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Explaining Growth: A Contest between Models

by

Michael Bleaney and Akira Nishiyama

Centre for Research in Economic Development and International Trade, University of Nottingham

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Abstract
Recent contributions to the empirical growth literature show no tendency to convergence in specification, as researchers seek to identify new variables that can account for significant regional effects in earlier work. We conduct non-nested tests between the models of Barro (1997), Easterly and Levine (1997) and Sachs and Warner (1997). The data strongly prefer an encompassing model, but fail to reject any of the candidate models, implying that each model represents a partial truth. We identify a model that includes most (but not all) of the regressors in the candidate models and is robust to the inclusion of regional dummies.

Outline

1. Introduction
2. The Competing Models
3. An Encompassing Model
4. Conclusions

I INTRODUCTION

The empirics of growth has itself been a growth area of research in the last fifteen years, stimulated by new theoretical developments and new data bases. In an article published in 1992, Levine and Renelt noted the proliferation of explanatory variables in published growth regressions, and attempted to introduce some order into the discussion by identifying the variables which were robustly significant across specifications. This exercise has since been repeated with a different methodology and somewhat different results (Sala-i-Martin, 1997). Nevertheless empirical growth research has continued to show a strong tendency towards further proliferation of alternative specifications, and not of convergence towards an agreed specification. New variables such as ethno-linguistic diversity, measures of institutional quality, and the share of primary products exports in GNP have been found to be statistically significant in growth regressions (Easterly and Levine, 1997; Sachs and Warner, 1997).

This trend towards divergence has been driven by several factors. One is that investment (one of Levine and Renelt's few robust variables) has increasingly been seen as endogenous to growth, and therefore part of what needs to be explained rather than part of the explanation (e.g. Barro, 1997, pp. 32-3). A second factor is that the statistical significance of regional dummy variables (e.g. for sub-Saharan Africa) in Barro's (1991) regression has been regarded as evidence of omitted regressors and therefore as a challenge to be met by finding more acceptable alternatives. Thirdly, of course, researchers are continually having new ideas and finding new data. The purpose of the present paper is to test how some recent models, with different specifications, match up against one another when tested on the same data set. The point of the exercise is that these models contain very different explanatory variables. The models tested are those of Sachs and Warner (1997) (whose data set we use), Barro (1997) and Easterly and Levine (1997). Our main conclusion is that we can improve considerably on any one of these models by adding elements from the others. This is encouraging in the sense that new models are offering genuine value added.

II THE COMPETING MODELS

We consider three models that have figured in the recent empirical growth literature: those of Barro (1997), Easterly and Levine (1997) and Sachs and Warner (1997). Barro's model is an update of his earlier work (Barro, 1991), but using a panel of ten-year average growth rates instead of a pure cross-section. The main innovations in his 1997 specification are the inclusion of male (but not female) secondary and higher schooling, a rule of law index, an index of democracy and its square, and an interactive term between male schooling and initial per capita income. Easterly and Levine (1997) [*EL* hereafter] emphasise the role of ethnic diversity or fractionalisation (defined as the probability that two randomly chosen individuals belong to different ethnic groups). They also include a measure of financial depth and a quadratic term in initial per capita income, together with a number of other variables from Barro's earlier work. They too use a panel of three ten-year averages. Sachs and Warner (1997) [*SW* hereafter] emphasise openness to international trade, the share of primary products in exports, exposure to a tropical climate and landlockedness, as well as more standard variables. Their data set is a pure cross-section of 1965-90 average growth rates.

