

perspective paper

EDUCATION

GEORGE PSACHAROPOULOS



COPENHAGEN
CONSENSUS 2012

solving the world's challenges



Copenhagen Consensus 2012 Perspective Paper

Education

| | |
|--|----|
| I. Essence of the challenge..... | 2 |
| II. Adding perspective to the challenge | 3 |
| III. Theory | 3 |
| IV. Educational development frontiers in the World today | 5 |
| A. Education quantity issues..... | 5 |
| B. Quality state..... | 10 |
| V. Cost-benefit tests..... | 12 |
| VI. Broadening the challenge | 14 |
| VII. Summing up | 16 |
| VIII. Real solutions? | 18 |
| References..... | 19 |
| Appendix..... | 23 |

I. Essence of the challenge

The challenge paper is thought provoking and will serve well the purpose it has been written. Its line of argument goes as follows:

- There has been a lot of progress worldwide regarding education quantity (e.g., coverage), hence the policy frontier today lies in improving education quality.
- Investments in education quantity or quality are likely to yield returns only in non-failed states because the lack of basic institutions in failed states dampens the incentives to invest in education.
- Complementary inputs, such as health, raise the marginal product of schooling.
- In theory, the present value of any given year of additional schooling rises unambiguously with school quality.
- In theory, improvements in school quality have an ambiguous effect on years of schooling but must raise the present value of lifetime earnings.
- The evidence on the contribution of years of schooling or education quality on economic growth is mixed.
- Focusing on school quality makes sense because the returns from expanding access to schools have been exhausted.
- The policy focus should be on the quality of schooling offered to those already in school, because the return from getting the last 5% of children never attending school to enter a school is outweighed by the cost.

Three options are reviewed to improve school quality:

- . Decentralizing educational management
- . Offering teachers' incentives
- . Lowering the opportunity cost of attending school

After reviewing the empirical evidence on the above options, conditional cash transfers is the only intervention that exhibits an acceptable benefit-cost ratio.

II. Adding perspective to the challenge

In what follows I offer a series of remarks on the theoretical, empirical and policy sections of the challenge paper. I list a number of additional references that could be considered in refining the challenge. I produce additional cost-benefit evidence on some of the key issues raised in the challenge paper. And in doing so I take the liberty of broadening the challenge and proposing new real solutions.

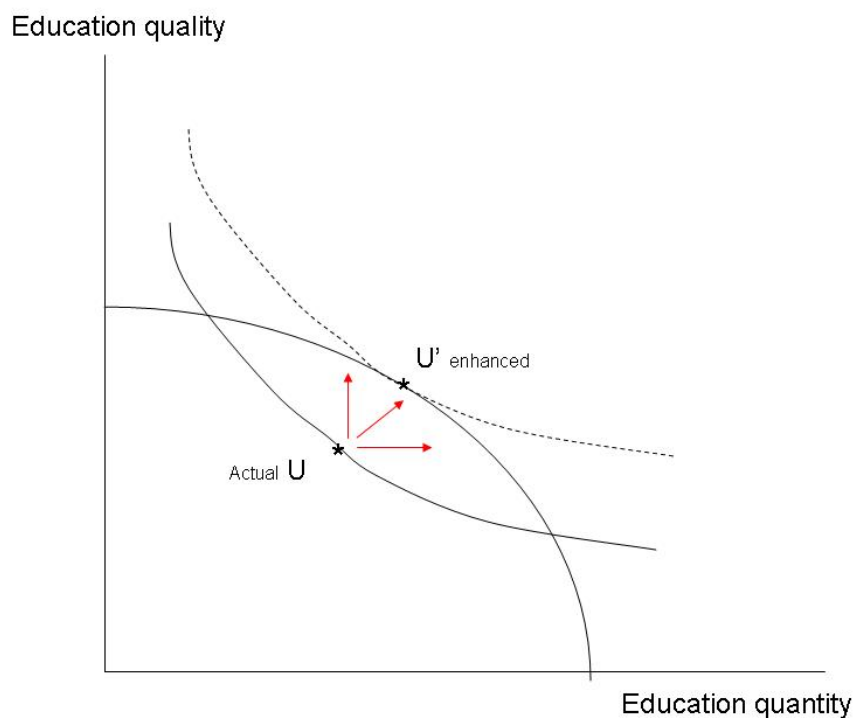
The thrust of my perspective is that expanding education quantity is a necessary condition for quality improvements to be enacted, and that the benefit-cost ratios of investment in human capital in poor countries pass the Copenhagen Consensus test. Perhaps it is in the so-called “failed states” (dismissed in the challenge paper as candidates for human capital investments), that such investment should take place as a matter of priority.

III. Theory

The supply and demand model underpinning Figure 1 in the challenge paper provides a nice framework for disentangling the education quantity/quality quandary. The way the relative shifts of the marginal product and marginal cost curves are drawn results in an ambiguous effect of enhanced school quality on years of schooling but an unambiguous positive effect on the present value of any given year of schooling. Of course what matters for policy purposes is the [net](#) present value of quality enhancements. Thus, in theory, costly quality interventions might not pass a cost-benefit test.

A complementary way at looking at the problem is to use an equally simplified supply and demand framework depicted in Figure 1 below. Country resources allow different mixes of quantity and quality of schooling along a production transformation curve that is concave to the origin. Superimposed are indifference curves convex to the origin representing levels of utility derived by the beneficiaries of education or society as a whole. In any given country, rich or poor, the actual situation must be at utility level U , i.e., inside the production possibility curve due to inefficiencies of various kinds. Removing such inefficiencies would mean a higher level of utility, perhaps never reaching the optimal U^* . The model predicts that it is possible to achieve a higher level of utility (e.g., per capita income) by raising [either](#) education quantity or quality. Whether the move would be more quantity-oriented or quality-oriented, depicted by the arrows, is again an empirical matter depending on cost-benefit analysis of the various options.

