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Human capital, fertility decline, and economic development: the case of Costa Rica since 1950.

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Context

The case of Costa Rica since 1950 is a good test case for studying the joint influences of fertility decline and increased investment in human capital on economic development. Fertility was very high before 1966, then declined continuously after that date (Graph 1). At the same time health (measured through the infant mortality rate and life expectancy at birth) experienced continuous improvement (Graph 2). Per capita expenditure on health and education were relatively high and government policy aimed to build a welfare state, within the context of an underveloped but modernizing national economy.

Per capita income (measured as real GDP per working age population) grew continuously from 1950 to 1980. During the 1980s a severe economic crisis affected the country, imposing sharp cuts in government expenditures, particularly those oriented to social programs. Per capita income declined at the beginning of this decade, then remained close to stagnation. Modest increments during the 1990s have not been sufficient to recuperate the levels of income before the crisis (Graph 3).

During most of the period under consideration a major effort was made to improve and extend the education system, as demonstrated by time series data on gross enrollment rates in primary and secondary school (Graph 4). The starting level of primary school coverage was notably high in contrast with the very low level observed for secondary education. The gains in high school enrollment were particularly impressive from 1950 to 1980. After 1963 primary school coverage attained one hundred percent of the school age

population. At the secondary level a ceiling was reached by the 1980s. Undoubtedly this reflected the economic crisis and the subsequent changes in public policies.

Briefly stated, during the period under study Costa Rica started a rapid process of demographic transition, while economic achievements allowed the state to finance an important and steady investment in human capital focused on education and health. Although the trend seems to reverse during the 1990s, private investments in both sectors have been minimal as compared to public investments. In other words, the development of national systems of education and health, with universal access and coverage, was during most of the period under consideration a major feature of the welfare state.

Model testing

This paper focuses on the effects of human capital investments and demographic variables on economic welfare. Basic time series data cover the period 1950-1998. The dependent variable is per capita income, measured as real GDP per working age population. This is an indicator of wellbeing as well as economic performance (Bloom, 1999). The independent variables address several dimensions of demographic change and human capital investment: total fertility rate, life expectancy at birth, infant mortality rate, working age population, population density, and gross enrollment rates in primary and secondary school. Logs were taken to allow the interpretation of the linear regression coefficients as elasticities.

Different models were tested using the Prais-Winsten (1954) transformed regression estimator to correct for first-order serially correlated residuals. The Prais-Winsten estimator is a generalized least squares estimator. The advantage of this procedure over the classic Cochrane-Orcutt (1949) method is that preserves the first observation instead of dropping it, as is the case in the iterative method developed by Cochrane-Orcutt.

The fitted models are reported in Table 1. Although the signs of the coefficients are as expected, none of the demographic variables show significant relationships with per capita income. The final model only includes the gross enrollment rates in primary and secondary school as independent variables. The Durbin-Watson statistic is close to 2.0, the expected value under the null hypothesis of no serial correlation, and the estimated

elasticities are significant at the 95% confidence level. The adjusted R-squared coefficient is certainly very high.

The estimated model is

$$\text{Log Per capita income} = 2.9 + 0.69 \text{ Log Primary} + 0.20 \text{ Log Secondary} + u_t$$

And $$u_t = 0.51\, u_{t-1} + e_t$$

The term u_t incorporates an autoregressive process of first order.

Discussion

The available literature about human capital and economic growth (P.T.Schultz, 1994, Barro, 1998, etc.) has developed a wide consensus showing strong and positive effects of schooling on economic performance. The Costa Rican case is not an exception. The ceiling attained by the gross enrollment rate in secondary school and per capita income in the 1980s and 1990s is an additional proof of this strong and important relationship.

The weak relation between fertility and mortality change and per capita income illustrate the fact that in spite of the economic crisis and stagnation during the 1980s and 1990s, life expectancy at birth was continuously increasing and the infant mortality rate was continuously declining. In other words, it seems that the investments in health had an "inertia effect" that came into effect once a certain level of improvement was achieved.

Fertility effects are more difficult to grasp. The total fertility rate increased during the 1950s, reaching its zenith at the beginning of the 1960s. After reaching that ceiling it steadily declined. The economic environment does not seem to have a clear effect.

The purpose of this paper has been simply exploratory. It is necessary to improve the education indicators, introducing gender distinctions and more refined indices. With respect to health it is important to add specific indicators for public health services and morbidity. The effect of demographic variables on economic development still deserves further consideration. The framework recently developed by Bloom and associates (1999) seems to be as fruitful as promising.

