Response to Edwards and McGuirk: Income Level, Economic Growth, and Inequality: Flawed Methodology and Inaccurate Inference

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THE COMMENT BY EDWARDS AND MCGUIRK (2004) HAS numerous significant flaws. These include: (1) an incomplete understanding of the paper by Chang and Ram (2000), (2) lack of familiarity with development data sets and the vast literature on cross-country studies of inequality and growth, and (3) an inadequate grasp of the basics of econometric model specification and the elementary principles of generating predicted values from regression estimates. We first briefly note a few aspects that might not be considered major, and then explain the fatal flaw that renders its main conclusion inaccurate.

NONFATAL PROBLEMS

Kuznets hypothesis

The Comment carries several types of misunderstandings about our work. In particular, despite our explicit statements (Chang and Ram 2000, 790-791), Edwards and McGuirk do not recognize the point that testing of Kuznets's hypothesis was a minor and secondary part of our paper—our

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principal objective was to compare evolution of income inequality in low-growth and high-growth countries. Neither the functional form used nor the actual structure of the income-inequality relation, is critical for a comparison of the income-inequality profiles in high- and low-growth contexts. Therefore, long discussions about the functional form and repeated references to the validity, or lack of validity, of the hypothesis (and the cheap title) tend to obscure the main issue. However, since a large part of the Comment refers to, or discusses, the hypothesis, we note the following points that refute what Edwards and McGuirk say.

1. We explicitly stated that "Presence or absence of the inverted-U . . . is secondary to the main purpose of our study," and that the "evidence in favor of Kuznets's hypothesis [in Table 1 of our original paper] is not the main point of our work" (Chang and Ram 2000, 790, 791).

2. The functional form chosen by us to relate income with inequality is not "arbitrary" or "ad hoc," but is probably the most widely used specification in the literature. Besides its usage in numerous studies, the survey by Adelman and Robinson (1989, 958) noted that researchers on the subject "generally assumed that the relationship . . . is quadratic in the log of per capita GNP." The terminology used in the Comment about the functional form reflects its lack of familiarity with the literature.

3. Before asserting that our work contains a "critical . . . assumption that the Kuznets hypothesis holds," Edwards and McGuirk could have read our observation (790) that our equation "does not necessarily presume that there is an inverted-U pattern. Presence or absence of the inverted-U in either group is determined by the data." Perhaps even more important, it should be evident that presence or absence of an inverted-U does *not* affect comparisons of income-inequality profiles in the two growth groups.

4. In the above context, it seems absurd to suggest that forcing the data through our specification produces an inverted-U. It should be elementary to see that, depending on the signs and magnitudes of the parameter estimates, the quadratic specification can reveal the relation between income and inequality to be linear, inverted-U, regular-U, monotonically increasing, or monotonically decreasing. Such quadratics have been used in numerous studies to *test* and not to force an inverted-

U, or any other pattern. In fact, the quadratic specified by us has been used to show that there is an inverted-U relation, a regular-U relation, or no relation between the variables. There are scores of studies in the literature where this very specification yields evidence *against* the Kuznets hypothesis. By way of a quick example, consider the following two subsample estimates from the data used in the present work (t-statistics are in parentheses).

Low-growth cases: Gini = -121.44 + 42.10 LRY – 2.68 LRYSQ +11.57CAMER
 (N=23, RSQ= 0.43)   (-0.97)   (1.30)   (-1.29)   (3.08)

High-growth cases: Gini = -382.31 + 101.13LRY – 5.99LRYSQ –9.48EUROPE
(N=25, RSQ= 0.60)   (-3.03)   (3.34)   (-3.33)   (-3.49)

Thus, our quadratic specification produces strong evidence in favor of the hypothesis in one subsample and against the hypothesis in the other with almost identical sample size. It is not the quadratic specification that produces a Kuznets (or any other) curve— what one sees depends on the data. The subsample estimates indicate two additional points. First, it should be evident that, contrary to what the Comment suggests, the structure of the income-inequality relation does differ markedly in the two groups. Second, the low-growth group has no member from "Europe," and the high-growth group contains no country from "Central America," indicating that the regional dummies might be surrogates for low- and high-growth scenarios and could distort considerably the low- and high-growth classification.

5. It is not obvious which observations are covered in Edwards and McGuirk's Figure Six, nor what is meant by "The appearance of any quadratic correlation between the Gini coefficient and per capita GDP is not apparent." However, the following estimates may be instructive relative to the observations in the Comment about the absence of Kuznets-curve in our data (t-statistics are in parentheses).