Figure 1. Education quantity and quality combinations



The most critical statistic for the position taken in the challenge paper is benefit-cost ratios for education quantity vs. quality improvements. The challenge paper does not present any benefit-cost ratios of improving school quality, apparently because such analyses do not exist. The only cost-benefit ratios in the challenge paper refer to conditional cash transfers that are designed to bring or keep children in school, i.e., they refer to education quantity¹.

¹ Regarding conditional cash transfers the challenge paper could use the published version of Behrman et al. (2011). Regarding the role of parents the challenge paper could consider a recent paper by Getler et al. (in press) regarding the AGE program in Mexico that reduced grade failure and repetition.

IV. Educational development frontiers in the World today

The frontier of a country's state of education is a function of the level of economic development. Thus in poor countries the challenge is at least to enroll all children in primary school², and in advanced countries to have no students dropping out before completing secondary education.³ In both country settings an additional challenge is to improve the quality of any given level of schooling.⁴

A. Education quantity issues

Out of school children in developing counties. According to the latest Unesco (2011) data, today there are 67 million out children out of school. The majority of these children are in the so-called failed states cited in the challenge paper (Table 1).

Table 1. Countries with over one million children out of school, 2009

| Country | Children out of school |
|---------------|------------------------|
| Nigeria | 8,650,000 |
| Pakistan | 7,300,000 |
| India | 3,852,000 |
| Ethiopia | 2,184,000 |
| Bangladesh | 1,835,000 |
| Cote d'Ivoire | 1,384,000 |
| Niger | 1,073,000 |
| Kenya | 1,059,000 |
| Yemen | 1,037,000 |

Source: Unesco (2011), p. 3.

Enrolling all children in school has been a moving target of governments and international organizations for a very long time. In 1990 "Education for All" by 2000 was proclaimed by UNDP, Unesco, Unicef, and the World Bank (1990). Yet this target has been shifting every five years or so, and the prospects are that the latest 2015 target will be missed as well (Unesco 2011). The latest World Bank (2011) education strategy shifted the emphasis to "Learning for All".

² UNDP et al. (1990).

³ E.g., European Commission (2006).

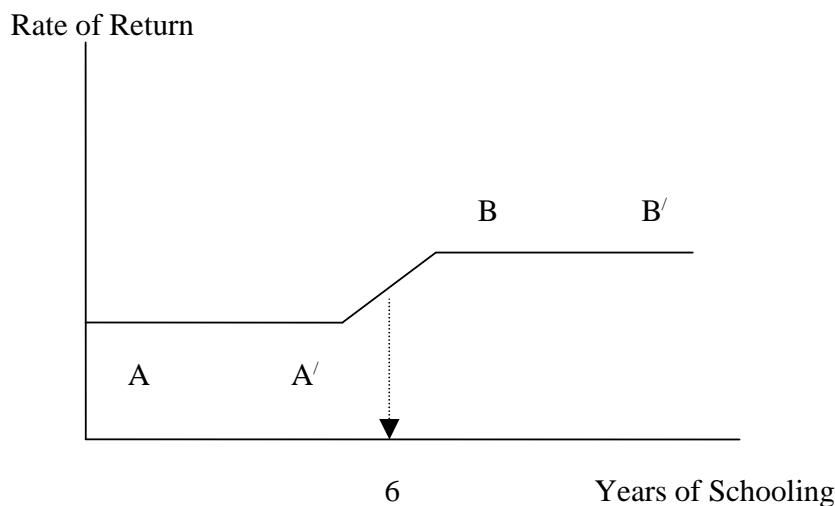
⁴ E.g., World Bank (2011).

The role of international organizations in building human capital in developing countries might not be as significant as one might think. For example, the first World Bank (1962) loan for education in Tunisia cited in the challenge paper was not exactly aimed to bring more children to school. In 1962 only about half of children aged 6-14 were in school in Tunisia, yet the Bank opted for expanding secondary education. The reason mentioned in the appraisal report was to meet manpower requirements, a discredited Bank policy that carried into the late eighties. Also, Bank loans for improving education quality, e.g., by diversifying the secondary curriculum and injecting a degree of vocationalization, did not have the expected effects according to the Bank's own evaluations (Psacharopoulos and Loxley, 1985).

Given this state of education enrollments in poor countries, the case for expanding the quantity of education cannot be dismissed that easily.

Azariadis and Drazen (1990) using a model that allows for multiple equilibria suggest that "once ... the stock of knowledge surpass[es] certain critical values, aggregate production possibilities may expand especially rapidly". As depicted in Figure 2, a country is trapped in a low-returns equilibrium (AA') until the level of human capital accumulation rises, say, when the mean years of schooling of the population exceeds 6 years. Once the threshold is passed, the country rides on a higher returns-growth path (BB'). An empirical test of this theory found that the threshold might be early literacy.

Figure 2. A critical level of education quantity



Others have found that there might be a threshold in terms of human capital accumulation before a country can reap growth benefits (Anderson and Bowman 1963, Easterlin 1981). Lau, Jamison, Liu and Rivkin (1996) using data from Brazil, found a threshold effect of education on output between three and four years of schooling (see also Jamison and Lau 1982). In other words, a country must have a critical mass of basic education before the returns to education manifest themselves. This finding is consistent with Romer's (1986) hypothesis that there exist increasing returns to intangible capital. Regarding the effect of education on economic growth in Sri Lanka the challenge paper could use the findings of Ganedodage and Rambaldi (2011).

