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Effects of Income Inequality on Aggregate Output

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Abstract

This paper estimates the effect of income inequality on real gross domestic product per capita using a panel of 104 countries during the period 1970–2010. The empirical analysis addresses endogeneity issues by using instrumental variables estimation and controlling for country and time fixed effects. The analysis finds that, on average, income inequality has a significant negative effect on transitional gross domestic product per capita growth and the long-run level of gross domestic product per capita. However, the impact varies by the level of economic development, so much so that in poor countries income inequality has a significant positive effect on gross domestic product per capita.

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Effects of Income Inequality on Aggregate Output

by

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1. Introduction

The relationship between aggregate output and the distribution of income is an important topic in macroeconomics (see Galor, 2011). The role that income inequality plays for economic growth has recently received also quite a bit of attention in policy circles and the press. For instance, the World Bank Group has made extreme-poverty eradication and boosting the incomes of the bottom 40 percent of developing countries' distribution of income across households its key global objective for development. The International Monetary Fund has weighed in with a discussion on the role of income distribution as a cause and consequence of economic growth; see, for example, Ostry et al. (2014).

This paper provides estimates of the within-country effect that income inequality has on aggregate output. Our empirical analysis starts from the premise that the effect of changes in income inequality on GDP per capita may differ between rich and poor countries. This premise is grounded in economic theory. In a seminal contribution, Galor and Zeira (1993) proposed a model with credit market imperfections and indivisibilities in investment to show that inequality affects GDP per capita in the short run as well as in the long run. The Galor and Zeira model predicts that the effect of rising inequality on GDP per capita is negative in relatively rich countries but positive in poor countries. We test this prediction by introducing in the panel model an interaction term between income inequality and countries' initial (i.e. beginning of sample) GDP per capita.

Our empirical analysis shows that, for the average country in the sample during 1970-2010, increases in income inequality reduce GDP per capita. Specifically, we find that on average a one percentage point increase in the Gini coefficient reduces GDP per capita by around 1.1 percent over a five-year period; the long-run (cumulative) effect is larger and amounts to about -4.5 percent. To be clear: this finding implies that, on average, increases in the level of income inequality lead to lower transitional GDP per capita growth; increases in the level of income inequality have a negative long-run effect on the level of GDP per capita. We document the robustness of this result to alternative measures of income inequality; alternative income inequality data sources; splitting the sample between the pre- and post-1990 periods (end of the Cold War); and restricting the sample to countries located in Latin America and the Caribbean or Asia.

While the average effect of income inequality on GDP per capita is negative and significantly different from zero, it varies with countries' initial income level. In an econometric model that includes an interaction term between initial GDP per capita and income inequality, the coefficient on the interaction term is negative and significantly different from zero at the 1 percent level. Quantitatively, the size of the coefficient on the interaction term implies that differences in initial income induce a substantial effect on the impact that changes in income inequality have on GDP per capita. For example, at the 25th percentile of initial income, the predicted effect of a one percentage point increase in the Gini coefficient on GDP per capita is 2.3 percent (with a corresponding standard error of 0.6 percent); at the 75th percentile of initial income, the effect is -5.3 percent (the corresponding standard error is 0.8 percent). The estimates from the interaction model thus suggest that in poor countries increases in income inequality increase GDP per capita while the opposite is the case in high and middle income countries.

Additional evidence that our empirical results are in line with the Galor and Zeira (1993) model comes from the response of investment and human capital.[1] Our panel estimates show that within-country increases in income inequality significantly increase the investment-to-GDP ratio in poor countries but decrease it in high and medium income countries. Furthermore, within-country increases in income inequality significantly increase the stock of human capital (measured by the average years of schooling and share of the population with secondary and tertiary education) in poor countries; on the other hand, in high and medium income countries increases in income inequality reduce human capital.

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1 Ideally, in the cross-country time series context, we would like to use data on the distribution of wealth rather than income since wealth inequality is the relevant measure in theoretical models with credit market imperfections. Unfortunately, data on wealth inequality are not available to generate a long time-series for a large number of countries. As noted in previous empirical research (e.g. Perotti, 1996), income inequality and wealth inequality are highly positively correlated.

Identification of the causal effect of income inequality on aggregate output is complicated by the endogeneity of the former variable. Income inequality may be affected by countries' GDP per capita as well as other variables related to deep-rooted differences in countries' geography and history. We address this issue by estimating a panel model with country and time fixed effects. We instrument income inequality with variation in that variable not driven by GDP per capita.

The remainder of the paper is organized as follows. Section 2 reviews related literature. Section 3 discusses the data. Section 4 presents the econometric model. Section 5 discusses the empirical results. Section 6 concludes.

2. Related Literature

The literature on the relationship between income inequality and aggregate output is well established in economics and we refer the reader to Galor (2011) for an exhaustive survey. In this section we only discuss empirical papers that make an attempt to use plausibly exogenous variation in income inequality.