Full sample: (N=65, RSQ= 0.46)

Gini = -214.06 + 64.09LRY – 3.97LRYSQ – 7.57 Europe + 11.80 CAMER
       (-2.94)   (3.56)   (-3.60)   (-2.59)   (3.30)

Excluding medium-growth cases: (N=48, RSQ= 0.54)

Gini = -123.01 + 41.23LRY – 2.55LRYSQ – 8.94 Europe + 12.46 CAMER
       (-1.66)   (2.23)   (-2.23)   (-2.94)   (3.79)

The estimates provide unmistakable evidence in favor of the hypothesis even with the regional dummies, and this is what the *data* show, and not what the specification forces on the data. As noted, there are numerous studies where the same specification yields evidence against the hypothesis.

Data

Edwards and McGuirk's observations about the Deininger-Squire compilation reflect their lack of familiarity with the strong and weak points of inequality data sets. Similarly, their suggestion about growth rates being based on PWT indicates that they do not realize that PWT data are in international dollars and do not constitute as good a basis for intracountry growth rates as domestic currency numbers. Also, Edwards and McGuirk do not appear to have noticed that we (Change and Ram 2000, 799 n23) had explicitly said that the patterns are similar for different growth periods and inequality measures.

Specification search

While making a big issue about the properties of the error terms, Edwards and McGuirk start with six regional groups that are defined geographically and have little obvious relevance to cross-country distribution of income inequality. After stating that the five regional dummies are jointly significant, they drop three "to save degrees of freedom," and finally truncate "North America" to retain only Guatemala, Honduras, Mexico, and Panama. Edwards and McGuirk show little awareness of the potentially serious hazards of such specificational searches in terms of pretest bias and omitted-variable problems due to the deletion of individually "insignificant" variables. The poverty of the model Edwards and McGuirk choose (in their Table Three) is reflected in the fact that it shows the two regional dummies as the only significant determinants of cross-country distribution of income inequality.

FATAL ERROR

After having strenuously argued that the inclusion of regional dummies is "critical," it is amazing that Edwards and McGuirk offer the plots in Figure Five by way of a comparison of predicted income-inequality profiles in low-growth and high-growth cases. The plots are drawn by ignoring the parameters for the regional dummies and by assuming that "countries are all in the control group." In other words, the plots are drawn on the assumption that the constant term for all countries is the same, which is a blatant contradiction of their major claim. Thus, the plots are inaccurate relative to Edwards and McGuirk's own estimates (in their Table Three), and the conclusion drawn from the plots is wrong even in terms of the model estimates chosen.

Although Edwards and McGuirk do not state what countries are included in "Europe," we were able to replicate almost exactly (except for the constant term) estimates of their Table Three by treating this group as consisting of Denmark, Finland, Germany, Italy, Luxembourg, Norway, Spain, and U.K. These estimates are shown in Table 1.

Table 1:
Estimates of the model proposed in the Comment that includes two regional dummies

Constant	LY	LYSQ	D	D*LY	D*LYSQ	Europe	CAMER
-121.445	42.098	-2.675	-260.864	59.028	-3.311	–9.483	11.568
(-1.09)	(1.45)	(-1.44)	(-1.44)	(1.31)	(-1.20)	(-3.08)	(3.44)

t-statistics are in parentheses
N=48, R-square is 0.61, Dependent Variable is Gini

Table 2 shows the value of predicted Gini for each country in the low-growth and high-growth groups on the basis of the estimates in our Table 1 here. We follow Edwards and McGuirk in using the actual income data to generate the predicted value of Gini for each country, and the countries are listed in the ascending order of GDP per capita. Figure 1 here plots the predicted inequality profiles for the two groups. Several points may be noted from Table 2 and Figure 1.

Table 2

Predicted value of Gini for each country in high-growth and low-growth groups					
LOW-GROWTH CASES			HIGH-GROWTH CASES		
County	GDP pc	Predicted Gini	Country	GDP pc	Predicted Gini
Uganda	548	37.6	India	1092	32.2
Mauritania	788	40.3	China	1262	34.6
Ghana	811	40.5	Pakistan	1262	34.6
Rwanda	834	40.7	Indonesia	1610	38.0
Lesotho	949	41.4	Sri Lanka	2040	40.7
Nigeria	973	41.6	Thailand	2510	42.5
Zimbabwe	1182	42.5	Botswana	2662	42.9
Cameroon	1342	43.0	Seychelles	2811	43.3
Honduras	1381	54.7	Turkey	3441	44.2
Philippines	1542	43.4	S. Korea	4217	44.7
Cote d' Ivo.	1545	43.4	Malaysia	4420	44.8
Bolivia	1658	43.6	Mauritius	4462	44.8
Guatemala	2104	55.6	Spain	7536	33.9
Dom. Republic	2157	44.1	Singapore	10316	41.0
Jamaica	2443	44.2	Italy	11115	30.8
Algeria	2769	44.2	U.K.	11237	30.7
Panama	2785	55.7	Hong Kong	11520	39.9
Peru	2838	44.2	Finland	11746	30.2
Jordan	3649	43.9	Japan	11771	39.6
Iran	4027	43.7	Germany	12302	29.7
Mexico	5524	54.2	Luxembourg	13175	28.8
Venezuela	6483	42.0	Denmark	13449	28.6
Tri. & Tobago	11738	38.1	Norway	14144	27.9
			Canada	15589	36.1
			U.S.A.	16570	35.2

