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NÚMERO 217

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**THE LONG -TERM IMPACT OF HEALTH ON
ECONOMIC GROWTH IN MEXICO, 1950-1995**

Abstract

We report on a study of the effects of life expectancy and mortality by age and gender groups on economic growth in Mexico, 1950-1995, using a Granger causality test in economic growth equations. Results indicate stronger causality for longer periods up to 25 years. The effects have a high magnitude of about 2% annual growth for this period. Conditions under which this magnitude is consistent with a series of other studies are discussed. Especially important are: considering many channels of long-term effects and a context of strong economic growth. Significant causality from income to life expectancy is also detected.

Resumen¹

Reportamos un estudio sobre los efectos de la salud, medido por la esperanza de vida y la mortalidad por grupos de edad y sexo, sobre el crecimiento económico de México, 1950-1995. Utilizamos una prueba de causalidad de Granger integrada en ecuaciones de crecimiento económico. Los resultados indican una mayor causalidad para periodos más largos de hasta 25 años. Los efectos muestran una magnitud bastante alta cerca de 2% de crecimiento anual para este periodo. Se discuten las condiciones bajo las cuales esta magnitud es consistente con una serie de estudios. Resulta especialmente importante considerar canales múltiples de efectos de largo plazo y un contexto de crecimiento económico acelerado. Se detecta también una causalidad significativa del ingreso hacia la esperanza de vida.

¹ Este artículo está publicado en Mayer, D. (2001) "The Long-Term Impact of Health on Economic Growth in Mexico, 1950-1995", *Journal of International Development*, 13(1), pp. 123-126.

Introduction

Health improvements, especially amongst adults, resulted in long-lasting income increments in Mexico during the period 1950-1995. These are the main results of Mayer (2000a), summarized in this note, in one of several studies to appraise the macroeconomic effects of health in Latin America (Mayer *et al.*, 2000). One of these studies, which use several Latin American data sets, finds evidence that health is a robust predictor of economic growth (Mora and Barona, 2000). Another, on Brazil, finds that health variables intervene in the dynamics of income, education, school attendance, female economic participation, wages, and net fertility (Mayer, 2000b). A third, a Latin American cross-country study parallel to the one reported here, finds that health has an important long-term impact on income (Mayer, 2001¹). The impact takes time to come into full effect, and is an increasing function of the time lag within the thirty-year data horizon. The implications of the effects of health on income such as these has gained increased attention of such policy making bodies as the World Bank (1993) and the Pan American and World Health Organizations (WHO, 1999).

1. The study

The study we report here applies Barro's (1995) convergence model to a 5-yearly database for the states of the Mexican federation. The partial correlations with future economic growth obtained by several health indicators at different time lags are compared. Significant coefficients imply, as in a Granger test, that causality from health to economic growth, after the effects of the remaining variables have been taken into account, cannot be rejected (for further details see Mayer, 2001).

The database contains economic and educational indicators for 1970-1995; life expectancy for men and women, fertility and infant mortality for the period 1955-1995; and mortality by age and gender groups for 1950-1995.² Economic growth is estimated in regressions using as independent variables: logarithm of initial income, some health indicator, percentage of the population speaking an indigenous language, logarithm of the public expenditure per unit of income, percentage of the population 4 years and younger (this controls for effects of the demographic transition, see Bloom and Williamson, 1998), and time fixed effect dummies, which control for variations in economic conditions that have greatly

¹ See this article for a discussion of the two-way interaction between health and economic growth.

² Excluding the oil-producing state of Campeche, the sample includes 31 federative entities.

affected economic performance over the period being analyzed.³ The choice of variables unfortunately reflects the poor quality of the data available for the Mexican states over this period. There are no good indicators for saving and for educational and medical services. Educational and migration indicators show poor quality and colinearity with health, a problem that using several health indicators together also presents. Indigenous language is thus included partly because of a lack of better indicators, expected to control for some types of variability between the Mexican states and possible biases in the data.

The health indicators used were logarithms of mortality by age groups with lags between 5 and 25 years,⁴ and log fertility and the transformation of male and female life expectancy given by $-\log(80-LE)$ with lags of 5 to 20 years. Results for male and female life expectancy yield a very consistent pattern shown in Figure 1. The coefficients are highly significant⁵ and become larger for longer time lags, something that, for example, is not observed for lagged income. The implied annual growth correlated with the *actual increases in life expectancy* is shown in Figure 2. Female life expectancy increased further and is correlated with a higher level of income growth. The implied magnitude of the proposed causal relationship for the period is of the order of 2% annual growth.