Glaeser (1994) used the Mincerian earnings function in a country cross-section to decompose the effect of education on growth into (a) an effect of the changed returns to education over time, (b) an indirect effect of schooling's positive effect on schooling growth, and (c) a direct effect of education raising income, holding education growth constant. He found that the indirect, schooling-to-schooling effect had the greatest impact in the decomposition. This finding is in the spirit of Becker and Murphy (1992) suggesting that earlier human capital creates later human capital, linking to the new growth literature on increasing returns to scale. Several other studies have found that parental education is a strong determinant of children's school participation and eventual educational attainment (e.g., Birdsall 1985 on Brazil).

It is well known that often micro and macro estimates of the effect of human capital on growth are at odds. In a recent paper, Breton (2012) finds that for 36 countries the (macro) marginal product of human capital accruing to workers is consistent with estimates of the (micro) marginal return on investment in schooling in workers' earnings studies. Regarding the effect of education quality on economic growth the challenge paper could use the findings of Castello-Climent and Hidalgo-Cabrillana (2011).

Advanced countries. Turning to advanced countries, the frontier of the education quantity problem is secondary school graduation. In 2000 the European Union defined the dimension of the school failure problem as: “The number of 18 to 24 year olds with only lower-secondary level education who are not in further education and training”. An EU benchmark was set, that the proportion of early school leavers should be not be more than 10% by 2010 (European Commission, 2006).

According to the latest Eurostat (2012) data, 15% of secondary school students fail to complete the upper secondary cycle and receive no further training. As shown in Table 2, 22 European countries register a dropout rate above the 10% target.

Table 2. Secondary school dropouts in advanced countries

| Country | Early leavers (%) |
|------------------|-------------------|
| Malta | 36.9 |
| Portugal | 28.7 |
| Spain | 28.4 |
| Iceland | 22.6 |
| Italy | 18.8 |
| Romania | 18.4 |
| Norway | 17.4 |
| F. Yugoslav Rep. | 15.5 |
| United Kingdom | 14.9 |
| Bulgaria | 13.9 |
| Greece | 13.7 |
| Latvia | 13.3 |
| France | 12.6 |
| Cyprus | 12.6 |
| Belgium | 11.9 |
| Germany | 11.9 |
| Estonia | 11.6 |
| Denmark | 10.7 |
| Ireland | 10.5 |
| Hungary | 10.5 |
| Finland | 10.3 |
| Netherlands | 10.1 |

Source: Eurostat (2012).

Note: Percentage of the population aged 18-24 with at most lower secondary education and not in further education or training.

There have been several studies assessing the costs and benefits of avoiding secondary school failure. The most comprehensive study refers to the United States where three out of ten students do not graduate on time in the public school system (Levin 2005, Levin et al. 2006, 2007a, 2007b).

Based on labor market, health⁵, crime, welfare expenditures and taxes, and the cost of interventions to keep students in school, the study reports net present values of each intervention ranging from \$65,500 to \$150,100 per high school graduate and cost-benefit ratios ranging from 1.5 to 3.5, i.e. the benefits far exceed the costs of the intervention in all cases. If the number of high school dropouts were reduced by half through teacher salary increases, the net present value of the economic benefits would be \$45 billion per year.

In a related sub-analysis of minorities, Levin et al. (2007b) calculated the public savings (financial benefits) from greater public investments in the education of African American males among whom over one-fifth does not graduate from high school. Based on a number of interventions, they calculated the lifetime public benefits in terms of increased tax revenues and lower spending on health and crime. In terms of present values for a black male aged 20, these public benefits amount to \$256,700 per new graduate, while the median intervention would cost only \$90,700. Taking into account the increased tax revenues, health cost savings and crime cost savings, and comparing these benefits to the cost of the five interventions, they came up with the benefit-cost ratios reported in Table 3. If the high school graduation rate of black males were equalized to that of white males, the net public benefit would range from \$3.3 to \$4.7 billion for a single cohort of 20 year olds.

Table 3. Costs and benefits of education for interventions for blacks

| Intervention | First Things First | Chicago Parent-Child | Perry Preschool | Class size reduction | Teacher salary increase |
|---|--------------------|----------------------|-----------------|----------------------|-------------------------|
| Net present value | \$197,599 | \$188,951 | \$165,971 | \$159,292 | \$136,427 |
| Benefit-cost ratio | 4.4 | 3.8 | 2.8 | 2.6 | 2.1 |
| Total economic effect of equal graduation rates for black and white males | \$4.74 bn | \$4.53 bn | \$ 3.98 bn | \$3.82 bn | \$ 3.27 bn |

Source: Levin et al. (2007a), Table 4.

Levin (2005) reports a 7:1 benefit-cost ratio of preschool programs in terms of reduced costs of crime, drug use and teen parenting.

⁵ Notwithstanding Sansani's (2011) findings inverting the causation, i.e., education quality affecting health.

A Rand Corporation study (Vernez et al. 1999) found benefit-cost ratios ranging from 2.4 to 5.7 for bringing keeping minorities in school (Table 4).

Table 4. Benefit-cost ratios of closing the high school gap for Blacks and Hispanics

| Location | Public | Societal |
|-----------------|--------|----------|
| California | 2.4 | 4.6 |
| Rest of the USA | 3.3 | 5.7 |

Source: Vernez et al. (1999), Table 5.2.

Note: The “public” ratio includes the savings in public expenditures and the increase in tax revenues. The “societal” ratio includes these two public benefits plus the increase in private disposable income.

There also exist similar studies in Australia reporting high net present values and benefit-cost ratios for interventions to reduce secondary school dropouts - Applied Economics (2002) ; Allen Consulting Group (2003); Access Economics (2005).

B. Quality state

Whereas education quantity typically is measured by years of schooling or highest degree obtained, education quality is measured by student performance at cognitive achievement tests, such as IEA’s TIMMS⁶ or OECD’s PISA⁷. It has been a great conceptual and empirical advance to measure education quality by such output, rather than the older cost-based input method (e.g., expenditure per student).