Galor et al. (2008) examine the impact that land inequality had on human capital for the United States at the beginning of the 20^{th} century using state level data. Instrumenting land inequality with the interaction between nationwide changes in the relative prices of agricultural crops and variation in climatic characteristics across states, the authors find that inequality had on average a significant negative effect on human capital. According to Maddison (2013), the real GDP per capita of the United States at the beginning of the 20^{th} century was around 5,000USD. Using a value of (the natural logarithmn) 5,000USD and plugging it into our estimates, we find that the effect of inequality on education and GDP per capita is negative (see Section 5). Our panel estimates, which are based on a sample of 104 countries during 1970-2010, are therefore consistent with the results in Galor et al. (2008).

Easterly (2007) uses the abundance of land suitable for growing wheat relative to that suitable for growing sugarcane as an instrument for income inequality in a cross-section of 104 countries. He finds that inequality has a significant negative average effect on GDP per capita, as we do. Easterly does not explore how the impact of income inequality on GDP per capita varies depending on countries' initial level of development. In contrast to our panel analysis, the results in Easterly are driven exclusively by cross-country variation.

There exist a number of empirical studies using panel data which instrument inequality using internal instruments (i.e. lagged values of inequality). Examples are Forbes (2000), Panizza (2002), Banerjee and Duflo (2003), Voitchovsky (2005), and Halter et al. (2014). Unfortunately, none of these papers address the important issue of whether the instruments for inequality are relevant. As noted in Bound et al. (1995), IV regressions based on weak instruments lead to inconsistent estimates. It should, furthermore, be pointed out that none of the papers that use an IV approach in a panel context explores how the impact of income inequality on GDP per capita depends on countries' initial level of economic development.

3. Data

Income Inequality. The main indicators of income inequality -- the Gini coefficient and the share of income held by the 1st, 2nd, 3rd, 4th and 5th quintiles -- are taken from Brueckner et al. (2015). Brueckner et al.'s (2015) primary data source is the UN-WIDER World Income Inequality Database, supplemented with data from the World Bank’s POVCALNET database for developing countries. According to Brueckner et al. (2015), comparability between the two data sources is ensured by making adjustments to the data sets for individual countries so that the income (or consumption) shares consistently correspond to those of a consumption (or income) survey. The authors drop duplicates as well as survey-years with inferior data quality from the WIID, survey-years for which no extra information (consumption/income) is available; and survey-years for which the income shares add up to less than 99 or more than 101. As robustness checks on our main source of income inequality data, we will present estimates based on the Gini income inequality coefficient and income shares of the 1st, 2nd, 3rd, 4th, and 5th quintiles provided by WDI (2014).

Other Data. Data on real GDP per capita and investment are from the Penn World Tables (Heston et al., 2012). Data on the average years of schooling and the share of population with secondary and tertiary education are from Barro and Lee (2010). Descriptive statistics for the above variables are provided in Appendix Table 1. For a list of the countries in the sample, see Appendix Table 2.

4. Estimation Framework

Following the empirical literature on the impact of income inequality on economic growth (e.g. Forbes, 2000), the baseline econometric model is:

(1) $\ln(y)_{it} - \ln(y)_{it-1} = a_i + b_t + \theta_1 Inequality_{it} + \theta_2 Inequality_{it} * \ln(y_{i1970}) + \varphi \ln(y)_{it-1} + u_{it}$

where $\ln(y)_{it}$ stands for the natural logarithmn of real GDP per capita in country i and period t; $\ln(y_{i1970})$ is the natural logarithmn of country i's GDP per capita at the beginning of the sample, i.e. in 1970[2]; a_i are country fixed effects; b_t are time fixed effects; u_{it} is an error term. We note that this equation can be re-written as:

(1') $\ln(y)_{it} = a_i + b_t + \theta_1 Inequality_{it} + \theta_2 Inequality_{it} * \ln(y_{i1970}) + (1+\varphi)\ln(y)_{it-1} + u_{it}$

We estimate equation (1') with 5-year non-overlapping panel data. The panel comprises 104 countries during the period 1970-2010. This is the largest possible 5-year non-overlapping sample given the availability of data on GDP per capita and income inequality. Our measures of income inequality are the Gini coefficient and the income shares accruing to the 1st, 2nd, 3rd, 4th, and 5th quintiles.

The parameter φ captures the convergence rate over a 5-year period. The contemporaneous effect of a within-country change in inequality on the natural logarithmn of GDP per capita is captured by $\theta_1 + \theta_2 * \ln(y_{i1970})$. If φ is significantly negative, so that $1+\varphi$ is below unity in absolute

[2] The term, $\ln(y_{i1970})$, does not appear in the econometric model because it is implicitly contained in the country fixed effects, a_i.

value (i.e. there is convergence), then the long-run effect on the level of GDP per capita is given by $(\theta_1+\theta_2*\ln(y_{i1970}))/-\varphi$.

An important issue in the estimation of equation (1') is the endogeneity of inequality to within-country changes in GDP per capita. Brueckner et al. (2015) use an instrumental variables estimation to identify the effect of GDP per capita on inequality within countries. Their instrumental variables for GDP per capita are trade-weighted world income and the interaction between the international oil price and countries' net-export shares of oil in GDP. Specification tests reported by the authors indicate that these are valid. According to Brueckner et al. within-country variations in GDP per capita have a significant negative effect on income inequality. That is, in the equation below α is negative:

(2) $$\text{Inequality}_{it} = e_i + f_t + \alpha \ln(y)_{it} + \varepsilon_{it}$$

The negative coefficient on GDP per capita is consistent with theories of the relationship between income inequality and growth when credit markets are imperfect, see e.g. Galor and Zeira (1993). Quantitatively, Brueckner et al. (2015) estimate α to be around -0.08 for the Gini coefficient; i.e. a 1 percent increase in real GDP per capita reduces the Gini coefficient by around 0.08 percentage points. The authors also provide estimates of the response of the income quintiles to within-country changes in GDP per capita.