Table 1. Specification of alternative growth models

Variable	Sign of effect on growth	Barro	*EL*	*SW*
Initial per capita income (*Y*)	–	*	*	*
Square of *Y*	–		*	
Openness	+			*
Openness * *Y*	–			*
Black market premium	–		*	
Schooling	+		*	
Male schooling	+	*		
Male schooling * Y	–	*		
Financial depth	+		*	
Inflation rate	–	*		
Fertility rate	–	*		
Central gov't savings/GDP	+		*	*
Gov't consump-tion/GDP	–	*		
Life expectancy	+	*		*
Life expectancy squared	–			*
Rule of law index	+	*		
Institutional quality	+			*
Assassinations	–		*	
Democracy index	+	*		
Democracy index squared	–	*		
Terms of trade growth	+	*		
Primary product exports/GDP	–			*
Tropical climate	–			*
Landlockedness	–			*
Economically active minus total pop. growth	+			*
Ethnic diversity	–		*	

Note: * denotes that variable is included in the model's specification. Barro: Barro (1997); *EL* – Easterly and Levine (1997); *SW* – Sachs and Warner (1997).

The extent of the variation in the regression specifications of these three models is demonstrated in Table 1. The log of initial per capita GDP is in fact the only one amongst 26 regressors that is common to all three models.[1] This variation does not appear to be the consequence of any identifiable theoretical differences between authors. The choice of variables is an empirical decision made by investigators drawing on a common corpus of theory. Using a single data set (that of *SW*), we investigate whether any of these three models can be rejected in favour of the others, and if not, which variables would be included in an encompassing model that yields a better fit to the data than any of the individual candidates. We begin by performing non-nested tests between each pair of models. This results in six separate tests (see Table 2). The *EL* model performs considerably less well than others, with a much higher standard error. Nevertheless it still has statistically significant *J*-statistics (*t*-statistics of the fitted values) of 2.41 ($p<0.02$) against the Barro model and 3.61 ($p<0.01$) against *SW*. Both of the other two models have *J*-statistics of at least 5.98 in each test ($p<0.001$). This constitutes very strong evidence that no single one of the candidate models unambiguously dominates the others. The *SW* model performs best (not surprisingly, because the tests use their data set and cross-section method), but the Barro model is not far behind, and the results imply that each of these models can be significantly improved by adding at least some elements from the other models. The *EL* model is clearly inferior to the others in terms of fit, but even this model significantly improves each of the others.

1 Nevertheless some of the variables are closely related. For example the black market premium is a component of *SW*'s measure of openness, and Barro's rule of law index and *SW*'s measure of institutional quality are drawn from the same source.

Table 2. Non-nested tests between alternative models

Davidson-MacKinnon *J*-statistics for pairs of models

Alternative Model:	Barro	Easterly & Levine	Sachs & Warner	No. of obs. in regression	Standard deviation of residuals
Tested Model					
Barro		2.41	7.70	71	0.897
Easterly & Levine	10.44		14.36	75	1.28
Sachs & Warner	5.98	3.61		84	0.769

Notes: the statistic is the *t*-statistic of the fitted values of the alternative model listed at the top of the column in an augmented regression in which the other variables are those of the tested model listed in the relevant row. See Davidson and MacKinnon (1981) for details.

Table 3. An encompassing model

Dependent variable: per capita annual growth of PPP-adjusted GDP, 1965-90

Variable	Coefficient (*t*-statistic)	Source Model
Constant	–32.9 (–3.45)	
Log 1965 per capita income (*Y*)	7.36 (3.08)	all
Square of *Y*	–0.594 (–4.07)	*EL*
Openness	1.31 (5.20)	*SW*
Log 1965 life expectancy	2.99 (4.05)	*B*, *SW*
Male schooling	0.455 (3.65)	*B*
Institutional quality	0.403 (6.24)	*SW*
Democracy index	3.44 (3.54)	*B*
Democracy index squared	–2.69 (–2.94)	*B*
Central government saving/GDP	7.69 (3.49)	*EL*, *SW*
Government consumption/GDP	–7.32 (–4.10)	*B*
Primary product exports/GDP	–3.02 (–3.58)	*SW*
Terms of trade growth	0.216 (4.52)	*B*
Tropical climate	–0.579 (–2.66)	*SW* (amended – see Appendix)
Economically active minus total population growth	0.633 (2.22)	*SW*
No. of observations	70	
Adjusted R-squared	0.920	
Standard error	0.541	

Notes: *B* – Barro (1997); *EL* – Easterly and Levine (1997); *SW* – Sachs and Warner (1997). For definition of variables see Appendix.

