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Does globalization hurt the poor?

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Abstract. This paper examines analytically and empirically the extent to which globalization affects the poor in developing countries. I begin with a description of various channels through which trade openness and financial integration may have an adverse effect on poverty. I also stress the possible non-linearities involved – possibilities that have been seldom recognized in the existing literature. I then present cross-country regressions that relate measures of real and financial integration to poverty. The regressions control for changes in income per capita, as well as various other macroeconomic and structural variables, such as inflation, changes in the real exchange rate and the terms of trade, and schooling indicators. I use both individual indicators of trade and financial openness, and a "globalization index" based on principal components analysis, and test for both linear and nonlinear effects. The results suggest the existence of an inverted U-shape relationship between globalization and poverty. At low levels, globalization appears to hurt the poor; but beyond a certain threshold, it seems to reduce poverty – possibly because it brings with it renewed impetus for reform. Thus, globalization may hurt the poor not because it went too far, but rather because it did not go far enough.

Key words: Globalization, poverty, cross-country regressions

1 Introduction

Globalization – defined as the process through which goods and services, capital, people, information and ideas flow across borders and lead to

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greater integration of economies and societies - has made substantial advances in recent decades and is viewed by many as an inescapable feature of the world today. There are, undoubtedly, significant potential benefits to globalization. Openness to foreign direct investment, for instance, can contribute to growth by stimulating domestic capital formation and improving efficiency and productivity, as a result of greater access to new technologies. At the same time, openness to capital flows may also increase opportunities for portfolio risk diversification and consumption smoothing through borrowing and lending; and producers who are able to diversify risks on world capital markets may invest in riskier (and higher-yield) projects, thereby raising the country's rate of economic growth (Obstfeld (1994)). Increased access to the domestic financial system by foreign banks may raise the efficiency of the intermediation process between savers and borrowers, thereby lowering markup rates in banking, as well as the cost of investment, and again raising growth rates (Baldwin and Forslid (2000)). And to the extent that financial openness helps to mitigate asymmetric information problems and to reduce the fixed costs associated with small-scale lending, it can improve the opportunities for the poor to access the formal financial system.[1]

Similarly, openness to trade may generate significant gains, both static and dynamic. Static economic gains, as emphasized by conventional trade theory, refer to the fact that under greater openness to trade, productive resources tend to be reallocated toward activities where they are used with comparatively greater efficiency and away from less efficient activities (such as import-substitution industries or rent-seeking activities). In addition, the literature on endogenous growth has emphasized the existence of various mechanisms through which trade openness may generate dynamic gains and thereby affect the economy's rate of growth in the long run. In particular, it has been argued that trade openness may facilitate the acquisition of new inputs, less expensive or higher-quality intermediate goods, and improved technologies, which enhance the overall productivity of the economy. Romer (1994), for instance, has argued that in an economy subject to trade restrictions, only a narrow range of specialized intermediate goods or capital goods can be profitably produced and therefore the full range of technological possibilities, which rely on a potentially broader range of inputs, cannot be exploited effectively. In this model a greater variety of inputs does more for production than a greater quantity of a narrow range of inputs. Thus, access to a variety of foreign inputs at a lower cost shifts the economy-wide

[1] As discussed by Eichengreen (2001), however, although there is evidence suggesting that international financial openness and financial development may raise growth – as in Bekaert, Harvey and Lundblad (2002), Bosworth and Collins (2000), Jalilian and Kirkpatrick (2002) – there is some debate as to the exact magnitude of these effects. Klein and Olivei (2001), for instance, analyzed the effects of capital account liberalization on growth and financial depth for a cross-section of countries over the period 1986–95. They found that countries with open capital accounts experienced a larger increase in financial depth than countries with closed capital accounts, and through that channel, higher rates of economic growth. However, this positive effect appears to be significant only for industrial countries, not for developing countries. Carkovic and Levine (2002), and Edison et al. (2002), also failed to find a robust, independent effect of FDI and various other measures of international financial openness on growth.

production possibility frontier outward, thereby raising productivity.[2] Moreover, the mechanism through which increased productivity and growth rates occur as economies become open to international trade is not limited to the adoption of more specialized intermediate inputs and machinery available from trading partners; there are many types of useful knowledge that are not embodied in material inputs (such as production engineering and information about changing product patterns) that can also be transferred as a result of trade with more advanced countries. As argued by Romer (1992), in practice, the transmission of ideas may be as important, if not more important, than the transmission of new inputs.

There is indeed some empirical evidence suggesting that trade integration has beneficial effects on the level and growth rate of output. Studies by Frankel and Romer (1999) and Irwin and Tervio (2002) have shown that countries that are more open to trade tend also to have higher growth rates and incomes per capita. Klenow and Rodriguez-clare (1997) used a computable general equilibrium framework that accounts for product variety effects through a production function in which a greater number of intermediate input varieties results (along the lines of Romer's (1994) model mentioned earlier) in productivity gains and higher output, despite the same capital and labor inputs. They found that accounting for such effects can quadruple the static gains from unilateral trade liberalization. Coe et al. (1997) found that trade flows provide a conduit through which advanced production techniques and technological knowledge are transmitted across countries.[3] Wacziarg (1998) found that investment is the most important channel through which trade openness raises growth, accounting for more than 60 percent of the total effect. Moreover, the empirical evidence also suggests that the learning-by-doing and growth effects of these spillovers are largest in countries with higher levels of education. Finally, a recent study by the World Bank (2002) suggests that the countries that have opened themselves the most to trade in the last two decades (the "new globalizers") have, on average, grown the fastest. These countries reduced import tariffs, on average, by 34 percentage points since 1980, compared with 11 percentage points for those developing countries that, on average, saw no growth in per capita incomes over the period. Because trade is good for growth, and growth is allegedly good for the poor (on average, increased growth raises the incomes of the poor in proportion to those of the population as claimed by Dollar and Kraay (2001)) the study concludes that trade (or, more

[2] Several other contributions have emphasized the role of the international diffusion and adoption of new technologies or new goods. Grossman and Helpman (1991) and Rivera-Batiz and Romer (1991), for instance, developed models in which technology is produced by profit-maximizing firms. They showed that openness to international markets can increase the growth rate of technology by increasing the size of the market available to technology producers and allowing those countries with a comparative advantage in technology production to specialize in that activity. International trade may also improve domestic productivity and economic growth by increasing knowledge spillovers from more advanced trading partners. Baldwin and Forslid (2000) extend the Grossman-Helpman framework to account for imperfect competition and scale economies in the research and development sector.

[3] As mentioned earlier, foreign direct investment provides another, perhaps more direct, route through which technology and advanced managerial and production techniques can flow from industrial to developing countries.

generally, international economic integration) is good for the poor. Nevertheless, as for financial integration, there is significant controversy as to the exact magnitude (if not direction) of the benefits associated with trade liberalization. In a detailed review of some of the existing empirical studies, for instance, Rodriguez and Rodrik (1999) cautioned that several of them lack of robustness.

Moreover, it is now increasingly recognized that the process of globalization entails significant risks and potentially large economic and social costs. Openness to global capital markets has brought greater volatility in domestic financial markets, particularly in countries whose financial systems were weak to begin with and economic policies lacked credibility. Large reversals in short-term capital flows (often induced by contagion effects or abrupt changes in market sentiment on world capital markets) have led to severe financial crises and sharp increases in unemployment and poverty, which have in some cases persisted beyond the short term. Similarly, trade liberalization has led in some countries to reduced demand for unskilled labor and lower real wages in the short run; combined with a low degree of inter-sectoral labor mobility, job losses and income declines have often translated into higher poverty rates. As a result, there have been growing concerns about the negative effects of globalization, and an increasingly polarized debate on the plight of the world's poorest – namely, whether many of the 1.2 billion people who still live on less than $1 a day are sharing in the benefits of greater integration among economies, or on the contrary are disproportionately hit by short-run crises and economic downturns.

The main purpose of this paper is to try to assess, using cross-country econometric techniques, the extent to which globalization may indeed hurt the poor. Cross-country regressions – most notably in the context of empirical growth economics – have been the subject of criticism for their *ad hoc* specification and the fragility of many of the results that they lead to (see Temple (1999)). They are, nevertheless, useful tools with significant advantages over "event" or "case" studies. Such studies generally suffer from sample selectivity bias and are unable to isolate with any degree of precision the independent effect of a particular variable or set of variables (that is, in the present context, the impact of globalization on poverty, as opposed to domestic factors and exogenous shocks). Although the econometric methodology used in this paper does not allow one to take a firm stand regarding issues such as causality, it provides a useful first step (subject to the caveats discussed below) in an attempt to disentangle the effects of globalization *per se* on poverty, while at the same time controlling for, and assessing the effects of, a number of other determinants.

