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The Life-And-Death Implications of Globalization

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Abstract

As an alternative to examining the effect of trade openness on economic growth, this paper investigates the connection between openness and a society's health status. There are a number of advantages with this approach, including a more direct link with welfare and a more comparable data definition across countries. We report several pieces of evidence suggesting that higher trade openness (especially when measured by a lower tariff rate) is associated with a longer life expectancy and a lower infant mortality. On the other hand, financial openness does not seem to help promote better health.

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1. Introduction

Does globalization improves the lives of the people in developing countries? The importance of this question is self-evident. It is only natural that the question has attracted a large scholarship. Most researchers have chosen to address the following version of the question: Does trade openness raise the rate of economic growth? Prominent papers that have answered affirmatively include Dollar (1992), Edwards (1992 and 1998), Ben-David (1993), Sachs and Warner (1995), Frankel and Romer (1999) and Dollar and Kraay (2000). The affirmative answer does not represent a consensus of the profession. In an acid review of the literature, Rodriguez and Rodrik (2001) and Rodrik (2000) argued that each of these papers have serious flaws. In particular, they faulted the previous authors for not using tariff rate or other more direct measure of trade policy in their analyses. In their view, there is no convincing evidence from any existing cross-country study that shows trade openness raises economic growth. [A related question worth asking is whether globalization tends to improve or worsen the income distribution. This literature includes Higgins and Williamson (1999), Spilimbergo et al, (1999) and Dollar and Kraay (2000). The last paper suggested that globalization does not have any systematic effect on the distribution.]

In this paper, we take a different tack by asking: Does globalization help to raise life expectancy and reduce infant mortality in developing countries? There are three motivations for studying this question. First, as life expectancy and infant mortality are important dimensions of a society's well-being, they are interesting objects to look at in their own right. In fact, there is a sense that the health status measure is a better variable to look at than growth rate, because, as Rodriguez and Rodrik (2001) and others have pointed out, the connection between economic growth and a society's welfare is not very tight. As far as we know, there has been no previous study that probes into the relationship between economic openness and a society's health status.

The scarcity of research on this topic contrasts with a relatively large literature on the effect of openness on growth. We suspect that the main reason for this imbalance is that life expectancy and infant mortality are not the usual objects that macroeconomists or trade economists work with. This paper attempts to fill this void.

Second, since vital statistics come from an entirely different data source (i.e., birth and death records) than national income accounts and are collected in a different way, an examination of the change in health status offers at least an independent and complementary check on the effect of openness that development economists care about.

Third, studies on income equality are sometimes criticized because poverty and income distribution are not always measured with a consistent methodology across countries. Even for OECD countries, whose data are arguably of higher quality than for developing countries in general, Atkinson and Brandolini (2001) noted the pitfalls in making cross-country comparisons based on existing data. For example, for countries where multiple measures of income distribution are available (households versus individuals, income versus consumption, etc.), the different measures can give different, sometimes contradictory, patterns. The authors further noted that "in cross-country analysis, use of a dummy variable adjustment for data differences is not appropriate." Given the existing data sources, running cross-country regressions involving income distribution data from developing countries can only make things worse. In addition to the Atkinson-Brandolini criticism, we can add the difficulty in making cross-country comparison of the purchasing power of a given nominal income. The so-called PPP-adjusted income rests on an assumption that a common "representative consumption basket" can be meaningfully constructed for all countries and all straddles of society. We can certainly imagine places where this assumption can break down. In contrast, the definitions of life and death are more consistent across countries, so there is a higher degree of comparability than the data on poverty or income distribution.

There are several channels that globalization may affect life expectancy and mortality. First, embracing globalization may affect a country's income or growth rate, and a change in income would affect the ability of the people in the country to afford medicine, medical care, proper nutrition, proper housing, and other dimensions that may affect health status.[1] Of course, how important this channel is depends on the effect of openness on income or growth rate, which as we said earlier, is controversial.

Second, holding a country's average income constant, globalization can affect public health status by affecting the distribution of income, and therefore, the health status of the poor segment of the society. At a given point in time, life expectancy has an upper bound, and infant mortality a lower bound, due to the limit of biology and medical science. It seems sensible to assume that a nation's average health status is largely a reflection of that of its lower-income members.[2] Therefore, anything that improves or worsens the income distribution, (holding the average income constant), tends to improve or worsen the average public health status of the country.[3] If openness has no systematic effect on income distribution (as Dollar and Kraay, 2001, argued), then this channel would be trivial.

Third, globalization can also have a more direct effect on public health. Countries that embrace globalization which includes not protecting domestic pharmaceutical industries are likely to make the most effective medicine available to domestic citizens at the lowest possible price. Some more people would have better access to effective medicines. Foreign trade and investment may also encourage better exchange of information in other ways, including faster

[1] Countries with higher income level are usually healthier (Pritchett and Summers, 1996).
[2] Wagstaff (2000) calculates child mortality rates by quintile of equivalent consumption for 9 developing countries. He finds that in many countries there is a large gap between the bottom quintile and the rest of the population.
[3] Many authors have pointed out that more equal society is healthier. See, for example, Rodgers, 1979; Flegg, 1982; Walsdmann, 1992; and Wilkinson, 1992. It is often argued that income inequality will play a more important role once the average income pass a threshold of income level (Wilkinson, 1996). Deaton (2001) surveys the literature and argues that the empirical link between income inequality and ill-health is not robust.

introduction of technologies that are more environmentally friendly and therefore more helpful to public health.

Fourth, globalization can also have impact on public health in indirect ways. For example, holding constant the income level, efficiency of government, and the willingness of the government to devote more resources on public health matter as well. If embracing globalization leads to a higher spending on public health, or a better-run government, including a reduction in corruption, then globalization may promote better health in the country.

In the paper, we undertake a systematic look at the evidence based on a panel of 125 countries over the period 1962-1997. We pay particular attention to developing countries, where public health probably has the biggest room for improvement.

The plan of the paper is the following. In Section 2, we review the evolution of globalization patterns and the health status in the developing word from the 1960s to the 1990s. In section 3, we develop some suggestive ideas by focusing on two small subsets of developing countries. The first subset is a collection of countries that have experienced a sustained trade liberation in the last two decades. The second is a group of countries that have experienced a sustained trade retrenchment during the same period. We trace out the evolution of their health status. In Section 4, we perform more formal statistical analyses. Section 5 concludes.

2. Data and Basic Facts

We start by noting that we construct the data on all variables every five years, starting from 1962 whenever possible and ending in 1997. The five-year interval is chosen because the data on life expectancy and infant mortality are available only on this basis. To maintain compatibility, we report measures of openness also on the basis of the same five-year spans.

Furthermore, whenever the data are available, we use three-year average for all variables (over current and the previous 2 years) to smooth out short-term fluctuations due to idiosyncratic factors.

