Economic Growth and Poverty Alleviation: A reconsideration of Dollar and Kraay.

by

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This is work in progress and further comments are welcome

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Abstract

The Dollar and Kraay (2000) paper has proved to be remarkably influential with many of its conclusions widely quoted, particularly in support of the open market policies of the 'Washington consensus'. However, although there have been a number of critical commentaries there have been very few formal analyses of the results or of the robustness of the support which they provide for the policy conclusions. In this paper the Dollar and Kraay results are investigated from a number of different perspectives. First, a number of questions are raised about the approach adopted. In particular, the Dollar and Kraay paper is notable for having no theoretical structure supporting the specification of the equations. It is unclear how much significance therefore can be attached to the correlations uncovered. In addition, there are the well-known difficulties of drawing conclusions from large cross section samples as well as the attendant problems of data quality. Finally, the identification of poverty with the income of the lowest quintile does not map into either an absolute or relative measure of poverty. There are thus grounds for an initial scepticism. However, this paper then considers in some detail the precise results reported in Dollar and Kraay. The results are replicated and a number of experiments with different regressors and different samples are performed. It is found that the central result of a strong correlation between average per capita income and the income of the lowest quintile is robust and holds under all of the various regressions. However, a number of important caveats are noted. First, a similarly strong result is also found for the higher quintiles. One is entitled to wonder whether the regressions are picking up any movement in the distribution of income, which is known to have changed markedly in a number of countries. Second, the significance of the other regressors in Dollar and Kraay, upon which much of the policy support hinges, changes dramatically under different samples and equations. Although the negative impact of inflation is maintained in most, but not all, of the alternative experiments, the significance of the openness variable vanishes while the significance of the rule of law variable, for which Dollar and Kraay found no evidence, emerges strongly. In addition, when the Gini coefficient is substituted for the income of the bottom quintile the performance of the equation falls markedly, with, however, a strong negative correlation with average income suggesting that higher income reduces inequality. It is unclear how this result is consistent with the Dollar and Kraay findings. The implications of this paper are that in general the policy prescriptions associated with the Dollar and Kraay regressions cannot be sustained. In addition, the weakness of the variable chosen to measure poverty and the differing support provided in different specifications for the other regressors fully justifies the initial scepticism and invites further research in this area.

Introduction

In March 2000, a paper was released by the World Bank's Development Research Group (Dollar and Kraay, 2000, revised in 2001), which argued that the income of the poor rises one-for-one with overall growth. The analysis was based on a sample of 80 countries covering four decades and the poor were defined as the bottom one fifth of the income distribution.

This has proved to be a remarkably influential paper, which has been widely quoted (for example, World Bank, 2001, Chapter 3; DFID, 2000; Easterly, 2001) and has rapidly assumed the status of a new orthodoxy in development economics. This is not surprising in the sense that it would be difficult to find a reputable development economist who would deny the primacy of economic growth in poverty alleviation. It has generally been taken for granted that economic growth was a necessary but not a sufficient condition for the achievement of generally agreed upon development objectives, among which poverty reduction has a high priority. As Rodrik (2000, p.8) has noted, growth and poverty reduction go largely hand in hand, although "…the magnitude of the poverty reduction payoff from growth depends, in part, on a country's specific circumstances and policies" (in large part relating to policies with respect to income distribution). In this respect, "…the observed correlation between growth and poverty reduction tells us little of interest as far as policy choices and priorities are concerned" (Rodrik, 2000, p.9).

In this paper we present first a critical overview of Dollar and Kraay and point to a number of important shortcomings in both theory and analysis. We note in particular the limited value of the lowest quintile as a measure of either absolute or relative poverty. We then replicate the Dollar and Kraay results, using their own data set and note a number of limitations on the conclusions which they draw. A number of alternative specifications are then applied to the data and some interesting results reported. In particular, while the central result of a strong correlation between average per capita income and the income of the lowest quintile is maintained, this results holds for the other quintiles. This suggests that the analysis is failing to capture any of the large

changes in distribution which are known to have taken place in several of the world's major economies. In addition, the variables which Dollar and Kraay base their policy conclusions are found to be much less robust to changes in the specification of the equations. In general, apart from the impact of the rule of law and, on most occasions inflation, all of the other variables are found to be statistically insignificant.

Our work to date suggests that Dollar and Kraay's work must be integrated with the pre-existing body of literature on income distribution and growth. In particular, it must be made consistent with the case studies of individual countries which suggest a much more complex relationship between poverty, inequality and economic growth. Our work also suggests the utility of further empirical investigation of the relationship between inequality, poverty and growth which makes use of more appropriate measures of poverty and a clearer distinction between the notions of poverty and inequality.

Dollar and Kraay (2000;2001): An Overview

Dollar and Kraay (2000) investigate the link between the income of the poor and overall income (per capita GDP at ppp in 1985 international dollars). As noted above, the data set covers 80 countries over four decades and the poor are defined as the bottom one fifth of the income distribution. The main conclusions of the paper are as follows:

- The income of the poor rises one-for-one with overall growth and the effect of growth on the income of the poor is no different in poor countries than in rich countries;
- The incomes of the poor do not fall more than proportionately during economic crises;
- The poverty-growth relationship has not changed in recent years;
- Openness to foreign trade benefits the poor to the same extent that it benefits the whole economy;
- Good rule of law and fiscal discipline benefit the poor to the same extent that they benefit the whole economy;

- The avoidance of high inflation is "super-pro-poor";
- No evidence is found that formal democratic institutions or public spending on health and education have systematic effects on the incomes of the poor;
- There is no empirical evidence to support the Kuznet's hypothesis; the available evidence suggests that income distributions are relatively stable over time.

Dollar and Kraay (2000, p.27) argue that "What we learn is that growth generally does benefit the poor and that anyone who cares about the poor should favour the growth enhancing policies of good rule of law, fiscal discipline, and openness to international trade" Furthermore, "This is not some process of "trickle down", which suggests a *sequencing* in which the rich get richer first and eventually benefits trickle down to the poor. The evidence, to the contrary, is that private property rights, stability, and openness directly create a good environment for poor households to increase their production and income" (p.6).