The paper is organized as follows. Section 2 identifies various mechanisms, related to both trade openness and financial integration, through which globalization *may* hurt the poor. This review is by no means exhaustive; my objective here is mainly to show that although there are very good analytical arguments to suggest that globalization may benefit the poor (as discussed earlier), there are equally plausible ones that support the view that trade or financial integration may have an adverse effect on poverty. By implication, determining whether globalization is (on net) "good" or "bad" for the poor is – as is often the case in economics – an

empirical issue, not a matter of faith. This is by no means a claim to novelty but rather a reminder of a point that has often been "lost" by partisan views on both sides of the debate. I also emphasize the fact that the relationship between trade and financial openness and poverty may be non-monotonic. This is also important, not only because the possibility of a nonlinear relationship has seldom been recognized in the debate, but also because it has significant implications for empirical tests.[4] Section 3 discusses the basic specification of the regression model (including the choice of control variables) and explains the two dimensions through which globalization is measured. By necessity, my operational definition of "globalization" is narrower than what the concept usually involves (as defined earlier); I focus on measures of trade and financial openness (which indirectly account for technology transfers), but I do not capture the potentially important effects of labor and information flows. Section 4 discusses some basic (linear) regression results. Section 5 extends the analysis and defines a "globalization index" based on principal components analysis. This index is then used as an explanatory variable in both linear and nonlinear regressions – using in the latter case the squared value of the index as a regressor. I also discuss some robustness tests associated with these regressions. Section 6 offers some concluding remarks and stresses the need for further empirical testing.

2 How globalization may hurt the poor

It is actually not very difficult to think of a number of channels through which the process of globalization may hurt the poor. Even some of the most ardent "pro-globalization" advocates would admit that, for instance, trade reform in developing countries may lead in the short run to higher unemployment and greater poverty, as a result of pervasive labor market distortions – such as a low degree of wage flexibility and imperfect labor mobility across sectors. In this section I want to emphasize, without trying to be exhaustive, the possibility that globalization may affect poverty adversely *in the long run* as well. I first describe some possible channels through which trade liberalization may increase poverty, and then proceed to do the same for financial integration. I conclude this overview by stressing the importance of understanding the possible discontinuities and other nonlinearities that may arise in trying to assess the direction and strength of the link between globalization and poverty. Throughout the discussion, I will stress not only the possible direct effects of globalization on the poor, but also the indirect effects that may operate through the rate of economic growth and the distribution of income.

[4] Edwards (2001) did point out the possibility that capital account openness may be beneficial only once a certain level of development is reached. Similarly, Bekaert et al. (2002) found that the impact of financial liberalization on growth depends on the country's level of secondary school enrollment. However, Arteta et al. (2001) found that Edwards' results were not robust; and Bekaert, Harvey and Lundblad focused only on stock market liberalization.

2.1 Trade openness

Although, as noted in the introduction, there are some good arguments suggesting that trade liberalization may improve resource allocation in the short term or raise growth rates permanently (and thus be beneficial to the poor), there are a number of other arguments suggesting the opposite.[5] Opening a country's markets to foreign firms, for instance, tends to reduce the market power of domestic firms and increase competitive pressures on them, eventually forcing (some of) them out of business. In the longer run, the country may well become more efficient in using its productive resources, thereby enjoying higher growth rates and lower poverty. But in the short term, the inability to compete, and the presence of labor market rigidities (segmentation due to minimum wage legislation or wage-setting behavior by firms or trade unions, as well as imperfect mobility across sectors), may hamper the reallocation of all categories of labor from the nontradables sector to the tradables sector that a reduction in tariffs normally entails (see, for instance, Agénor and Aizenman (1996)).[6] As a result, both unemployment and poverty may increase and persist over time.

Similarly, the effects of scale economies and learning-by-doing emphasized in the new theories of trade and growth take place mostly in the production of advanced manufactured products, such as high-technology goods. However, if a country is "lagging behind" technologically and has an initial comparative advantage in "non-dynamic" sectors, openness to trade can reduce the growth rate (Matsuyama (1992)). Indeed, exports of many developing countries continue to consist of raw materials (including energy and agricultural products) and relatively low-technology manufactured goods (such as textiles). Even though openness to trade (and capital flows) may help these countries to assimilate technologies and production techniques over time (thereby enabling them to shift eventually toward the production of goods and services that are characterized by dynamic gains) there may again be a "transition period" during which globalization may have an adverse effect on growth and poverty. Indeed, opening an economy to trade may discourage domestic research and development activities, for instance by inducing the poorer countries to allocate too much of their limited supply of skilled labor to the production of manufactured goods. In such conditions, restrictions on trade may accelerate growth.

Trade liberalization may also lead to higher poverty by reducing the demand for unskilled labor (not only in import-substitution industries, as discussed earlier, but also in other sectors as well) and a worsening of wage income distribution. In a number of countries in Latin America and Asia, openness to trade during the 1980s and 1990s has coincided with an increase in the demand of, and the return to, skilled labor relative to unskilled labor, and a worsening of wage inequality (see Robbins (1996) and Harrison and Hanson (1999)). A possible explanation of this phenomenon is that trade liberalization has been associated with the introduction of higher-level

[5] See Winters (2002) for a detailed discussion of the linkages between trade policies and the poverty.

[6] Imperfect labor mobility across sectors seems indeed to have characterized several recent episodes of trade reform in developing countries (see Seddon and Wacziarg (2001)).

technology, the use of which requires skilled labor. The reason is that the cost of (imported) capital depends not only on the relative price of capital goods but also on tariffs that are incurred in purchasing a unit of capital goods abroad. To the extent that a fall in tariffs translates into a fall in the cost of capital (as the evidence suggests), a high degree of complementarity between skilled labor and capital, and a high degree of substitutability between unskilled labor and capital, would indeed entail an increase in the demand for skilled workers – thereby leading to a widening of the wage gap between skilled and unskilled labor.[7] The reduction in the demand for unskilled labor may translate into higher unemployment for that category of labor and increased poverty. Moreover, in the presence of imperfect credit markets (and following the logic of Galor and Zeira (1993)), the worsening of income distribution may hamper the ability of unskilled workers to pledge collateral and borrow to finance the acquisition of skills, thereby making an escape from the "poverty trap" more difficult. There is strong empirical evidence suggesting that, indeed, human capital accumulation in developing countries is subject to this type of credit market imperfections.

The link between trade openness and the accumulation of human capital is important to understand the long-run effects of globalization on poverty. Do open trade regimes lead to high investment in human capital in developing countries? Some theoretical models actually predict that free trade may lead to a *decrease* in the accumulation of human capital in countries that are initially skills-scarce. Findlay and Kierzkowski (1983), for instance, using a model in which capital markets are perfect, showed that the accumulation of human capital (and thus the supply of skilled labor) in countries that are initially skills-scarce falls when the rewards to education are reduced by the availability of cheaper, skills-intensive import goods. If human capital formation has spillover effects on growth (as in endogenous growth models of the Lucas-Romer variety), trade liberalization may thus lead to higher poverty rates. By contrast, Cartiglia (1997) showed that trade may actually *reduce* initial differences in supplies of human capital. A key element of his analysis is the assumption that credit constraints (as mentioned earlier) limit the ability of unskilled workers to finance the education needed to become skilled. In such conditions, capital market imperfections affect the pattern of comparative advantage and the impact of trade liberalization. Because the argument is, I think, quite relevant for assessing the link between globalization and poverty in developing countries, it is worth reviewing it in some detail.[8]

To begin with, consider a two-sector small open economy in which all workers (skilled and unskilled) live for two periods. Two tradable goods are produced: a "high-tech" good and a "low-tech" good (denoted by the subscripts H and L, respectively). Production of the H good, Y_H, requires both capital and skilled labor (in quantities K_H and S_H, respectively), whereas production of the L good, Y_L, requires capital and unskilled labor

[7] For instance, Beyer et al. (1999) found that trade openness, as measured by the volume of trade over GDP, widened the wage gap between skilled and unskilled labor in Chile.

[8] Galor and Zeira (1996) present an alternative framework in which trade liberalization, by increasing the relative price of goods produced by skilled workers, affects the return to human capital.

(in quantities K_L and U, respectively). Assuming the same Cobb-Douglas technology in both sectors, production is given by

$$Y_H = K_H^{\alpha} S_H^{1-\alpha}, \quad 0 < \alpha < 1, \tag{1}$$

$$Y_L = K_L^{\alpha} U^{1-\alpha}, \tag{2}$$

with the (constant) total stock of capital given by

$$K = K_H + K_L. \tag{3}$$

Let z denote the relative price of the H-good in terms of the L-good; because both goods are tradable, z is given on world markets. Assuming perfect mobility of capital across sectors and perfect competition, the rates of return on capital in each sector (that is, the marginal product of capital) must be equal:

$$\alpha K_L^{\alpha-1} U^{1-\alpha} = z\alpha K_L^{\alpha-1} S_H^{1-\alpha} = r. \tag{4}$$

Using (3) and (4), the equilibrium value of K_H is thus

$$K_H = \frac{K/U}{1/U + z^{1/(\alpha-1)}/S_H}.$$

Wages of skilled and unskilled workers, w_S and w_U respectively, are determined from (1) and (2) by the marginal productivity of labor. Using the resulting expressions and (4), it can be established that

$$\frac{w_S}{r} = \frac{1-\alpha}{\alpha}\left[\frac{S_H}{K} + z^{-1/(1-\alpha)}\frac{U}{K}\right]^{-1}. \tag{5}$$

Thus, for z and the composition of the labor force (S_H and U) given, the composition of production and factor returns are uniquely determined.