2.1 Trade Openness

We review some basic facts regarding the level and evolution of policy restrictions to trade. The most direct measure of policy restriction to trade would be tariff level. However, governments also employ a variety of non-tariff barriers (NTBs) to restrict trade. Indeed, the very success of various rounds of trade negotiation under the auspices of the General Agreements on Trade and Tariff (GATT) and now the World Trade Organization (WTO) probably shifts governments choice of protection more towards NTBs. However, unfortunately for economic analysts, the name NTBs itself suggests that non-tariff types of barriers come in different shapes and forms and probably keep reinventing themselves. So by their nature, they are far more difficult to define and quantify than tariffs. As a consequence, after reviewing a standard measure of NTB coverage ratio, we will also examine the evolution of the trade-to-GDP ratio as a proxy of trade openness that presumably reflect the combined influence of tariffs and NTBs.

We start with a review of the evolution of the tariff rates across countries. The tariff data cover up to 158 developing countries during the period 1982 – 1997. The tariff rates on unweighted averages for all goods in *ad valorem* rates (MFN rates whenever possible). It is arguably the best panel data set on tariff levels available. It is compiled from a large number of sources, including World Trade Organization, the World Bank, and the Inter-America Development Bank. The details are provided in an data appendix. We are somewhat concerned with possible problems with data comparability from pooling data from disparate sources. On the other hand, we do not have a non-arbitrary way to improve/clean the data.

In any case, the top panel of Table 1a reports summary statistics on tariff levels decade by decade as well as for the entire time period. In the 1980s, the mean (or median) tariff rate across all developing countries was 28 percent (or 25 percent). In comparison, the tariff rates in the 1990s were noticeably lower by approximately ten percentage points, with a mean (or median) equal to 18 per cent (or 15 per cent). To reinforce the message, the top panel of Table 1b reports the summary statistics on changes in tariff rates for all the five year spans. As we can see, the mean changes in the tariff rate have always been in the direction of lower barriers to trade in every single five year span. Figure 1 plots the frequency distribution of the tariff changes across all countries and all time periods. Again, it is clear that a majority of tariff changes were tariff reductions. Therefore, judging purely from the evolution of the tariff levels, one would say that the developing countries, collectively, have unambiguously embraced more trade liberalization over time.

Of course, tariffs are not the only barriers to trade. Indeed, the very success of various rounds of multilateral negotiations on tariff reductions might have induced many governments less inclined to embrace openness to resort to non-tariff barriers (NTBs) to trade. The trouble with the NTBs is that they come in different shapes and forms, and are notoriously difficult to measure accurately. For a small number of countries – 30 to be exact, one can obtain a measure of NTB coverage ratio, or the fraction of HS 2-digit tariff-lines that involve licensing requirement, prohibitions, quotas and administered pricing. In the middle panel of Table 1a, we report the summary statistics on the level of the NTB coverage ratio. By this measure, 30 percent of the tariff lines, on average, involved some type of NTBs in the early 1990s. This ratio was reduced to 14% in the second part of the 1990s. For only 17 of the 30 countries, the data on NTBs were available for both sub-periods. The country coverage is probably too small for this data to be useful in more systematic statistical analysis. More importantly, any existing measure

of NTBs almost certainly capture only a subset of all possible NTBs. There is no strong basis to assert that the left-out NTBs should be proportional to the subset of NTBs that get measured.

A third possible way to infer a country's openness is to look at an outcome variable, the ratio of total trade (exports plus imports) to GDP. This measure has drawbacks: Many factors other than tariffs and NTBs could affect this ratio. An obvious example would be the proximity to the world's major export markets such as the United States and Western Europe. If one instead look at the change in the trade-to-openness rather than the level (or equivalently, if one includes country fixed effects in any regression analysis), the problem is mitigated partially. This measure also has its advantages relative to the previous tariff data and especially the data on NTBs: the effect of the unmeasured part of the NTBs is reflected here too. Moreover, the data on this ratio is readily available for a larger set of developing countries over a longer span of time.

The lower panel of Table 1a reports the summary statistics on the level of trade-to-GDP ratio for all decades from the 1960's to the 1990's. Both the mean and the median ratios exhibit a steady increase over time. The lower panel of Table 1b reports the summary statistics on the change in the trade-to-GDP ratio over seven 5-year intervals. Two features of the data are worth noting. First, the average and the median changes are almost always positive, with the exception of the 1982-87 interval. Second, there is tremendous amount of variations across countries in every 5-year interval. There are always countries that exhibit a decline in the trade-to-GDP ratio while others show an increase in the ratio.

Figure 2 presents a scatter plot of the log ratio of trade-to-GDP against the tariff level. A negative relationship is discernible easily. This suggests that the variation in the trade-to-GDP ratio reflects partly variation in the tariff level (across countries and times). At the same time, the correlation is far from perfect, suggesting that other factors including various forms of non-tariff barriers to trade may also at work to affect the trading volume.

Here are the bottom lines of the discussion: The data on NTBs are too sparse to be useful in the subsequent statistical analyses. Neither tariff nor trade-to-GDP ratio is a satisfactory measure of the overall trade policies. Tariff level is an explicit part of a country's trade policy, but its usefulness as an indicator of overall trade policy framework probably declines over time. For example, the correlation coefficients between tariff rate and log trade-to-GDP ratio were -0.55 and -0.56 in 1982 and 1987, but declined to -0.44 in 1992, and further to -0.29 in 1997. Moreover, comprehensive data on tariff levels are only available only in more recent years, limiting the scope of feasible analysis. The ratio of trade-to-GDP may help to capture the comprehensive effect of all NTBs as well as the tariff level and is available for many more countries over a longer span of time periods, but it may be contaminated by factors other than trade policies.

In the subsequent analysis, we will look at both tariff levels and ratios of trade to GDP as indicators of openness, while keeping in mind the caveats discussed above.

2.2 Life Expectancy and Infant Mortality

We use two measures of a country's overall health status: life expectancy and infant mortality. Life expectancy is the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Infant mortality is the number of infants who die before reaching one year of age, per 1,000 live births in a given year. The life expectancy and infant mortality data are at 5-year interval over the period from 1962 to 1997 for the years ending with 2 and 7.[4] Data for both variables are from the World Bank's *World Development Indicator* CD-ROM (WDI).

[4] While the data are sometimes reported annually in WDI, the additional data are often simply extrapolations between estimates at five-year frequencies. Life expectancy for Japan is not available in 1977, 1978 data is used instead.

Table 1c reports the summary statistics on the levels of life expectancy and infant mortality decade by decade. Table 1d reports the summary statistics on the changes in the two health measures for all seven 5-year intervals in the sample. A few patterns from these summary statistics are worth highlighting here. First, both the mean and the median changes in life expectancy are positive, suggesting a steady increase in life expectancy in the developing world. Second, symmetrically, the mean and median statistics on infant mortality exhibit a steady decline over time. Third, there are variations across countries. In every period, there are countries that exhibit a decline in life expectancy and/or a rise in infant mortality. We will note later that almost all cases of extreme changes – those that are more than three standard deviations away from the mean – can be identified with large-scale wars, famines, or a dramatic burst in AIDS epidemics. These cases will be eliminated when we move to the section on a more formal statistical analysis.