References

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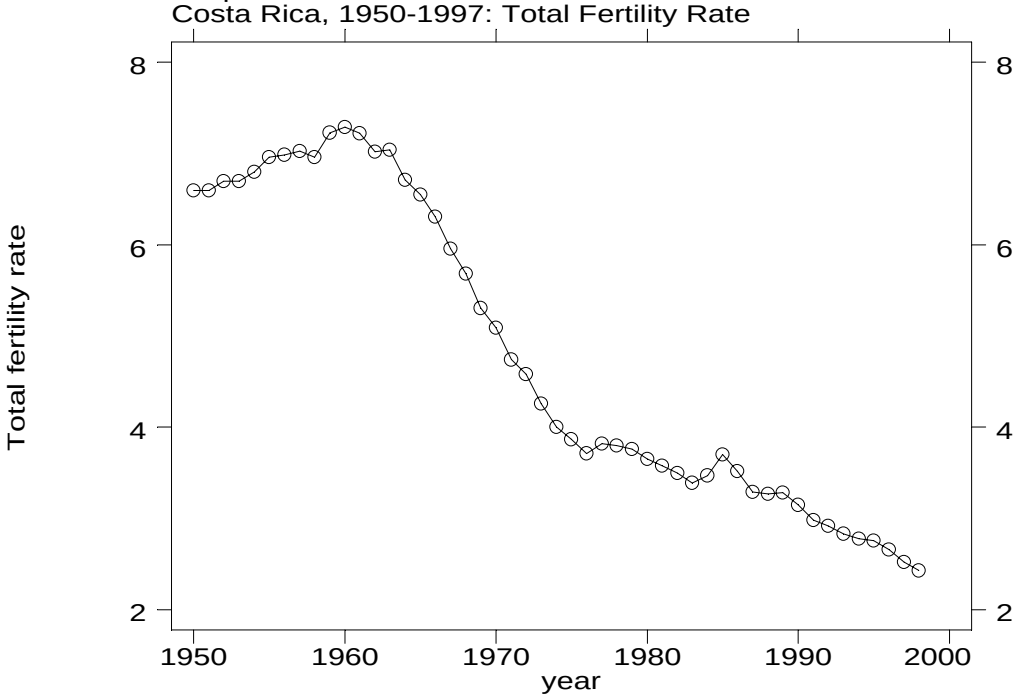
Table 1: Costa Rica (1950-1997): Explaining changes in per capita income.
Dependent variable: Log Real GDP per working age population

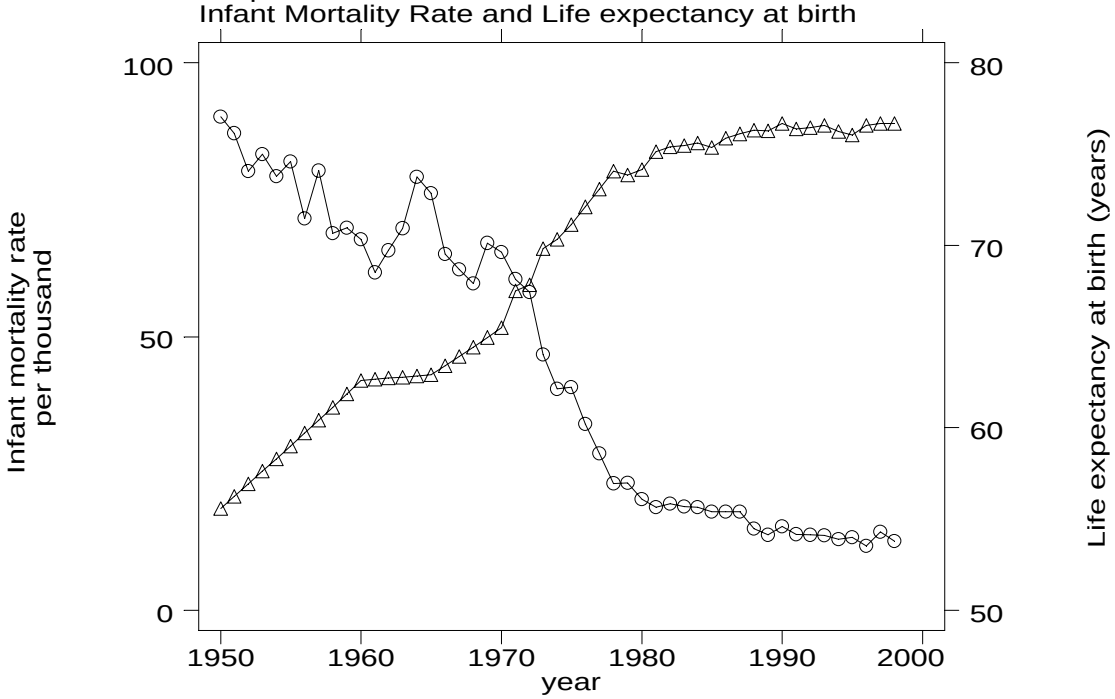
Independent variables	Full model	Final model
Constant	10.05 (4.579) P=0.034	2.8769 (0.6241) P=0.000
Log total fertility rate	-0.1616 (0.11) P=0.151	
Log life expectancy at birth	-0.556 (0.593) P=0.354	
Log infant mortality rate	-0.0269 (0.593) P=0.623	
Log working age population	-0.3615 (0.344) P=0.300	
Log population density	0.6074 (0.319) P=0.342	
Log gross enrollment rate in primary school	0.5095 (0.249) P=0.047	0.6863 (0.1428) P=0.000
Log gross enrollment rate in secondary school	0.3557 (0.663) P=0.000	0.2914 (0.0164) P=0.000
Rho	0.4564	0.5125
Durbin-Watson statistics	1.809	1.90
Adjusted R-squared	0.9912	0.9927
Number of observations	48	48