Critique

The first task is to take a critical look at the Dollar-Kraay findings. Weisbrot et al (2000) present a number of criticisms and argue that the research "misses the mark in several crucial aspects", the important question being the causes of the slowdown in global economic growth over the past two decades, and the possible role of the IMF and World Bank in that slowdown. Wade (2001) refers to the Dollar-Kraay paper in the context of tensions and disagreements in the World Bank over the 2000-2001 World Development Report, but does not criticise the Dollar-Kraay paper as such.. One of the important critical perspectives flows from reliance of Dollar and Kraay on cross country regressions. Although applied to a different context Srinivasan and Bhagwati (2001) provide a useful re-iteration of the limitations of inferences based on cross country regression which applies *pari passu* to Dollar-Kraay.

The main criticisms of Dollar-Kraay which have appeared to date are as follows:

- The policy conclusions inferred by Dollar and Kraay from their regressions are not persuasive as in most cases the results are statistically insignificant.

- The paper has no theoretical underpinnings or foundations; that is, presumed relationships are not derived from any theoretical models. Why should there be a one-to-one relationship between increases in per capita income and the income of the poor?

- The study is based on cross- country data, not time series data, although some countries have two observations. This tells us little about how individual countries will develop over time. Cross -country studies may indicate average trends but individual country experiences can and do differ quite significantly. In fact, the use of a cross country regression, based on the variability of income between countries, to infer the likely temporal variability as economies grow is a very strong assumption;

- Correlation does not imply causation; even if there is a relationship between the variable on the left hand side of the equation and the independent variables on the right hand side, it may run in both directions and the postulated regression is then one of a set of relationships characterising the interrelationships among jointly determined variables (Srinivasan and Bhagwati,2001);

- What happens to overall income distribution as per capita incomes grow? If it is the case as Dollar and Kraay assert, that income distributions do not change significantly over time, it must be the case that the income growth of every quintile is proportionate to the overall growth of GDP. Does such a scenario make sense? If, on the other hand, income distributions do change over time, and the evidence shows this to be the case in a number of economies, what causes such changes and what happens to the income of the poor when there are significant changes in the size distribution of income?

- The definition of poverty used by Dollar-Kraay is open to question. Taking the bottom quintile of the income distribution as an indication of the extent of poverty is inadequate, as it is neither a measure of absolute poverty (the headcount measure) nor is it necessarily an appropriate measure of relative poverty (which

takes income distribution into account). It tells us nothing about the relationship between the average income of the bottom 20 per cent of income recipients and the poverty line, and it cannot highlight changes that may occur in income distribution within the bottom quintile. Even if economic growth does benefit the poor, thus defined, on a one-to-one basis, the poor would still fall behind the rest of the population in absolute terms, a situation hardly acceptable in the longer run and inconsistent with any common sense notion of "pro-poor" economic growth.

- Care needs to be exercised with respect to the quality of the data used and the construction of proxies of critical explanatory variables (good government, for example). Cross country regressions are also critically dependent on the time period, sample of countries and variables chosen (Srinivasan   ).

Weisbrot at al (2000) in particular focus on measurement errors when estimating the incomes of the poor and systematic measurement problems giving a strong selection bias between and within countries. The problem within countries is particularly acute and relates to the measure of poverty referred to above. The identity of the bottom quintile of households will in part depend on economic conditions and will not be the same under all economic conditions (Weisbrot et al, 2000).

They are also critical of the openness index used by Dollar and Kraay, and further argue that the regressions show no direct relationship between openness and the incomes of the poor. If openness is good for poverty reduction it must have an indirect effect through growth, rather than a direct effect on poverty *per se*.

Overall, Weisbrot et al (2000) conclude that the relationship between economic growth and the incomes of the poor is not as close as it appears to be and that the share of the poor in the gains from economic growth can vary over time and as a result of policy changes; the variables in the regressions show little or nothing about the relationships between most of the variables examined and that except for the correlation between economic growth and the incomes of the poor, nearly all the tests in the paper are

statistically insignificant. Given the large errors in the data, no conclusions can be drawn from failures to find significant results.

"These measurement problems should suggest considerable caution in relying on test results in the DK [Dollar-Kraay] paper. The poor overall quality of the data produce a strong bias against finding any statistically significant relationships, so that the fact that the paper does not find many should not be surprising. Furthermore, there are reasons for believing that the data contains [sic] a bias towards overstating the negative relationship between inflation and the income of the poor, and between any form of government spending and the income of the poor. It may also contain a bias towards understating the positive impact of some forms of government spending on the income of the poor. Unless these issues can be effectively addressed, the paper's conclusions on these topics should not be accepted" (Weisbrot et al, p.14).

Growth, Inequality and Poverty

Dollar (quoted in Wade, 2001, p.1440) has apparently denied that the Dollar-Kraay paper is a manifesto for the view that "growth is everything" and has argued that "The main effort of our paper is to explain income inequality and changes in inequality…". Nevertheless, this is the way in which the paper has been widely interpreted and there is at least a *prima facie* case for highlighting the apparent tension between Dollar-Kraay and World Bank (2001) and both academic and popular perceptions of "pro-poor" economic growth.

The World Bank (2001, Chapter 3) explicitly links growth and changes in income distribution together as part of a poverty alleviation strategy. It argues that, "For a given rate of growth, the extent of poverty reduction depends on how the distribution of income changes with growth and on initial inequalities in income, assets, and access to opportunities that allow poor people to share in growth" (p.52). The argument is repeated: "How growth affects poverty depends on how the additional income generated by growth is distributed within a country" (p.52); "For a given rate of economic growth, poverty

will fall faster in countries where the distribution of income becomes more equal than in countries where it becomes less equal" (p.52).

With respect to policy, World Bank (2001) argues that more "recent thinking" and empirical evidence indicate that "lower inequality can increase efficiency and economic growth through a variety of channels" and that "These results open the possibility that policies to improve the distribution of income and assets can have a double benefit – by increasing growth and by increasing the share of growth that accrues to poor people" (p.56).

What conclusions can we draw from this review of World Bank thinking and what are the possible conflicts with Dollar-Kraay? (In passing we should note that many eminent economists in the 1960s and early-1970s, including Hollis Chenery (Chenery et al, 1974), who was at the time Vice President, Development Policy at the World Bank, were arguing along similar lines – such thinking is clearly "less recent" than the current generation of World Bank economists realises, highlighting the problem of limited institutional memory in large organisations!).

Two points can be highlighted:
- Income distribution "matters" and can, does and "should" change over time;
- "Pro-poor growth" at the very least implies that the poor should benefit disproportionately from the additional resources that economic growth makes available – it is difficult to see how growth that "merely" benefits the poor on a on-to-one basis can either be "pro-poor" or effectively poverty alleviating in the longer run.