3. A Tale of Two Country Groups: Sustained Trade Expansion vs. Retrenchment

To fix ideas, before we go into a more formal statistical analysis, we take a look at the experience of two small subsets of developing countries. The first subset is a collection countries which have experienced a sustained expansion of trade (relative to GDP) over the last two decades, while the second subset is a group of countries that have experienced a sustained trade retrenchment during the same period. We then trace out the evolution of life expectancy and infant mortality to see if the performances of the two groups diverge in any systematic way. This exercise is not a substitute for a formal analysis, but meant to be a road-pointer.

We use the following procedure to identify the countries of interest. First of all, for all (non-oil-exporting) developing countries for which we have data, we identify major trade expansion and major trade contraction episodes, based on how they are compared with the

empirical distribution of all changes in log trade-to-GDP ratio over the sample. Specifically, all episodes whose increase in log trade-to-GDP ratio exceeds the 75th percentile threshold are defined as "trade expansion episodes." All those whose (negative) change in log trade-to-GDP ratio fall below the 25th percentile threshold are defined as "trade retrenchment episodes." There are 165 trade expansion and 165 trade retrenchment episodes, respectively.

A country is defined as having experienced "a sustained trade expansion" in the 1980s and 1990s if

(a) There have been at least two trade expansion episodes since 1982,

(b) At least one trade expansion episode takes place in the 1980s,

(c) No trade retrenchment episode occurs anytime in the 1980s and 1990s.

Of the 117 developing countries in the sample, only eight countries satisfy these criteria. They are: Bangladesh, China, Malaysia, Mali, Mexico, Nepal, Paraguay and Turkey.

Similarly, a country is defined as having experienced "a sustained trade retrenchment" since the 1980s if

(a) There have been at least two trade retrenchment episodes since 1982,

(b) At least one trade retrenchment episode takes place in the 1980s,

(c) No trade expansion episode occurs anytime in the 1980s and 1990s.

Ten countries satisfy these criteria: Benin, Bolivia, Central Africa Republic, Cyprus, El Salvador, Haiti, Liberia, Malawi, Niger, Peru, and South Africa[5].

The top panel of Table 2 reports the evolution of the mean life expectancy and mean infant mortality for these two groups of countries. Generally speaking, the mean life expectancy grows faster for the group of countries with sustained trade expansion than for the group with sustained trade retrenchment. By 1997, the difference in the cumulated increments in life expectancy reached 2.7 years between the two groups of countries. Similarly, the mean infant

mortality almost always shrinks faster for the group with sustained trade expansion. By 1997, the cumulative reduction in infant mortality is faster for the group with sustained liberalization by 7.7 infants per 1000 live births. Figures 3a and 3b visually present these patterns.

In the lower panel of Table 2, the median values of these two variables for the two groups are reported. Essentially similar patterns emerge as from the top panel. The difference between the two groups of countries is somewhat smaller. Figures 4a and 4b record these evolutions. Overall, the result based on the medians suggest that the difference between the two groups is unlikely driven by one or two countries with extreme values.

Of course, it is not the case that every country in the group of sustained trade expansion dominates every country in the other group in terms of changes in life expectancy or infant mortality. However, the impression one can get from these cases is that there is a plausible case to be considered that trade expansion may be associated with a faster increase in life expectancy and a faster reduction in infant mortality.

In the next section, we will investigate whether this association goes beyond the possibility that countries with a sustained and fast expansion in trade tend also be those that experience a sustained and fast expansion in income per capita.

4. Panel Regression Analyses

Before we proceed with the regressional analyses, we choose to exclude three sets of countries from our sample. The first set is a group of countries whose change either life expectancy or infant mortality in any of the 5-year interval exceeds three standard deviations from the sample mean[6]. They are virtually are countries with long-lasting civil wars or border

[5] Seychelles and Grenada were dropped as their data in 1977 were missing.
[6] They are Botswana, Burundi, Cambodia, Democratic Republic of Congo, Kenya, North Korea, Lesotho, Liberia, Libya, Mozambique, Rwanda, Somalia, South Africa, Vietnam, Zambia, Zimbabwe.

wars, large-scale genocide, famines, or a major outburst in AIDS epidemic. The second set is a group of Central and Eastern European countries and the former Soviet Republics. Many of these countries experienced a decline in life expectancy subsequent to the break-up of the Soviet Union. This happened to coincide with a collapse of their trade with Russia and a major reorientation of trade towards the West. The third set of countries to be excluded are major oil exporters.[7]

Let H_{kt} denote health status (either log life expectancy – in years – or infant mortality – number of deaths per 1000 live births) for country k in year t. X_{it} is a measure of openness (tariff rate in the first part of this subsection). The basic specification we use is of the following form.

$$(1) \qquad H_{kt} = \beta X_{kt} + W_{kt}\Gamma + \sum \alpha_i D_i + \varepsilon_{it},$$

where W_{it} is a matrix of control variables. D_i represents country fixed-effect which takes the value of 1 if i=k and zero otherwise.

We start with log life expectancy as the left-hand-side variable. As a benchmark, reported in Column 1 of Table 3, we only have a dummy for high AIDS incidence country/years. The coefficient on tariff is -0.174 and statistically significant at the one percent level. This is consistent with the view that higher trade barriers may hinder the improvement in life expectancy. In Column 2, we add log income per capita. The idea is to see if the negative association between tariff and life expectancy simply reflects the possibility that as countries grow richer, they may simultaneously reduce tariffs and experience a rise in life expectancy. The coefficient on income per capita is positive and significant, reflecting the unsurprising fact that richer countries have longer lives due to better nutrition, better access to health care and a

[7] Major oil-exporting developing countries are: Algeria, Angola, Bahrain, Congo, Rep., Gabon, Iran, Iraq, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela.

slew of other good things that go with being richer. The interesting observation for us is that the coefficient on tariff, although smaller in absolute value, remains negative and statistically significant. This suggests that may be some direct channels for openness to be beneficial to improvement in life expectancy that go beyond any possible indirect effect through raising income.

