MISSION IMPOSSIBLE! : AN ECONOMETRIC INVESTIGATION INTO THE ECONOMIC ROLE OF HEALTH, EDUCATION AND POPULATION GROWTH IN THE THIRD WORLD .

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PART ONE

Motivation:

OF ALL THE factors of production, the one which has proven most problematic for the analytical logic of economies has been labour. And paradoxically thinkers from Adam Smith to Keynes to Hayek have overwhelmingly postulated that the ultimate determinant of a society's level of welfare are the skills, aptitudes and capacities of its people.

Economics is a discipline concerned with the optimal allocation of scarce resources. Therefore my study will deal with one area where resources are at their scarcest and where conversely economics faces its severest challenge. My area of analysis shall be the economies of the world's poorer countries. Much of the prestige of economics, and of econometrics, shall rest upon its ability to come to terms with these two issues. Our ability to gain a comprehensive and valid understanding of the forces at work within this situation using a combination of empirical tools and theory and the level of our competence to offer worthwhile policy prescriptions will be extremely critical to the intellectual locus standi of our discipline. This paper shall outline and illustrate many of the difficulties which arise during such an enterprise.

PART TWO

Hypothesis:

My working hypothesis shall be one which is harmonious with contemporary mainstream economic opinion. I shall begin by assuming that a change in the productivity or quality of labour leads, ceteris paribus, to increased levels of production and value creation. I shall postulate further that this productivity depends upon three factors; technical aptitude, physical ability and physiological motivation, each of which can be manipulated in a way conducive to enhanced levels of

output.

The first two of the these three factors are treated of by T.W Schultz (1981). In a succinct summary of conventional opinion he argues that a workforces' technical ability is positively related to the level of education which it has received. Resources diverted to education can thus be seen as a form of investment, which by adding to the stock of human capital will result in higher output levels during subsequent time periods. Schultz then argues a similar case for health. A healthier population will be more productive, reflecting greater physical abilities and longer working lives. Again an addition to this stock of capital will lead to increased production quantities.

The third leg of my tripartite thesis is probably the most complex one: psychological motivation. The nature and scope of the forces acting upon this variable are infinite. Cultural, religious, genetic and historical factors all have roles to play. However, I shall confine my study to an examination of the demographic factors influencing the motivations which drive a society's people.

I shall adopt Simon's paradigm (1977) that population growth is conducive to per capita income growth. There are two main reasons for this. Firstly he argues that larger populations can make efficiency gains from economies of scale. Secondly, and more importantly, populations which are growing are more likely to have a dynamic and energetic enterprise culture. This 'population push' thesis sees pressure from increasing numbers, as acting as a spur to individuals and communities to greater efforts and higher levels of efficiency, so much so that a higher per capita GNP results than would otherwise be the case. This represents my starting hypothesis. Further theoretical speculation shall occur after I have confronted it with data.

Part Three

Data collection:

In my efforts to establish the validity or non-validity of these assumptions I collected information from eighteen selected middle-income lesser developed nations (each nation being defined as such by the "1990 World Bank Development Report"). Middle income nations were selected due to the fact that sufficient reliable data was not forthcoming from low income states. The following criteria were used in the selection of the sample set.

1. Available figures - Jordan, Cameroon, and Thailand could not be included due to lack of information on literacy levels and/or life expectancy.

2. Special cases - South Africa and Lebanon were excluded from my data. It was felt that the impact of civil war during the time period covered by this analysis would be such as to distort social and economic life to such an extent that the

inclusion of these two nations would confuse the picture which this project would give of the forces at work within normal or typical third world countries.

PART FOUR

Variables:

Given that my brief is to test my theory by quantifying the impact on economic welfare of varying levels of health and education and of rates of population growth within developing economies, the following variables were constructed:

A. Dependent Variable (Y) - Average annual percentage change in real GNP per capita from 1965 to 1988. Per capita GNP is widely accepted as the most satisfactory proximate indicator of a society's level of economic welfare. The fact is that its rate of change is averaged out over a twenty-three year interval means that stochastic random fluctuations will be evened out and that these figures are valid indicators of the secular trend in the level of economic welfare prevailing within these societies.