Table 4. Effects of adding further regressors individually to the Table 3 regression

Dependent variable: per capita annual growth of PPP-adjusted GDP, 1965-90

Regressor	No. of observations in regression	*t*-statistic of added variable	Adjusted R-squared
Table 3 model	*70*		*0.920*
Landlockedness	70	-0.59	0.919
Square of life expectancy	70	-0.66	0.919
Financial depth	69	0.03	0.916
Ethnic diversity	69	-1.21	0.921
Female schooling	70	-0.74	0.919
Fertility	70	1.15	0.920
Male schooling * *Y*	70	-1.35	0.921
Openness * *Y*	70	-1.64	0.922
Inflation rate	67	-0.37	0.918
Neighbouring countries' growth	70	-0.82	0.919

Note: For fuller definition of variables see Appendix.

III AN ENCOMPASSING MODEL

The next stage is to estimate what improvements can be made by combining all the regressors from the three candidate models in an encompassing model, and then eliminating those regressors that are statistically insignificant. The model that results from this process is shown in Table 3. This model omits landlockedness, the square of life expectancy, and the interactive term between openness and income from the *SW* model, and includes the square of initial per capita income (an *EL* variable) and also the following Barro variables: male schooling, democracy and its square, terms of trade growth and government consumption. The sample size is reduced to 70, but the adjusted R-squared rises to 0.920, and the standard deviation of the residuals falls to 0.541 (compared with 0.847 and 0.769 respectively for *SW*, which is estimated on 84 observations).[2] This is a considerable improvement.

2 *SW* prefer to omit five countries (Botswana, Gabon, Madagascar, Guyana and Israel) as outliers, which substantially improves the fit, yielding an adjusted R-squared of 0.890 and a standard error of 0.628. Their technique for identifying outliers (that of Belsley *et al*., 1980) is however model-specific. In comparing alternative models, it is therefore correct to include these five observations, which might not be identified as outliers with a different model.

The model implies that the relationship between growth and initial per capita income has an inverted U-shape (as Easterly and Levine also find), with a maximum at $Y = 6.12$ [=7.36/(2 x 0.59)]. Since this maximum is below the level of the poorest country in the sample, the implication is that the relationship between income and growth is negative (and with an increasing slope as income increases). The coefficient of openness implies that a country that corresponded to the *SW* definition of "open to international trade" throughout the 25-year period is estimated to have grown 1.3% p.a. faster than one that was closed throughout the period, or 0.05% p.a. faster for each year of openness.[3] Each 1% added to 1965 life expectancy is estimated to add 0.3% to the growth rate. An additional year of schooling for the male population over 25 years adds 0.5% to the growth rate, which is considerably less than Barro's (1997) estimate of 1.2%. A unit increase in institutional quality (which is measured on a scale of 1 to 6) raises growth by 0.4% p.a., which is intermediate between *SW*'s estimate of 0.3% and Barro's estimate of 0.5% for the rule of law index (which is one component of the institutional quality index). The democracy index is measured on a scale of 0 to 1 (1 being the most democratic), and the coefficients indicate a maximum positive effect at a value of 0.65; around this value an increase in the democracy index of 0.1 adds 0.1% to the growth rate.[4]

We come now to the fiscal variables. These imply that an increase in central government saving by 1% of GDP, or a fall in government consumption expenditure by the same amount (with saving unchanged), each raise growth by 0.075% p.a.[5] Lower consumption *accompanied* by increased saving of 1% of GDP (e.g. because other expenditures and taxation are unchanged) is estimated to raise growth by 0.15% p.a. An extra 10% share of primary product exports in GDP is estimated to reduce the growth rate by 0.3%, whilst each 1% p.a. addition to the trend in the terms of trade adds 0.2% to the growth rate. Location in the tropics reduces the growth rate by 0.6%, whilst each percentage point difference between the growth rates of economically active and total population adds 0.6% to growth.