If α is negative in equation (2) then the least squares estimate of θ in equation (1') is downward biased. That is, least squares estimation is biased towards finding a negative effect of income inequality on GDP per capita. We note that instrumental variables estimates based on weak instruments suffer from a similar bias (i.e. Bound et al., 1995). In order to correct for endogeneity bias of θ in the estimation of equation (1') we construct an inequality variable that is adjusted for the impact that GDP per capita has on inequality, i.e. $Z_{it} = \text{Inequality}_{it} - \alpha\ln(y)_{it}$. This instrument is, by construction, uncorrelated with the natural logarithmn of GDP per capita.[3] Using Z as an

[3] An analogous instrumental variables strategy has been used in the macro literature on fiscal policy, see e.g. Blanchard and Perotti (2002) or Fatas and Mihov (2003). Brueckner (2013) applies this instrumental variables

instrument for inequality thus cleans the estimate of reverse causality bias.

Another issue in the estimation of equation (1) is that the presence of the country fixed effects implies a bias. Nickel (1981) showed that in the dynamic panel estimation, i.e. where lagged GDP per capita is included as a regressor on the right-hand side, the coefficients are biased (the bias is inversely related to T). We address this issue in two ways. First, we present estimates from a static panel model. In the static panel model inequality is instrumented with Z. In that model, the presence of the country fixed effects cause no bias. Second, we present estimates from a dynamic panel model with country fixed effects where we use the system-GMM estimator. In the system-GMM estimation we instrument the lagged dependent variable with its lag in addition to instrumenting income inequality with Z.

5. Results

5.1 Baseline Results

We begin by discussing instrumental variables estimates from the static panel model. In the statistic panel model the natural logarithmn of real GDP per capita is regressed on measures of income inequality. The control variables are country and time fixed effects (jointly significant at the 1 percent level). Table 1 presents the relevant results. The table shows that the within-country effect of income inequality on GDP per capita varies depending on countries' initial level of GDP per capita. This can be seen, for example, in column (1) where the two-stage least squares estimate on the Gini coefficient is positive and significant at the 1 percent level; the interaction term between the Gini coefficient and initial GDP per capita is positive and significant at the 1 percent level. Looking at the income shares, we see that the estimated coefficients on the income shares accruing to the 1st, 2nd, 3rd, and 4th quintiles are negative while the interaction with initial GDP per capita is positive; the opposite is the case for the coefficient on the 5th income quintile.

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strategy to estimating the effect of foreign aid on economic growth.

In terms of instrument relevance, we note that the first-stage Kleibergen Paap F-statistic is well in excess of 10 (17) so that according to the tabulations provided in Stock and Yogo (2005) we can reject the hypothesis that the IV size distortion is larger than 15 (10) percent at the 5 percent significance level. In Figure 1 we plot the relationship between the Gini coefficient (net of country and time fixed effects) and the instrument -- i.e. the Gini coefficient adjusted for the impact of GDP per capita (also net of country and time fixed effects). As can be seen the relationship is positive and highly significant.

In Table 2 we present estimates from a dynamic panel model that includes the one-period lag of GDP per capita on the right-hand side. Panel A shows two-stage least squares estimates where inequality is instrumented with the residual variation in inequality that is not due to GDP per capita. Panel B shows system-GMM estimates where the lagged dependent variable is instrumented with its second and third lag; inequality continues to be instrumented with the residual variation in inequality that is not due to GDP per capita.

Several findings emerge that are worthwile pointing out. First, the message from the dynamic panel estimates is qualitatively the same as from the static panel estimates: income inequality has a significant positive effect on GDP per capita for low levels of initial GDP per capita; the effect is significantly negative for intermediate and high levels of initial GDP per capita. Second, there is evidence of significant within-country convergence in GDP per capita: the AR(1) coefficient on GDP per capita is in the range of 0.7-0.8; this suggests that in the sample the per annum convergence rate of GDP per capita is in the range of 4-6 percent. Third, 2SLS regressions provide estimates that are quantitatively similar to system-GMM regressions. Fourth, the size of the contemporaneous (five year) and long-run effect of income inequality on GDP per capita is substantial.

Consider, for example, the estimates in column (1) of Panel A in Table 2. When evaluated at the sample mean (median) of the natural logarithmn of GDP per capita in 1970[4] the marginal effect of a change in the Gini on the natural logarithmn of GDP per capita is equal to -1.13 (-0.97). Its standard error is 0.42 (0.41). These numbers should be read as a one percentage point increase in the Gini coefficient reducing GDP per capita over a five year period by around 1 percent. The long-run effect is larger and amounts to about 4 percent.