In Column 3 of Table 3, we add a measure of a country's average educational attainment as a control, specifically the average years of schooling for females age 25 or older. This measure is highly correlated with other measures of average educational attainment. The coefficient on this variable is positive and statistically significant, which is perhaps not surprising per se. Interestingly, the addition of this variable knocks out the statistical significance of income per capita. On the other hand, the coefficient on tariff level remains negative and statistically significant. The point estimate (-0.097), however, is substantially smaller than before. In the last two columns of Table 3, we include some additional controls: number of physicians per thousand residents, as a measure of access to health care; a dummy for democratic political system, to explore the idea that societies with politically enfranchised poor are more likely to have social programs addressing extreme poverty and diseases that afflict the poor; a measure of capital account openness, defined as the ratio of gross capital flows to GDP, to check if the tariff effect may in part usurp the effect of a more open capital account; and finally a measure of corruption (ICRG ratings), to assess the possibility that bad institutions may simultaneously lead to higher trade barriers for rent-seeking purpose and to lower public health spending or other factors that could reduce life expectancy. As it turns out, none of these additional regressors is statistically significant. The shrunken sample might be partially responsible for this. Importantly for us, the coefficient on tariff level continues to be negative and statistically significant. Therefore, the negative association between trade barriers and life expectancy is, so far, a sturdy result.

It might be useful to also reflect on the quantitative importance of the statistical result. Taking the point estimate on the tariff level in the last column (-0.121) literally, an eleven percentage points increase in tariff rate – approximately one standard deviation of the changes in tariffs over a five year period – is associated with a rise in life expectancy by 1.2 years.

It is also noteworthy that financial openness, unlike trade openness, does not seem to be associated with any improvement in life expectancy for the developing countries.

In Table 4, we turn to infant mortality as an alternative measure of a society's health. We proceed in the same way as before by sequentially adding more control variables. By itself, tariff rate has a positive and statistically significant coefficient (0.065 in Column 1 of Table 4). This means that higher trade barriers are associated with a higher infant mortality. Log income per capita enters into the regression with a negative and statistically significant coefficient (in Column 2 of Table 4), indicating that as countries get richer, infant mortality tends to fall. On the other hand, tariff rate still has a positive and significant coefficient, suggesting the positive association between trade barriers and infant mortality goes beyond their common association with income level. When other controls are added in the last two columns, per capita income again loses statistical significance, but tariff rate retains its positive and statistically significant coefficient. So Table 4 corroborates with Table 3 in that lower trade barriers are found to be associated with a better health status for developing countries.

In Table 5, we replicate the key regressions above, but this time, with the addition of the year dummies. The first three columns report results on life expectancy. Generally speaking, tariff rate is no longer statistically significant. This might be interpreted as evidence that the association between lower barriers and better health is not very robust. On the other hand, the coefficients on income per capita and schooling become negative and statistically significant. It is hard to think of a sensible story in which higher income level or more schooling should be associated with a worsening in a society's health status. Therefore, this evidence may also

suggest that inclusion of the year dummies is not appropriate in this context, although the exact reason for this is not clear.

In any case, Columns 4-6 of Table 5 re-examine infant mortality with year dummies in the regressions. Again, per capita GDP switches signs in a way that puzzles us. On the other hand, all the coefficients on tariff rate, although smaller in absolute value than without the year dummies, remain positive and statistically significant. In other words, as far as infant mortality is concerned, there is a robust association between higher trade barriers and poorer health status for developing countries.

We now turn to using log trade-to-GDP ratio as an alternative measure of trade openness. The basic results are reported in Tables 6 and 7. Generally speaking, a greater degree of trade openness is associated with a longer life expectancy and a lower infant mortality (according to Columns 1 and 3 of Table 6). This relationship goes beyond the possible common association of these variables with income per capita (according to Columns 2 and 4 of Table 6). Per capita income enters into the regressions with the "correct" sign: a higher income per capita is associated with better health. When one adds number of physicians, corruption, democracy and capital account openness, then trade openness is not significant (Columns 2 and 4 in Table 7). In thise case, the added regressors are not significant either. Note that the inclusion of these additional regressors have substantially reduced the number of observations in the sample, which might be responsible for the change in the point estimate on trade openness. If one deletes these insignificant regressors, one returns to Columns 1 and 3 in Table 7, where trade openness is statistically significant. If one adds year dummies to the regressions (not reported to save space), income per capita paradoxically switches to the "wrong" sign: a rise in come would be associated with a worsening in health status. At the same time, the openness variable as measured by trade-to-GDP ratio would become insignificant.

Dynamic Panel Regressions

Up to now, we have not allowed for the possibility that a society's health status may be very persistent and any improvement can only be small and incremental. One way to allow for this possibility is to estimate a dynamic panel regressions in which lagged value of health status enters into the specification.

$$(2) \qquad H_{kt} = \theta H_{k,\,t-1} + \beta X_{k,t} + W_{k,t}\Gamma + \sum \alpha_i D_i + \varepsilon_{it}$$

The coefficient on the openness measure X in the current specification can be thought of as the short-run effect of openness on a society's health. If openness measures are persistent too (e.g., countries that were closed in the 1970s were also more likely to be closed in the 1990s), then the estimates in the previous sub-section can be thought of as the long-run effect of openness on a society's health.

Arellano and Bond (1991) proposed an approach that utilize past sample moments, upon appropriate testing, as instrumental variables for the lagged dependent variable (and potentially other non-exogenous regressors). We follow their procedure here.

The results on log life expectancy are reported in Columns 1-4 of Table 8. In Column 1, lagged life expectancy (i.e., 5 years ago), tariff rate and log per capita income are the main regressors (in addition to the country fixed effects). The coefficient on lagged life expectancy is 0.85 and statistically significant. This indicates a high degree of persistence for life expectancy: e.g., countries that were ranked high in the 1970s are likely to be ranked high in the 1990s too. Tariff rate has a negative and statistically significant coefficient, suggesting that, after conditioning on a country's recent past health status, a reduction in tariff rate is associated with an increase in life expectancy. The p-value for the Sargan test for over-identification restriction

is high, suggesting that one cannot reject the hypothesis that lagged values of the regressors are uncorrelated with the error term and therefore can be used as valid instrument. In Column 2 of Table 8, we add years of schooling and # physicians to the regression. These two variables produce positive and statistically significant coefficients, which are not surprising. The per capita income now has a negative and significant coefficient, which is somewhat counter-intuitive. In any case, the coefficient on tariff rate remains negative and statistically significant. Again, both the Sargan test for the over-identification restrictions and the test for the second order autocorrelation do not reject that the selected lagged values are valid instruments.

In Columns 3 and 4 of Table 8, we add year dummies to the dynamic panel regression specification. This has the effect of rendering years of schooling insignificant. Log income per capita still has a counter-intuitive negative sign. More important for us, however, the coefficient on tariff rate continues to be negative and statistically significant. That is, conditioning on the past health status, higher trade barriers appear to be associated with a lower current life expectancy.

In Columns 5-8 of Table 8, we examine infant mortality as the dependent variable. The rest of the specification is similar to the first four columns. The coefficients on tariff rate in all four columns are positive, consistent with the notion that higher trade barriers are associated with higher infant mortality. However, only two of the four coefficients are statistically significant. This probably suggests that the effect of trade openness, in the short run, is stronger for life expectancy than for infant mortality.