Note: Standard errors in parenthesis

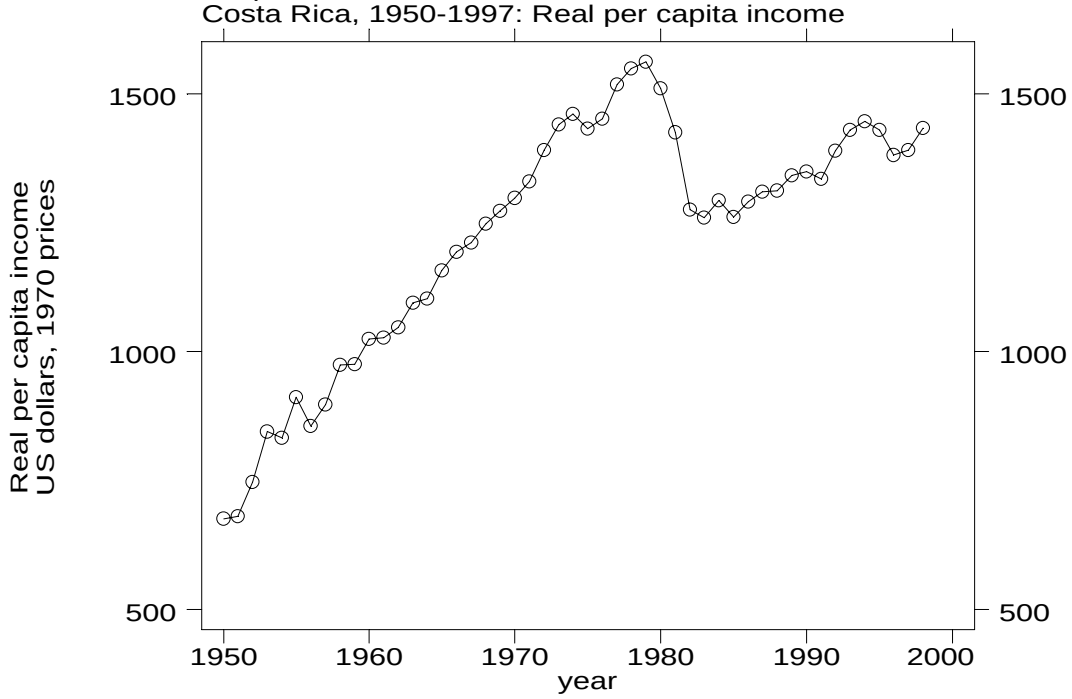
Graph 1
Costa Rica, 1950-1997: Total Fertility Rate



Graph 2
Infant Mortality Rate and Life expectancy at birth



Graph 3
Costa Rica, 1950-1997: Real per capita income



Graph 4
Gross enrollment rates in primary and secondary school