Kakwani and Pernia (2000) illustrate how "pro-poor" growth can be operationalised. Given that poverty reduction depends on both the rate of economic growth as well as changes in income distribution, we need to measure separately the impact on poverty of changes in average income and its distribution. They thus decompose the total change in

poverty into (i) the impact of growth when the distribution of income does not change and (ii) the effect of income redistribution when total income does not change. Various outcomes are now possible:

- The poor may benefit, that is, the extent of poverty is reduced, as a result of economic growth and a redistribution of income that favours the poor;

- The poor may still benefit from economic growth even if income redistribution moves against them;

- Economic growth may occur but its beneficial effects on poverty are more than offset by an adverse income redistribution;

- Economic growth may not occur, that is, per capita incomes may be stagnant or falling, along with an adverse income redistribution, the worst possible scenario as far as poverty alleviation strategies are concerned.

The importance of this approach is that it provides us with a much richer understanding of the complex relationships between growth, inequality and poverty than the Dollar-Kraay analysis. It brings income distribution back onto the development agenda (after an absence of nearly 25 years) and highlights the importance of state action in ensuring the achievement of development objectives.

Replicating Dollar and Kraay

We start with the basic Dollar and Kraay specification in which the log of the per capita income of the bottom quintile is regressed on the log of per capita income of the whole population. The estimated model is shown in the first column of Table 1. It should be noted that Dollar and Kraay (2001) consider a more restricted sample than ours. Although, they start with 285 observations they finally present results using 269 observations; it is unclear why their sample is restricted in this way. In our broader sample we obtain a slightly different coefficient estimate and standard error on the average income variable. This also holds when we consider the effects of additional

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control variables**.** The second column reports the same regression estimated over the full sample (including the one-observation countries)[1].

Table 1: Per capita Income of the bottom quintile on average per capita income.

	Restricted sample		Full sample	
	OLS	IV	OLS	IV
Constant	-1.714	-1.690	-1.772	-1.743
	(0.216)	(0.224)	(0.182)	(0.190)
Average income	1.067	1.065	1.074	1.071
	0.025)***	(0.026)***	(0.022)***	(0.023)***
R-sq	0.8906		0.8844	
# Obs	285		418	
Diagnostics				
Average income=1	0.008		0.001	

 Notes: OLS and IV refer to ordinary least squares and instrumental variables estimation; instrumental variable used is average income at lag 1; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; diagnostic test results are presented as p- values; R-sq is the coefficient of determination.

It can be readily seen that in both cases average income is not only highly significant (p-values are 0.000) but also greater than 1 (p-values are 0.008 and 0.001). The same result holds when we instrument for the average income using the first lag of average income.

Table 2 reports the effects of introducing Dollar and Kraay's chosen variables reflecting the determinants of growth. The growth determinants employed by Dollar and Kraay are: exports plus imports as a proportion of GDP, government consumption as a share of GDP, inflation, financial development and the rule of law. In this broader regression, for the restricted sample only, the coefficient on average income is insignificantly different from unity for all the alternative specifications. Therefore, we are able to replicate Dollar and Kraay's central finding that there is a one-for-one positive relationship between the

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[1] Initially the overall sample includes 418 country-year observations spanning 137 countries. Then, it is restricted to the set of 285 observations covering 92 countries for which at least two spaced observations on average income of the poor are available, so that we can consider within-country growth rates in the underlying variable (for details see Dollar and Kraay, 2001).

average income of the bottom 20% of the income distribution and the average income of the population as a whole.[2]

Table 2: Income of the bottom quintile on average income and the growth determinants.

Restricted sample						
Average income	1.022 (0.031)***	1.027 (0.028)***	1.005 (0.028)***	1.027 (0.034)***	1.001 (0.036)***	1.005 (0.045)***
Openness	0.034 (0.059)					0.046 (0.059)
Government Con.		-0.423 (0.445)				-0.578 (0.471)
Inflation			-0.171 (0.074)**			-0.164 (0.076)**
Financial Dev.				-0.028 (0.170)		-0.090 (0.159)
Rule of Law					0.034 (0.038)	0.037 (0.043)
R-sq						0.9357
# Obs	261	275	285	263	284	248
Diagnostics Growth slope=1	0.474	0.347	0.862	0.430	0.969	0.906

Full sample						
Average income	1.099 (0.028)***	1.096 (0.024)***	1.075 (0.023)***	1.078 (0.029)***	1.011 (0.031)***	1.024 (0.041)***
Openness	0.025 (0.065)					0.017 (0.059)
Government Con.		-0.463 (0.458)				-1.202 (0.559)**
Inflation			-0.160 (0.076)**			-0.095 (0.098)
Financial Dev.				0.125 (0.173)		0.026 (0.184)
Rule of Law					0.086 (0.033)**	0.128 (0.040)***
R-sq						0.9019
# Obs	348	378	394	351	414	316
Diagnostics Average growth=1	0.000	0.000	0.001	0.008	0.725	0.554

Notes: Ordinary least squares (OLS) estimation; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; diagnostic test results are presented as p-values; R-sq is the coefficient of determination; models do not include regional dummies.

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[2] This finding is also in line with Ravallion and Chen (1997**).**

The results of Dollar and Kraay (2001) show that, as well as the positive one-for–one relationship between income of the lowest quintile and average income, inflation has a significant negative effect at the 5% level, while, somewhat surprisingly, government consumption also has a negative association with the incomes of the lowest quintile.[3] While our results also reveal a strong negative association with inflation, in contrast to Dollar and Kraay, we find no significant influence arising from government consumption in our restricted sample.[4]

However, the results for the broader sample moderate these conclusions. In the full sample, it appears that the rule of law variable is positively associated with the incomes of the lowest quintile at the 5% level, indicating that this variable is associated with higher income in the poorest quintile, which does not arise in Dollar-Kraay. In addition, when we include all five measures together in the full sample, the rule of law variable increases in magnitude and significance. Furthermore, in this regression the inflation variable ceases to have a significant effect whereas the government consumption appears with a significantly negative effect at the 5% level, which echoes Dollar and Kraay (2001).

It is evident that in all variants the average income variable is highly significant and in some cases[5] we can reject the null hypothesis of a unit coefficient in favour of the alternative that its coefficient is significantly greater than 1. In appendix 1 we plot each of these measures against the log of the per capita income of the lowest quintile.

