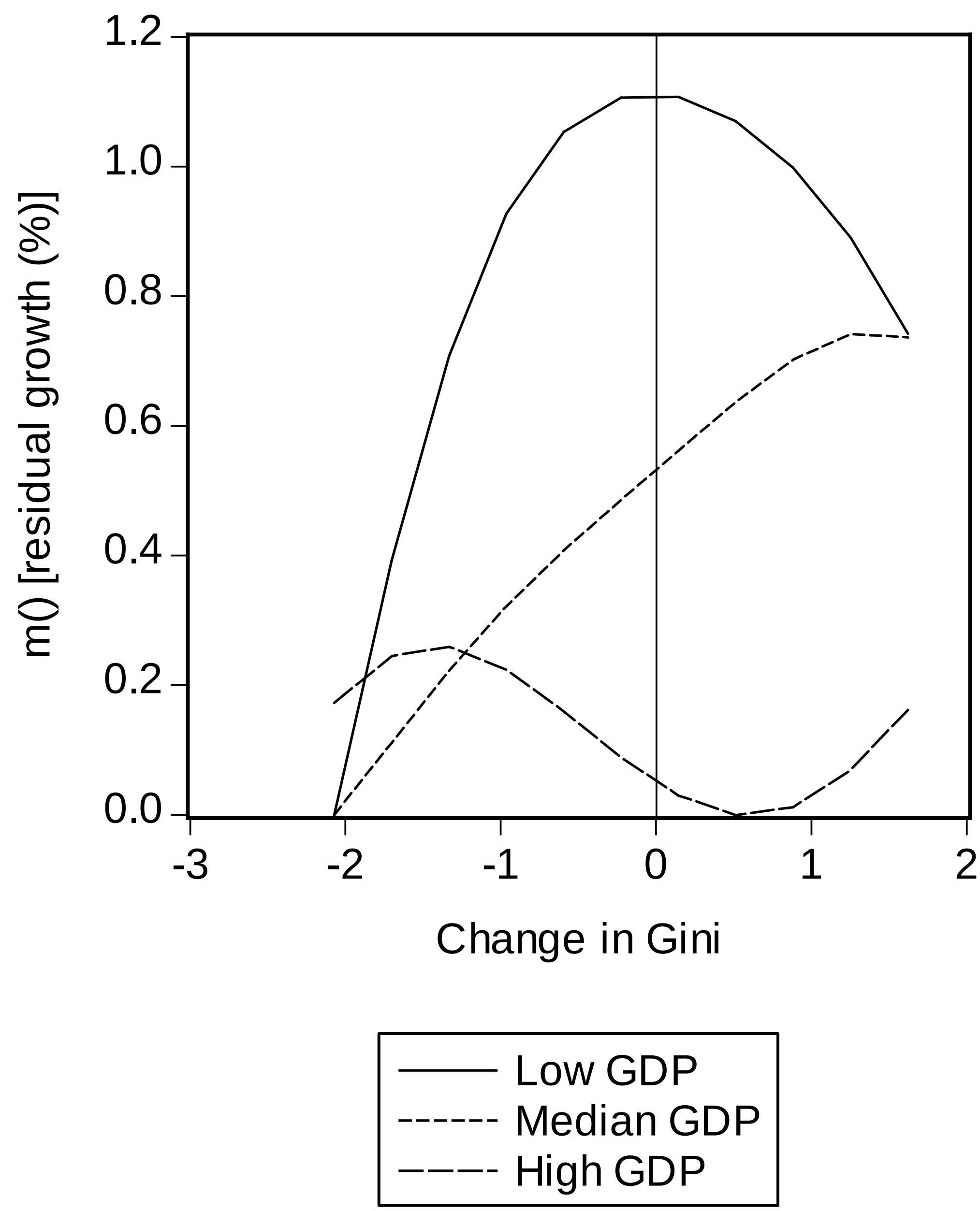

Figure 4 – Growth vs. Inequality in Levels