Figure 2 displays graphically how the marginal effect of a change in the Gini coefficient on the natural logarithmn of GDP per capita varies across countries' initial GDP per capita. The x-axis displays values of initial GDP per capita that fall in between the sample minimum and maximum. As can be seen, for low values of initial GDP per capita the effect of income inequality on GDP per capita is positive, while for high and intermediate values of initial GDP per capita it is negative. The marginal effect of the GINI becomes zero at around $665 PPP-adjusted U.S. dollars per capita in 1970 (equivalent to log of GDP per capita of 6.5).

5.2. Robustness

Table 3 shows that our baseline estimates are robust to the use of alternative income inequality data. We use the inequality data discussed in Section 3 for our baseline regressions because these data provide us with the largest number of country-year observations. In column (1) of Table 3, we present instrumental variables estimates based on the Gini coefficient provided by WDI (2014); the remaining columns use the shares of income accruing to the 1st, 2nd, 3rd, 4th, and 5th quintiles. The estimate on the Gini coefficient is positive and significant at the 1 percent level; the interaction term between the Gini coefficient and initial GDP per capita is negative and significant at the 1 percent level. Looking at the income shares, we see that the estimated coefficients on the income shares accruing to the 1st, 2nd, 3rd, and 4th quintiles are negative while the coefficients on the interaction terms between the 1st, 2nd, 3rd, and 4th quintiles and initial GDP per capita are positive; the opposite

[4] The sample mean (median) of the natural logarithmn of GDP per capita in 1970 is 6.82 (6.78).

is the case for the coefficient on the 5th income quintile and its interaction with initial GDP per capita. Estimates based on the WDI income inequality data thus confirm the message from our baseline regressions: increases in income inequality increase GDP per capita in poor countries but decrease it in rich countries.

Table 4 shows that our main finding holds for the sub-sample of countries located in Latin America and the Caribbean. These economies are notorious for their relatively high levels of inequality. For example, of the top 10 countries with the highest Ginis, 7 are from Latin America and the Caribbean in 2000-2010. Table 4 shows that for the sub-sample of countries located in Latin America and the Caribbean, the coefficient on the interaction between the Gini coefficient and initial GDP per capita is significantly negative; this is also the case for the 5th income quintile. On the other hand, the coefficients on the interactions between initial GDP per capita and the income shares of the 1st, 2nd, 3rd, and 4th quintiles are significantly positive. We note that in terms of instrument strength the F-statistic continues to be above 10 for the majority of columns in Table 4; however it is below 10 in columns (4) and (5). The lower F-statistic is expected because the sample size is smaller.

Table 5 reports estimates for the pre- and post-1990 period. The split between pre- and post-1990 period is of interest because it allows to examine whether the estimated coefficients are stable over time. The year 1990 marks the mid-point in the time period over which the model is estimated so it is a natural point to check for stability of coefficients. The main message of Table 5 is that the heterogeneous effect of income inequality on GDP per capita between rich and poor countries is present in both periods.

5.3. Effects on Investment and Human Capital

In the Galor and Zeira (1993) model the mechanism through which income inequality affects aggregate output is through investment, in particular, investment in human capital. In this section we present estimates from an interaction model where the dependent variables are the investment-to-GDP ratio and the average years of schooling. The results in this section should be read as evidence on the channels through which income inequality affects aggregate output.

Table 6 documents the effects of income inequality on the investment-to-GDP ratio. Column (1) shows that the marginal effect of a within-country change in the Gini coefficient on investment is significantly declining in countries' initial GDP per capita. For example, at sample mean initial GDP per capita the effect of a one percentage point increase in the Gini coefficient on the investment-to-GDP ratio is -0.23 percentage points (s.e. 0.13 percentage points). At the 25^{th} percentile of initial GDP per capita the effect is 0.75 percentage points (s.e. 0.24 percentage points); at the 75^{th} percentile of initial GDP per capita it is -1.34 (s.e. 0.36 percentage points). Hence, increases in income inequality lead to a higher (lower) investment-to-GDP ratio in poor (rich) countries. Columns (2)-(6) of Table 6 show that the same message arises when using data on the income quintiles.

Table 7 presents estimates of the effect that income inequality has on the average years of schooling. Column (1) shows that the marginal effect of a within-country change in the Gini coefficient on schooling is significantly declining in countries' initial GDP per capita. For example, at sample mean initial GDP per capita, the effect of a one percentage point increase in the Gini coefficient on the average years of schooling is -0.029 years (s.e. 0.008). At the 25^{th} percentile of initial GDP per capita the effect is 0.0022 years (s.e. 0.011 percentage points); at the 75^{th} percentile of initial GDP per capita it is -0.064 (s.e. 0.022). Hence, income inequality is detrimental for human capital accumulation at relatively high levels of GDP per capita. Columns (2)-(6) of Table 7 show that the same message arises when using data on the income quintiles.