First, the plot in Edwards and McGuirk's Figure Five is inaccurate since it does not use the regional-dummy parameter estimates. Figure 1 here shows the correct plot of predicted Gini for every country in each group based on the estimates in Tables 1 and 2 here.

Second, the overall scenario in Figure 1 here is very different from that suggested by Edwards and McGuirk, and is almost identical with that shown by Chang and Ram (2000, 794). Of the 48 cases, there is only one (Trinidad and Tobago) where a low-growth country has smaller predicted

inequality than a high-growth country at a similar income level. Therefore, the Chang-Ram inference, that a high-growth country is likely to have smaller income inequality than a low-growth country at the same income level, is true even on the basis of Edwards and McGuirk's model that includes two regional dummies after a highly selective procedure.

Figure 1:
Predicted values of Gini at various income levels in
high- and low-growth cases
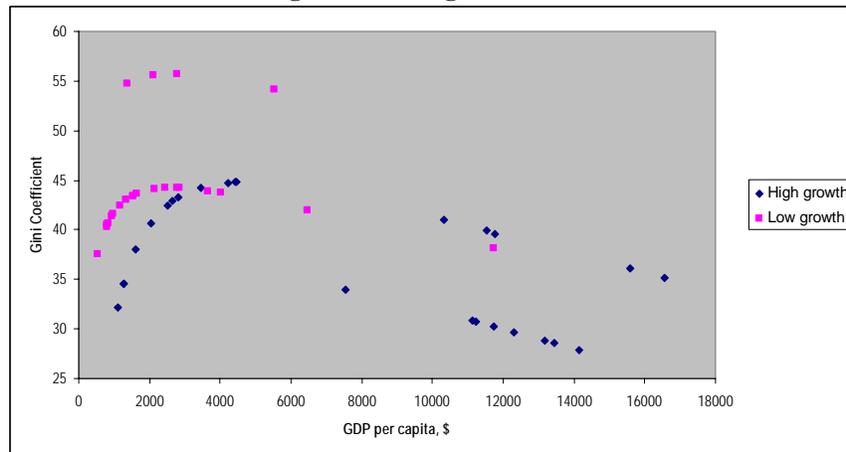
Third, unlike our original Figure 1 (Chang and Ram 2000, 794), the predicted inequality profiles in Figure 1 of this reply are not smooth, because inequality now depends, not merely on income, but also on regional location, and, in either growth regime, two countries with the same income level would have different values of predicted Gini, if these are located in different regions. It was such a truncation of predicted income-inequality profiles that Chang and Ram sought to avoid by working with the simple Kuznets quadratic that contains only income terms and that has been used in scores of cross-country studies of income inequality. Edwards and McGuirk's Figure Five portrays smooth income-inequality profiles by assuming the same constant (intercept) term for all regions, which is a blatant contradiction of its own "insight" about the need for regional dummies. In fact, the title of the Comment seems to apply more to what it does to generate predicted inequality than to anything that Chang and Ram (2000) might have done.

Last, despite the truncation of the inequality profiles, Figure 1 here supports our important observation (Chang and Ram 2000, 793, 795) that the high-growth advantage in terms of smaller inequality is particularly large for countries at lower income levels, relative to whom the entire discussion is more meaningful.

CONCLUSION

Putting aside Edwards and McGuirk's largely irrelevant observations about the Kuznets-quadratic and the degree of validity of the Kuznets-hypothesis in our data, and even overlooking their highly selective choice of the regional dummies, the estimates of their own specification generate a picture of predicted income-inequality profiles that is remarkably similar to that shown by Chang and Ram (2000) and is very different from the profiles displayed in the Comment, profiles which are inaccurate relative to Edwards and McGuirk's own specification. Therefore, nothing in Edwards and McGuirk's Comment alters the Chang-Ram conclusion that at any income level a high-growth economy is likely to experience smaller inequality than a low-growth country. As a secondary matter, we note that, while carrying a denigrating tone relative to the Chang-Ram work, the Comment assumes the air of a superior understanding of development data sets, models of cross-country inequality and the related literature, and econometric methodology, although, as our brief observations might indicate, the opposite seems more likely.

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