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3 A country has to be non-socialist, not have an export marketing board, have average tariffs and coverage of non-tariff barriers each below 40%, and have a black market exchange rate premium of less than 20% to be classified as open.

4 The industrial countries all have a value of one. Compared with a value of zero, a value of one adds 0.7% to the growth rate.

In Table 4, we show the *t*-statistics of omitted candidate variables when added individually to the regression in Table 3. Of the *EL* variables, financial depth is highly insignificant, whilst ethnic diversity has the expected negative coefficient and slightly increases the adjusted R-squared. This is consistent with *EL*'s results, since they find ethnic diversity to be significantly negative only in some specifications. Landlockedness is now not at all significant, and neither is inflation nor growth of neighbouring countries (a variable suggested in Easterly and Levine, 1998). Female schooling actually has a negative coefficient (as Barro also finds), whilst fertility has a positive one (compared with a significant negative coefficient in Barro, 1997). There is a case for including the interactive variable openness times initial income, with a *t*-statistic of –1.64, since its inclusion raises the adjusted R-squared from 0.920 to 0.922. Schooling times initial per capita income also raises the adjusted R-squared (to 0.921), but performs slightly worse than openness times income.

As an additional test of the robustness, we have added dummy variables for sub-Saharan Africa, Latin America and the Caribbean, East Asia and the OECD to the model. The results are shown in Table 5. The first column of Table 5 reproduces the Table 3 regression, whilst the second shows the results of adding the regional dummies. Collectively, these dummies are insignificant ($p>0.10$), and only one (East Asia) has a coefficient that exceeds one regression standard error.

How, therefore, does our equation explain the large differences in average growth rates of different regions over the period? We address this question in Table 6. The Table shows the growth rate of each region, and the estimated contribution of each variable in explaining it, relative to the omitted category (the Mediterranean, Oceania and Asia west of Thailand - *MOWA*). The first row of Table 6 shows that sub-Saharan Africa (*SSA*) and Latin America and the Caribbean (*LAC*) grew at similar rates, but 1.5% p.a. slower than *MOWA*, 1.8% slower than *OECD* and 3.6% slower than East Asia (*EAS*) in per capita terms.

5 The definition of consumption excludes education and defence expenditures.

Table 5. Testing for regional effects

Dependent variable: per capita annual growth of PPP-adjusted GDP, 1965-90

Variable	Coefficient (*t*-statistic)	Coefficient (*t*-statistic)
Constant	–32.9 (–3.45)	-36.3 (-3.72)
Log 1965 per capita income (*Y*)	7.36 (3.08)	7.89 (3.26)
Square of *Y*	–0.594 (–4.07)	-0.616 (-4.21)
Openness	1.31 (5.20)	1.19 (3.71)
Log 1965 life expectancy	2.99 (4.05)	3.23 (4.32)
Male schooling	0.455 (3.65)	0.399 (3.16)
Institutional quality	0.403 (6.24)	0.383 (4.89)
Democracy index	3.44 (3.54)	2.79 (2.70)
Democracy index squared	–2.69 (–2.94)	-1.94 (-1.95)
Central government saving/GDP	7.69 (3.49)	7.41 (3.35)
Government consumption/GDP	–7.32 (–4.10)	-6.95 (-3.70)
Primary product exports/GDP	–3.02 (–3.58)	-3.18 (-3.77)
Terms of trade growth	0.216 (4.52)	0.209 (4.16)
Tropical climate	–0.579 (–2.66)	-0.768 (-2.73)
Economically active minus total population growth	0.633 (2.22)	0.454 (1.31)
Sub-Saharan Africa dummy		0.234 (0.59)
Latin America and Caribbean dummy		-0.009 (-0.03)
East Asia dummy		0.671 (1.54)
OECD dummy		-0.230 (-0.63)
No. of observations	70	70
Adjusted R-squared	0.920	0.922
Standard error	0.541	0.533
F-test for regional dummies		F(4, 51) = 1.45

Notes: for definition of variables see Appendix. The 10% critical value of F(4, 51) is 2.06.