Finally, in the spirit of Dollar and Kraay (2001) we examine the impact of openness to international trade by considering several different measures of openness, namely, trade volumes adjusted, Saches-Warner index, import taxes as a share of imports, whether a country is member of the World Trade Organization (WTO) and capital controls. The results[6] find no evidence of a significant impact of this variable on the bottom quintile of

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[3] See for example Easterly and Fischer (2001) and references within.
[4] As already mentioned, there are differences in the sample size.
[5] See for example Table 3.
[6] The results are not presented but are available from the authors upon request.

the income distribution. Therefore, there seems to be no direct support for the argument that "globalization is good for the poor".[7]

It has already been noted that the bottom quintile does not provide an acceptable proxy for poverty. In addition, it is important to note that it also fails to provide an adequate measure of the overall degree of inequality, as it fails to take account of the other quintiles. In fact, it is quite possible for the relationship of the income of the bottom quintile to overall per capita income to be consistent with any level of inequality. For example, the bottom half of the distribution might all be equally poor in what is a very poor but very unequal country if the whole distribution is considered. Some experiments with the data show that implicitly using the relationship between the bottom quintile and average income may generate counter-intuitive results.[8] For this reason we have re-examined our regressions for those countries for which Gini coefficients are available. These results are shown in tables 3 and 4 below while appendix 2 plots the log of the Gini index against the log of average income and then successively each of the growth determinant variables.

One can readily see from table 1 that the relationship between inequality as measured by the Gini and overall per capita income is not as strong as the previous relationship between the poorest 20% of the population and average income. The R-squared value of around 0.13 is very modest in the basic specification, so we are not explaining much of the variation in inequality. However, we should mention that in the above regression the (negative) coefficient on average income is highly significant implying that higher per capita income is associated with lower levels of inequality.

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[7] Of course, there seems to be no direct support for this in Dollar and Kraay (2001).

[8] We looked at the ratio per capita income of the poorest 20% of the population over average per capita income. The results show that for Bangladesh this ratio varies (over time) between 0.26 and 0.42, for Pakistan between 0.38 and 0.46, for India between 0.38 and 0.43, for Jordan between 0.28 and 0.39. On the other hand, for France the ratio varies (over time) between 0.22 and 0.36, for the US between 0.30 and 0.23, for the UK between 0.47 and 0.38, for Germany between 0.52 and 0.44, and for Australia between 0.35 and 0.40. Therefore, according to this measure of poverty, based implicitly on an inequality ratio, tends to be lower in developing countries in comparison to the developed ones. This is counter-intuitive and is contradicted by other evidence.

Table 3: Gini index and average income.

	Restricted sample		Full sample	
	OLS	IV	OLS	IV
Constant	4.378	4.435	4.430	4.419
	(0.122)	(0.151)	(0.101)	(0.128)
Average income	-0.095	-0.101	-0.101	-0.100
	(0.014)***	(0.018)***	(0.012)***	(0.015)***
R-sq	0.1237		0.1374	
# Obs	285		418	

Notes: OLS and IV refer to ordinary least squares and instrumental variables estimation; instrumental variable used is average income at lag 1; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; R-sq is the coefficient of determination.

When the 'growth determinants' are added to this basic specification the only variable which is strongly significant is the rule of law. It is also interesting to note that the introduction of this variable removes the significance of average income from the equation; in this specification only the rule of law has a significant correlation with inequality as measured by the Gini coefficient. These results are shown below in table 4.

Table 4: Gini index and growth determinants.

	Restricted sample					
Average income	-0.092	-0.088	-0.092	-0.099	-0.014	-0.010
	(0.018)***	(0.017)***	(0.015)***	(0.023)***	(0.025)	(0.031)
Openness	-0.080					-0.035
	(0.054)					(0.044)
Government Exp.		-0.385				0.212
		(0.372)				(0.402)
Inflation			0.049			0.017
			(0.069)			(0.072)
Financial Dev.				-0.046		-0.019
				(0.150)		(0.159)
Rule of Law					-0.112	-0.130
					(0.029)***	(0.032)***
R-sq	0.1531	0.1288	0.1272	0.1651	0.1864	0.2724
# Obs	261	275	285	263	284	248

Full sample						
Average income	-0.104	-0.103	-0.098	-0.108	-0.053	-0.044
	(0.016)***	(0.014)***	(0.013)***	(0.019)***	(0.021)**	(0.025)*
Openness	-0.058					-0.039
	(0.048)					(0.037)
Government Con.		-0.067				0.546
		(0.311)				(0.333)
Inflation			0.068			0.025
			(0.045)			(0.056)
Financial Dev.				-0.014		0.056
				(0.115)		(0.127)
Rule of Law					-0.069	-0.115
					(0.024)***	(0.026)***
R-sq	0.1772	0.1444	0.1458	0.1857	0.1610	0.2830
# Obs	348	378	394	351	414	316

Notes: Ordinary least squares (OLS) estimation; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; R-sq is the coefficient of determination; models do not include regional dummies.

The disparity between the results when the Gini coefficient is substituted for the per capita income of the lowest percentile suggest the value of investigating the relationship between the per capita income of the other quintiles and overall per capita income. These results are reported in tables 5-9 below

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Table 5: Income of the second and third quintiles and average income.

	Quintiles 2 and 3	
	OLS	IV
Constant	-1.083	-1.074
	(0.098)	(0.118)
Average income	1.076	1.075
	(0.012)***	(0.014)***
R-sq	0.9571	
# Obs	365	
Diagnostics Average income=1	0.000	

Notes: OLS and IV refer to ordinary least squares and instrumental variables estimation; instrumental variable used is average income at lag 1; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; diagnostic test results are presented as p- values; R-sq is the coefficient of determination.

Table 5 investigates the Dollar and Kraay relationships substituting the 2nd and 3rd quintiles for the bottom quintile. Figure 3 in the appendix plots the log of the per capita income of the second plus third quintiles against the log of average income and then each of the growth determinants corresponding to the results reported in table 5.   What is striking is the similarity between this result and the relationship with the bottom quintile. This result continues to hold when the other explanatory variables are added to the regression as shown in table 6.

Table 6: Income of quintiles 2 and 3 and growth determinants.