Table 8 examines robustness of the schooling results to using alternative measures of education. Columns (1)-(4) report estimates for the share of population with secondary schooling and tertiary schooling. For both measures we find that the effect of income inequality is significantly decreasing with countries' initial GDP per capita. Quantitatively the estimated effects are sizable. Consider, for example, the estimates in column (1) of Table 8. At sample mean initial GDP per capita, the effect of a one percentage point increase in the Gini coefficient on the share of population with secondary education is -0.23 percentage points (s.e. 0.09 percentage points). At the 25th percentile of initial GDP per capita the effect is 0.20 percentage points (s.e. 0.13 percentage points); at the 75th percentile of initial GDP per capita it is -0.72 percentage points (s.e. 0.26 percentage points). For tertiary education the effects are somewhat smaller but still statistically significant. For example, the estimates in column (3) of Table 8 imply that at sample mean initial GDP per capita the effect of a one percentage point increase in the Gini coefficient on the share of population with tertiary education is -0.05 percentage points (s.e. 0.05 percentage points); at the 25th percentile of initial GDP per capita the effect is 0.16 percentage points (s.e. 0.07 percentage points); and at the 75th percentile of initial GDP per capita it is -0.30 percentage points (s.e. 0.13 percentage points).

5.4 Extensions

In this section we consider two extensions of our baseline econometric model. The first extension is to interact initial (i.e. 1970) average years of schooling with income inequality. If schooling is a key determinant of GDP per capita then we should find similar results to those in Section 5.1. The second extension is to include in the model an interaction between income inequality and the GDP share of government expenditures (in addition to an interaction between schooling and income inequality). This extension allows to examine the question of whether initial cross-country differences in schooling have an effect on the impact that income inequality has on GDP per capita, independently of a relationship between schooling and the size of government.

Table 9 presents estimates from an econometric model where initial (i.e. 1970) average years of schooling in the population are interacted with income inequality. The estimated coefficient (standard error) on the interaction term between average years of schooling and the Gini coefficient is -0.49 (0.09), see column (1). This suggests that the marginal effect of income inequality on GDP per capita growth is significantly decreasing in countries' initial level of human capital. The same message is obtained when considering the income quintiles, see columns (2)-(6).

To illustrate the implied difference in marginal effects, it is useful to consider some specific values of the average years of schooling in the sample. At the 25th percentile, the average years of schooling is around 4.2 years. Plugging the value of 4.2 into the estimates shown in column (1) of Table 9 yields a predicted marginal effect of 0.51 with a standard error of 0.18.; that is, a one percentage point increase in the Gini coefficient increases GDP per capita by around 0.5 percent. Consider now the sample median of average years of schooling. The sample median is around 6.4 years. The predicted marginal effect (standard error) at the median value of schooling is -0.56 (0.22). It is also instructive to consider the effect at the 75th percentile. At the 75^{th} percentile the value for average years of schooling is around 8.6 years. The predicted marginal effect (standard error) is in that case -1.64 (0.39).

In Table 10 we document the robustness of the interaction between initial years of schooling and inequality to restricting the sample to: (i) Asia (column (1)); (ii) Latin America and the Caribbean (column (2)); the pre-1990 period (column (3)); and the post-1990 period (column (4)). As can be seen from Table 10, the coefficient on the Gini coefficient is significantly positive while the coefficient on the interaction between the Gini coefficient and schooling is significantly negative.

Table 11 reports estimates from an econometric model that includes an interaction between income inequality and schooling as well as an interaction between income inequality and government size (as measured by the GDP share of government expenditures). The table shows that there is a negative interaction effect between income inequality and the size of government. Hence, income inequality is less conducive for GDP per capita growth in countries with a higher share of government expenditures in GDP. Importantly, the table shows that the interaction between income inequality and schooling remains negative and significant when controlling for an interaction between income inequality and government size.

6. Conclusion

This paper provided panel estimates of the within-country effect that income inequality has on GDP per capita. Motivated by the theoretical work of Galor and Zeira (1993), which examined the relationship between income inequality and aggregate output in the presence of credit market imperfections and indivisibilities in human capital investment, our econometric model included an interaction between measures of income inequality and countries' initial level of GDP per capita. Our instrumental variables estimates showed that income inequality has a significant negative effect on aggregate output for the average country in the sample. However, for poor countries income inequality has a significant positive effect. We documented that this heterogeneity is also present when considering investment, in particular, investment in human capital, as a channel through which inequality affects aggregate output. Overall, our empirical results provide support for the hypothesis that income inequality is beneficial for economic growth in poor countries, but that it is detrimental for economic growth in advanced economies.

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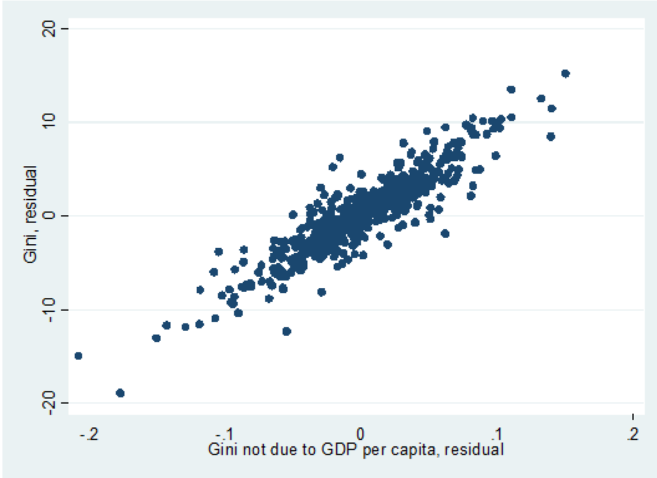
Figure 1. Relationship between Gini coefficient and the Gini coefficient net of GDP per capita



Note: *Gini, residual* refers to the Gini coefficient net of country and year fixed effects. *Gini coefficient not due to GDP per capita residual* refers to the gini coefficient net of country and year fixed effects, and adjusted for the effect that GDP per capita has on the gini coefficient.