We also use log trade-to-GDP ratio as an alternative measure of trade openness. The basic regression results are reported in Table 9. Generally, the conclusion is qualitatively similar to before: Conditioning on the past health status, a better current health status tends to be associated with a higher trade openness.

5. Conclusions

This paper examines the connection between globalization and health status. We report several pieces of evidence suggesting that higher trade openness is associated with a longer life expectancy and a lower infant mortality. As statistically significant coefficient on trade openness is not obtained in every single specification, we cannot say that the evidence is beyond any shred of doubt. On the other hand, if one has to weigh the likelihood between the hypothesis that trade has nothing to do with life expectancy (or infant mortality) and the hypothesis that trade contributes to an improvement in a society's health status, the evidence appears to favor assigning a greater weight to the latter possibility. Furthermore, there is certainly no evidence suggesting that trade openness is detrimental to a society's health. As a noteworthy byproduct, we find that financial openness, unlike trade openness, does not seem to help promote better health.

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Data Appendix:

Trade data are from WDI. All tariff rates are based on unweighted averages for all goods in *ad valorem* rates, or applied rates, or MFN rates whichever data are available in a longer period. Tariff data are from the following sources: WTO, IDB CD ROM database and *Trade Policy Review -- Country Report*, *various issues, 1990-2000*; United Nations Conference of Trade and Development (UNCTAD), *Handbook of Trade Control Measures of Developing Countries -- Supplement, 1987* and *Directory of Import Regimes, 1994*; The World Bank, "Trade Policy Reform in Developing Countries since 1985," World Bank Discussion Paper #267, 1994; *The Uruguay Round: Statistics on Tariffs Concessions Given and Received, 1996* and *World Development Indicators, 1998-2000*; OECD, *Indicators of Tariff and Non-Tariff Trade Barriers, 1996*; IDB, *Statistics and Quantitative Analysis data, 1998*. The tariff data cover 1982-1997.

capital account openness is calculated as the ratio of total capital inflows and outflows to GDP in absolute value. Total capital inflows/outflows are the sum of FDI, portfolio, and other investments (all in absolute value), where other investments have excluded the other investments by monetary authorities and general government. Data are from IMF's *Balance of Payments Statistics* and cover 1972 to 1997.

We further include control variables measuring income, investment, education, health facilities, corruption and democracy.

GDP per capita data are from the Penn World Table 6.0 measured in PPP (chain method, code *rgdpch*) [8]. Investment (to GDP ratio) data are from WDI.

We use three measures of education level: secondary school enrollment, female literacy rate (age 15 and above) and average years of schooling for female ages 25 and above. Data for the first two measurements are from WDI. The data for female literacy rate are only available for 1972 to 1997. Data for years of schooling are from the Barro-Lee data set and are measured as 5-year average (1960-64, 1965-69, etc.). As to the measure of health facilities, we use physician per 1000 person which are also from WDI.

Corruption is measured by the ICRG corruption index (1982-97) from *Political Risk Services*. We also construct a democracy variable (1972 – 97) as the sum of civil liberty and political freedom. Data are from the Barro-Lee data set and Freedom House.[9]

Finally, we include a dummy for high Aids incidence countries. The dummy is assigned as 1 for 1987/92/97 for the 20 countries classified as "Generalized Epidemic" by the World Bank (1997).[10] A dummy for transitional economies is also included in some of the regressions. The dummy is assigned as 1 for the transitional economies for 1992 and 1997.

[8] From Bettina H. Aten's web site (http://webhost.bridgew.edu/baten/).

[9] 1962-87 data are from the Barro-Lee data set, usually in 5-year average. For example, the 1977 data is the average of 1975-79. 1992 data are from Freedom House (1994), used 1993 data. 1997 data are from Freedom House (1994), used 1995 data.

[10] The countries include: Burundi, Benin, Burkina Faso, Botswana, Central African Republic, Cote d'Ivoire, Guinea-Bissau, Guyana, Haiti, Kenya, Lesotho, Mozambique, Malawi, Namibia, Rwanda, Tanzania, Uganda, South Africa, Zambia, Zimbabwe. Aids put a threat to life expectancy. The World Bank (1997) estimates that Aids reduces life expectancy by 22.2 years for Zimbabwe in 1996. The figure for some other countries include: Burkina Faso 11.3 years, Cote d'lvoire 11 years, South Africa 7 years, Brazil, 5.3 years, Thailand: 2 years.

Table 1a: Barriers to Trade and Trade

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
Tariff Rate						
Overall	282	0.22	0.18	0.15	0	0.99
1980s	124	0.28	0.25	0.17	0	0.99
1990s	158	0.18	0.15	0.12	0	0.80
Core NTMs						
1989-94	29	30.52	22.7	27.15	0	99
1995-98	30	14.48	10.9	17.65	0	93.8
Trade/GDP						
Overall	807	0.71	0.59	0.48	0.03	4.2
1960s	145	0.53	0.43	0.36	0.12	2.59
1970s	176	0.64	0.55	0.44	0.04	3.24
1980s	222	0.76	0.61	0.51	0.11	4.23
1990s	264	0.82	0.71	0.50	0.03	3.78

Notes: Non-tariff Measures (NTMs) is calculated as frequency ratio in % of all HS 2-digit product categories. Core NTMs include licensing, prohibitions, quotas and administered pricing.

Table 1b: Barriers to Trade and Change in Trade

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
Change in Tariff Rate						
1997-82	43	-0.12	-6.3	0.15	-0.62	0.10
1982-87	40	-0.03	-0.01	0.14	-0.68	0.27
1987-92	51	-0.04	-0.02	0.08	-0.28	0.10
1992-97	50	-0.07	-0.06	0.11	-0.54	0.10
All 5-year periods	141	-0.05	-0.02	0.11	-0.68	0.27
Change in Core NTMs						
(1995-98)-(1989-94)	17	-0.15	-0.14	0.18	-0.45	0.15
Change in Trade/GDP						
1962-97	63	0.28	0.22	0.35	-0.68	1.23
1962-67	69	0.03	0.01	0.13	-0.45	0.51
1967-72	76	0.02	0.01	0.09	-0.27	0.28
1972-77	82	0.10	0.09	0.15	-0.29	0.92
1977-82	91	0.06	0.04	0.18	-0.28	0.99
1982-87	107	-0.06	-0.05	0.17	-0.76	0.39
1987-92	110	0.06	0.05	0.18	-0.33	1.01
1992-97	126	0.05	0.04	0.20	-0.79	1.00
All 5-year periods	661	0.04	0.03	0.17	-0.79	1.01

