Malaria and National Income: Examining a Two Way Causal Relationship

Saurabh Datta
Doctoral Candidate
Department of Agricultural and Resource Economics
213 Ballard Hall, Oregon State University, Corvallis, OR, 97331
saurabh.charles.datta@gmail.com

Jeffrey J. Reimer
Assistant Professor
Department of Agricultural and Resource Economics
213 Ballard Hall, Oregon State University, Corvallis, OR, 97331
jeff.reimer@oregonstate.edu

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Saurabh Datta and Jeff Reimer
Department of Agricultural and Resource Economics, Oregon State University

Abstract

Simple plots of data show that malaria has a negative correlation with national income per capita, whether looking across countries at a point in time, or looking at a single country over time. Some countries have been able to move from an equilibrium characterized by low income and high malaria, to a new equilibrium with higher income and lower rates of malaria. This study develops and estimates a simultaneous equations model to explain these changes. We distinguish three potential causal chains: (a) the ability for higher levels of income to reduce malaria (true causality), and (b) external factors that may lead to both higher income and lower malaria (correlation). We find that changes in income have a much stronger effect on malaria than the other way around. While a 1% rise in the number of malaria cases per million decreases income per capita by less than 0.01%, a 1% rise in income per capita decreases the number of malaria cases per million by more than 1%.

Problem of identification

Our theoretical model shows that there are two causal chains that could explain the negative relationship between income and malaria over time. When graphed in malaria-income space (see below), both have a negative slope. The identification of the income-to-malaria curve is possible, however, since it’s not shifted by factors that do shift the other curve, e.g., tariff rates and capital intensity. The identification of the malaria-to-income curve is possible since it’s not shifted by factors that do shift the other curve, e.g., climate, geography, percentage of children in the population, and number of physicians.

Results

We find that raising national income per capita has a stronger effect on malaria incidence than the other way around. A 1% rise in malaria incidence decreases per capita income by less than 0.01%. However, a 1% rise in income per capita decreases malaria incidence by no more than 1%. If income were just 1% higher in the 100 countries of the sample, 603,100 cases of malaria could be avoided annually.

These results are statistically significant and quite robust across a range of specifications and estimation techniques (10LS, 2SLS, and 3SLS). They hold whether the sample consists of all 100 countries, just Sub-Saharan Africa alone, or just East Asia alone.

We conclude the negative relationship between malaria and income is best explained by rises in income over time. Our results are consistent with the idea that it is very expensive to reduce malaria, and that increased reductions in malaria are generally accompanied by sustained increases in income.

Our results may possibly extrapolate to a wider variety of diseases and health conditions. In turn, our modeling approach itself is novel and could be used to analyze similar types of issues for other diseases. The economic model might ideally be applied at the household level using survey data. Instead of restricting the sample to a particular region and time in space, however, we have compared the experiences of a large sample of countries over a long period of time. This has allowed us to uncover some interesting stylized facts and contribute toward a preliminary explanation.

References


For further information: Please contact: saurabh.charles.datta@gmail.com

Why this matters

Knowing the direction of causality — or whether a third factor influences both — is important for international development policy. If the negative relationship between malaria and income is driven mainly by the positive effect of reducing malaria so that incomes can increase, then policymakers may want to reallocate public expenditures towards malaria prevention and treatment. If, however, rising incomes are the primary contributor to the negative relationship between malaria and national income per capita, then the policy implications could be different. The government may want to focus expenditures on activities that generate the economy first and foremost, leaving malaria prevention and control to subsequent expenditures paid for with the newly generated income.

Knowing the relative importance of these two channels is important since a number of countries are trapped in an equilibrium characterized by low income per capita and high malaria rates.

A new model

To address this problem, we develop a simultaneous equations model of malaria and economic well-being. We start with a household whose utility function is a function of consumption and health status of the household, as given by the presence of malaria. Malaria in turn is affected by investment in malaria prevention and treatment as well as other exogenous factors, such as climate and medical infrastructure. Every household is a producer as well as consumer, with productivity affected by rates of malaria as well as other factors, such as capital stock.

The model highlights the conflict that arises from provision of costly malaria prevention and treatment. This takes away from direct consumption of other goods, but enhances utility through better health and leads to an increase in household productivity.

The model yields two equations, each of which predict a negative relationship between malaria and economic well-being over time. Conditions are imposed that allow us to work with a representative household for each country, since this corresponds to the nature of the available data.