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Distributional Effects of Educational Improvements:

Are We Using The Wrong Model?

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Abstract

Measuring the incidence of public spending in education requires an intergenerational framework distinguishing between what current and future generations – that is, parents and children – give and receive. In standard distributional incidence analysis, households are assumed to receive a benefit equal to what is spent on their children enrolled in the public schooling system and, implicitly, to pay a fee proportional to their income. This paper shows that, in an intergenerational framework, this is equivalent to assuming perfectly altruistic individuals, in the sense of the dynastic model, and perfect capital markets. But in practice, credit markets are imperfect and poor households cannot borrow against the future income of their children. The authors show that under such circumstances, standard distributional incidence analysis may greatly over-estimate the progressivity of public spending in education: educational improvements that are progressive in the long-run steady state may actually be regressive for the current generation of poor adults. This is especially true where service delivery in education is highly inefficient – as it is in poor districts of many developing countries – so that the educational benefits received are relatively low in comparison with the cost of public spending. The results have implications for both policy measures and analytical approaches.

This paper—a product of the Human Development and Public Services Team, Development Research Group—is part of a larger effort in the department to understand how public expenditures on education affect the well-being of students and their families. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at hrogers@worldbank.org.

Distributional effects of educational improvements: Are we using the wrong model?[1]

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Does public expenditure on basic education redistribute resources to poor people? According to standard incidence studies of public finance, the answer is yes. Those studies show that most redistribution in developing countries takes place on the expenditure side, through a few nearly universal public services in education and health.[2] In his early well-known study of the redistribution effect of public spending in Malaysia, Meerman (1979) found that the cost per pupil in public primary and secondary education represented a subsidy equal to less than 10 percent of average income for all households, but almost 30 percent of income for the poorest quintile of households. Likewise, free health services dispensed in public health centers and hospitals represented 5 percent of total household expenditures, but three times as large a share for the poorest quintile. More recent studies confirm this finding for Malaysia and reveal similar patterns in several other countries.[3] By contrast, other better-targeted programs with explicit redistribution objectives – such as food subsidies, public employment schemes, and some infrastructure investments – have much less redistributional impact, because of their relatively modest budgets.[4]

Despite this consensus, there is no unanimity on just how to measure the redistributive effect of public spending in education and health. The two leading alternatives are the "standard" incidence analysis, on the one hand, and the "estimated willingness to pay" (or simply "estimation") approach, on the other. In the standard analysis, the total public cost of education and health services is imputed proportionally to the number of users – the number of children attending school, for example, or the number of people having access to health care units. This was the approach taken in the first studies of the distributional incidence of public spending by Meerman (1979) and Selowski (1979)[5]. By contrast, in the 'estimation approach', the estimated benefits from public spending are based on how much users are willing to pay for the corresponding good – in this example, school enrollment for their children or access to a hospital or a health care unit (Gertler & Glewwe, 1990; Gertler & van der Gaag, 1990; Jimenez, 1986). Although no direct comparison of the two approaches seems to be available (see Selden & Wasylenko, 1995), it is not clear that which method is used makes a big difference. Under either method, public spending on primary and secondary education and on some types of health care units appears extremely progressive.

This paper focuses on another aspect of social public spending that incidence analysis has not handled explicitly: the inter-temporal or intergenerational nature of the effects of many of these expenditures. We will show that once these effects are recognized, it is no longer possible to assume – as is usually done in incidence analysis – that social expenditures are equivalent to cash transfers, food subsidies, and other programs of direct redistribution. Improving the quality of schooling or opening more schools is an investment in future generations and may have redistributive effects for these generations. But in the medium run, spending more on education may not increase the instantaneous well-being of the poorer elements of the population – and in fact is likely to worsen distribution initially. In this respect, educational expenditures clearly differ from a food subsidy or a cash transfer.

It might be argued that this difference is more apparent than real, if poor families have access to perfect capital markets that allow them to smooth consumption across periods. As we will show below, in a Barro and Becker (1989) type of dynastic model, parents expecting an increase in the earnings of their children would themselves increase their consumption either by reducing the amount bequeathed to their children or by borrowing against future increases in their children' earnings. If this were possible, then the standard incidence analysis of public spending in education would be correct.

But in the real world, moral hazard makes it infeasible to borrow against the human capital of one's descendants. Thus, poor parents who cannot leave a bequest to their children do not benefit from an improvement in the education system. Under these conditions, an increase in public education expenditures financed by an increase in a neutral tax may actually be regressive for the generations with school-age children. Poor households in this generation pay the tax and receive no benefit, whereas rich households pay the tax but may recover it through intergenerational reallocation of consumption (that is, smaller bequests to their children). This problem is exacerbated by inefficiencies in public service delivery, which reduce the impact of spending in education and health, and which especially afflict poorer communities and households.