As noted above, each Individual lives two periods. In the first period, the individual can either go to school or work as an unskilled worker. Individuals who go to school in the first period of their life work as skilled labor in the second period; the others remain unskilled. At the end of the second period, all individuals die and have one child. There is no population growth, and the size of each generation is normalized to one. At every point in time, one young generation and one old generation are alive, so that the total size of the population is 2. In what follows, let $e_t \in (0, 1)$ denote the proportion of (unskilled) individuals born in period t who go to school in period t.

Within each generation, individuals differ in the ownership of capital. Specifically, the distribution of capital within each generation is assumed to be constant over time and distributed uniformly over the interval ($k_m = a + \upsilon + t$, $k_M = b + \upsilon - t$):

$$n(k_s) = n(k_s; a, b, \upsilon, t) = \frac{1}{b - a - 2t} I_{k_m, k_M}(k_s),$$

where $t \geq 0$, $\upsilon \geq 0$, $a \geq 0$, $b > a + 2t$ and $b > 0$. The richest individuals own $k_M = b + \upsilon - t$ units of capital, whereas the poorest own $k_m = a + \upsilon + t$ units. Thus, of course $k_M - k_m = b - a - 2t$, which is positive given the restriction imposed on b. Let $n(k_s)$ denote the number of individuals who own k_s units of capital.

The number of individuals in each generation is

$$\frac{1}{b-a-2t}\int_{k_m=a+\upsilon+1}^{k_M=b+\upsilon-t} dk_s = 1,$$

whereas the total stock of capital owned by each generation is

$$\frac{1}{b-a-2t}\int_{k_m=a+\upsilon+t}^{k_M=b+\upsilon-t} k_s dk_s = \frac{a+b+2\upsilon}{2},$$

so that

$$K = a + b + 2\upsilon. \tag{6}$$

Thus, because in every period the total size of the population is 2, the size of the aggregate capital stock is $a + b + 2\upsilon$.

The number of individuals in each generation whose stock of capital is at least as large as q is

$$n_q = 1 - \frac{1}{b-a-2t}\int_{k_m=a+\upsilon+t}^{q} dk_s = \frac{k_M - q}{b-a-2t}. \tag{7}$$

A quantity S_E of skilled workers are used to educate those individuals e_t who go to school in each period. Suppose, for simplicity, that the "production" of education is linear:

$$S_{Et} = \gamma e_t. \tag{8}$$

The supply of skilled workers at t is therefore equal to the number of individuals who went to school in the previous period, e_{t-1}, and is allocated between teachers and production of the H-good:

$$S_t = e_{t-1} = S_{Ht} + S_{Et}, \tag{9}$$

which implies that, using (8):

$$S_{Ht} = e_{t-1} - \gamma e_t. \tag{10}$$

The supply of unskilled workers at t is the sum of those who chose not to go to school in the previous period, $1 - e_{t-1}$, and those who opted not to go to school in the current period:

$$U_t = 2 - e_{t-1} - e_t. \tag{11}$$

In the steady state, the number of individuals who become educated is the same in every generation ($e_t = e$); thus, equations (8) to (11) imply

$$S_E = \gamma e, \quad S_H = (1-\gamma)e, \quad S = e. \tag{12}$$

$$U = 2(1-e). \tag{13}$$

Suppose that the price of the H-good is high enough to ensure that the wage differential between w_U and w_S is such that all individuals would prefer to be skilled, but that at the same time imperfections of the credit market (again, along the lines of Galor and Zeira (1993)) are such that the ability to invest in human capital in the first period of life depends on inherited wealth.

Specifically, suppose that individual i will be able to attend school only if the income that he derives from its own capital, rk_i, is as least as large as the cost of tuition, given by the wage of a (skilled) teacher, w_S, multiplied by the teacher-students ratio, γ. That is,

$$rk_i \geq \gamma w_S.$$

Then, setting $q = \gamma w_S/r$ and $n_q = e$ in (7) yields

$$e = \frac{b + \upsilon - t - \gamma(w_S/r)}{b - a - 2t}. \tag{14}$$

This equation gives the number of individuals in each generation that will be able to attend school, as a linear function of w_S/r. Inverting it yields

$$\frac{w_S}{r} = \frac{b + \upsilon - t}{\gamma} - \frac{(b - a - 2t)}{\gamma} e. \tag{15}$$

Substituting the steady-state values of S_H and U from (12) and (13) in (5) and using (6) yields

$$\frac{w_S}{r} = \frac{1 - \alpha}{\alpha} \left[\frac{(1 - \gamma)e}{a + b + 2\upsilon} + z^{-1/(1-\alpha)} \frac{2(1 - e)}{a + b + 2\upsilon} \right]^{-1}. \tag{16}$$

Equations (15) and (16) are two steady-state relations between e and w_S/r that determine the long-run general equilibrium of the economy. An interior solution is obtained for $0 < e < 1$; otherwise, the economy either has no skilled labor and is specialized in the production of the L-good, or has only skilled labor and is specialized in the production of the H-good ($e = 1$).

To examine the effect of trade openness in this setting, consider an economy that is initially skills-scarce and whose comparative advantage in autarky (or prior to liberalization) is in the production of the L-good. When the economy is opened, the price of the H-good falls, and thus z falls as well. This, in turn, leads to a reduction in w_S, the return to the factor specific to the H-sector. The (equilibrium) number of individuals who attend school therefore increases. The reason is that when the price of the H-good falls, the wage of skilled workers falls as well, both because of the direct effect of the price change and because capital tends to move toward the L-good sector. Trade openness makes employment in the production of the H-good less profitable and induces skilled workers to switch away from production and into teaching; the fall in the cost of education that the reduction in w_S entails makes credit constraints less binding and more people can afford education. The supply of skilled labor therefore increases in equilibrium.

The opposite happens in a country whose initial endowment of skilled labor is high and whose comparative advantage, prior to openness, is in the H-good. Trade increases the price of the H-good and induces skilled workers to switch from teaching toward production of the H-good. z rises and trade liberalization is associated with an increase in the demand for skilled labor relative to the demand for unskilled labor; the wage differential between labor categories widens. The cost of education rises and a smaller number of (unskilled) individuals are able to afford it. Put differently, trade liberalization increases the rewards of education in countries that are skills-abundant to begin with, and reduces the reward to education in countries that are skills-scarce initially. Capital market imperfections hinder the accumulation

of human capital because the cost of education is a binding constraint. In initially skills-scarce countries, trade liberalization eases financing constraints (because the cost of education falls as w_S falls) and induces an increase in the accumulation of skills.[9]

Thus, in the presence of capital market imperfections that affect the ability of workers to borrow and invest in human capital, the impact of trade liberalization depends crucially on initial conditions, namely, the country's endowment of skilled labor. Suppose that one is considering a country characterized by a comparative advantage in the production of the *L*-good prior to trade liberalization (a fairly reasonable assumption for many low-income countries); does the model imply that poverty would fall as a result of trade openness? If one takes the unskilled wage as a measure of the poverty line and the ratio of unskilled workers to the total number of workers as an approximation to the "headcount" poverty index, the answer is yes. But if the poverty line is exogenous and the behavior of wages in the aftermath of liberalization is taken into account, the answer is ambiguous, for two reasons. First, although the number of skilled workers rises, their wage falls. Second, as a result of gross complementarity between factors, physical capital used in the production of the *H*-good rises (as can be inferred from (1)) and falls in the *L*-sector; thus, although the fall in the supply of unskilled workers tends to put upward pressure on wages for that category of labor, the fall in the capital stock in the *L*-sector exerts an opposite effect, because of its impact on the marginal productivity of labor in that sector (as can be inferred from (2)); thus, whether w_U goes up or down cannot be established *a priori*.[10] As a result, one cannot say for sure whether poverty rises or falls – it all depends on where the poverty line stands with respect to the initial and post-liberalization levels of the unskilled wage. The point, nevertheless, is that poverty *may* increase, as a result of the interplay between trade openness, the incentives that changes in factor returns create to accumulate human capital, and the borrowing constraints that individuals may face on the credit market when seeking to finance the acquisition of skills.