The good called education (E) can be expressed as a function of both the quantity of schooling measured, say in years (S), and the quality of each year of schooling, say measured by the PISA score (Q),

$$E = f(S, Q)$$

A simple way to specify the above function is multiplicative:

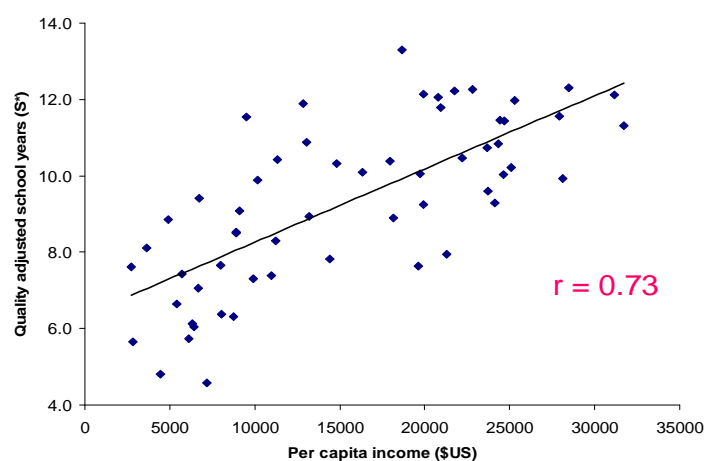
$$E = S Q ,$$

⁶ <http://timssandpirls.bc.edu/timss2011/frameworks.html>

⁷ <http://www.oecd.org/dataoecd/34/60/46619703.pdf>

where E is expressed as quality-adjusted years of schooling, a good proxy for a country's level of educational development. Based on matched data on the quantity and the quality of schooling in 58 countries (Appendix Table A-5), there is a strong positive correlation between economic and educational development.

Figure 3. Quality-adjusted years of schooling and per capita income



Source: Based on Appendix Table A-5.

V. Cost-benefit tests

How does the expansion of education or improvements in its quality fare on a cost-benefit scrutiny?

The challenge paper reviews a vast set of literature on its subject and presents only one set of benefit-cost ratios related to conditional cash transfers designed to keep children in school. This type of evidence refers more to the quantity rather than the quality of education. This paucity is understandable given the scarcity of cost-benefit analysis of education quality interventions. On the other hand, the literature is very rich on cost-benefit analysis of investments in the quantity of education.

I review below the evidence on improvements in the quantity of education relative to the two policy frontiers identified above, i.e., expanding primary school coverage in developing countries, especially the “failed” ones; and policies on reducing secondary education dropouts in high-income countries.

Returns to education in failed and other states

The Fund for Peace, a think tank based in Washington, D.C., publishes an annual “Failed States Index” (Foreign Policy 2011). The index is based on a series of indicators such as weak central government, non-provision of public services, widespread corruption, criminality and sharp economic decline. Sixty countries (out of the United Nations 193 countries) are classified as failed (Appendix Table A-1).

It so happens there exist evidence on the returns to investment in education in 21 of the failed countries (Appendix Table A-2) that can be compared to the returns in non-failed countries (Appendix Table A-3).

The returns to investment in education are estimated using a common methodology by comparing the present value of benefits of education to the cost of obtaining a given level of education. The benefits are typically earnings differentials between adjacent levels of education, before tax in the private calculation and after tax in the social calculation. The cost refers to what the individual foregoes in terms of lost earnings and incidental schooling expenses in the private calculation, and the full resource cost of education in the social calculation.

As shown in Table 5 the rate of return of investment in any level of education is higher in the failed states relative to the rest. It is true that in some rural areas and in failed states the returns obtained by local surveys may be lower than those in Table 5. But this does not seem to apply using data for a country as a whole from national household surveys that tacitly incorporate the effect of corruption and other barriers.

Table 5. Mean returns to investment in education by country type (%)

| Country type | Private returns (%) | | | Social returns (%) | | | N of obs. |
|-------------------|---------------------|------|--------|--------------------|------|--------|-----------|
| | Prim. | Sec. | Higher | Prim. | Sec. | Higher | |
| Failed states | 29.3 | 21.4 | 24.5 | 20.2 | 17.1 | 12.1 | 21 |
| Non-failed states | 25.5 | 15.6 | 17.0 | 18.2 | 11.6 | 10.4 | 62 |

Source: Appendix Tables A-2 and A-3.

It should not be surprising that the pay off of educational investment is higher in failed states, in the sense that the poorer the country the higher the returns to investment in education because of the relative scarcity of human capital.⁸ And it so happens that the failed countries are also very poor.

Turning to the research frontier in advanced economies, the OECD (2011) reports net present values and returns to completing upper secondary education in a large number of countries (Appendix Table A-4).

The reference to advanced countries demonstrates that even in these countries attention to the quantity of schooling is important in the sense that it yields high returns and benefit-cost ratios.

As shown in Table 6, both private and social net present values are positive at OECD's 3% discount rate, implying a benefit-cost ratio well above unity. In other words, investments in completing upper secondary education pass the Copenhagen Consensus benefit-cost test.

Table 6. Net present values and returns to investment in upper secondary education completion, OECD average

| Cos-benefit type | Net present value per person (\$US) | Rate of return (%) |
|------------------|-------------------------------------|--------------------|
| Private | 77,604 | 11.4 |
| Social | 36,302 | 7.7 |

Source: Appendix Table A-4.