This model suggests that in analyzing the distributional incidence of public spending in education and health in developing countries, we should use intergenerational accounting to identify the explicit trade-off between greater future earnings equality and a present worsening of the well-being of poor populations. This paper explores how doing so might change the conclusions of the standard incidence analysis of public spending in education in developing countries.

The paper is organized into three parts. Section 1 analyzes a simple dynastic model with perfect capital markets and shows it to be a good justification of standard incidence analysis of educational expenditures. In Section 2, we show how an imperfect capital market framework requires that we change distributional incidence analysis to take into account intra- as well as intergenerational tradeoffs. As noted above, this change in assumptions changes the conclusions: whereas educational quality improvements still reduce inequality for future generations, they worsen it for the current generation of adults. Section 3 adds other problems that exacerbate the adverse impact of educational improvements on the current generation of the poor – most notably, the risk that problems with service delivery will prevent increased tax revenues from translating into improved learning. The concluding section asks what this model implies for policy: Does it mean that the current generation of the poor is doomed to suffer from well-meaning attempts to improve their children's lives?

1. Incidence with a simple dynastic model of demand for education

To make the exposition as simple as possible, we consider here an elementary model of demand for education by parents for their children, which is a direct application of the dynastic model first introduced by

Barro and Becker (1989). We first state the model and examine its implications for imputing benefits from public spending on education in an environment of perfect competition and no transaction costs.

The dynastic model is a model where the utility of an altruistic individual depends on his or her own consumption and the utility of his or her descendant, which in turn depends on that descendant's consumption and the utility of his or her own descendant, and so on. When it is additive, an interesting analytical feature of this model is that it is equivalent to assuming an infinitely lived individual who optimizes the inter-temporal allocation of his or her consumption over an infinite horizon. It thus provides a convenient and simple way of representing and analyzing intergenerational issues.

Let u(c_t) be the utility that each generation in a dynasty derives from its lifetime consumption c_t, and let ρ be the rate at which one generation discounts the utility of the next generation. To make matters simple we assume no demographic growth, so that every person has a single descendant in each generation. The objective of the generation alive at period 0 is therefore

$$\text{Max} \sum_{t=0}^{\infty} U(c_t).(1+\rho)^{-t} \qquad (1)$$

and the budget constraint is given by:

$$b_{t+1} = (1+r).b_t - c_t + (w_t - T_t) \qquad (2)$$

In this expression, b_t stands for the transmission of wealth[6] from parents of generation *t-1* to children of generation *t*; *r* is the rate of interest in capital markets, which are assumed to be perfect; w_t is the income that any individual of generation *t* will obtain over his or her lifetime in the absence of any investment in human capital by his or her parents; and T_t stands for a lump-sum transfer payment that the individual makes to the state.

In this framework, the quality of the public education system is captured by the variable w_t. Schooling in free public schools may be thought of as being compulsory until a certain age. Beyond that age, people in generation *t* may go to work, in which case they will earn w_t. over their lifetime.[7] Alternatively, their parents may pay the costs of keeping them in school; this decision leads to increased future earning power for the children, which is represented by an increase in the bequest term, b_t. To simplify, it is also assumed that the rate of return on this additional schooling is equal to the rate of interest, as in Mincer's (1958) original model. Changing the quality of the public school system in this framework is equivalent to modifying exogenously the value of basic earnings, w_t.. These school improvements are assumed to be financed by an increase in the lump-sum transfer T_t. (We will return later to the public-sector budget constraint.)

Solving (1) subject to (2) yields the familiar Euler equation

$$\frac{u'(c_{t+1})}{u'(c_t)} = \frac{1+\rho}{1+r} \qquad (3)$$

Under the additional assumption that the discount rate ρ is equal to the interest rate *r*, optimal consumption is thus constant across generations. In what follows, we will restrict ourselves to this simple case. However, conclusions would not be modified under alternative assumptions.

The constant consumption level *c** is given by the budget constraint (2). Once integrated over an infinite horizon, this constraint yields:

$$c^* = r.b_0 + r.Y \quad \text{with} \quad Y = \sum_{t=0}^{\infty} (w_t - T_t).(1+r)^{-t} \qquad (4)$$

Y is the discounted net earnings of all generations. For simplicity, consider the stationary case where the basic level of earnings and taxes is (or at least is expected to be) constant over time, with values *w* and *T*. This yields the following simple dynamics of wealth and consumption for the whole dynasty:

$$c_t = c^* = r.b_0 + (w - T) \qquad b_t = b_0 \quad \textit{for all} \quad t \geq 0 \qquad (5)$$

The optimal consumption path for each generation thus consists of spending its current earnings (net of taxes) plus the returns on inherited wealth; this path keeps the level of wealth unchanged across generations.[8]