2.2 Financial integration

As noted earlier, although international financial market integration may bring significant benefits in the long term, it is now well recognized that a high degree of financial openness may entail significant short-term costs as well. The magnitude of the capital inflows recorded by some developing countries in recent years and the abrupt reversals that such flows have displayed at times have been associated with deep financial instability, economic crises and sharp increases in poverty rates – particularly in

[9] Kim and Kim (2000) argued that education (or what they called "general" human capital) may also help to increase the degree of *mobility* of workers across sectors, thereby attenuating the costs of trade reform (including a short-run increase in poverty) and raising growth rates.

[10] Moreover, note that the fact that the supply of skilled labor increases in the model is entirely due to the assumption that the cost of education is proportional to w_U; if one assumes that tuition costs are exogenous, then the credit constraint would not change, possibly leading to no change in the equilibrium number of skilled workers.

countries with imprudent sovereign debt management, improperly sequenced capital account liberalization, and poorly regulated domestic financial systems. The recent crisis in East Asia is a case in point (see, for instance, Horton and Mazumdar (2001), and Fallon and Lucas (2002)).

A key problem associated with financial openness is that access to world capital markets tends to be *asymmetric*. Many developing countries (including some of the richer ones) are able to borrow on world capital markets only in "good" times, whereas in "bad" times they tend to face credit constraints. Access is thus pro-cyclical. Clearly, in such conditions, one of the alleged benefits of accessing world capital markets (the ability to borrow to smooth consumption in the face of temporary adverse shocks), is nothing but a fiction. Pro-cyclicality may, in fact, have a perverse effect and increase macroeconomic instability (see, for instance, Agénor (2003) and Dadush, Dasgupta and Ratha (2000)): favorable shocks may attract large capital inflows and encourage consumption and spending at levels that are unsustainable in the longer term, forcing countries to over-adjust to adverse shocks as a result of abrupt capital reversals. The impact on poverty may thus be magnified.

In recent years, financial globalization in many transition and developing economies has taken the form of greater penetration of the domestic financial system by foreign banks. Unlike trade liberalization, which has often resulted from unilateral decisions by governments to lower tariffs, this form of financial integration has often been less a matter of choice than a decision imposed by the country's situation – in several cases, the need to recapitalize domestic banks in the aftermath of a banking crisis (see Agénor (2003)). Although there are potentially large benefits associated with greater foreign penetration (such as enhanced quality of financial services, better techniques for credit analysis, and reduced risks of domestic financial instability), which may translate into higher growth rates and lower poverty, there are potentially adverse effects as well. Most importantly for the issue at stake, to the extent that foreign penetration is accompanied by a greater concentration of credit flows toward large firms producing tradables, and reduced access to loans by small and medium-size firms (which tend to be more labor intensive than larger ones), it may lead to reduced levels of economic activity, lower demand for labor, and possibly to a greater incidence of poverty and worsening of income distribution. Evidence on this issue is still rather tenuous, but the possibility cannot be dismissed.

Another channel through which financial openness may have an adverse effect on the poor (at least in the short run) is the credit market. As argued by Agénor and Aizenman (1998, 1999) – in a framework that emphasizes the links between capital flows, the financial system, and the supply side of the economy, and monitoring costs, as in the costly state verification approach pioneered by Townsend (1979) – the increased exposure to volatile shocks that is associated with financial openness may translate into higher domestic interest rates (because of the increased risk of default), lower domestic output, and thus possibly higher poverty rates. The key reason is that increased volatility (of world interest rates, in particular) raises expected intermediation costs and lead domestic financial institutions (whose ability to

enforce loan contracts is limited) to either increase domestic interest rates or to ration credit to maintain expected profits.[11]

In addition to *level* effects associated with greater exposure to volatility, financial openness may also have adverse effects on growth and, through that channel, on poverty. If financial openness is accompanied by capital flight, the lower rate of accumulation of domestic capital that may result could be associated with a persistent, adverse effect on growth in the presence of increasing returns driven by externalities in knowledge and capital formation (Song, 1993). Along similar lines, Devereux and Smith (1994) examined the effects of international risk sharing (the ability to diversify portfolios of risky assets) in a multi-country world in which growth is based upon the spillover effects of human capital accumulation. A key finding of their analysis is that when countries share endowment risk via international capital markets, the saving and growth rates can be lower than in autarky. How they arrive at this conclusion is worth examining in more detail.

Consider a world consisting of N countries, each of them with a stationary population. All countries produce a single homogeneous good, and there is an infinitely-lived, representative agent with constant relative risk aversion (CRRA) preferences, given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_{it}^{1-\sigma}}{1-\sigma} \right\}, \quad i = 1, 2, \ldots N.$$

Production technology is also identical across countries. Specifically, output y_{it} is given by

$$\gamma_{it} = \theta k_{it}^{\alpha} (H_{it} x_{it})^{1-\alpha},$$

where k_{it} is the firm's capital stock (and also country i's investment at t, assuming full depreciation within a period), H_{it} the stock of knowledge (or human capital), and x_{it} hours (supplied inelastically). In equilibrium, $H_{it} = K_{it}$ (the economy-wide capital stock), so that there are aggregate constant returns to scale in capital alone.

Each country faces idiosyncratic income risk but there is no aggregate uncertainty at the world level. More formally, there is a country-specific, random income shock, ε_{it}, which is assumed to be proportional to the economy-wide capital stock in each country:

$$\varepsilon_{it} = \gamma_{it} K_{it},$$

where the distribution of the γ_{it} is assumed to be such that each country faces a zero-mean, i.i.d. process for its income risk over time and the aggregate world shock is zero in a symmetric equilibrium $\sum_{i=t}^{N} \gamma_{it} = 0$.

Agents choose consumption, investment, and asset holdings to maximize lifetime utility. Under "financial autarky", there are no markets that allow for international diversification of country-specific risk, and thus no trade in (state-contingent) assets between countries. Domestic saving must therefore

[11] Of course, what this argument implies is not that financial openness *per se* is undesirable, but rather that financial integration should be accompanied by adequate reforms of the domestic financial system to minimize the adverse effects of volatility on output, employment, and poverty.

be equal to domestic investment. Devereux and Smith show that the growth rate in this case, g_{it}^A, is a random variable and is given by

$$g_{it}^A = \phi(\theta + \gamma_{it}), \quad \phi \equiv \left[\beta\alpha\theta E_t(\theta + \gamma_{it+1})^{-\sigma}\right]^{1/\sigma}, \tag{17}$$

where ϕ can be shown to be a time-invariant function of the distribution of γ. This expression shows that, because of the assumption of CRRA preferences (which implies positive third-order derivatives), an increase in country-specific income risk (as measured by a mean-preserving spread in the distribution of γ_i) will increase the economy's (average) growth rate through its positive impact on savings (which equals investment under autarky).

By contrast, under "financial openness", there are complete international markets for risk sharing; with no aggregate uncertainty, this completeness allows agents in each country to fully diversify country-specific risk. Devereux and Smith show that the growth rate in this case is non-stochastic and given by

$$g_{it}^O = \eta\theta, \quad \eta \equiv (\beta\alpha\theta^{1-\sigma})^{1/\sigma}. \tag{18}$$

The expression in (18) is similar to (17), except that the γ distribution does not appear.[12] By eliminating country-specific income risk, financial market integration eliminates the impact of this risk on savings, and therefore on economic growth. A comparison of (17) and (18) shows indeed that the average growth rate is lower under openness, because the elimination of income risk reduces world savings. Put differently, equilibrium growth rates in all countries are lower under financial openness. The reason is that, as indicated above, with CRRA preferences riskier income leads to greater saving as a result of a precautionary motive. With full risk sharing, income risk is diversified away, reducing the equilibrium savings rate in each country. Lower saving in turn tends to lower the growth rate in each country.[13]

As shown by Devereux and Smith, the above result also holds if, instead of income-specific risk, countries differ in that they face specific productivity disturbances, θ_{it}, provided that the distribution of productivity shocks satisfies again a "no aggregate uncertainty" condition and that $\sigma > 1$ (the most relevant case empirically).[14] However, it is sensitive to the assumption that there is only one investment technology available. As can be inferred from the results of Greenwood and Jovanovich (1990) and Obstfeld (1994), if there are many (risky) technologies available, financial openness may increase the equilibrium growth rate – even if it reduces savings rates, as a

[12] Note that to ensure positive growth requires imposing $\eta\theta > 1$.

[13] They also show that if the gains from risk sharing under openness are more than offset by the losses associated with a reduced growth rate, welfare of each country may be lower than under financial autarky.