Table 1c: Life Expectancy and Infant Mortality

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
Life Expectancy						
Overall	1087	59.0	61.46	11.6	31.2	79.1
1960s	244	52.64	51.02	11.41	32.01	72.11
1970s	245	56.54	57.03	11.05	31.22	73.71
1980s	294	61.46	64.48	10.25	35.46	76.98
1990s	305	63.56	68.03	10.71	34.11	79.13
Infant Mortality						
Overall	1071	76	65	53	3.6	263
1960s	245	108	115	55	19.8	215
1970s	248	88	88	53	12.4	263
1980s	273	67	58	45	7.4	189
1990s	305	50	34	41	3.6	195

Table 1d: Change in Life Expectancy and Infant Mortality

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
Change in Life Expectancy						
1962-97	122	10.74	10.88	6.18	-2.98	22.58
1962-67	122	2.03	2	0.97	-0.60	5.50
1967-72	122	1.97	2.05	1.25	-5.10	7.19
1972-77	121	1.78	2	1.57	-9.10	4.94
1977-82	123	1.92	1.99	1.57	-1.65	13.79
1982-87	144	1.74	1.66	1.16	-1.60	6.25
1987-92	149	0.78	1.2	2.53	-14.00	3.87
1992-97	151	0.73	1.14	2.50	-11.11	7.81
All 5-year periods	932	1.52	1.80	1.87	-14	13.79
Change in Infant Mortality						
1962-97	122	-61.05	-58	30.22	-136.1	-6
1962-67	121	-10.71	-10	5.97	-29	3.8
1967-72	122	-10.17	-10	8.86	-35	51
1972-77	121	-9.28	-9	11.01	-31	82
1977-82	123	-10.76	-9	11.74	-103	10
1982-87	134	-8.35	-6	8.63	-36	25
1987-92	137	-5.76	-5	11.10	-37	55
1992-97	152	-6.55	-5	9.31	-74	19
All 5-year periods	910	-8.67	-8	9.84	-103	82

Table 2: Health Indicators in Sustained Liberalization/Retrenchment Episodes
Change Since 1977

	1982	1987	1992	1997
Life expectancy (mean)				
Sustained liberalization	2.45	4.52	5.69	7.24
Sustained retrenchment	1.96	3.98	4.08	4.52
Infant mortality (mean)				
Sustained liberalization	-9.25	-24.38	-36.88	-46.45
Sustained retrenchment	-11.92	-22.13	-26.5	-38.7
Life expectancy (median)				
Sustained liberalization	2.57	4.37	5.72	6.64
Sustained retrenchment	2	3.9	4.22	4.36
Infant mortality (median)				
Sustained liberalization	-9.5	-22	-35	-44.5
Sustained retrenchment	-10	-19	-20	-40.75

Table 3: Life Expectancy in Panel Regressions, 1982-97

Dep. Variable: log life expectancy	(1)	(2)	(3)	(4)	(5)
Tariff rate	-0.174**	-0.155**	-0.097**	-0.090**	-0.121**
	(0.025)	(0.025)	(0.025)	(0.035)	(0.043)
Log GDP p.c.		0.064**	0.005	-0.005	-0.031
		(0.015)	(0.016)	(0.022)	(0.028)
Years of schooling (25+)			0.031**	0.035**	0.031**
			(0.004)	(0.007)	(0.008)
Physicians (per 1,000 people)				0.006	-0.007
				(0.015)	(0.016)
Democracy				-0.002	-0.001
				(0.002)	(0.002)
Capital account openness				-0.028	-0.006
				(0.081)	(0.089)
Corruption					-0.007
					(0.007)
Dummy for High Aids	-0.028**	-0.022#	-0.030*	-0.042*	-0.040
Incidence countries	(0.014)	(0.014)	(0.015)	(0.022)	(0.036)
R-squared	0.28	0.40	0.61	0.61	0.62
No. of Obs.	209	183	149	112	83
No. of country	79	67	52	47	40
country fixed effects?	Yes	Yes	Yes	Yes	Yes

Notes:
1. ** 5% level significance, * 10% level significance, #15% level significance.
2. All RHS variables are lagged by one period (i.e. by 5 years) and are calculated as 3-year average (current plus two previous years) when data are available, except for the AIDS dummy.

Table 4: Infant Mortality in Panel Regressions, Tariff, 1982-97

Dep. Variable: infant mortality	(1)	(2)	(3)	(4)	(5)
Tariff rate	0.065**	0.061**	0.044**	0.045**	0.055**
	(0.008)	(0.008)	(0.008)	(0.012)	(0.014)
Log GDP p.c.		-0.012**	0.000	0.001	0.003
		(0.005)	(0.005)	(0.007)	(0.009)
Years of schooling (25+)			-0.008**	-0.009**	-0.006**
			(0.001)	(0.002)	(0.003)
Physicians (per 1,000 people)				-0.001	0.002
				(0.005)	(0.005)
Democracy				0.001	0.001
				(0.001)	(0.001)
Capital account openness				0.019	-0.003
				(0.027)	(0.029)
Corruption					0.003
					(0.002)
Dummy for High Aids	-0.008*	-0.006	-0.006	-0.003	-0.011
Incidence countries	(0.004)	(0.005)	(0.005)	(0.007)	(0.012)
R-squared	0.36	0.40	0.57	0.58	0.59
No. of Obs.	209	183	149	112	83
No. of country	79	67	52	47	40
Country dummy?	Yes	Yes	Yes	Yes	Yes

Table 5: Panel Regressions, 1982-97
(Adding Year Dummies)

Dep. Variable:	Log life exp.	Log life exp.	Log life exp.	Infant mortality	Infant mortality	Infant mortality
Tariff rate	-0.041**	-0.020	-0.006	0.026**	0.026**	0.024**
	(0.020)	(0.034)	(0.029)	(0.007)	(0.011)	(0.012)
Log GDP p.c.	0.009	-0.018	-0.028*	0.007*	0.005	0.002
	(0.012)	(0.017)	(0.016)	(0.004)	(0.006)	(0.006)
Years of schooling (25+)		0.0001	-0.012*		0.002	0.006**
		(0.008)	(0.007)		(0.003)	(0.003)
Physicians (per 1,000 people)		-0.010	-0.023**		0.004	0.006#
		(0.012)	(0.010)		(0.004)	(0.004)
Democracy		-0.001	0.002		0.001	0.000
		(0.002)	(0.002)		(0.001)	(0.001)
Capital account openness		-0.052	-0.031		0.023	0.001
		(0.066)	(0.052)		(0.022)	(0.021)
Corruption			0.000			0.002
			(0.004)			(0.002)
Dummy for High Aids	-0.072**	-0.072**	-0.130**	0.009**	0.006	0.013
Incidence countries	(0.011)	(0.018)	(0.024)	(0.004)	(0.006)	(0.009)
R-squared	0.72	0.78	0.88	0.70	0.76	0.81
No. of Obs.	183	112	83	183	112	83
No. of country	67	47	40	67	47	40
Year and country dummies?	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Panel Regressions, Trade to GDP ratio, 1962-97