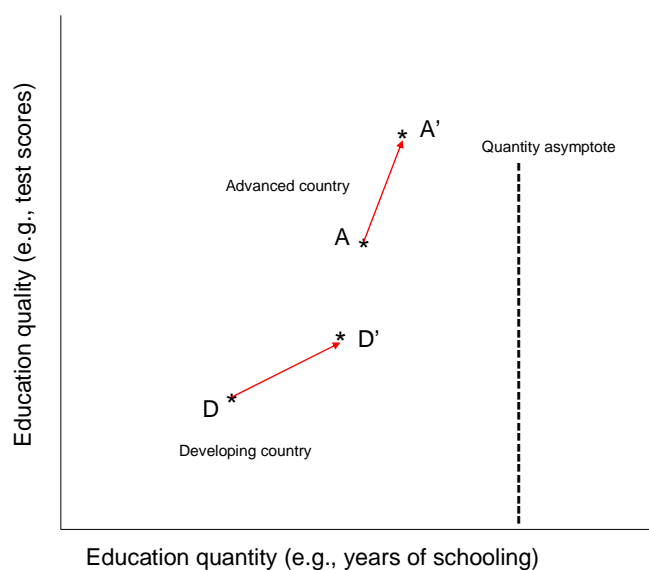
⁸ This is a kind of the law of diminishing returns in operation, extensively documented since the beginning of the literature on the subject, e.g., Psacharopoulos (1973).

VI. Broadening the challenge

Educational development has been associated with a large number of benefits, private and social. Educational development can be brought about by expanding the quantity of schooling and/or improving its quality. Given budgetary constraints governments and international donors alike face the difficult task of allocating resources towards expanding education places and/or improving education quality.

The relative mix of education quantity and quality is a function of the country's level of economic development (Figure 4). In developing countries the mix is bound to be quantity-biased (DD' path), i.e., the main challenge being how to bring more children to school, while of course trying to improve the quality of any given level of schooling.⁹ The desirability of such mix is supported by extensive evidence regarding the profitability of investment in expanding education coverage. Advanced countries sooner or later face an asymptote regarding how many years an individual can stay in education, so the challenge is to improve the quality of schooling (AA' path).

Figure 4. Alternative education quantity and quality paths

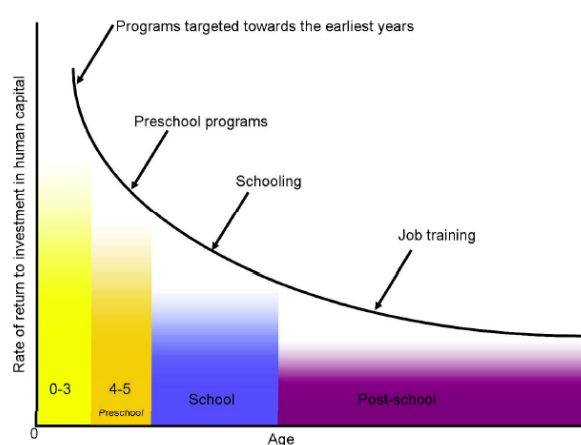


Heckman and his colleagues are now pointing to high returns to interventions before children are in the formal school system. Evaluations of the HighScope

⁹ Regarding school quality and student attendance see Marshall (2011).

Perry Preschool program found that adults at age 40 who had the preschool program had higher earnings, were more likely to hold a job, had committed fewer crimes, and were more likely to have graduated from high school than adults who did not have preschool. Similar evaluations exist for the Chicago Child Parent Centers that provide services to preschool children and their parents who live in low income areas. Comparing the costs of these programs to their long term benefits yield benefit-cost ratios of the order to 8 to 9 (Cunha et al. 2006). Heckman's (2009) conclusion is that interventions targeted to the earliest years exhibit the highest social return (Figure 5).

Figure 5. Returns to investment in human capital by age



Source: Heckman (2008).

As shown in Table 7 there exist several estimates of benefit-cost ratios for early interventions in developing countries ranging from 2 to 700.

Table 7. Benefit-cost ratios of early interventions in developing countries

| Country | Intervention | Benefit-cost ratio |
|-------------|-------------------------|--------------------|
| India | Tutorial program | 711.0 |
| Kenya | Deworming | 642.0 |
| Kenya | Preschool and nutrition | 77.0 |
| Kenya | Iron supplements | 45.2 |
| Pakistan | Urban girls scholarship | 36.3 |
| Uganda | Free primary | 26.3 |
| Pakistan | Rural girls scholarship | 10.1 |
| Mexico | PROGRESSA transfers | 6.8 |
| Nicaragua | RED social protection | 3.8 |
| Bolivia | Preschool and nutrition | 3.7 |
| Philippines | Preschool | 3.0 |
| Colombia | School voucher | 2.5 |
| Egypt | Preschool | 2.3 |
| Brazil | Preschool | 2.1 |

Source: Bolivia, Kenya, Pakistan, India, Uganda, Colombia, Mexico and Nicaragua from Orazem et al. (2008), Table 4. Brazil, Egypt and the Philippines from Patrinos (2007), Table 2.

Note: All benefit-cost ratios estimated using 3% discount rate.

VII. Summing up

Beyond moral grounds, to be financially sustainable education investments must pass the Copenhagen Consensus cost-benefit test. Given the available evidence reviewed above, we are very confident that expanding education quantity passes this test, especially in poor countries. The test is positive even in failed states.¹⁰

Unfortunately, we are not yet on such solid ground regarding investments in school quality (Glewwe et al., 2011). In addition, Hanushek and Woessmann's (2008) widely cited finding that it is the quality and not the quantity of schooling that determines economic growth has been recently challenged. Breton (2011) claims that the statistical analysis underpinning this finding is flawed. He shows that when a country's average

¹⁰ Of course there is the risk that educating people in failed states may have the adverse effect of more educated persons to be more efficient in exploiting the corruptive system. But such possibility must be diluted in the overall beneficial effect of education on society.

test scores and average schooling attainment are included in a national income model, both measures explain income differences, but schooling attainment has greater statistical significance. The high correlation between a nation's average schooling attainment, cumulative investment in schooling, and average tests scores indicates that average schooling attainment implicitly measures the quality as well as the quantity of schooling.