[14] Note that the assumption of time-separable, CRRA preferences is important for the argument but not crucial: as shown by Weil (1990), with generalized iso-elastic preferences that do not satisfy the axioms of expected utility and in which risk aversion is distinct from (the inverse of) intertemporal substitution, the response of savings to risk would depend in sign only on intertemporal substitution. Thus, in the Devereux-smith model, greater opportunities for risk sharing through international financial integration would therefore lead to lower savings and growth rates if the elasticity of intertemporal substitution is less than one.

result of the precautionary motive alluded to earlier – by leading to a reallocation of savings to projects with high risk and return. In addition, it should be noted that the above model takes the *depth* of the financial system as given when assessing the impact of financial integration; but it is possible that the two may be positively related. In Agénor and Aizenman (1999), for instance, financial openness translates into lower interest rate markups and more efficient intermediation by domestic banks. In that case, international financial openness may bring additional benefits, which could mitigate the adverse impact of a greater opportunity for risk diversification on savings and growth. The point, nevertheless, is that it is possible for financial globalization to have a persistent, negative impact on the poor by lowering growth rates permanently.

2.3 Nonlinearities

The foregoing discussion focused on the possibility of a linear, negative relationship between increased globalization and poverty. There are also, however, possible discontinuities (or threshold effects) and other nonlinearities that may come into play and alter the sign of the relationship between globalization and poverty. Understanding what causes these nonlinearities (which have seldom been acknowledged in the debate on the benefits and costs of globalization) is important not only from an analytical standpoint but also from the perspective of empirical analysis.

Consider the following example.[15] Suppose that trade liberalization has two types of effects. The first is an *output effect*, which translates into an increase in income per capita (as a result, for instance, of improved efficiency in the allocation of domestic resources). Suppose also that, in line with the evidence provided by Greenaway et al. (2002), this effect has a J-curve shape: at first, output falls (as output in import-competing industries drops) and then increases gradually (as the exportables sector expands). Assuming for simplicity a one-to-one, inverse relationship between income and poverty, this implies that globalization has an inverted J-curve effect on the economy's poverty rate.

The second effect of trade liberalization is a *relative wage effect*, which is also assumed to be non-monotonic. Specifically, suppose that at first, the skilled-unskilled wage differential increases with trade openness, possibly because (as discussed earlier) imports of capital goods and the demand for skilled labor increase, leading firms to substitute away from unskilled labor. Employment of that category of labor falls initially and poverty tends to increase. Over time, however, the initial widening in wage differentials may lead to investment in human capital and a gradual increase in the supply of skilled labor; this would tend to narrow the wage differential across skill categories, and liberalization may end up reducing poverty. This second effect may thus take the form of an inverted U-shape relation – which would depend, for instance, on whether there exists a subsidy to skills acquisition or not.

[15] See for instance Albuquerque and Rebelo (2000) for another example of the nonlinear effect of trade reform. Their focus, however, is on changes in the industrial structure, rather than unemployment and poverty.

It is intuitively easy to see that, with both effects being nonlinear, multiple equilibria may emerge. However, for the purpose at hand, what is important to note is that the initial and longer-run effects of trade liberalization on poverty, operating either through output or relative wages, differ in sign: although poverty may rise in the short run, as output increases and investment in education rises, poverty begins to fall. Thus, not only does the sign of the relationship between globalization and poverty vary over time, the absolute value of the elasticity between these two variables is also not constant. Moreover, discontinuities may appear: the initial widening of the wage differential, for instance, may not be sufficiently large to translate into strong incentives to invest in skills; beyond a certain threshold, however, the impact of the wage differential on the propensity to acquire an education may change in a discrete fashion and may trigger a large increase in the supply of skilled labor. These discontinuities could lead, for instance, to a piece-wise linear relationship between globalization and poverty. Similar arguments can readily be developed to argue in favor of the existence of a nonlinear relationship between financial integration and poverty – as can be inferred, for instance, from the "threshold" effect on the volatility of world interest rates discussed by Agénor and Aizenman (1999) in their analysis of the welfare benefits and costs of financial integration.

The thrust of the foregoing discussion is thus twofold. First, although there are solid analytical arguments to suggest that globalization may improve the plight of the poor, there are also equally-convincing reasons to suggest that the poor may not, after all, benefit much from trade and financial integration – at least without government interference. Assessing the net effects of globalization on the poor is therefore not a matter of faith, but rather an empirical issue. Second, there are important nonlinearities that may emerge in assessing the link between globalization and poverty. These nonlinearities are not mere theoretical curiosities; on the contrary, it can plausibly be argued that they may be very much at play in the real world. Ignoring them may seriously hamper the reliability of empirical results and may lead to misleading conclusions regarding the impact of globalization on the poor, as I now show.

3 Methodology

To assess the relationship between globalization and poverty I use a cross-country regression framework, using unbalanced panel data for a group of developing countries for which I was able to collect sufficient data. The dependent variable is the poverty rate (POV), measured by the poverty gap for the population as a whole, based on two international poverty lines used by the World Bank: \$1.08 a day (which yields a measure of "absolute" poverty) and \$2.16 a day ((which yields a measure of "relative" poverty).[16] In

[16] The poverty gap measures the *depth* of poverty, and is defined as the average shortfall of the income of the poor with respect to the poverty line, multiplied by the headcount ratio (which measures the *incidence* of poverty, that is, the proportion of individuals or households earning less than a given absolute level of income). As is well known, there are serious conceptual and practical issues associated with the measurement of poverty, and the use of an "international poverty line" for cross-country comparisons (see, for instance, Deaton (2001)). I will return to these measurement issues in the concluding section.

addition to measures of trade and financial integration, I include two sets of "control" variables, based on my previous results (see Agénor (2002)): macroeconomic variables and structural indicators. Specifically, The set of explanatory variables used in the regressions are the following (see Appendix A for more precise definitions):

INFL is the inflation rate in terms of consumer prices;
LITY is the youth literacy rate in percent of the population aged 15–24, which aims to capture the level of education of the labor force;
GDPPC is GDP per capita at PPP exchange rates, which captures the level of economic development;
REALGR is the annual growth rate of GDP per capita, measured at PPP exchange rates, which can be viewed as either a proxy for the rate of return on physical investment, or as a measure of cyclical movements in output;
REALEX is the annual rate of change of the real effective exchange rate (defined such that an increase is a depreciation);
CTOT is the annual percentage change in the terms of trade.

I have discussed at length elsewhere the rationale for considering these variables (see Agénor (2002)), so only a brief justification is offered here. Inflation (which is a tax on non-indexed assets, such as currency holdings) lowers the overall purchasing power of households and tends to raise poverty. A higher literacy rate, or an increase in either the level of GDP per capita or its rate of growth, are expected to be negatively correlated with the poverty rate. The effect of a real exchange rate depreciation is in general ambiguous; it may lead to a reduction in poverty if it benefits small farmers in the tradable sector (as is the case in many low-income developing countries); but if at the same time it is accompanied by a significant increase in the cost-of-living index in urban areas (as a result of an increase in the domestic price of imported goods), overall poverty may increase. An improvement in the terms of trade tends to reduce poverty if it is brought about by an increase in the price of exports of agricultural commodities (thereby benefiting small farmers in rural areas) or if it results from a reduction in the price of imported consumption goods (benefiting therefore households in urban areas). In addition, a fall in the foreign-currency value of import prices may also have a positive supply-side effect (because it lowers the cost of imported inputs) and may raise output, employment, and real wages, thereby reducing further the poverty rate.[17]

To measure globalization, even narrowly defined (as is the case in this study) to focus on trade and financial integration, is an arduous task. In particular, it is difficult to find an adequate measure of trade openness, which ideally should measure how open markets are to foreign competition. Proxies

[17] In preliminary regressions, I also tried a number of additional variables, such as current transfers as a proportion of GDP, which have a priori an ambiguous effect. The effect of an across-the-board cut in transfers, for instance, may be to raise poverty; but to the extent that it is accompanied by better targeting, poverty may fall. Other variables included health indicators (as measured by the number of hospital beds or the infant mortality rate), and macroeconomic volatility (as measured by volatility of the real exchange rate or inflation). None of these variables proved significant (in contrast to some of the results reported in Agénor (2002)) and often had the wrong sign, and were therefore dropped from the final regression results.

for openness that have been used include tariffs, nontariff barriers, effective rates of protection, trade ratios, import penetration, export intensity, and deviations of actual from predicted trade flows or volumes (see Edwards (1998), Harrison (1996), Harrison and Hanson (1999), and Rodriguez and Rodrik (1999)). Here, to measure trade globalization, I use the average tariff rate (that is, total tariff revenue divided by the value of imports), denoted *TARIFF*. I deliberately excluded the most popular indicator of trade openness, the ratio of the sum of nominal exports and imports to nominal GDP, because of its excessive sensitivity to short-run fluctuations in world commodity prices.

The most common approach to examining the impact of financial openness in cross-country studies is to build an index of capital account restrictions on the basis of the qualitative information reported in the IMF's *Annual Report on Exchange Arrangements and Restrictions*.[18] The trouble with this approach is that it provides no clue regarding the *intensity* of capital restrictions – or, what amounts to the same thing, the effective degree of capital account liberalization. Here, I chose a different route and opted for an "effective" measure of financial globalization, the ratio of foreign direct investment flows (FDI) to GDP, as for instance in Bosworth and Collins (2000). Put differently, the assumption is that more longer-term capital flows as share of output is a signal of greater international financial integration.