Dep. Variable	Log life exp.	Log life exp.	Infant mortality	Infant mortality
Log(Trade/GDP)	0.148**	0.109**	-0.042**	-0.032**
	(0.011)	(0.014)	(0.003)	(0.004)
Log GDP p.c.		0.087**		-0.024**
		(0.013)		(0.004)
Dummy for High Aids	0.051**	0.058**	-0.027**	-0.026**
Incidence countries	(0.019)	(0.020)	(0.006)	(0.006)
R-squared	0.30	0.40	0.29	0.36
No. of Obs.	513	422	515	424
No. of country	98	75	98	75
With country country?	Yes	Yes	Yes	Yes

Table 7: Adding control variables in Panel Regressions, 1962-97

Dep. variable	Log life exp.	Log life exp.	Infant mortality	Infant mortality
Log(Trade/GDP)	0.060**	-0.025	-0.019**	0.0002
	(0.014)	(0.022)	(0.005)	(0.008)
Log GDP p.c.	0.014	-0.004	0.001	-0.002
	(0.015)	(0.027)	(0.005)	(0.010)
Years of schooling (25+)	0.048**	0.033**	-0.015**	-0.008**
	(0.005)	(0.008)	(0.002)	(0.003)
Physicians (per 1,000 people)		0.010		-0.002
		(0.017)		(0.006)
Democracy		-0.001		-0.001
		(0.002)		(0.001)
Capital account openness		0.021		-0.002
		(0.078)		(0.027)
Corruption		-0.010#		0.004#
		(0.006)		(0.002)
Dummy for High Aids	0.008	-0.036	-0.013*	-0.007
Incidence countries	(0.022)	(0.039)	(0.007)	(0.014)
R-squared	0.57	0.49	0.53	0.40
No. of Obs.	331	93	331	93
No. of country	52	42	52	42
country dummy?	Yes	Yes	Yes	Yes

Table 8: Dynamic Panel Regressions, Tariff, 1982-97

Dep. variable	Log life exp.	Log life exp.	Log life exp.	Log life exp.	Infant mortality	Infant mortality	Infant mortality	Infant mortality
Lag of Dep. variable	0.847**	0.829**	0.819**	0.766**	0.723**	0.689**	0.612**	0.677**
	(0.034)	(0.049)	(0.036)	(0.078)	(0.032)	(0.059)	(0.048)	(0.066)
Tariff rate	-0.023**	-0.017**	-0.026**	-0.014**	0.003	0.004*	0.011**	0.003
	(0.006)	(0.004)	(0.006)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)
Log GDP p.c.	0.001	-0.019**	0.000	-0.019**	0.005**	0.004**	0.007**	0.003#
	(0.003)	(0.003)	(0.004)	(0.006)	(0.001)	(0.002)	(0.002)	(0.002)
Years of schooling (25+)		0.005**		0.003		0.000		0.000
		(0.002)		(0.003)		(0.001)		(0.001)
Physicians (per 1,000 people)		0.007**		0.007**		-0.001*		0.000
		(0.003)		(0.004)		(0.001)		(0.001)
Dummy for High Aids Incidence countries	-0.037**	0.011	-0.034**	-0.001	-0.004	-0.014**	-0.001	-0.019**
	(0.007)	(0.013)	(0.006)	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)
No. of Obs.	101	56	101	56	102	57	102	57
No. of country	42	26	42	26	42	27	42	27
year dummy?	No	No	yes	yes	No	No	yes	yes
country dummy?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value for Sargan test of OIR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
p-value for second-order autocorrelation	0.24	0.32	0.23	0.30	0.68	0.24	0.68	0.22

Notes: Two-step estimations. Trade to GDP ratio and income are treated as predetermined.

Table 9: Dynamic Panel Regressions, Trade to GDP ratio, 1962-97

Dep. variable	Log life exp.	Log life exp.	Infant mortality	Infant mortality
Lag of Dep. variable	0.837**	0.863**	0.898**	0.921**
	(0.033)	(0.023)	(0.047)	(0.038)
Log(Trade/GDP)	0.018**	0.012**	-0.007**	-0.007**
	(0.006)	(0.003)	(0.002)	(0.001)
Log GDP p.c.		0.008**		0.007**
		(0.003)		(0.002)
Dummy for High Aids Incidence countries	-0.005	-0.008**	0.002	0.003**
	(0.005)	(0.003)	(0.002)	(0.001)
No. of Obs.	352	295	355	298
No. of country	88	70	88	70
p-value for Sargan test of OIR	0.39	0.91	0.98	0.94
p-value for second-order autocorrelation	0.41	0.26	0.75	0.67

Figure 1: Histogram of the Chang in Tariff Rate
(All 5-year Periods, 1962-1997)

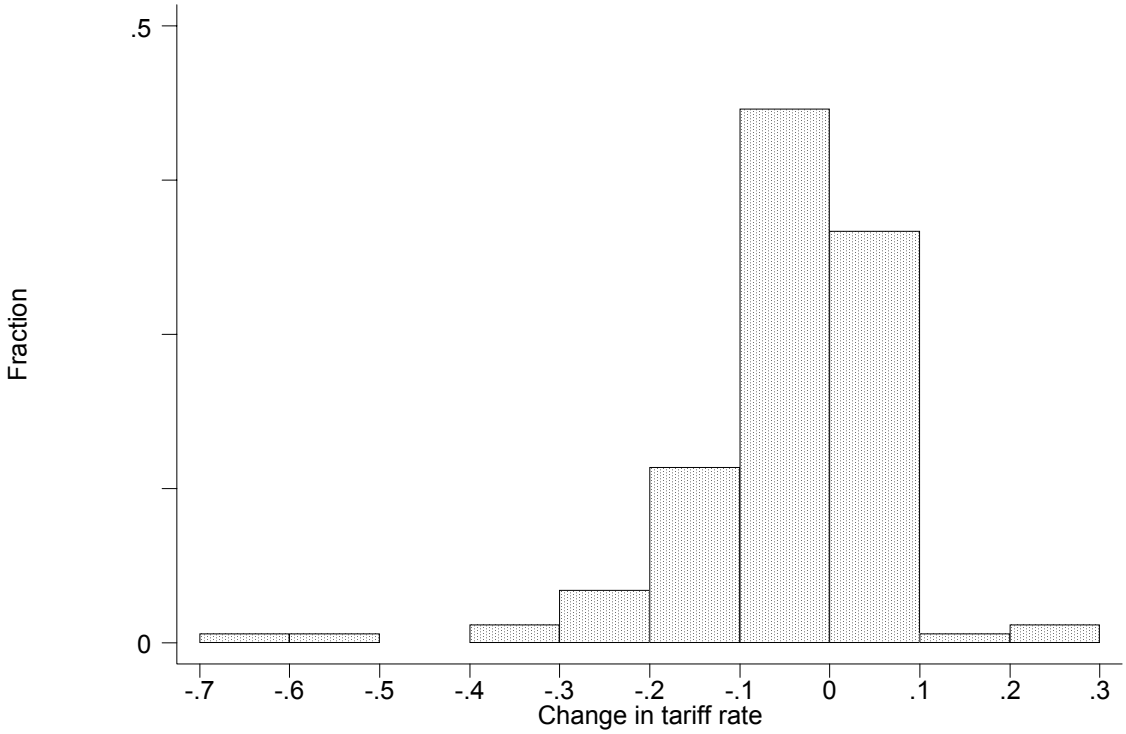

Figure 2: Tariff Rate vs. Log (Trade/GDP)