Table 6. Explaining regional differences in growth rates

Differences in growth rates between regions and in the estimated impact of each variable in the Table 3 regression (% p.a.)

	Sub-Saharan Africa	Latin America & Caribbean	East Asia	OECD
p.c. growth	-1.52	-1.46	+2.16	+0.36
Independent variables				
Per capita income	+2.32	–0.75	–0.07	–3.32
Openness	–0.09	+0.14	+0.51	+1.04
Life expectancy	–0.72	+0.18	+0.12	+0.78
Male schooling	–0.26	–0.07	+0.10	+0.35
Institutional quality	–0.05	–0.10	+0.63	+1.75
Democracy	–0.16	+0.14	+0.21	+0.21
Central gov't saving	–0.07	–0.30	–0.09	–0.36
Government consumption	–0.38	+0.07	+0.08	+0.35
Primary product exports/GDP	+0.19	+0.28	+0.47	+0.51
Terms of trade growth	–0.54	–0.53	–0.41	–0.79
Tropical climate	–0.38	–0.35	–0.27	+0.14
Growth rate of econ. active pop.	–0.19	+0.14	+0.28	+0.01

Notes. All numbers are relative to the omitted region (Mediterranean, Oceania and Asia west of Thailand). Figures reflect the data for the full sample of countries (more than 100 for each variable), not just those used in the regression.

The rest of Table 6 indicates how this is explained by the individual variables in the Table 3 regression. Income effects are very large, highly favourable for *SSA* and highly unfavourable for *OECD*. Most of the other variables offset this enormous income effect, tending to be least favourable for *SSA* and most favourable for *OECD*. East Asia has fast growth, according to this model, because it resembles *OECD* considerably more closely than other developing countries whilst having a low initial per capita income. East Asia is not in fact an exceptional region in any dimension (except the increase in the proportion of the population which is economically active, whose impact is relatively minor) when the full range of countries is considered, but *for a developing region* it has high levels of openness, male schooling, institutional quality and measures of democracy and fiscal rectitude. According to the model low initial per capita income should make *SSA* grow 3% p.a. faster than *LAC*, other things being equal, but that is offset by inferior values of practically every other variable, especially life expectancy, openness, democracy and the trend in the economically active population.

In summary, our results suggest that most of the new variables that have been introduced into growth regressions in the 1990s survive a rigorous test against alternative models. The ones that do not (landlockedness, growth of neighbouring countries) are arguably those with the weakest theoretical basis. Human capital, institutions, specialisation in primary products, and terms of trade changes all seem to be important determinants of growth, and there is considerable evidence of non-linearity in the relationship between income level and growth.

IV CONCLUSIONS

In this paper we have compared the performance of alternative empirical growth models on a common data set. The purpose of the exercise was not just to match these models against one another, but also to establish a benchmark model that encapsulates the state of current research. We found that the model which best fits the data includes elements from all three of the candidate models considered. This encompassing model provides a framework against which future innovations in empirical growth research may be judged: in introducing previously untried variables, an investigator needs to show that these variables improve the fit even in the presence of the full complement of regressors from our encompassing regression. Otherwise, he or she will have failed to demonstrate that the new variables genuinely outperform old ones.

REFERENCES

Barro, Robert J. 1991. Economic growth in a cross-section of countries, *Quarterly Journal of Economics* 106, 2 (May), 407-33.