It is important to acknowledge at the outset that the above measures of globalization are problematic, because they capture only indirectly the process of trade and financial openness. For instance, the average effective tariff rate does not capture non-tariff barriers – information on which is hard to collect. There are also many factors influencing capital flows, and the ratio of FDI to GDP may not be an accurate proxy for financial openness.[19] Nevertheless, these indicators seem to be a reasonable choice given the alternatives. Thus, if trade openness lowers poverty, the tariff rate should have a positive coefficient in the estimated regressions, whereas if financial integration reduces poverty, the FDI-to-GDP ratio should have a negative coefficient.

In addition to the problem of finding adequate indicators of trade and financial openness, there is a major data constraint relative to poverty rates and some of the other control variables defined earlier. I first started by compiling all the data available on poverty gaps in developing countries contained in the World Bank Live Database (LDB), which cover the period from the late 1980s to the late 1990s. This gives a sample of 59 countries, and a total number of observations equal to, at most, 151. However, due to the

[18] For instance, in their study on capital flows to transition economies, Garibaldi et al. (2002) constructed indices of restrictions on foreign direct investment and portfolio investment. The categories covered in the first index are approval requirements, the extent to which profits can be remitted abroad, ease in liquidating assets, and whether or not direct investment benefits from preferential treatment.

[19] A complementary (or alternative) measure of financial globalization, in light of the growing internationalization of banking, would be the share of assets of the domestic financial system held by foreign banks. However, I was unable to obtain sufficient observations from the Bankscope database to include this variable in the regressions. Yet another possible approach would be to use the indicator of intensity of capital controls developed by Edison and Warnock (2001); Unfortunately, their calculations pertain mostly to middle-income countries.

Table 1. Poverty and globalization: basic regression results (OLS with fixed effects)

	Dependent variable: Poverty gap			
	Poverty line at $1.08 a day		Poverty line at $2.16 a day	
	(1)	(2)	(3)	(4)
INFL	0.002 (3.913)	0.002 (4.214)	0.003 (1.837)	0.003 (1.931)
LITY	−0.335 (−2.301)	−0.330 (−2.344)	−0.379 (−1.627)	−0.379 (−1.737)
GDPPC	−0.043 (−3.948)	−0.040 (−3.709)	−0.122 (−5.505)	−0.121 (−5.700)
REALGR	−0.028 (−0.602)		−0.008 (−0.084)	
REALEX	0.031 (3.532)	0.032 (3.682)	0.086 (3.412)	0.087 (3.587)
CTOT	0.014 (0.958)		0.008 (0.174)	
FDI	0.850 (2.442)	0.732 (2.186)	1.433 (1.537)	1.376 (1.657)
TARIFF	−0.119 (−1.951)	−0.130 (−2.204)	−0.394 (−2.593)	−0.398 (−2.768)
Adj. R2	0.770	0.779	0.872	0.879
Number of obs.	60	60	60	60
Standard Error of Regression	0.015	0.014	0.035	0.034

Note: INFL is the annual change in the consumer price index. LITY is the literacy rate for the youth as a share of total population. GDPPC is the lagged value of the log of the GDP per capita (purchasing power parity). REALGR is the lagged value of the annual growth rate of GDP per capita (purchasing power parity). REALEX is the annual change in the real effective exchange rate index (a rise is depreciation). CTOT is the percentage change in the terms of trade. FDI is the lagged value of foreign direct investment as a share of GDP. TARIFF is the lagged value of the tariff rate, which is the ratio of import duties to imports

lack of available data on some of the control variables or globalization indicators (average tariffs and FDI flows), the maximum number of countries that can be used drops to 36. I then excluded the countries for which the number of observations on the poverty gap is equal to one, and end up with a sample of 16 countries and 60 observations – 3 countries for which the number of observations is equal to two (Dominican Republic, Morocco, Tunisia); 3 for which the number of observations being equal to three (Jordan, Peru, Sri Lanka); 6 for which four observations are available (Colombia, Costa Rica, Ghana, Indonesia, Mexico, Pakistan); 3 for which five observations available (Brazil, the Philippines, Thailand); and one for which six observations available (Venezuela).

The first estimation method that I use is OLS with fixed effects. To account for simultaneity problems with the control variables, which from my previous studies appear to be particularly important for growth and GDP per capita, I used lagged values of these two variables. I also use lagged values of the tariff rate and the FDI-to-GDP ratio, to account for possible simultaneity problems between these indicators and poverty.

4 Preliminary evidence

Table 1 summarizes some preliminary results, based on linear regressions, for both measures of the poverty gap defined earlier. Regressions (1) and (3) include all the variables defined earlier, whereas (2) and (4) exclude those variables that are statistically insignificant. Inflation has the correct (positive)

sign in all cases and is statistically significant at conventional levels. Growth in income per capita and changes in the terms of trade have no significant effect on poverty. An increase in the rate of depreciation of the real exchange rate has a strong, negative effect on poverty in all specifications, possibly because improvements in the relative price of tradables benefit to a significant extent farmers producing exportables in the agricultural sector. The literacy rate has the correct sign in all the regressions shown in the table but is only weakly significant when the relative poverty measure is used. The level of real GDP per capita, by contrast, has the expected negative sign and is highly significant in all regressions. Finally, the FDI-to-GDP ratio does appear to have a significant (adverse) effect on the behavior of poverty across countries, and so does the average tariff rate. Thus, trade and financial integration appear to increase poverty – perhaps through some of the various channels identified earlier. But drawing strong conclusions on the effects of globalization would be premature; the regression results shown in Table 1 assume the existence of a linear relationship between globalization and the poor. But as discussed earlier, there are good reasons to believe that the relationship may be nonlinear.

5 Testing for nonlinearities

To capture the possibility of a nonlinear relationship between globalization and poverty, I proceed in two steps. First, instead of using two independent indicators as before, I derive a "composite" index of globalization (defined in such a way that an increase represents greater integration) by using principal components analysis. Second, I introduce the squared value of the index in the regressions. For an inverted U-shape curve between poverty and globalization to exist, the coefficient of the linear term should be positive, whereas the coefficient of the squared term should be negative. The peak of the quadratic equation would then identify the "threshold" level of globalization beyond which further integration reduces poverty.

5.1 Principal components analysis

Various approaches can be devised to construct a composite indicator of globalization. One option is to extend the methodology used for instance by Wacziarg (1998), and use regression techniques to combine various indicators of trade openness and financial openness.[20] A general problem with that approach, however, is the difficulty of defining relative weights in an objective manner. In this study, I tackle the problem differently. To derive a composite indicator of trade and financial globalization, I use principal components analysis (PCA). In essence, PCA aims to replace a given set of variables by a smaller set that best "summarizes" the larger set. More formally, the principal components display the eigenvalue decomposition of

[20] Wacziarg (1998) developed an index of trade policy by combining several indicators, including average tariffs and an indicator of non-tariff barriers. The weights used to construct the combined index are determined from a regression of trade volumes (as a share of GDP) on these indicators plus some other determinants.

the sample second moment of a group of series. The first principal component is computed as a linear combination of the series in the group with weights given by the first eigenvector, and so on. The higher the degree of co-movement existing among the original set of series, the fewer will be the number of principal components needed to explain a large portion of the variation of that set. Alternatively, if all n initial series are perfectly uncorrelated, it will take n principal components to explain all of the variance in the original series; no advantage would be gained by looking at common factors, because none exists in the first place.[21]

Specifically, I use a weighted average of the principal components as a globalization index. That is, using the two previously-defined indicators of trade and financial openness (FDI and one minus the tariff rate), I use PCA to construct one series, a weighted average of the two principal components, using as weights the proportion of total variance explained by each component.[22] The calculations are based on standardized variables, to ensure that each series has a zero mean and a unit standard deviation; this procedure helps to ensure that all series receive uniform treatment and that the construction of the principal components is not influenced disproportionately by the series exhibiting the largest variation.[23]

5.2 Estimation results

The results of both linear and nonlinear regressions using the globalization index are displayed in Table 2, regressions (1) and (2) for the absolute poverty gap measure, and regressions (4) and (5) for relative poverty. In all these regressions, all the previous conclusions regarding the control variables continue to hold. In particular, both inflation and the literacy rate remain significant, and so does the level of income per capita. The results also indicate that globalization tends to have an adverse effect on poverty, although the degree of significance of the composite index is not statistically very high. However, this is not the whole story. As shown in regressions (2) and (5), the squared value of the globalization index has a negative and highly significant coefficient, particularly when the relative poverty measure is used. The implication of these results are clear: Given that the linear term has a positive coefficient, and the quadratic term a negative one, poverty at first increases when the index of globalization rises from low to moderate levels, and falls once globalization increases beyond a certain point. Put differently, although globalization at low levels tends to increase poverty, it actually reduces it at higher levels.