The results obtained for mortality by age and gender groups indicate the age groups driving the life expectancy results. The 30 to 49 age group obtained the only significant coefficients for males, with most significant at a 25 year lag. The most significant female coefficients for time lags greater than 10 years occurred at a time lag of 20 years for age groups 5 to 14 and 15 to 29, while for a 5 year lag age groups 15 to 29, 50 to 69 and over 70 obtained significant coefficients. The single significant male coefficient was larger than the several significant female coefficients. These results show that it is mainly adult and possibly reproductive health that is driving the long-term life expectancy results, rather than infant mortality. Due to the short time lag, the 5-year results for women may reflect reverse causality from income fluctuations to maternal and old age female health.

Educational indicators⁶ contemporaneous with initial income added as explanatory variables, of which the most significant is schooling, loose significance in the presence of the lagged health variables, indicating that some of the effects of health may occur through education. The opposite causality test, from income to health, was also carried out, although with less lags available in the data. Income is

³ Otherwise an error structure with different expected means for different periods would be introduced. The full equation is $(y_{t+s} - y_t)/5 = \alpha_0 y_t + \alpha_p H_{t+s-5p} + \beta_1 X_1 + \dots + \beta_r X_r + u_t$, where H is some health indicator, p ranges from 1 to 4 for life expectancy and 1 to 5 for mortality indicators (in independent estimates), and X_i represent the independent variables and time fixed effects.

⁴ The age groups were 0 to 4, 5 to 14, 15 to 29, 30 to 49, 50 to 69, 70 and over.

⁵ Probabilities of better than 0.001, t-statistics at least 3.265. The R-squared statistics obtained were about 0.47. The convergence coefficient was always negative and significant. Time fixed effects and the indigenous language variable were also significant.

⁶ Literacy; primary; schooling and an initial year of college.

found to have a significant effect on health. The small size of the coefficients, though, by comparison with other studies such as Pritchett and Summers (1996), indicate that income may increase health indirectly, for example through federally directed compensatory public programs. Primary education for men and all educational indicators for women were found to significantly promote health.

2. Conclusions

The study finds evidence that permanent health improvements lead to permanent increments in income. The magnitudes found for the effects, of an order of 2%, are very large. Of course, much more detailed information is needed for a reliable estimate. Given that economic growth in Mexico was very high during an important part of the period under consideration, the estimates are consistent with Fogel's (1994) finding that a third of the economic growth in Great Britain over the last 200 years can be explained by better nutrition and health. Arora (2001) also finds in a study of nine advanced economies over 100 to 125 years that the proportion of total growth that can be attributed to health indicators lies between 26 and 40 percent. The study on Latin America parallel to the one on Mexico reported here has better economic indicators and is more detailed in that the full life expectancy tables are available (Mayer 2001). It finds for a set of countries experiencing slower economic growth a contribution of health to income of the order of between 0.8 and 1.5% per year. Both studies indicate that health has long-term effects on income that must be addressed in microeconomic studies if they are to fully account for the economic effects of health.

Figure 1. Partial Correlation of Life Expectancy with Future Economic Growth

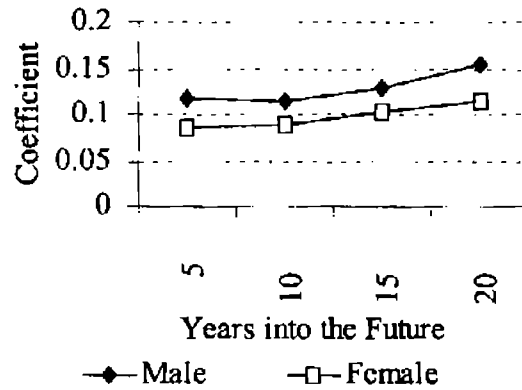
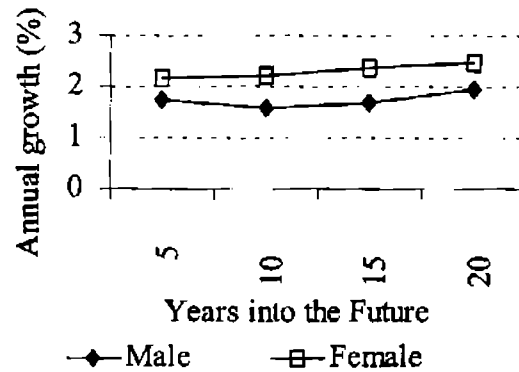


Figure 2. Magnitude of the Correlation of Life Expectancy with Future Economic Growth



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