Figure 2: Marginal effect of inequality on GDP per capita as a function of initial (1970) GDP per capita

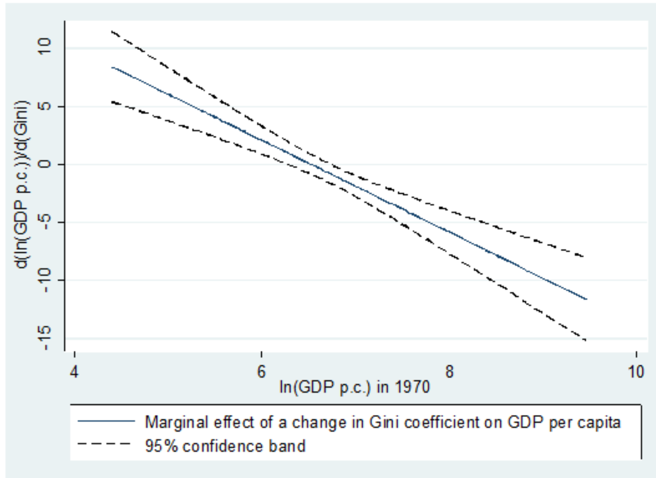


Table 1. Effects of Income Inequality on GDP per capita: The Role of Initial Income (Static Interaction Model)

Dependent Variable is:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	64.55***	-194.23***	-201.23***	-243.46***	-263.23**	85.86***
	(12.89)	(32.58)	(38.62)	(49.45)	(75.47)	(18.50)
Inequality * ln(GDP per capita in 1970)	-9.92***	28.25***	30.33***	37.10***	39.68***	-13.28***
	(1.94)	(4.70)	(5.75)	(7.43)	(11.86)	(2.81)
Kleibergen Paap F-Stat	34.28	64.05	43.31	34.34	15.80	27.83
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 2. Effects of Income Inequality on GDP per capita: The Role of Initial Income (Dynamic Interaction Model)

Dependent Variable is:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
	Panel A: 2SLS					
Inequality	25.80***	-78.28***	-79.55***	-94.61***	-103.32***	33.91***
	(4.23)	(11.51)	(12.21)	(16.27)	(25.04)	(5.97)
Inequality * ln(GDP per capita in 1970)	-3.95***	11.35***	11.90***	14.34***	15.56***	-5.23***
	(0.63)	(1.64)	(1.80)	(2.42)	(3.97)	(0.90)
Lagged ln(GDP per capita)	0.74***	0.75***	0.76***	0.76***	0.75***	0.75***
	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Kleibergen Paap F-Stat	76.81	160.78	119.80	76.66	6.12	59.82
	Panel B: Sys-GMM					
Inequality	22.73***	-75.73***	-71.94***	-79.36***	-79.37***	28.50***
	(3.05)	(9.16)	(8.46)	(10.80)	(12.22)	(4.08)
Inequality * ln(GDP per capita in 1970)	-3.49***	10.97***	10.79***	11.95***	11.74***	-4.39***
	(0.47)	(1.33)	(1.28)	(1.65)	(1.81)	(0.63)
Lagged ln(GDP per capita)	0.70***	0.68***	0.72***	0.71***	0.65***	0.71***
	(0.09)	(0.08)	(0.08)	(0.09)	(0.11)	(0.10)
AR(1), p-value	0.00	0.02	0.00	0.00	0.00	0.00
AR(2), p-value	0.32	0.05	0.13	0.22	0.99	0.48
Sargan, p-value	0.59	0.95	0.53	0.98	0.32	0.50
	Controls and Number of Observations in Panels A and B					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation in Panel A is two-stage least squares; Panel B system-GMM. Huber robust standard errors (shown in parentheses) are clustered at the country level. In Panels A and B the (external) instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. Panel B uses as (internal) instrument for lagged GDP per capita the second and third lag. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 3. Effects of Income Inequality on GDP per capita: The Role of Initial Income (WDI Inequality Data)

Dependent Variable is:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	55.41***	-269.89***	-219.91***	-195.78***	-175.52***	61.52***
	(13.72)	(71.25)	(55.09)	(45.82)	(37.20)	(14.76)
Inequality * ln(GDP per capita in 1970)	-9.10***	44.34***	44.74***	53.16***	27.59***	-9.97***
	(2.26)	(11.74)	(16.98)	(14.58)	(5.89)	(2.40)
Lagged ln(GDP per capita)	0.45***	0.33*	0.36***	0.32***	0.67***	0.49***
	(0.17)	(0.18)	(0.09)	(0.07)	(0.10)	(0.06)
Kleibergen Paap F-Stat	18.46	15.78	17.95	21.70	33.20	33.20
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	296	296	296	296	296	296