[21] Appendix B provides a brief technical discussion of PCA, as well as a description of my calculations (which are based on the correlation matrix of the original matrix, instead of the variance-covariance matrix).

[22] I use one minus the tariff rate, instead of the tariff rate itself, in order to ensure that an increase in any of the original series corresponds to greater integration. I also performed all the calculations reported below with one over the tariff rate and obtained very similar results.

[23] I also performed all the regressions reported below with the first principal component only. Given that in most cases this component explained more than 70 percent of the variation in the original set of series, the results were similar to those discussed here.

Table 2. Poverty and globalization: linear and nonlinear regression results (OLS and instrumental variables with fixed effects)

	Dependent variable: Poverty gap					
	Poverty line at $1.08 a day			Poverty line at $2.16 a day		
	(1)	(2)	(3)	(4)	(5)	(6)
INFL	0.002 (5.163)	0.002 (5.142)		0.003 (2.116)	0.003 (2.098)	
PREINFL			0.002 (0.411)			0.006 (0.770)
LITY	−0.291 (−1.981)	−0.278 (−2.142)	−0.342 (−2.589)	−0.292 (−1.323)	0.250 (−1.231)	−0.347 (−1.554)
GDPPC	−0.031 (−2.276)	−0.030 (−2.195)		−0.108 (−4.653)	−0.103 (−4.654)	
PREGDPPC			−0.031 (−2.074)			−0.109 (−4.654)
REALEX	0.035 (3.554)	0.042 (3.998)	0.039 (3.518)	0.089 (3.507)	0.109 (4.467)	0.107 (4.142)
GLOBINDEX	0.005 (1.120)	0.005 (1.179)	0.007 (1.366)	0.016 (1.647)	0.016 (1.801)	0.021 (2.095)
GLOBINDEX 2		−0.007 (−2.090)	−0.007 (−2.008)		−0.023 (−3.298)	−0.023 (−3.214)
Adj. R2	0.740	0.750	0.710	0.856	0.869	0.860
Number of obs.	60	60	59	60	60	59
Standard error of regression	0.016	0.015	0.017	0.037	0.035	0.036

Note: INFL is the annual change in the consumer price index. PREINFL is the predicted value obtained by regressing INFL on the first and second lag of INFL, GLOBINDEX, and fixed effects. LITY is the literacy rate for the youth as a share of total population. GDPPC is the lagged value of the log of the GDP per capita (purchasing power parity). PREGDPPC is the predicted value obtained by regressing GDPPC on the first and second lag of GDPPC, GLOBINDEX, and fixed effects. REALEX is the annual change in the real effective exchange rate index (a rise is depreciation). FDI is the lagged value of foreign direct investment as a share of GDP. TARIFF is the lagged value of the tariff rate, which is the ratio of import duties to imports. GLOBINDEX is the globalization index calculated by taking the weights of the first and second principal components of TARIFF and FDI. The weights are the proportion of total variance explained by the first and second principal components

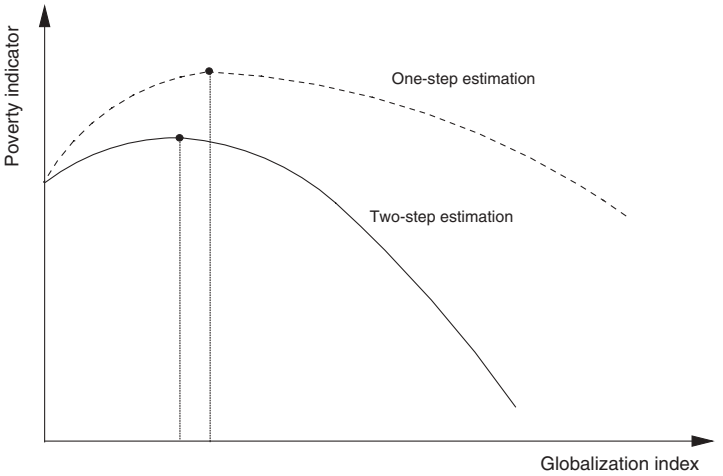

Fig. 1. The globalization–poverty curve

5.3 A Two-step procedure

To assess the sensitivity of the previous results (in addition to the standard diagnostic tests reported in the tables), I performed the following exercise. It may be argued that, in line with the previous analytical discussion, globalization may have an indirect effect on poverty by *a*) raising the growth rate of output and the level of income per capita; *b*) by strengthening macroeconomic discipline, thereby leading to lower inflation. In an attempt to account for these indirect effects, I used a two-step procedure. I first regressed inflation and the level of income per capita on two lagged values of each variable, together with the globalization index. I then re-run the regressions shown in columns (2) and (5) in Table 2 using the predicted values of these variables. The results are shown in columns (3) and (6) in the table and are broadly similar to those described previously, except for inflation (which retains, nonetheless, the correct sign).[24] Most importantly, the results obtained for the globalization index, using the relative poverty measure, are statistically significant for both the linear and quadratic terms. A standard F-test indicates also that the coefficients on these terms are both significant. A slight difference, however, is the increase in the value of the coefficient of the linear term in the globalization index between regressions (5) and (6), from 0.016 to 0.021. At the same time, the coefficient on the quadratic term remains the same, at −0.023. The shape of the globalization-poverty curve implied by the two estimation procedures is thus slightly different. To see this, let $\alpha > 0$ be the coefficient of the linear term, and $\beta < 0$ the coefficient of the squared term; the threshold value beyond which globalization starts reducing poverty is $-\alpha/2\beta$. With β being more or less the same under the one-step and two-step estimation results, differences in the shape of the curve depends only on α. Figure 1 illustrates the shape of the

[24] Results obtained with White heteroskedastic-consistent standard errors were similar to those reported in the table.

globalization-poverty curve for the two estimates of α obtained earlier (and for $\beta = -0.023$), under the assumption that the constant term in the functional forms is the same. Clearly, the higher value of α under the two-step procedure implies (*ceteris paribus*) a stronger adverse effect of globalization on poverty in the initial phase.

6 Concluding remarks

Globalization, or the integration of economies and societies through trade, investment, finance, information and labor flows is, in the view of many, an inescapable feature of the world today. On the one hand, there is a considerable body of opinion arguing that globalization has led to substantial economic progress among rich and poor countries alike and, indeed, may be the principal mechanism for the international convergence of living standards. On the other, many point to the challenges that it poses for many countries as well as for the most vulnerable socio-economic groups within countries.

The purpose of this paper has been to examine the extent to which globalization affects the poor. Section 2 presented various arguments that may explain how trade and financial integration may hurt the poor. Two main points emerged from the discussion. The first is that it is usually difficult to draw clear-cut theoretical conclusions regarding the effect of globalization on poverty as a result of conflicting effects, both in the short and the long run. Empirical studies are thus important to assess whether net effects are positive or negative. The second is that it is possible that strong nonlinearities may be involved in the relationship between globalization and poverty. Accounting for these effects is crucial in empirical analysis.

The second part presented some preliminary evidence, based on linear cross-country regressions linking various measures of real and financial integration to poverty. The regressions (performed over a group of 16 low- and middle-income countries and with data covering the late 1980s and the 1990s) control for changes in income per capita, as well as various other macroeconomic and structural variables, such as the inflation, changes in the real exchange rate and the terms of trade, and schooling indicators. The third part extended the analysis to derive a composite "globalization index" based on principal components analysis (using the trade and financial openness indicators defined in the preliminary regressions) and tested for both linear and nonlinear effects. I found that there appears to be a reasonably robust, inverted U-shape relationship between poverty and globalization: at low degrees of globalization, globalization does hurt the poor. However, at higher levels, globalization leads to a decline in poverty.

What is the source of this nonlinearity? At this stage, and without further empirical work, I can offer only conjectures, based on my analytical review of the links between globalization and poverty. One possible explanation is that beyond a certain threshold a greater degree of real and financial integration brings with it (or induces governments to implement) far-reaching domestic institutional reforms that improve the ability of private agents to save and invest, strengthen the financial system and the regulation and supervision of financial intermediaries (and therefore the ability of the economy to wither

large external shocks), and more generally improve the "social and legal infrastructure" that is conducive to greater risk taking. Regardless of the exact mechanism that may be at play, however, the striking implication of the globalization-poverty curve is that, paradoxically, globalization may hurt the poor in some countries not because it went too far but rather because it did not go far enough. Put differently, by focusing on different portions of the curve, both advocates and opponents of globalization have been missing part of the story.