Given state budgets, countries face a tradeoff between investing in the extensive (quantity) or extensive (quality) margin. The quality challenge might be more appropriate in advanced countries. The challenge could be split by the level of a country's economic development where improvements in quantity might be more relevant for low-income countries and quality improvements more relevant for high-income countries. Regarding failed states, it might be that these countries would exhibit the highest benefit-cost ratios by bringing children too school, let alone that educating those out of school now is certainly bound to help such states exit the failed list.

By way of summary, Table 8 gives an illustrative summary of the positions in the challenge and perspective papers. Participants at the Copenhagen Consensus 2012 roundtable should look forward to a lively discussion.

Table 8. Broadening the challenge

| Country type | Challenge paper position | | Perspective position | |
|--------------|--------------------------|-------------|----------------------|-------------|
| | Ed. Quantity | Ed. quality | Ed. quantity | Ed. quality |
| Failed | | | XXX | X |
| Not failed | | XXX | X | XX |

Red area: No feasible solution, no action needed

Green area: Feasible solution, priority action needed

Number of X-marks: Relative action importance

VIII. Real solutions?

Based on the evidence presented in this paper, CC12 may consider prioritizing two real solutions for addressing the global challenge of education:

Real solution 1 - Expand basic education capacity in developing countries, especially in failed states.

Real solution 2 - Expand preschool interventions in developing countries, especially in failed states

It is beyond the scope of this perspective paper to provide a full-fledged CCC-specs benefit-cost analysis of the above solutions. The Expert Panel, however, may judge that the evidence presented above is sufficient to give serious consideration of these solutions.

References

- Access Economics Pty Ltd (2005). *The Economic Benefit of Increased Participation in Education and Training*, Dusseldorp Skills Forum, Sydney.
- Allen Consulting Group (2003). "The Economy-Wide Benefits of Increasing the Proportion of Students Achieving Year 12 Equivalent Education: Modelling Results". Sydney, Australia.
- Anderson, C.A. and M.J. Bowman (1963), 'Concerning the role of education in development,' in Clifford Geertz (ed), *Old Societies and New States: The Quest for Modernity in Asia and Africa*, London: Collier Macmillan, 247-279.
- Applied Economics (2002). "Realising Australia's Commitment to Young People. Scope, Benefits, Cost, Evaluation & Implementation," Dusseldorp Skills Forum, Sydney.
- Azariadis, C. and A. Drazen (1990), 'Threshold externalities in economic development,' *Quarterly Journal of Economics*, 105 (2), 501-526.
- Barro, Robert J.; Jong-Wha Lee (2010). "A new data set of educational attainment in the World, 1950-2010", NBER Working Paper 15902.
- Becker, G.S. and K.M. Murphy (1992), 'The division of labor, coordination costs, and knowledge,' *Quarterly Journal of Economics*, 107 (4), 1137-60.
- Behrman , Jere R. & Susan W. Parker & Petra E. Todd (2011). "Do Conditional Cash Transfers for Schooling Generate Lasting Benefits?: A Five-Year Followup of PROGRESA/Oportunidades," *Journal of Human Resources*, vol. 46(1), pages 93-122.
- Birdsall, Nancy (1985), 'Public Inputs and Child Schooling in Brazil,' *Journal of Development Economics*, 18(1), 1985: 67-86.
- Breton, Theodore R. (2011), The quality vs. the quantity of schooling: What drives economic growth? *Economics of Education Review*, 30 (4): 765-773
- Breton, Theodore R. (2012), "Were Mankiw, Romer, and Weil Right? A Reconciliation of the Micro and Macro Effects of Schooling on Income", *Macroeconomic Dynamics* (in press).
- Castelló-Climent, Amparo and Ana Hidalgo-Cabrillana (2012), "The role of educational quality and quantity in the process of economic development, *Economics of Education Review* (in press).

- Cunha, F., J.J. Heckman, L. Lochner and D. V. Masterov (2006). "Interpreting the Evidence on Life Cycle Skill Formation". in Eric A. Hanushek, Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: North-Holland.
- Easterlin, R. (1981), 'Why isn't the whole world developed?' *Journal of Economic History*, 41 (1), 1-19.
- European Commission (2006). "Detailed Analysis of progress towards the Lisbon Objectives in education and training: Analysis of Benchmarks and indicators," (Annex). European Commission.
- Eurostat, Early school leavers, (2012)
<http://epp.eurostat.ec.europa.eu/tgm/download.do?tab=table&plugin=1&language=en&pcode=tsisc060>, accessed February 3, 2012.
- Foreign Policy (2011),
http://www.foreignpolicy.com/articles/2011/06/17/2011_failed_states_index_interactive_map_and_rankings
- Ganegodage, K. Renuka and Alicia N. Rambaldi (2011), "The impact of education investment on Sri Lankan economic growth", *Economics of Education Review*, Volume 30, Issue 6, December 2011, Pages 1491–1502.
- Gertler Paul J., Harry Anthony Patrinos, Marta Rubio-Codina (2012), "Empowering parents to improve education: Evidence from rural Mexico", *Journal of Development Economics*, (in press).
- Glaeser, E.L. (1994), 'Why does schooling generate economic growth?' *Economics Letters*, 44 (3), 333-37.
- Glewwe, Paul, Eric A. Hanushek, Sarah Humpage and Renato Ravina (2011). "School Resources and Educational Outcomes in Developing Countries: A Review of the Literature from 1990 to 2010." University of Minnesota, mimeo.
- Hanushek, E.A. L. Woessmann (2008). "The Role of Cognitive Skills in Economic Development." *Journal of Economic Literature* 46(3): 607-68.
- Heckman James J. (2008), "Schools, Skills, and Synapses," IZA. DP No. 3515.
<http://ftp.iza.org/dp3515.pdf>.
- Jamison, Dean T. and Laurence Lau (1982), *Farmer Education and Farm Efficiency*, Baltimore: Johns Hopkins University Press.
- Lau, Lawrence J., Dean T. Jamison, Shucheng Liu and Steven Rivlin (1996), 'Education and economic growth: some cross-sectional evidence,' in Nancy Birdsall and Richard H. Sabot (eds), *Education in Brazil*, Washington, D.C.: Inter-American Development Bank; Baltimore: Johns Hopkins University Press, 83-116.