Average income	1.074 (0.015)***	1.071 (0.014)***	1.070 (0.013)***	1.079 (0.017)***	1.022 (0.019)***	1.018 (0.026)***
Openness	0.058 (0.037)					0.053 (0.030)*
Government Exp.		0.174 (0.370)				-0.453 (0.415)
Inflation			-0.035 (0.046)			-0.010 (0.053)
Financial Dev.				-0.0003 (0.101)		-0.084 (0.104)
Rule of Law					0.079 (0.023)***	0.104 (0.025)***
R-sq						0.9647
# Obs	306	331	344	308	364	280
Diagnostics Average income=1	0.000	0.000	0.000	0.000	0.269	0.481

Average income	1.074 (0.015)***	1.083 (0.015)***	1.057 (0.016)***	1.062 (0.018)***	1.071 (0.013)***	1.074 (0.014)***
Trade Vol.	0.058 (0.037)					
Trade Vol.(adj)		0.011 (0.054)				
Sachs-Warner			0.083 (0.040)**			
Import Taxes				-0.164 (0.255)		
WTO					0.041 (0.031)**	
Capital Controls						0.049 (0.037)
# Obs	306	288	298	206	365	285
Diagnostics Average income=1	0.000	0.000	0.001	0.001	0.000	0.000

Notes: Ordinary least squares (OLS) estimation; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; diagnostic test results are presented as p-values; R-sq is the coefficient of determination.

The evidence of the relationship between the income of quintiles 2 and 3 and average income is particularly strong. Average income appears to explain a sizeable proportion (around 96%) in the total variation of middle quintiles income, which is somewhat higher than the proportion explained in the bottom quintile. From the first panel of Table 6, it can be seen that the rule of law is highly significant with a positive sign. The other finding of interest is related to the question of openness to international trade and income of the middle quintiles. From the second panel of Table 6, it can be seen that both the Sachs-Warner index and the WTO membership variable have a significant impact. The coefficients on these measures are positive and significant at the 5% level implying that exposure to the international economy is associated with a higher income share of the middle quintiles. Further, in the last column of the first panel, when all the growth determinants are included together, there is also some evidence of a positive impact of trade volumes on incomes of the middle quintiles. A final result is that in most of the specifications considered above, we find that average income is not only highly significant but also has a coefficient which is slightly but statistically significantly greater than unity.

Table 7 reports including the upper quintile to the Dollar-Kraay regression

Table 7: Income of the rich class (fifth quintile) and average income.

	Rich class	
	OLS	IV
Constant	1.363	1.374
	(0.077)	(0.101)
Average income	0.933	0.932
	(0.009)***	(0.012)***
R-sq	0.9623	
# Obs	365	
Diagnostics Average income=1	0.000	

Notes: OLS and IV refer to ordinary least squares and instrumental variables estimation; instrumental variable used is average income at lag 1; values in parentheses are standard errors; standard errors are corrected for heteroskedasticity and for first error autocorrelation using the Newey-West procedure; diagnostic test results are presented as p- values; R-sq is the coefficient of determination.

Table 8: Income of the rich class (fifth quintile) and growth determinants.

Average income	0.938	0.940	0.938	0.929	0.972	0.980
	(0.012)***	(0.011)***	(0.010)***	(0.015)***	(0.016)***	(0.020)***
Openness	-0.061					-0.058
	(0.033)*					(0.026)**
Government Exp.		-0.293				0.216
		(0.267)				(0.273)
Inflation			0.027			0.010
			(0.038)			(0.041)
Financial Dev.				0.013		0.081
				(0.088)		(0.091)
Rule of Law					-0.056	-0.079
					(0.018)***	(0.020)***
R-sq						0.9707
# Obs	306	331	344	308	364	280
Diagnostics Average income=1	0.000	0.000	0.000	0.000	0.089	0.323

In tables 7 and 8 we investigate the extent to which the per capita income of the top quintile of the population is correlated with overall average income and with the other growth determinants. Figure 4 in appendix 4 illustrates the starting point. As seen with

respect to the other quintiles, the relationship between per capita income of top quintile and average per capita income is very strong. The results of the basic specification are presented in Table 7, whereas the results including growth determinants are in Table 8. The R-squared in the first regression is 0.9623, which is as high as the proportion explained in the middle quintiles. Turning to the growth determinants, one can see again that the rule of law has a strong positive association with the income on the upper quintile. Therefore, the rule of law, which Dollar and Kraay found to be statistically insignificant, emerges as a key variable not only the bottom quintile but also the whole income distribution. Another result emerging from this section is that there is some evidence that capital controls are negatively associated with the per capita income of the upper quintile. Finally, it is perhaps surprising to note the negative impact of trade volumes, which is negatively related to the incomes of the upper quintile but positively related to the incomes of the middle quintiles.

The use of the different quintiles raises a number of issues. Firstly, in none of the regressions do we find that the one to one relationship with overall per capita income is seriously disturbed. This suggests that either there are no changes of distribution taking place or that these regressions are failing to properly capture the changes which are taking place. As we know that there have been significant changes in distribution (UNCTAD 1997) in many parts of the world we are forced to conclude that the Dollar-Kraay regressions are not capturing distributional changes. This reduces the weight that we can attach to their central finding.

There is a great deal of evidence of variation in GDP per capita and distribution in different regions of the world. Following Dollar and Kraay we investigate this by using regional dummies. The results are presented in table 9 below.

Table 9: Income of the poor including regional dummies

Con	-1.187
	(0.261)
Average income	1.020
	(0.027)***
Eap	-0.052
	(0.052)
Eca	0.135
	(0.085)
Lac	-0.490
	(0.060)***
Mena	-0.124
	(0.068)*
Sa	0.177
	(0.076)**
Ssa	-0.438
	(0.122)***
# Obs	285
Diagnostics	
Average income=1	0.469

Notes: Newey-West standard errors.

The Latin America (LAC) and Sub-Saharan Africa (SSA) dummies are highly significant with negative signs, which is consistent with Dollar and Kraay (2001). We also find a negative sign on the Middle East and North Africa (MENA) dummy, which is significicnat at the 10% level (restricted sample) and 5% level (full sample). Again this is consistent with the Dollar and Kraay (2001) results. The East Asia and Pacific (EAP) dummy is negative but not significant whereas it is significant at the 10% level in Dollar and Kraay (2001). The Eastern Europe and Central Asia (ECA) dummy is positive and significant at 5% level in the full sample. This result is not consistent with Dollar and Kraay (2001). Another surprising result is the positive and significant dummy for South Asia (SA), which again is not in line with Dollar and Kraay (2001). This may reflect the lower measured degrees of inequality in countries in those regions.