B. Independent Variable (X1) - The percentage of the adult population who were illiterate in the period immediately prior to 1965. Literacy rates were chosen as a proxy for indicating the levels of education present within societies. As such the level of literacy is a purely proximate measurement, the admissibility of which has been subject to vigorous debate (Blaug, 1972). However, I shall adopt it as being the best of the alternative indicators for which quantitative information is available. (School enrollment rates and %GNP devoted to education being even less widely accepted.) To remove the ambiguity about causality which often hinders investigation within the social sciences the figures for this independent variable will come from the time period prior to that covered by the independent variable (Y). In this way causality if it exists and can be distinguished and must flow, within this model, from literacy to national income.

C. Independent Variable (X2) - Average life expectancy at birth for the period immediately prior to 1965. Life expectancy is taken to be an indicator of the standard of health prevailing within a society. Again it has been challenged as such. However I believe it to be the best proxy for which statistical evidence is available and its use by respected international institutions such as UNESCO, UNO and the World Bank illustrate this. Again the question of the nature of the causal relationship has been dealt with by selecting figures from the period immediately prior to 1965.

D. Independent variable (X3) - Population number in 1988 as a percentage of that existing in 1965. This variable is based on the UN mid-year estimates for the years concerned and as such represents an acutely. accurate picture of the change in population which has occured over this period.

Because Y and X3 are from an identical time period the issue of causality can be raised. However I am not concerned primarily with this matter. I wish merely to test Simon's "population push" thesis which sees per capita income growth and population increases as being mutually comparible and mutually conductive against the old Malthusian maxim that they are largely mutually exclusive with population growth leading to fewer natural resources per head until its eventually ground to a halt by famine.

PART FIVE

The preliminary model was constructed in the form

$$Y = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + e$$

If our "a priori" hypothesis is supported by the assembled,

then the estimated parameter β_1 would be negative representing a negative correlation between illiteracy and growth, β_2 and β_3 would be positive reflecting a positive relationship between per capita income growth and the healthiness of a population and between per capita growth and population growth.

Multiple regression of the variable Y on X1, X2 and X3 produced the following results:

$R^2 = 0.47755$

Variable	Paramater Estimator	t-statistic	
		H_0:ß=0	P>(t)
Constant	ß0 2.642036	0.45307	0.65744
X1	ß1 0.031453	1.66636	0.11785
X2	ß2 -0.068766	-1.13098	0.27706
X3	ß3 0.014174	0.82213	0.4247

Filling in the parameter estimates produces a true regression line of the form:

$$Y=2.642036 + 0.31453X1 - 0.068766X2 + 0.014174X3 + e$$

e represents the error term

PART SIX

Analysis:

The analysis shall deal only with the multiple regression given above. The results of the regresion of Y on X1, X2 and X3 individually are given in the appendix. The problem which besets all multiple correlations, that of multicollinearity is formally acknowledged but still shall not form a major part of this discussion.

Initially the R^2 result, which was set at 0.47755 is extremely encouraging for our 3 independent-variable model. Given that an infinite plethora of factors determine growth, the fact that over 47% of the differences between the growth rates of these 18 nations can be explained by variations in the levels of literacy, life expectancy and population growth is remarkable.

However closer examination of the evidence produces a less inspiring picture. Firstly the parameter estimate β_1 is positive and that for $\beta 2$ is negative which roundly contradicts my paradigm by suggesting a negative relationship between growth and literacy and between growth and life expectancy. Only one part of my hypothesis, that concerning a positive relationship between per capita growth and population increase is supported by the evidence from this model.

Secondly and crucially none of the estimated parameters are statistically significant either at the 5% level or even at the 10% level as their t-statistics show. This may be due to the presence of multicollinearity, but in any case the result injures, I believe fatally, any remaining convicting power which this model may possess.

PART SEVEN

Ex-poste rationalisation can be employed in defence of the a priori assumptions that a higher educational and health standards are conductive to improved economic welfare.