Within this extremely simplified framework, consider the effect of a permanent exogenous improvement in the quality of compulsory public schooling that increases *w*. Assume that the improvement in education is financed by a change in the transfer *T* equal to an additional lump-sum tax τ. The improvement raises w_t permanently by an amount ω from t= 1 on. From (4), it may be seen that the level of constant consumption expenditures increases by ω/(1+r), net of τ, where the correction by the term in (1+r) reflects the fact that the improvement in productivity takes place from generation 1 onward. Because the earnings of generation 0 have not changed, that generation will bequeath ω/(1+r) less (again, net of τ) than other generations will:

$$c_t = c^* = r.b_0 + (w - T) + (\frac{\omega}{1+r} - \tau) \ \textit{for all} \ \ t \geq 0; \ \ b_t = b_0 - (\frac{\omega}{1+r} - \tau) \ \textit{for all} \ t > 0 \qquad (6)$$

Note that if public investments in education are actuarially neutral, then Ricardian equivalence holds: the bracketed term $\omega/(1+r) - \tau$ in equation (6) should be equal to zero, and public spending should have no effect on individual welfare or its distribution. There is a one-for-one substitution between earnings (driven by the productivity of public schooling), on the one hand, and the intergenerational transmission of wealth, on the other. If that transmission takes place through spending on post-compulsory schooling by parents, then this means that public accumulation of human capital crowds out private on a one-for-one basis.

In their distributional implications, these results support the standard distributional analysis of public spending, which allocates the benefit derived from public expenditures in education *equally* across the various dynasties or their representative person in the current generation.

Of course, it is unrealistic to assume that the improvement in the public education system will be financed by a uniform lump-sum tax. Assume instead that the tax is proportional to consumption at rate λ.[9] Then the change in the (constant) level of consumption of each dynasty is given by:

$$\Delta c_t = \Delta c^* = \frac{\omega}{(1+r).(1+\lambda)} - \frac{\lambda}{1+\lambda}.c^* \quad for\ all \quad t \geq 0^* \qquad (7)$$

This is equivalent to a linear tax system where everybody receives the same lump-sum transfer $\omega/(1+r)(1+\lambda)$ and pays a tax proportional to his or her consumption expenditures at the rate $\lambda/(1+\lambda)$.[10] If public spending in education were actuarially neutral, the tax rate λ would be given by:

$$\lambda = \frac{\omega}{(1+r).\bar{c}^*} \qquad (8)$$

where $\bar{c}^*$ is the mean consumption in the population.

2. Why intergenerational effects matter: Incidence with imperfect capital markets

The model in Section 1 provides a straightforward justification of standard benefit incidence analysis in a full model that takes into account the behavioral response of households. However, it relies on several assumptions that may be severely restrictive. In this section, we analyze the effects of relaxing the assumption of perfect capital markets.

An important imperfection of the capital market is that, for obvious adverse selection and moral hazard reasons, people cannot borrow against their future human capital. In the preceding model, this means that transmitted wealth, b_t, must be non-negative for all generations t. Suppose then that a dynasty starts out with no wealth or human capital – that is, that b_0=0. From (5), we see that its optimal strategy is simply not to accumulate or leave bequests: each generation consumes exactly what it earns. Although an oversimplification, this assumption is probably not too inaccurate as a description of the situation that most people in many developing countries face.

Consider now the same improvement as before in the educational system, which increases the basic earnings of all future generations by ω. To consume along the optimal path, the current generation of all dynasties must increase its current consumption, because optimality requires equal consumption across all generations and the improvement in education has increased the total income of all dynasties. According to (6), the current generation increases its consumption by reducing the bequest in human or physical capital

left to its descendants. For dynasties with zero wealth, this would require that bequests be negative: the current generation would need to borrow against the gains in the earnings of its descendents. But because market imperfections make borrowing impossible, the improvement in the educational system cannot increase the consumption of the current generation of poor dynasties. By contrast, the current generation of richer dynasties is not constrained by the capital market and can freely increase its level of current consumption. For the current generation, then, the educational improvement actually has regressive effects. Note that this worsening of current distribution takes place *even if* the poor dynasties are not required to pay for the educational improvements through taxes (for example, if the improvements are financed by foreign aid). Because they are unable to cash in on future generations' additional earnings, poor people in the current generation of adults do not benefit from educational improvements, whereas richer people do.

The effect on subsequent generations is different. When the gain ω materializes, the distribution of income and consumption becomes more equal as a result of the educational improvements. In comparison with the perfect capital market case, the drop in inequality is even stronger, since these future generations consume all of the increase in their earnings; this is the flip side of the initial worsening of the distribution.

For the current generation of poor dynasties, the situation is even worse when the financing side of the educational improvement is taken into account. Assume now that the improvement is financed by the ad valorem consumption tax mentioned in Section 1.[11] Then not only can the current generation not consume that part of the increase in the optimal consumption which corresponds to future gains in earnings – the first term on the right-hand side of (7) – but in addition its purchasing power is reduced by the amount of the consumption tax (which is the second term in the equation).