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 4. Effects of Income Inequality on GDP per capita: The Role of Initial Income (Latin America and the Caribbean)

Dependent Variable is:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	117.32***	-387.32***	-279.93***	-534.85***	-519.66***	157.27***
	(31.80)	(77.39)	(68.27)	(178.56)	(236.08)	(48.93)
Inequality * ln(GDP per capita in 1970)	-16.69***	55.09***	39.40***	75.40***	73.54***	-22.37***
	(4.56)	(11.04)	(9.77)	(25.25)	(33.58)	(7.01)
Lagged ln(GDP per capita)	0.50***	0.54***	0.51***	0.70***	0.53**	0.52***
	(0.14)	(0.11)	(0.12)	(0.22)	(0.18)	(0.16)
Kleibergen Paap F-Stat	14.98	31.66	21.97	9.74	5.10	10.98
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	153	153	153	153	153	153

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 5. Effects of Income Inequality on GDP per capita: The Role of Initial Income

(Pre- vs. Post-1990 Period)

Dependent Variable is:	ln(GDP per capita)					
	Panel A: Post-1990					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	21.39***	-66.45***	-71.98***	-72.52***	-116.97***	28.95***
	(3.80)	(11.75)	(12.99)	(17.04)	(28.75)	(5.60)
Inequality * ln(GDP per capita in 1970)	-3.50***	10.20***	11.53***	11.73***	19.58***	-4.81***
	(0.65)	(1.84)	(2.14)	(2.85)	(4.73)	(0.91)
Lagged ln(GDP per capita)	0.42***	0.36***	0.41***	0.45***	0.53***	0.44***
	(0.08)	(0.07)	(0.07)	(0.08)	(0.10)	(0.08)
Kleibergen Paap F-Stat	67.34	129.80	93.85	49.81	28.94	54.04
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	292	292	292	292	292	292
	Panel B: Pre-1990					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	42.00***	-121.10***	-96.34***	-167.50***	-96.89**	52.72*
	(19.94)	(44.43)	(30.91)	(81.26)	(48.97)	(27.78)
Inequality * ln(GDP per capita in 1970)	-6.09**	17.15***	13.78***	24.03**	13.59**	-7.67**
	(2.78)	(6.05)	(4.23)	(11.37)	(6.81)	(3.89)
Lagged ln(GDP per capita)	0.66***	0.68***	0.65***	0.70***	0.60***	0.65***
	(0.17)	(0.12)	(0.12)	(0.18)	(0.17)	(0.18)
Kleibergen Paap F-Stat	6.92	17.52	23.06	6.80	7.46	5.30
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	202	202	202	202	202	202

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 6. Effects of Income Inequality on Investment: The Role of Initial Income

Dependent Variable is:	Investment/GDP					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	6.63***	-18.83***	-20.40***	-25.72***	-28.12***	8.83***
	(1.74)	(5.02)	(5.44)	(6.52)	(8.74)	(2.36)
Inequality * ln(GDP per capita in 1970)	-1.01***	2.76***	3.06***	3.87***	4.17***	-1.35***
	(0.26)	(0.73)	(0.81)	(0.98)	(1.34)	(0.36)
Kleibergen Paap F-Stat	34.28	64.05	43.31	34.34	15.80	27.83
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 7. Effects of Income Inequality on Human Capital: The Role of Initial Income

Dependent Variable is:	Average Years of Schooling					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	18.92**	-33.20	-63.65**	-87.34**	-60.48	26.43**
	(9.62)	(29.58)	(30.79)	(35.97)	(41.11)	(12.65)
Inequality * ln(GDP per capita in 1970)	-3.22**	5.73	10.89**	14.68**	9.55	-4.47**
	(1.49)	(4.38)	(4.74)	(5.54)	(6.27)	(1.97)
Kleibergen Paap F-Stat	34.28	64.05	43.31	34.33	15.80	27.83
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 8. Effects of Income Inequality on Human Capital: The Role of Initial Income
(Robustness Alternative Measures of Human Capital)

	(1)	(2)	(3)	(4)
Dependent Variable is Share of Population with:	Secondary Education	Completed Secondary Education	Tertiary Education	Completed Tertiary Education
Gini	2.80**	2.57***	1.48**	0.81**
	(1.12)	(0.89)	(0.57)	(0.31)
Gini * ln(GDP per capita in 1970)	-0.45**	-0.41***	-0.22**	-0.12**
	(0.17)	(0.14)	(0.09)	(0.04)
Kleibergen Paap F-Stat	34.28	34.28	34.28	34.28
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 9. Effects of Income Inequality on GDP per capita: The Role of Initial Human Capital

Dependent Variable is:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	2.57***	-9.27***	-9.36***	-9.25***	-10.36***	3.13***
	(0.48)	(1.84)	(1.56)	(1.84)	(2.08)	(0.61)
Inequality interacted with	-0.49***	1.55***	1.68***	1.74***	2.00***	-0.62***
Years of Schooling in 1970	(0.09)	(0.31)	(0.30)	(0.38)	(0.45)	(0.13)
Lagged ln(GDP per capita)	0.75***	0.76***	0.75***	0.74***	0.73***	0.75***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Kleibergen Paap F-Stat	870.24	1785.57	1708.59	996.34	576.55	662.74
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 10. Effects of Income Inequality on GDP per capita: The Role of Initial Human Capital
(Robustness Asia, LAC, Pre vs. Post 1990 Period)