- Levin, H.M. (2005), "The social costs of inadequate education," A summary of the first annual Teachers College Symposium on Educational Equity, October 24-26, 2005. Teachers College, Columbia University.
- Levin, H.M., Belfield, C.R., Muennig, P and C.E. Rouse (2006). "The Costs and Benefits of an Excellent Education for America's Children - Technical Appendix", Teachers College, Columbia University.
- Levin, H.M., Belfield, C.R., Muennig, P and C.E. Rouse (2007a). "The Costs and Benefits of an Excellent Education for America's Children – Overview", Teachers College, Columbia University.
- Levin, H.M., Belfield, C.R., Muennig, P and C.E. Rouse (2007b). "The public returns to public educational investments in African American males," *Economics of Education Review*, vol. 26, issue 6, pages 699-708.
- Maddison, A. (2010). "Historical Statistics of the World Economy: 1-2008 AD" (http://www.ggdc.net/Maddison/Historical_Statistics/horizontal-file_02-2010.xls).
- Marshall, J.H. (2009), "School quality and learning gains in rural Guatemala," *Economics of Education Review*, Volume 28, Issue 2, April 2009, Pages 207–216
- OECD (2010), *PISA 2009 Results: What Students Know and Can Do: Student Performance in Reading, Mathematics and Science* (Volume I). Paris: OECD.
- OECD (2011), *Education at a Glance 2011*. Paris: OECD.
- Orazem, P., P. Glewwe and H. Patrinos (2008). "The Challenge of Education". Copenhagen Consensus 2008.
- Patrinos, H. (2007), "Living Conditions of Children," in *Solutions for the World's Biggest Problems: Costs and Benefits*, Bjørn Lomborg, ed., Cambridge University Press, pages 358-375. (Also: WPS4251, The World Bank.)
- Psacharopoulos, G. (1973). *Returns to Education: An International Comparison*. Amsterdam: Eslevier.
- Psacharopoulos, G. and W. Loxley (1985), *Diversified Secondary Education and Development: Evidence from Colombia and Tanzania*. Baltimore: Johns Hopkins University Press, 1985.
- Psacharopoulos, G. and H. Patrinos (2004), "Returns to investment in education: A further update," *Education Economics* 12, no. 2, 2004: 111-135.

- Romer, P. (1986), 'Increasing returns and long-run growth,' *Journal of Political Economy*, 94, 1002-1037.
- Sansani, Shahrar (2011), "The effects of school quality on long-term health," *Economics of Education Review*, Volume 30, Issue 6, December 2011, Pages 1320-1333
- UNDP, UNESCO, UNICEF and the World bank (1990). *Meeting Basic Learning Needs: A Vision for the 1990s*. New York: Unicef.
- Unesco (2011), *Out of School Children: New Data Reveal Persistent Challenges*. Montreal: UNESCO Institute for Statistics.
http://www.uis.unesco.org/FactSheets/Documents/FS12_2011_OOSC_EN.pdf
- Vernez, G., R. Krop and C. P. Rydell (1999). *Closing the Education Gap - Benefits and Costs*, RAND Corporation.
- World Bank (1962). "Tunisia Education Project Appraisal Report".
http://www-wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2002/07/25/000178830_98101903465813/Rendered/PDF/multi0page.pdf
- World Bank (2011). *Learning for All: Investing in People's Knowledge and Skills to Promote Development*. Washington, D.C.: The World Bank.

Appendix

Appendix Table A-1. Failed countries index and education characteristics

| Country | Failure index | Years of schooling S |
|----------------------|---------------|-------------------------|
| Afghanistan | 108 | 4.3 |
| Angola | 85 | |
| Bangladesh | 94 | 5.8 |
| Bhutan | 85 | |
| Bolivia | 83 | 9.9 |
| Burkina Faso | 89 | |
| Burma | 98 | 4.8 |
| Burundi | 99 | 3.3 |
| Cambodia | 89 | 6.0 |
| Cameroon | 95 | 6.1 |
| Central African Rep. | 105 | 3.6 |
| Chad | 110 | |
| Colombia | 87 | 7.7 |
| Comoros | 84 | |
| Dem. Rep. of Congo | 108 | 3.5 |
| Djibouti | 82 6 | |
| East Timor | 95 | |
| Egypt | 87 | 7.1 |
| Equatorial Guinea | 88 | |
| Eritrea | 94 | |
| Ethiopia | 98 | |
| Georgia | 86 | |
| Guinea | 103 | |
| Guinea-Bissau | 98 | |
| Haiti | 108 | 5.2 |
| Iran | 90 | 8.1 |
| Iraq | 105 | 5.9 |
| Israel/West Bank | 84 | |
| Ivory Coast | 103 | 3.7 |
| Kenya | 99 | 7.3 |
| Kyrgyzstan | 92 | 8.7 |
| Laos | 87 | 5.1 |
| Lebanon | 88 | |
| Liberia | 94 | 5.4 |