Taking capital-market imperfections into account thus alters the conclusions of the initial model and its implications for redistributive benefit incidence analysis. An increase in public educational spending has progressive effects at the steady state of the economy, but a regressive effect on the present generation. The problem is somewhat similar to the sacrifices imposed on the current generation when a country makes a switch from a pay-as-you-go to a funded pension system that is Pareto-improving in the steady state[12] – except that in our case, the sacrifice is imposed on the poor segment of the current generation. By ignoring this point, standard benefit incidence analysis thus tends to overestimate the progressive effect of public spending. To avoid this problem, analysis should assess the intergenerational distribution of the costs and benefits of these policies.

To make this point more rigorously, we consider the following simple example. The population is made up of two classes of identical households, or dynasties. The first class (indexed by 1), with weight *(1-p)* in the population, has no wealth and leaves no bequest to its offspring, in either human or physical capital. The second class (indexed by 2), with weight *p* in the population, is endowed with an amount *b* of wealth, which is transferred unchanged across generations in the reference situation. The economy is assumed to be

stationary. In the reference situation, the consumption of the two classes is constant across all generations and is given by:

$$c_1^* = w, \quad c_2^* = (r.b + w) \tag{9}$$

The corresponding discounted welfare of the two dynasties is given by:

$$V_1 = u(w) / r, \quad V_2 = u(r.b + w) / r \tag{10}$$

Consider now the case in which the government increases the quality of schooling, so as to increase the productivity of basic schooling by ω, and finances this through an increase in the tax rate equal to λ. Because of the capital-market imperfections, it is necessary to distinguish what happens to the different generations of the two classes. As before, the first generation in the poor class pays for the reform through its taxes, but because of the imperfection of the capital market, it cannot share the benefits with its descendants. By contrast, the first generation in the wealthier class may reclaim part of the increase in the earnings of its descendents by bequeathing less. From (7), we thus have:

$$\Delta c_{10}^* = -w.\frac{\lambda}{1+\lambda}; \text{ and } \Delta c_{1t}^* = \frac{\omega}{1+\lambda} - \frac{\lambda}{1+\lambda}.w \text{ for t>0} \tag{11}$$

$$\Delta c_{2t}^* = \frac{\omega}{(1+r).(1+\lambda)} - \frac{\lambda}{1+\lambda}.(rb + w) \text{ for t}\geq 0$$

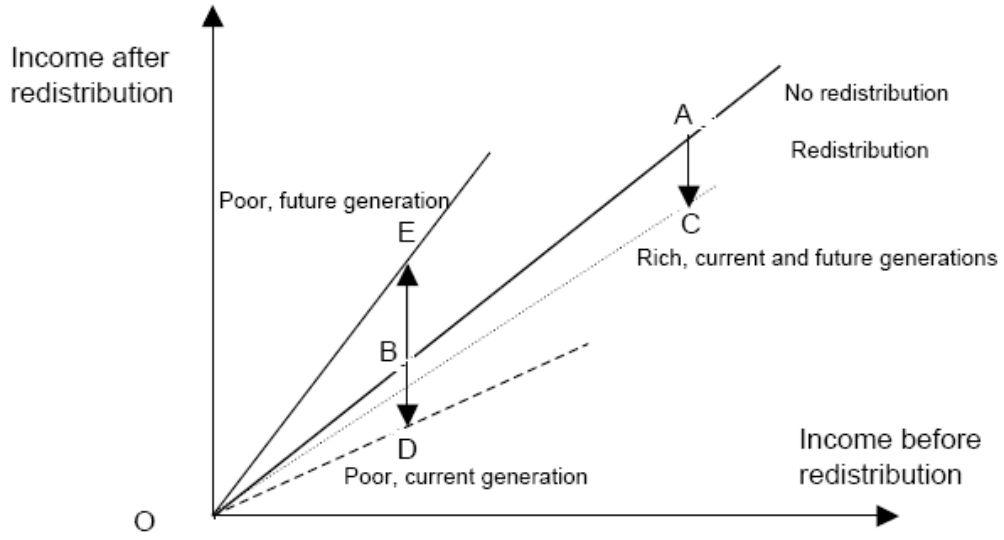
where the second subscript in c* indexes the generations.[13] Thus all generations in the rich class have the same increase in consumption, while all consumption gains to the poor class accrue to future generations. As a result, these future generations of the poor class enjoy a larger gross increase in consumption – that is, before netting out the additional tax payments – than do the members of the rich class. And the current generation of poor is the biggest loser: because it receives nothing from the educational improvements, the drop in its consumption is proportionally larger than the drop endured by the current generation of rich.