Conclusions

In this paper we have been able to replicate, with some minor amendments, the central result supporting the Dollar-Kraay analysi. However, we have shown that some of the results are sensitive to sample size with the support for some of the key policy proposistions advanced by Dollar and Kraay vanishing in alternative specifications and samples. We also find a much greater significance for the rule of law than Dollar and Kraay across a wide range of specifications.

The chosen variable to represent poverty, the per capita income of the bottom quintile of the income distribution is not a measure of absolute poverty or an adequate measure of relative poverty. The use of the bottom quintile is not merely an inadequate measure of relative poverty it is also a misleading measure of inequality because it provides no information on the behaviour of the rest of the distribution. We attempt to address this in two ways.

First, we substitute the Gini coefficient for the bottom quintile. We find that the overall performance of the equations deteriorate sharply when the more informative Gini is substituted. In addition, the equation including the Gini suggests a negative relationship with average per capita income, implying that higher average income is associated with a lower Gini, and therefore less inequality. It is difficult to see how this result is consistent with Dollar and Kraay's overall thesis.

Second, we investigated the degree to which overall average per capita income was correlated with the behaviour of the other quintiles. Experiments with the behaviour of the other quintiles vis-à-vis average per capita income suggested that the Dollar and Kraay results are failing to register any changes in the distribution of income. Yet this seems to be contradicted by abundant evidence of distributional change in many areas of the world.

In general , we find that the strong policy conclusions suggested by Dollar-Kraay are not supported by significant results in either the original regressions or our replication. We also find that the rule of law variable, which Dollar-Kraay found to be insignificantly correlated with the incomes of the bottom qunintile, is significant in our wider sample.

Although our results broadly replicate Dollar and Kraay, we have demonstrated further grounds for scepticism about the robustness of their conclusions. We remain unconvinced by Dollar and Kraay's central arguments and we re-emphasise the point that fundamental issues remain to be addressed. In particular,

- There is no formal model from which testable hypotheses have been drawn.
- Dollar and Kraay talk about growth when there are no rate of change variables in the equations. However, we do recognise that in providing two observations over time at least an *implicit* rate of change concept has been introduced. It must be stressed, though, that Dollar and Kraay have *not* provided a proper continuous growth variable.
- Dollar and Kraay infer their growth conclusions from a variety of different cross sections from different times and different parts of the world with differences in the levels of income. However, they do not discuss or even consider the problems of inferring temporal relationships (changes in income over time) from spatial relationships (changes in income between countries at a point in time).
- There is an apparent tension between the Dollar-Kraay results and World Bank 2001.

More generally, a greater effort is needed to reconcile the results from different studies of growth and income distribution and poverty, which at present do not sit easily with the Dollar-Kraay results. Further research is also required which tries to utilise more direct measures of poverty. Finally, it is worth noting that the Dollar and Kraay results imply widening absolute gaps between rich and poor which is hardly consistent with any common-sense interpretation of pro-poor growth.
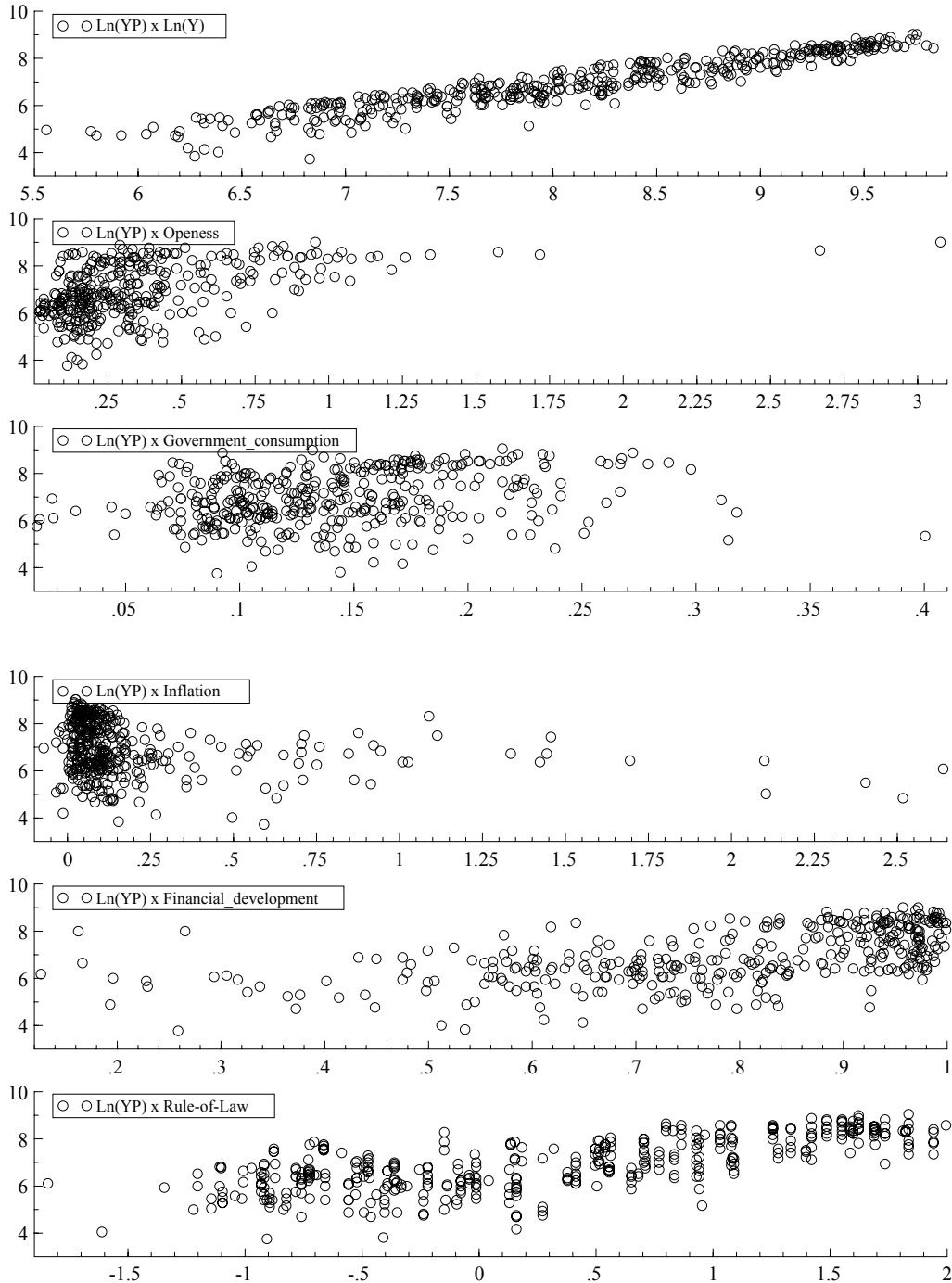
Appendix 1