Barro, Robert J. 1997. *Determinants of Economic Growth: A Cross-Country Empirical Study*, Cambridge, Mass.: MIT Press.

Belsley, David A., Edwin Kuh and Roy E. Welsch. 1980. *Regression Diagnostics*, New York: John Wiley and sons.

Davidson, Russell, and MacKinnon, James G. 1981. Several tests for model specification in the presence of alternative hypotheses, *Econometrica* 49, 3 (May), 781-93.

Easterly, William, and Levine, Ross. 1997. Africa's growth tragedy: policies and ethnic divisions, *Quarterly Journal of Economics* 112, 1203-50.

Easterly, William, and Levine, Ross. 1998. Troubles with the neighbours: Africa's problem, Africa's opportunity, *Journal of African Economies* 7 (1), 120-42.

Levine, Ross, and Renelt, David. 1992. A sensitivity analysis of cross-country growth regressions, *American Economic Review* 82 (4), 942-63.

Sachs, Jeffrey D., and Warner, Andrew. 1995. Economic reform and the process of global integration, *Brookings Papers on Economic Activity* 1, 1-118.

Sachs, Jeffrey D., and Warner, Andrew. 1997. Sources of slow growth in African economies, *Journal of African Economies* 6, 3 (October) 335-76.

Sala-i-Martin, Xavier. 1997. I just ran two million regressions, *American Economic Review* 87, 2 (May), 178-83.

APPENDIX

The following table lists the data sources and the precise designation of the variable in the data source. *SW* denotes Sachs and Warner (1997), and *BL* denotes Robert J. Barro and Jong-Wha Lee, *Data Set for a Panel of 138 Countries* (1994). The non-nested tests are based on the original *SW* model, but in estimating the encompassing model we made three minor modifications. (1) We replaced 1970 life expectancy by 1965 life expectancy, to avoid any possible endogeneity problems. (2) We amended the landlockedness variable, defining Jordan and Zaire, which do in fact have access to the sea, as not landlocked. (3) We amended the tropical climate variable (whose meaning in *SW* is never entirely clear) so that it more accurately represents the proportion of the country that falls between the Tropics of Cancer and Capricorn. This involves some significant reclassifications including Hong Kong as 1 (not 0), Egypt as 0.2 (not 1) and Bangladesh as 0.5 (not 0.1), and rectifying some omissions in the *SW* data set for this variable. A full list of these amendments is available from the authors on request.

Variable	Data source	Variable designation in source
Per capita growth 1965-90	*SW*	G6590
Per capita income in 1965 (log)	*SW*	LGDPEA65
Openness (dummy variable)	*SW*	OPEN6590
Black market premium average 1970-90	Sachs and Warner (1995)	BMP
Male schooling (secondary plus higher) 1965	*BL*	SYRM65 + HYRM65
Female schooling (secondary plus higher) 1965	*BL*	SYRF65 + HYRF65
Financial depth, ave. 1965-90	*BL*	LLY
Inflation rate, average 1965-90	*SW*	INFL6590
Fertility rate 1965	*BL*	FERT65
Central gov't savings/GDP	*SW*	CGB7090
Government consumption/GDP	*BL*	GVXDXE
Life expectancy in 1965 (log)	*SW*	LIFEE065
Institutional quality	*SW*	ICRGE80
Assassinations per capita	*SW*	ASSASSP
Democracy	*Barro (1997)*	DEMOCRACY 1975
Terms of trade growth 1965-90	*Authors*	TOTGR (constructed from World Bank data)
Primary product exports	*SW*	SXP
Tropical climate	*SW*	TROPICS
Tropical climate (amended)	*Authors*	CLIMATE
Landlockedness	*SW*	ACCESS
Landlockedness (amended)	*Authors*	INLAND
Economically active minus total population growth	*SW*	GEAP-POP
Ethnic diversity	*SW*	ETHLING

Neighbour countries' growth	*SW*	G7089N

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