If the rate of return on the educational investment is not much greater than the rate of interest *r*, then the most likely outcome, according to (11), is that the program reduces the consumption of the rich class. This is the redistributive effect discussed above. Thus the overall effect of the education policy is to redistribute consumption from all generations of rich dynasties and the current generation of poor to the future generations of poor.

These changes are illustrated in Figure 1, which shows the change in consumption of the various generations of the two classes of individuals. The tax-financed increase in the quality of education causes a drop AC in the consumption of all generations of the rich. For the poor, the consumption of the current generation drops by BD, which is proportionally more than AC, but increases by BE for future generations. Thus, poverty and inequality increase for the current generation but fall in future generations.

Figure 1

How a tax-financed improvement in education changes the post-tax income and consumption of different groups



With the tax-financed educational improvement, the total discounted welfare of the poor and rich dynasties is given respectively by the expressions

$$V_1 = u\left(\frac{w}{1+\lambda}\right) + \frac{1}{r}u\left(\frac{w+\omega}{1+\lambda}\right); \quad V_2 = \frac{1+r}{r}.u\left(\frac{r.b + w + \omega/(1+r)}{1+\lambda}\right) \quad (12)$$

To make the comparison with the reference situation (10) simpler, we will use a permanent consumption metric in terms of the pre-program utility levels. The new situation after the introduction of the program is equivalent to a stationary economy where the various generations in poor dynasties consume a quantity $\tilde{c}_1$ given by:

$$\frac{1+r}{r}.u(\tilde{c}_1) = u\left(\frac{w}{1+\lambda}\right) + \frac{1}{r}u\left(\frac{w+\omega}{1+\lambda}\right) \quad (13)$$

For the rich dynasties no transformation is necessary. Since their consumption is still stationary in the new situation, the permanent consumption equivalent to their dynamic consumption path is their actual stationary consumption.

The change in welfare from (10) to (12) – that is, from launching a tax-financed program to raise school quality – may therefore be summarized by the following changes in equivalent permanent consumption $\tilde{c}_i$:

$$\Delta\tilde{c}_1 = \tilde{c}_1 - w \quad \text{and} \quad \Delta\tilde{c}_2 = \frac{\omega}{(1+r).(1+\lambda)} - \frac{\lambda}{1+\lambda}.(w+rb) \tag{14}$$

Choosing the usual isoelastic specification of the utility function

$$u(c) = \frac{1}{1-\varepsilon}.c^{1-\varepsilon} \tag{15}$$

where ε (>0) is the inverse of the elasticity of intergenerational substitution, and applying it to (13)-(14), we see that:

$$\Delta\tilde{c}_1 = \frac{w}{1+\lambda}.\left[\frac{r}{1+r} + \frac{1}{1+r}.(1+\frac{\omega}{w})^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} - w \tag{16}$$

whereas with perfect capital markets, we would have:

$$\Delta\tilde{c}_1 = \Delta c_1^* = \frac{w}{1+\lambda}.\left[\frac{r}{1+r} + \frac{1}{1+r}.(1+\frac{\omega}{w})\right] - w \tag{17}$$

Comparing (16) and (17), we see that the capital-market imperfection reduces the equivalent permanent consumption of the poor dynasty by an amount that depends on the intergenerational elasticity of substitution.

We now are able to evaluate the change in social welfare due to the improvements in education quality. Before doing so, however, let us redefine the tax rate, λ, through the following identity:

$$\omega = \lambda.(w + p.rb).(1 + r + \pi) \tag{18}$$

where π stands for the "excess return" to the investment in education – that is, the premium that it yields above the rate of interest. Because *(w + p .rb)* is the mean consumption in the reference situation, the term λ*.(w + p .rb)* in (18) is the cost of the investment in education.

Adding the change in equivalent consumption of the two dynasties and taking into account the reparameterization of the tax rate permits us to express the total change in welfare as a function of four basic magnitudes: the excess return to education, π; the relative productivity gain of education, ω/w; the inequality of the initial distribution of income, as summarized by *rb/w* and *p* ; and the intergenerational elasticity of substitution, $1/\varepsilon$. The larger these four parameters are, the larger is the social gain of investing in education quality.

In this framework, it is easy to see that it is indeed possible for the educational improvement to reduce social welfare. One such case is the one in which the excess return on education is zero and the elasticity of substitution across generations is finite. Indeed, in that case, there is no difference between investing in education and investing elsewhere in the economy, so that even with perfect capital markets, the gain from the investment in education would be zero. It can be shown that the sum of the change in equivalent permanent consumption of the two dynasties – see (14) and (17) – is indeed zero in this case. This

means that when one introduces imperfect capital markets, thus switching from (17) to (16), the change in social welfare is necessarily negative. The reason is that the social investment in education is then equivalent to forcing the current generation of poor to transfer part of their consumption to their descendants, without any overall gain from doing so. As this is suboptimal for them, it clearly entails an overall drop in social welfare. By continuity, it follows that this may happen even with a positive return premium on educational investments. More generally, we have the following result:

> ***Proposition.*** *For any given size of the investment in education, the excess return to education, and the degree of inequality in the economy, there exists a threshold for the intergenerational elasticity of substitution below which the change in social welfare is negative in the presence of capital market imperfections.*

The proof is straightforward. The gain in welfare expressed in equivalent permanent consumption is given by the sum of the two expressions in (14) weighted by population shares, *p* and *1-p*. To simplify, consider that these shares are equal (the argument may easily generalize to other cases). In the perfect capital market case, the first expression is to be replaced by (17). The change in total equivalent permanent consumption is then given by:

$$\Delta\tilde{c}_1 + \Delta\tilde{c}_2 = \frac{\omega}{(1+\lambda)(1+r)} . \frac{\pi}{1+r+\pi} \qquad (19)$$

This expression shows that with perfect capital markets, the sign of the excess return to education, π, is what determines whether there is a net gain in social welfare. If one replaces (17) by (16), however, it is easily shown that the gain in social welfare declines monotonically with ε, the inverse of the elasticity of intergenerational substitution. In the case of zero elasticity, it comes that: $\Delta\tilde{c}_1 = -\lambda/(1+\lambda).\omega/(1+r)$, and the weighted sum of the changes in equivalent permanent consumption becomes unambiguously negative.[14]

This proposition is not an argument against improvements in education quality, but an argument for using the right model to analyze their effects and for adopting appropriate complementary policies. One example, which will be discussed in Section 4, is tax policy. Recall that our calculations assume a neutral consumption tax; making the tax structure progressive would mitigate the losses for the poor dynasty and lower the threshold elasticity level for welfare improvements.

There are many plausible extensions of this basic model, but some of the most obvious seem likely to reinforce the main conclusions. For example, we might want to embed the model in a growth framework, to capture the possible growth-enhancing effects of education (as in Lucas, 1988; Romer, 1989). This extension would increase the projected benefits of educational investment to future generations of the poor,

but growth would do nothing to prevent the current generation of the poor from losing out relative to future generations and to the non-poor. Similarly, we could add risk to the model; but again it is not obvious that this would change the basic conclusion. In fact, it might strengthen the findings: if households are taxed to pay current educational costs but are uncertain about how much their children will benefit, the net change in welfare for risk-averse poor households will be even lower.

3. An exacerbating factor: Inefficiencies in education spending

We have seen, then, that with a single change in assumptions – allowing imperfections in capital markets – the basic incidence model predicts that current generations of the poor may find that an ambitious program of educational quality improvement actually worsens their welfare. A second factor – inefficiencies in the government's investment in public education – may further exacerbate this problem of intergenerational distribution of benefits. The model assumes that the additional taxation λ (or τ, in the earlier model) translates effectively into an increase ω in the future earnings of generations t+1 and following. Underlying the basic model is clearly an implicit assumption that ω is not only positive but also reasonably large relative to the additional resources devoted to education – that is, that the additional taxation λ translates without loss or leakage into ω. But is this a reasonable assumption?

In many cases, the answer may be no. Given the documented problems with efficiency of service delivery in many countries, there is a real danger that the additional taxation will yield few benefits for even future generations of poor households. The service delivery problems that are widespread in many education systems often afflict poor households even more than the wealthier and better-connected, as documented in detail by the *World Development Report 2004: Making Services Work for Poor People* (World Bank, 2003). Consider the case of education, where there is strong evidence of inefficiencies in translating resources into results. First, revenues allocated for schools in poor areas often fail to reach their intended target because of leakages. In one famous example, in Uganda in 1991-95 only 13 percent of central-government capitation grants to schools for non-salary expenditures ever reached those schools (Reinikka & Svensson, 2004). Second, for political-economy reasons, additional resources may not go to the educational inputs with the highest marginal returns but to teacher salaries instead (Pritchett & Filmer, 1999). When the additional funds do ostensibly make it to the school level in the form of teacher salaries, teacher absenteeism or poor teaching skills may prevent money from translating into more rapid student learning. In India, a recent survey found that 25 percent of primary-school teachers were absent from school at any given time, and that the problem was most severe in poor states such as Bihar and Jharkhand, where absence rates reached 38 and 42 percent, respectively (Kremer, Muralidharan, Chaudhury, Hammer, & Rogers, 2005). And even when teachers are present and other resources reach the classroom, levels of learning are often abysmally low. In Chile, a

country that has been justly praised for some aspects of its education system, the 2000 PISA international assessment showed that 48 percent of Chilean 15-year-olds scored at Level 1 or below on a 5-level scale; by contrast, only 6 percent of Finnish children scored that poorly (Vegas & Petrow, 2007).[15] Taken together, these factors will tend to lower ω substantially, perhaps driving the excess return from schooling π into negative territory. They also drive a wedge between the ω and λ terms in (8), by in effect decreasing the efficiency with which λ is converted into ω. Both of these effects will increase the welfare losses for the current generation of the poor.