Figure 1: **Income of the poor (bottom 20% quintile) versus average income and growth determinant measures.**
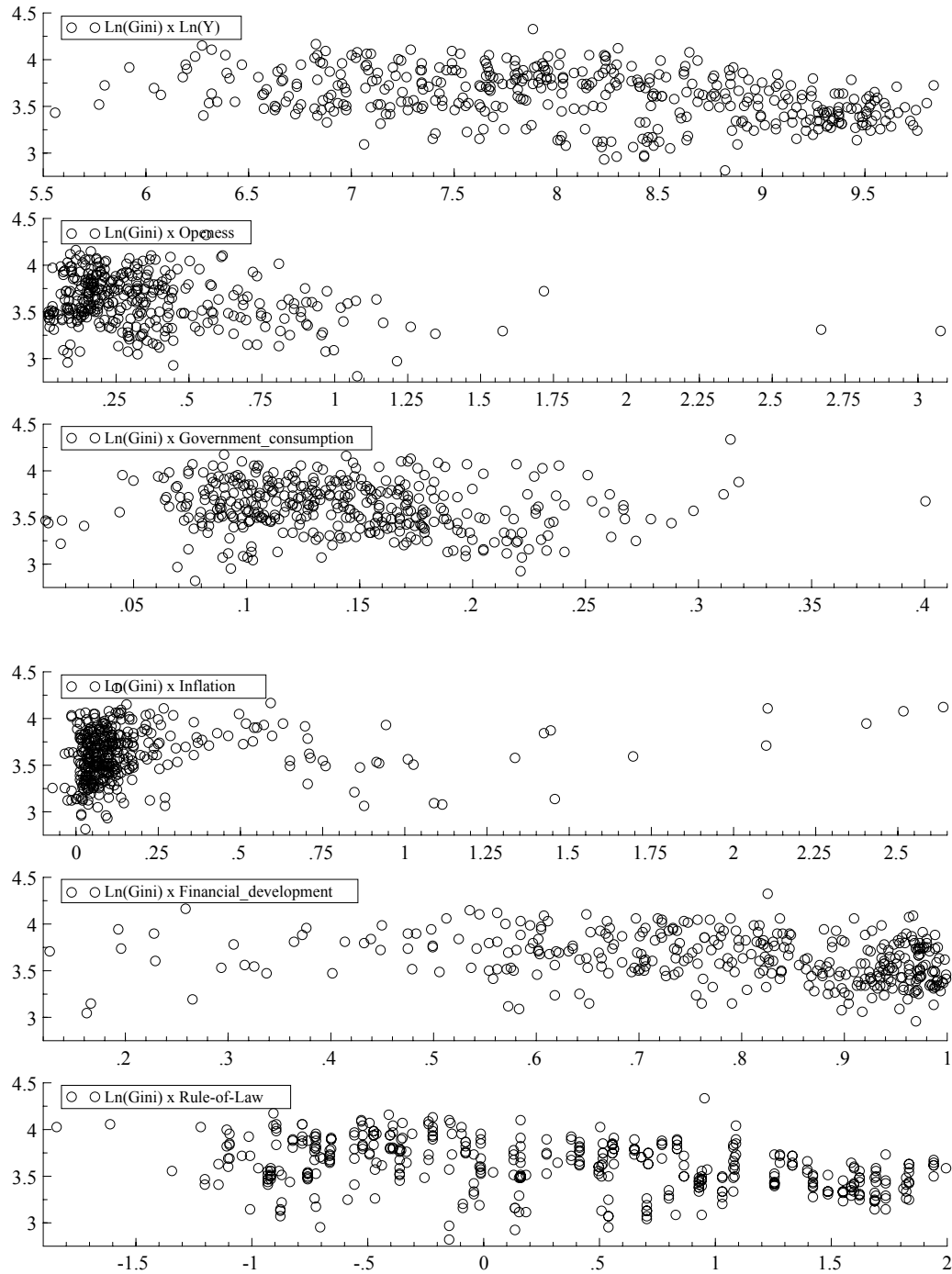
Appendix 2