Dependent Variable is:	ln(GDP per capita)			
	(1)	(2)	(3)	(4)
	Asia	LAC	Pre 1990	Post 1990
Gini	2.61***	9.92***	3.19***	2.06***
	(1.04)	(2.26)	(1.20)	(0.52)
Gini interacted with Years of Schooling in 1970	-0.60**	-2.07***	-0.71***	-0.43***
	(0.26)	(0.48)	(0.24)	(0.13)
Lagged ln(GDP per capita)	0.83***	0.48***	0.60***	0.39***
	(0.07)	(0.08)	(0.10)	(0.07)
Kleibergen Paap F-Stat	165.82	83.86	147.61	690.90
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	87	130	202	292

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 11. Effects of Income Inequality on GDP per capita:
(Interaction Model with Initial Human Capital and Government Size)

Dependent Variable:	ln(GDP per capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Inequality Variable is:	Gini	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Inequality	2.84***	-10.42***	-9.33***	-8.58***	-9.45***	3.29***
	(0.50)	(1.83)	(1.51)	(1.56)	(2.15)	(0.61)
Inequality interacted with Years of Schooling in 1970	-0.22***	0.82***	0.69***	0.66***	0.83***	-0.25***
	(0.05)	(0.18)	(0.17)	(0.23)	(0.38)	(0.07)
Inequality interacted with Government Cons./GDP in 1970	-9.71***	39.74***	32.46***	31.23**	33.59**	-11.23***
	(3.34)	(11.01)	(11.19)	(12.29)	(13.07)	(4.03)
Lagged ln(GDP per capita)	0.74***	0.76***	0.74***	0.74***	0.75***	0.74***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
Kleibergen Paap F-Stat	44.43	105.45	70.32	39.29	17.24	29.86
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	494	494	494	494	494

Note: The method of estimation is two-stage least squares. Huber robust standard errors (shown in parentheses) are clustered at the country level. The instrument for income inequality is the residual variation in inequality that is not due to GDP per capita. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Appendix Table 1. Descriptive Statistics

Variable	Source	Mean	Standard deviation
Gini	Brueckner et al. (2014)	0.39	0.11
1st Quintile Income Share	Brueckner et al. (2014)	0.07	0.02
2nd Quintile Income Share	Brueckner et al. (2014)	0.11	0.03
3rd Quintile Income Share	Brueckner et al. (2014)	0.15	0.03
4th Quintile Income Share	Brueckner et al. (2014)	0.21	0.02
5th Quintile Income Share	Brueckner et al. (2014)	0.46	0.10
Gini	WDI (2014)	0.41	0.11
1st Quintile Income Share	WDI (2014)	0.06	0.02
2nd Quintile Income Share	WDI (2014)	0.10	0.03
3rd Quintile Income Share	WDI (2014)	0.15	0.02
4th Quintile Income Share	WDI (2014)	0.21	0.02
5th Quintile Income Share	WDI (2014)	0.48	0.08
Ln GDP per capita	Heston et al. (2012)	6.82	1.09
Investment/GDP	Heston et al. (2012)	0.23	0.09
Average Years of Schooling	Barro and Lee (2010)	6.45	2.67
Share of Pop. Secondary Education	Barro and Lee (2010)	0.32	0.17
Share of Pop. Completed Secondary Education	Barro and Lee (2010)	0.15	0.11
Share of Pop. Tertiary Education	Barro and Lee (2010)	0.08	0.07
Share of Pop. Completed Tertiary Education	Barro and Lee (2010)	0.05	0.04

Appendix Table 2. List of Countries in Sample

Albania	Nicaragua	Norway
Algeria	Niger	Pakistan
Australia	Guatemala	Panama
Austria	Guyana	Papua New Guinea
Bangladesh	Haiti	Paraguay
Barbados	Honduras	Peru
Belgium	Hungary	Philippines
Benin	India	Poland
Bolivia	Indonesia	Portugal
Botswana	Iran	Republic of Moldova
Brazil	Ireland	Rwanda
Bulgaria	Israel	Senegal
Burundi	Italy	Sierra Leone
Cambodia	Jamaica	Singapore
Cameroon	Japan	South Africa
Canada	Jordan	Spain
Central African Republic	Kenya	Sri Lanka
Chile	Korea, Rep.	Swaziland
Colombia	Laos	Sweden
Congo, Rep.	Lesotho	Switzerland
Costa Rica	Liberia	Tanzania
Cote dIvoire	Luxembourg	Thailand
Cuba	Malawi	Togo
Denmark	Malaysia	Trinidad and Tobago
Dominican Republic	Mali	Tunisia
Ecuador	Mauritania	Turkey
Egypt, Arab Rep.	Mauritius	USA
El Salvador	Mexico	Uganda
Fiji	Mongolia	United Kingdom
Finland	Morocco	Uruguay
France	Mozambique	Venezuela
Gabon	Namibia	Vietnam
Gambia	Nepal	Zambia
Ghana	Netherlands	Zimbabwe
Greece	New Zealand	