To begin with the data used as the raw material for this model poses many problems in terms of its validity as a means of making international comparisons. I have outlined these issues in the notes to the data contained in the appendix.

Secondly it could be argued that 3 nations, Argentina, Chile, and Uruguay have historically had high literacy levels and good life expectancies and that the benefits in these nations from reducing illness and removing illiteracy were reaped in a time period prior to that covered by my Y variable in this model, a variable which dates only from 1965. This variable merely deals with the change in economic welfare since 1965 and does not record its absolute level. As such it ignores the probability that increases in output arising from improved education and health may

have occured before this year. This illustrates the difficulty with using a marginal measurement (i.e. average annual change in per capita GNP) as a dependant variable in a regression whilst simultaneously using total concepts (such as "life expectancy" and "total % of the adult population who are illiterate") as independent variables.

Just as these two propositions cannot be considered refuted, neither can the third one concerning per capita growth and population change, be considered verified. Neo-Malthusians could argue that the data supports an alternative thesis. This one would state that per capita output increases are not generated by a "population-push" but rather by improved technology and larger capital stocks which have allowed per capita income and population numbers to rise. In any case the compact time interval of five years(1960-1965)means changes would have been minimal.In any case this model's lack of statistically significant estimated parameters means that its status as a persuasive tool is almost non existent.

This model however does have policy relevance. It instils humility. It suggests that there is no way of predicting whether or not diverting resources towards improved health, educational and population measures will generate growth. Improved standards in these areas are neither necessary nor sufficient conditions for growth. This viewpoint is consistent with a pluralistic world view which sees the world as a mass of dynamic and highly heterogeneous but interlinked societies. A world in which parameters of fixed nature do not exist. In such a world the usefulness to policy makers of econometric models based on the aggregation of distinctive and unique societies as predictive tools is highly suspect. This model illustrates this fact.

Bibliography

Blaug, (1972), Mark,"Education and Economic Growth", pp 61-100 in "An Introduction to the Economics of Education", London, Allen Lane.

Schultz, Theodore W., (1981),"Investing in People: The Economics of Population Quality", University of California Press, London.

Simon, Julian L., (1977), "The Economics of Population Growth", Princeton, University Press, Princeton.

Appendix

Sources of data

X1: "UNESCO statistical handbooks", 1970 and 1975

X2: "United Nations statistical yearbook", 1970 and 1975

X3: "United Nations statistical yearbook", 1970 and 1990

Y : "World Bank World Development Report" 1990

Rounding of data

X1 and Y were rounded to one place after the decimal point

X2 and X3 were rounded to two places after the decimal point

Collection dates for data

X1: Data displayed was not collected on a similar date for each country.

Apart from Botswana (1946) I feel that the data is concentrated within a very compact time interval of five years(1960-1965) over which changes would have been minimal.

X2: Again no data was forthcoming from a single date from each country. The dates of estimation/collection is displayed in parenthesis beside each observation. Again I feel that, apart from Colombia, all figures are contained within a short time interval of twelve years (1960-1972), during which massive changes are unlikely to have occured. The intrusion of some of these observation periods into the time period for my Y variable may cause problems for my attempt to ensure that X2 remains strictly independent of Y. However I believe that this drawback is insignificant due to the fact that the infringement on the 1965-1988 period is limited in extent and highly concentrated in the early part of this interval, the latest part of this observation being from 1970-1972.

X3 and Y are observed over standardized time periods.

Collection Methods for data

Y: World Bank notes standardized internationally compatible calculation method.

X1: This is based on a compilation of individual national census returns by UNESCO. This raises problems as literacy can be seen as a continum and not as an absolute. Definitions of "literacy" are acknowledged to differ across countries. This will be reflected in census forms with some national procedures being more stringent and leading to higher rates of official illiteracy than would otherwise be the case. Therefore the validity of these figures as reflecting accurate international comparisons is highly questionable.

X2, X3: UNESCO notes standardised internationally compatible observation procedures