Figure 2: **Gini index versus average income and growth determinant measures.**
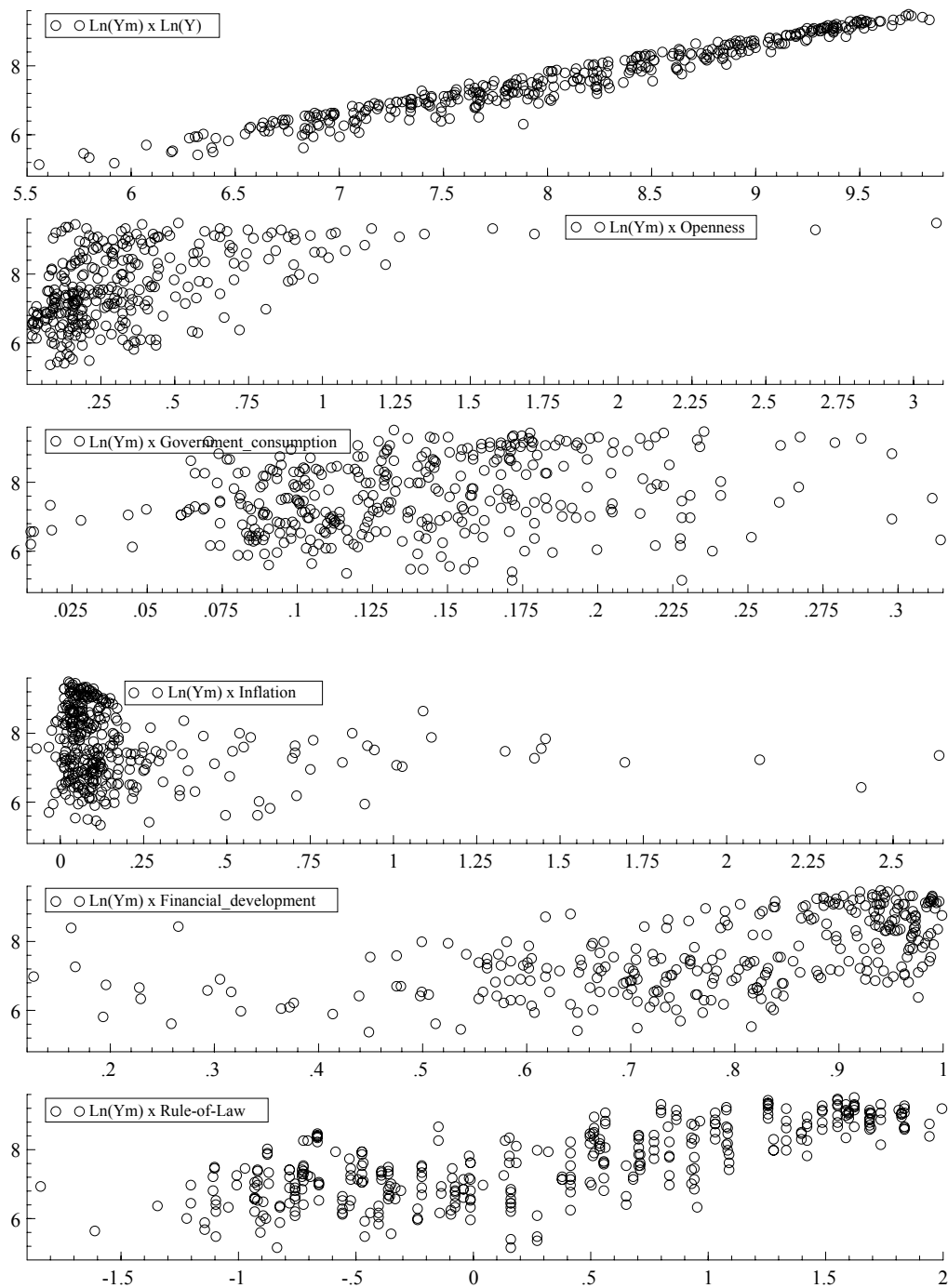
Appendix 3

Figure 3: **Income of the middle class (second plus third quintiles) versus average income and growth determinant measures.**
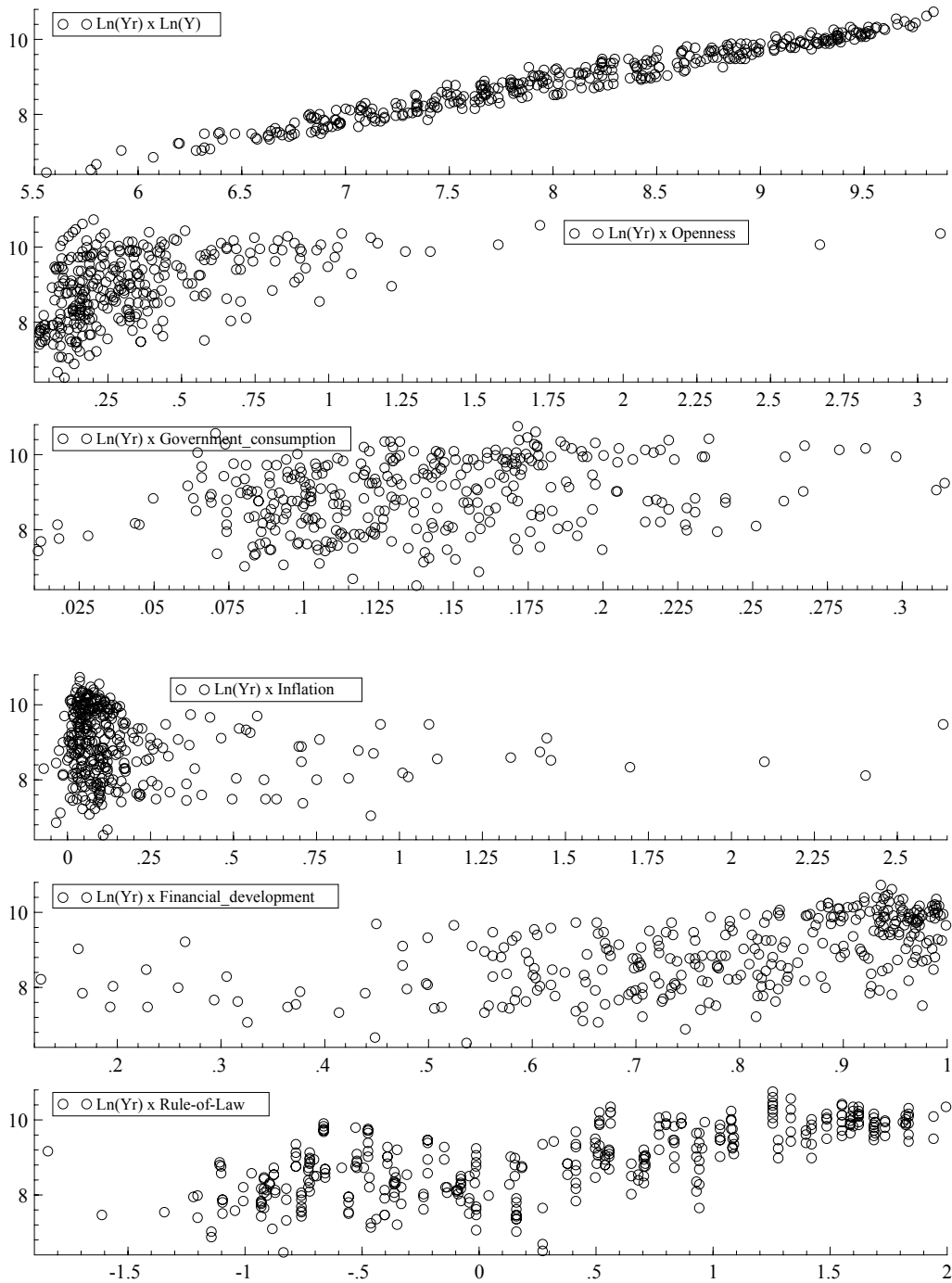
Appendix 4

Figure 4: **Income of the rich (fifth quintile) versus average income and growth determinant measures.**

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