The notion of a low ω is not merely theoretical. One indication of the poor quality of public education is the defection of even poor households to private schools in some countries, a trend documented by recent work in South Asia and elsewhere. For example, Kingdon (1996) presents evidence that by 1993, 10 percent of 6- to 10-year-old students in rural India already attended private schools, and that among rural students in the large state of Uttar Pradesh, the share had reached 30 percent. Some parents are doubtless making this choice for reasons unrelated to expected learning gains – for religious reasons, for example. But the evidence suggests that many poor parents are choosing private schooling for their children primarily because of the low quality of education in the public schools, and that they are willing to pay more out of pocket to do this. In terms of the model of this paper, this corresponds to a situation where, under perfect capital markets, the following inequality holds:

$$\frac{\omega}{1+r} \prec \frac{\omega^{pri}}{1+r} - c^{pri} \qquad (20)$$

where ω^{pri} represents the wage gains from and c^{pri} represents the marginal costs of private schooling.[16]

What this suggests is that the distributional implications of investments in educational quality may be even more ambiguous than the discussion in Section 2 indicated. Poor families may gain little from the additional public spending, and in the worst case may find themselves paying higher taxes even as their children remain in private school because of low public-school quality. Thus the welfare effects of higher taxes to finance educational improvements will depend heavily on whether those taxes translate into increased quality and on whether poor students attend public schools.

4. Implications for policy and analysis

The model in the previous sections has shown that once we allow for a world with capital market imperfections and inefficiencies in public service delivery, the standard approaches to incidence analysis give a distorted view of who is being helped by education improvements. In particular, they fail to capture the very real intergenerational tradeoffs for poor households. Improvements in educational quality benefit future generations of poor people but not today's adults, who often have to share the cost. As a result,

considering education improvements as equivalent to cash transfers can lead to false projections of the welfare consequences, and ultimately the political economy, of education reform.

In the end, should we simply accept that the current generation of poor people must sacrifice to improve the future prospects of their children? Not necessarily; even in the terms of this model, very different inferences are possible. The knowledge that ostensibly redistributive programs can involve intergenerational tradeoffs for poor households should lead us in new directions, in terms of both policy and analysis.

On the policy side, this model has at least three implications. First, by extension it may argue for renewed efforts to build *progressive taxation* systems – or those that are progressive at least toward the bottom end of the consumption scale. The consumption tax parameter λ is assumed to be uniform across classes, but as noted in Section 3, we need not take neutrality as a given. Although there are good public-finance reasons to keep the tax base as broad as possible, it may be possible to introduce greater progressivity into the tax structure, so that the poorest households are not saddled with much of the additional taxation.

Second, it may be possible to finance the educational quality expansion with *aid*, rather than tax revenues. Aid financing would seem at first glance to respond to the dilemma posed by this paper: it allows an education-based increase in incomes of future generations of the poor, without imposing any additional costs on the current generation of poor people. Whether this works in practice depends crucially on the relationship between the financing source and the efficiency of educational spending. Recent research has argued that heavy reliance on aid could actually worsen governance (including the quality of service delivery), by severing the connection between taxation and government programs and thereby reducing democratic accountability for results (Brautigam & Knack, 2004). Moreover, our model predicts that even effective aid will not completely prevent distribution from worsening in the short term: because rich dynasties can share in future education-induced productivity gains by reducing bequests and increasing current consumption, consumption inequality worsens initially even if poor dynasties are not taxed to pay for the improvements. To improve distribution in the current generation, then, the educational quality improvements will likely have to be packaged with other progressive policies and programs.

Third, this analysis argues for efforts to increase *the efficiency of service delivery* in education. Policies that improve incentives, information, and accountability can raise the quality of schooling, thereby increasing the benefits to future generations of any tax-financed educational expansion today (or reducing the cost today of any improvement). Strong efficiency improvements may induce more poor households to return to public education, freeing them from having to pay private tuition. Both of these effects will improve the cost-benefit tradeoffs for poor families.

The model's implications on the analytical side are perhaps more far-reaching. Unlike the policy implications, which largely reinforce policies that are already high on the education agenda in developing

countries, the analytical lesson of this paper is that the approaches currently used are inherently unsatisfactory. Given the problems that we have identified with traditional incidence analysis, attempts to analyze the distributional implications of educational expansion in terms of current income will often miss key issues.

An alternative approach would focus on assessing how educational improvements affect *equality of opportunity* rather than the equality of incomes of present or future adult generations. The model analyzed in this paper implies that the incidence analysis of a reform in educational spending must distinguish between present and future generations. For the present generation of adults, the analysis should focus on the way the educational policy is being financed and whether it may substitute for intergenerational transmission of wealth, in the case of those with positive wealth. For future generations, the emphasis must be on the increase in expected earnings and on the way the educational policy being considered may modify future relative incomes. However, to the extent that these future incomes are not known, such an analysis is more about the equality of opportunities than about relative incomes.