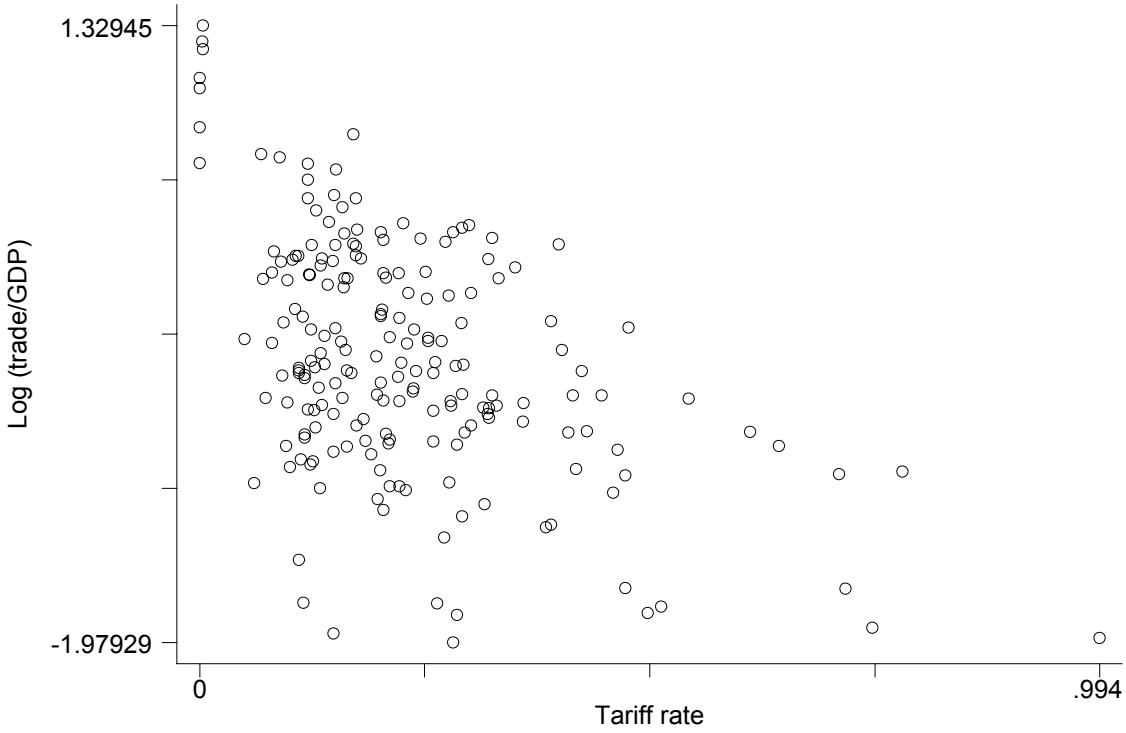

Figure 3a: Change in Life Expectancy Since 1977, Mean

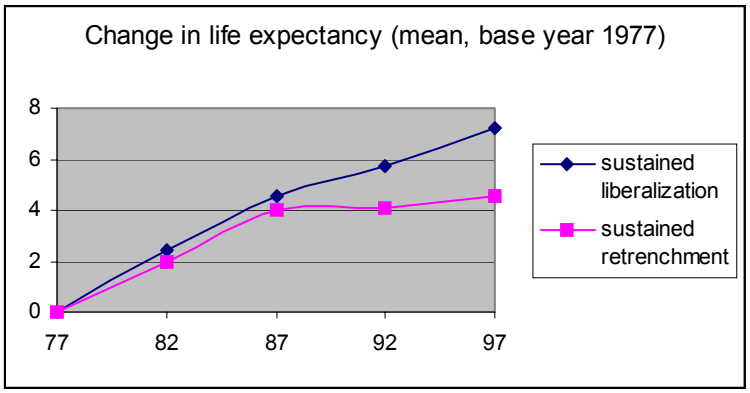

Figure 3b: Change in Infant Mortality Since 1977, Mean

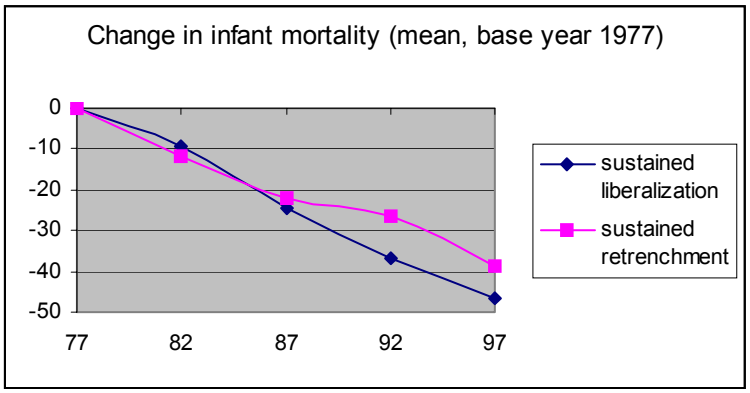

Figure 4a: Change in Life Expectancy Since 1977, Median

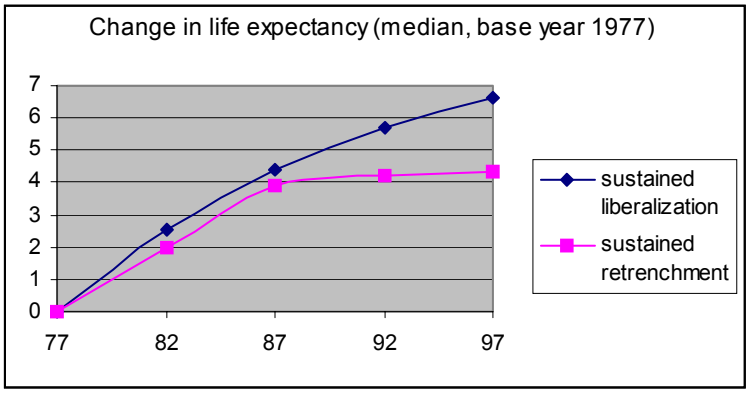

Figure 4b: Change in Infant Mortality Since 1977, Median