I will conclude with a strong note of caution – the empirical results reported in this paper require further testing to assess their robustness. The existence of nonlinearities could be further explored by using splines and exploring their sensitivity to the choice of breakpoints. Alternatively, one could exploit techniques such as projection pursuit (as in Friedman and Stuetzle (1981)) or the method of alternating conditional expectations (Breiman and Friedman (1985)). More importantly perhaps, the sample size used in this study is small, mostly due to the lack of available data on poverty rates. The lack of a sufficient number of observations prevents the use of more advanced regression techniques, such as dynamic panel methods that would allow to control at the same time for both unobserved country-specific characteristics and endogeneity (as for instance in Hansen and Tarp (2001) and Edison, Levine, Ricci, and Slok (2002) in a different context). Moreover, the available data on both sides of the regression equation are not highly reliable. As is well known, the aggregate measure of poverty used in this study is based on survey data; but there are large differences across countries in measuring poverty from these micro data (related most notably to differences in definitions of income or consumption), which create potentially serious comparability problems. I have used "effective" measures of trade and financial integration, but the data are not without problems. Using average import tariffs does not account for the existence of non-tariff barriers (which themselves are very difficult to measure with any degree of precision). An alternative option to measure trade openness might be to use the new index of trade restrictiveness compiled by the IMF, which is based on a variety of published and unpublished sources (see Lankes (2002)); and as noted earlier, the share of assets of the domestic financial system held by foreign banks could be a complementary measure of financial globalization. In both cases, however, the number of observations available remains an issue.

I also found that fixed effects (which were not reported here to save space) are statistically significant in many cases, suggesting that country-specific factors are important in determining the behavior of poverty rates. There is therefore a risk of misspecification that may persist despite my effort to control adequately for various determinants of poverty. More generally, parameter heterogeneity is a key problem in the type of cross-country, growth-poverty regressions presented in this study. Indeed, an implicit assumption in this type of regressions is that the parameters are constant across countries, that is, that all countries follow the same underlying model relating growth and poverty (as well as poverty and the other variables included as regressors). If one is interested only in estimating parameter averages, this can be weakened slightly, by assuming only that parameters are distributed independently of the variables in the regression. Yet even this

weaker assumption is likely to be too strong. One can easily suggest examples of parameters that are likely to be correlated with variables in the regression – for instance, macroeconomic instability may be associated with both lower growth and a lower impact of growth on poverty, so that the coefficient on macroeconomic instability should ideally be allowed to vary across countries. A sensible response to this is to find ways of modeling heterogeneity. For instance, in the above example, it might be possible to reduce the extent of heterogeneity by introducing an interaction term between macroeconomic instability and growth. Even so, however, the regression model would likely continue to embody restrictions on the parameters, thereby making its use at the individual country level problematic at best. An alternative approach would be to perform explicit tests for pooling and parameter heterogeneity. Unfortunately, the lack of observations remains a serious constraint.[25]

Appendix A

Country names, variable definitions, and data sources

This Appendix presents the list of countries included in the regression results presented in the Tables, a more precise definition of the variables used in the regressions, and sources of the data.

Countries

Regressions with the complete sample are based on the following list of countries (years of observation on poverty rates in parentheses): Brazil (1985, 1988, 1989, 1993, 1995), Colombia (1988, 1991, 1995-96), Costa Rica (1985, 1990, 1993, 1996), Dominican Republic (1989, 1996), Ghana (1987, 1989, 1992, 1993), Indonesia (1987, 1993, 1996, 1998), Jordan (1987, 1992, 1997), Mexico (1984, 1989, 1992, 1995), Morocco (1985, 1989), Pakistan (1987, 1990, 1993, 1996), Peru (1985, 1994, 1996), Philippines (1985, 1988, 1991, 1994, 1997), Sri Lanka (1985, 1990, 1995), Thailand (1981, 1988, 1992, 1996, 1998), Tunisia (1985, 1990), and Venezuela (1981, 1987, 1989, 1993, 1995, 1996). As noted in the text, these countries are all of those for which at least two data points on poverty (as measured by the poverty gap) were available in the World Bank LDB database, taking into account as well the availability of data on some of the control variables and the globalization indicators.

Definition and source of variables used in regressions

POV: Poverty gap where the poverty line is \$1.08 or \$2.16 a day. Source: World Bank Global Poverty Monitoring Database.

[25] To detect parameter heterogeneity (or the "poolability" of the data) one could use a two-step Chow test (as, for instance, in Evans et al. (2002)), or the Dutta-Leon test (see Dutta and Leon (1991)). Other methods, based on Bayesian analysis, are described by Maddala and Wu (1996, 2000). However, none of these tests can be implemented here because they all require sufficiently long time series for each individual country.

INFL: Inflation rate in terms of consumer prices. Source: 2001 World Development Indicators CD-ROM (WDI).
LITY: Youth total literacy rate as a share of people ages 15–24. Source: WDI.
LGDPPC: Log of GDP per capita measured at purchasing power parity exchange rates. Source: WDI.
REALGR: Growth rate of per capita real GDP, measured at purchasing power parity exchange rates. Source: WDI.
REALEX: Percentage change in the real effective exchange rate. A rise is a depreciation. Source: International Financial Statistics, IMF.
FDI: Foreign direct investment as a share of GDP (net inflows). Source: WDI.
TARIFF: Ratio of import duties over imports. Source: WDI.
CTOT: Percentage change in the terms of trade index. Source: WDI.

Appendix B

Calculation of principal components

This Appendix describes briefly the methodology of principal components analysis (PCA) and explains how PCA was applied in this study.[26]

PCA is based on a key result from matrix algebra, according to which a $p \times p$ symmetric, nonsingular matrix, such as the correlation matrix $\mathbf{R}$, may be reduced to a diagonal matrix Λ by pre- and post-multiplying it by a particular orthonormal matrix $\mathbf{U}$, which is such that

$$\mathbf{U}'\mathbf{R}\mathbf{U} = \Lambda.$$

The diagonal elements of Λ, $\lambda_1, \lambda_2, \ldots, \lambda_p$, are the characteristic roots (or eigenvalues) of $\mathbf{R}$, which are obtained from the solution of the characteristic equation:

$$|\mathbf{R} - \lambda\mathbf{I}| = 0,$$

where $\mathbf{I}$ is the identity matrix. This equation produces a pth degree polynomial in λ, from which the values $\lambda_1, \lambda_2, \ldots, \lambda_p$ are obtained.

When using correlation matrices in PCA, the first step is to put all of the data in standard units; that is, perform the operation $(x - \bar{x})/s$ for each variable, where x is the mean of original variable and s is the standard deviation. These standardized data are then treated as observations. By doing this, all of the transformed variables have unit variances and the resulting covariance matrix is actually the correlation matrix of the original variables.

Let $\mathbf{D}$ be a diagonal matrix of standard deviations of the original variables, that is

[26] The following brief presentation of PCA is based on Morrison (1990) and Jackson (1991), and uses the correlation matrix, instead of the variance-covariance matrix. The reason is that, in general, even if the original variables used in PCA are in the same units, their variances may differ widely, often because they are related to their means. This may give undue weight to certain variables.

$$\mathbf{D} = \begin{bmatrix} s_1 & 0 & \dots & 0 \\ 0 & s_2 & \dots & 0 \\ \vdots & \vdots & \dots & \vdots \\ 0 & 0 & \dots & s_p \end{bmatrix}$$

The correlation matrix **R** can therefore be written as

$$\mathbf{R} = \mathbf{D}^{-1}\mathbf{S}\mathbf{D}^{-1},$$

Where **S** is the variance-covariance matrix.

The principal axis transformation transforms p correlated variables x_1, x_2, …, x_p into p new uncorrelated variables z_1, z_2, …, z_p. The coordinate axes of these new variables are described by the characteristic vectors $\mathbf{u}_i$, which make up the matrix **U** of direction cosines used in the transformation:

$$z = \mathbf{U}'[x - \bar{x}].$$

Here x and $\bar{x}$ are $p \times 1$ vectors of observations on the original variables and their means. The transformed variables are called the principal components of x. The ith principal component is

$$z_i = \mathbf{u}_i'[x - \bar{x}],$$

and has mean zero and variance λ_i, the ith characteristic root.

Let

$$\mathbf{V} = \mathbf{U}\Lambda^{1/2}.$$

This matrix gives the correlation between the principal components and the original variables. It can be used to determine the correlation of each principal component with each of the original variables. Specifically, the correlation of the ith principal component, z_i, and the jth original variable, x_j, is equal to

$$r_{z_i x_j} = u_{ji}\sqrt{\lambda_i}\,.$$

In this study, the first and second principal components are calculated country by country, before running the poverty regressions. The following 16 countries referred to in the text and in Appendix A are used: Brazil, Colombia, Costa Rica, Dominican Republic, Ghana, Indonesia, Jordan, Mexico, Morocco, Pakistan, Peru, the Philippines, Sri Lanka, Thailand, Tunisia, and Venezuela. Applying the formula above indicates that the correlation of the first principal component with the tariff rate is in general the highest.

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