To be complete, the analysis should also be expanded to cover educational policies aimed at increasing the "quantity" rather than the quality of schooling. Efforts to attract more children to school through building schools closer to rural populations may be analyzed in very much the same way as the quality-increasing policies considered in this paper. Such efforts have an effect on the current generation of adults, and possibly different effects on future generations. Referring to the "equality of opportunities" to deal with the latter issue makes still more sense than in the preceding case.

Unlike standard incidence analysis, testing for equality-of-opportunity does not require the analyst to project how an expansion of education today will affect the future relative wages of poor children. Instead, he or she would need only to calculate the correlation between current educational access (in terms of both quantity and quality) and current household income, and then assess how much the program increases or reduces that correlation.[17] Judged by this equality-of-opportunity test, the welfare implications of an expansion of universal education may look much better than under standard incidence analysis.

Whether we use the equality-of-opportunity test, or simply a modified version of the standard incidence analysis, the key lesson of this paper is that policymakers who care about distribution and poverty should pay attention to intergenerational issues and transition costs. The current generation of the poor already faces stark tradeoffs between its own welfare and that of its children in its household decision-making. It would be regrettable indeed if public programs aimed at improving social mobility had the effect of exacerbating those tradeoffs.

[1] Delivered by François Bourguignon at the IREDU International Conference on the Economy and Education, June 2006, Dijon, France. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors, and do not necessarily represent the views of the World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

[2] For a review of distributional incidence on the expenditure side of public finance in developing countries, see van de Walle and Nead (1995). Few studies are available on the tax side, perhaps because of the consensus that little progressivity may be achieved through existing tax instruments, as argued, for instance, in Burgess and Stern (1993). Other studies supporting this point include Devarajan and Hossain (1993) and Sahn and Younger (2000).

[3] See Hammer, Nabi and Cercone (1995) for Malaysia and the early study on Colombia by Selowski (1979). For other references, see Demery (1997).

[4] See van de Walle and Nead (1995).

[5] These studies were inspired themselves by the first incidence studies in developed countries – in particular Gillespie (1966).

[6] This term may also include human capital passed on intergenerationally outside the public education system

[7] This paper focuses on the quality of education for those children going to school rather than the decision of parents to send their children to school. The general argument in the paper may be adapted to this second case, however. In effect, it applies to all situations where the government raises taxes to finance spending in education that does not directly benefit the adult generation of some segment of the population.

[8] This is a rather standard result of this model. See, for instance, Bertola (1993).

[9] This is a plausible assumption for developing countries, given the relative importance of sales and import taxes in their revenue bases. Considering an income rather than a consumption tax would require modifying the optimal consumption path of the dynasty, since it would modify the net rate of return on wealth.

[10] This tax is often referred to as the 'negative income tax'. It may also be considered as part of a basic income with flat tax rate schedule (see Atkinson, 1995)

[11] This will turn out to be an important assumption; in the concluding section, we discuss the effects of relaxing it.

[12] See for instance Brunner (1996).

[13] To be completely general, it would be necessary to consider possible links between the variation of consumption of present and future generations of poor adults. The drop in the adult generation, 0, might imply less non-

education human capital – e.g. nutrition or health – being invested in children and therefore less earning potential for those individuals as adults.

[14] An exercise by Bourguignon (1999) using data for Malaysia from Meerman (1979) shows that with imperfect capital markets, credit-constrained poor households with an intergenerational elasticity of 0.2 would find their welfare lowered by an education program that, under standard incidence analysis, would give them a net benefit equivalent to 25% of initial income. It might be objected that the extraordinary willingness of some parents to sacrifice current consumption for their children's future welfare illustrates that, empirically, the elasticity of intergenerational substitution is often very high. However, it does not follow that a social planner would have to accept such high elasticities as given. In the same way that societies ban workers from selling themselves into indentured servitude to improve their children's prospects, a social planner making welfare calculations might choose to assume a lower intergenerational elasticity in making normative judgments..

[15] Indeed, the failure to improve the quality of education more rapidly was cited as a cause of nationwide demonstrations by Chilean students in June 2006.

[16] It must be stressed that the presence of alternatives to public schooling may modify slightly the preceding analysis. Parents sending their children to private school and incurring the cost c^{pro} when they could send them to public school for nothing are implicitly transmitting wealth to their children and cannot be considered as fully liquidity-constrained.

[17] In applying this test, adjustment for quality would be very important. Otherwise, a program that expanded access to low-quality schooling for the poor while simultaneously ramping up schooling quality (but not access) for rich children would incorrectly be identified as highly progressive, in incidence terms.

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