| | | |
|-------------------------|-----|-----|
| Madagascar | 83 | |
| Malawi | 91 | 4.7 |
| Mauritania | 88 | 4.6 |
| Mozambique | 84 | 1.8 |
| Nepal | 94 | |
| Niger | 99 | 1.8 |
| Nigeria | 100 | |
| North Korea | 96 | |
| Pakistan | 102 | 5.6 |
| Papua New Guinea | 84 | 4.8 |
| Philippines | 85 | 9.0 |
| Rep. of Congo | 91 | 6.0 |
| Rwanda | 91 | 4.0 |
| Sierra Leone | 92 | 3.4 |
| Solomon Islands | 86 | |
| Somalia | 113 | |
| Sri Lanka | 93 | 8.5 |
| Sudan | 109 | 3.3 |
| Syria | 86 | 5.3 |
| Tajikistan | 88 | 9.3 |
| Togo | 89 | 5.9 |
| Uganda | 96 | 5.4 |
| Uzbekistan | 88 | |
| Yemen | 100 | 3.7 |
| Zambia | 84 | 6.7 |
| Zimbabwe | 108 | 7.7 |
| Mean years of schooling | | 5.6 |

Source: Failure index from Foreign Policy (2011).
Years of schooling from Barro and Lee (2010).

Appendix Table A-2. Returns to investment in education in failed states (%)

| Country | Private | | | Social | | |
|--------------|---------|------|--------|--------|------|--------|
| | Prim. | Sec. | Higher | Prim. | Sec. | Higher |
| Bolivia | 20.0 | 6.0 | 19.0 | 13.0 | 6.0 | 13.0 |
| Burkina Faso | | | | 20.1 | 14.9 | 21.3 |
| Colombia | 27.7 | 14.7 | 21.7 | 20.0 | 11.4 | 14.0 |
| Ethiopia | 24.7 | 24.2 | 26.6 | 14.9 | 14.4 | 11.9 |
| Iran | | 21.2 | 18.5 | 15.2 | 17.6 | 13.6 |
| Ivory Coast | 25.7 | 30.7 | 25.1 | | | |
| Kenya | | 16.0 | | | 10.0 | |
| Liberia | 99.0 | 30.5 | 17.0 | 41.0 | 17.0 | 8.0 |
| Malawi | 15.7 | 16.8 | 46.6 | 14.7 | 15.2 | 11.5 |
| Nepal | 16.6 | 8.5 | 12.0 | 15.7 | 8.1 | 9.1 |
| Nigeria | 30.0 | 14.0 | 34.0 | 23.0 | 12.8 | 17.0 |
| Pakistan | 8.4 | 13.7 | 31.2 | | | |
| Papua NG | 37.2 | 41.6 | 23.0 | 12.8 | 19.4 | 8.4 |
| Philippines | 18.3 | 10.5 | 11.6 | 13.3 | 8.9 | 10.5 |
| Sierra Leone | | | | 20.0 | 22.0 | 9.5 |
| Somalia | 59.9 | 13.0 | 33.2 | 20.6 | 10.4 | 19.9 |
| Sri Lanka | | 12.6 | 16.1 | | | |
| Uganda | | | | 66 | 28.6 | 12 |
| Yemen | 10.0 | 41.0 | 56.0 | 2.0 | 26.0 | 24.0 |
| Zambia | | | 19.2 | | | 5.7 |
| Zimbabwe | 16.6 | 48.5 | 5.1 | 11.2 | 47.6 | -4.3 |
| Mean | 29.3 | 21.4 | 24.5 | 20.2 | 17.1 | 12.1 |

Source: Based on Psacharopoulos and Patrinos (2004), Table A-1.
Failed classification from Foreign Policy (2011).

Appendix Table A-3. Returns to investment in education in non-failed states (%)

| Country | Private | | | Social | | |
|--------------------|---------|------|--------|--------|------|--------|
| | Prim. | Sec. | Higher | Prim. | Sec. | Higher |
| Argentina | 10.1 | 14.2 | 14.9 | 8.4 | 7.1 | 7.6 |
| Australia | | 8.1 | 21.1 | | | 16.3 |
| Austria | | 11.3 | 4.2 | | | |
| Bahamas | | 26.1 | | | 20.6 | |
| Belgium | | 21.2 | 8.7 | | 17.1 | 6.7 |
| Botswana | 99 | 76 | 38 | 42 | 41 | 15 |
| Brazil | 36.6 | 5.1 | 28.2 | 35.6 | 5.1 | 21.4 |
| Canada | | 7.8 | 13 | | | |
| Chile | 9.7 | 12.9 | 20.7 | 8.1 | 11.1 | 14 |
| China | 18 | 13.4 | 15.1 | 14.4 | 12.9 | 11.3 |
| Costa Rica | 12.2 | 17.6 | 12.9 | 11.2 | 14.4 | 9 |
| Cyprus | 15.4 | 7 | 5.6 | 7.7 | 6.8 | 7.6 |
| Denmark | | | 10 | | | 7.8 |
| Dominican Republic | 85.1 | 15.1 | 19.4 | | | |
| Ecuador | 17.1 | 17.2 | 12.7 | 14.7 | 12.7 | 9.9 |
| El Salvador | 18.9 | 14.5 | 9.5 | 16.4 | 13.3 | 8 |
| Estonia | | | | 14 | 2.2 | 10.3 |
| France | | 14.8 | 20 | | | |
| Germany | | 6.5 | 10.5 | | | |
| Ghana | 24.5 | 17 | 37 | 18 | 13 | 16.5 |
| Greece | | 8.3 | 8.1 | | 6.5 | 5.7 |
| Guatemala | 33.8 | 17.9 | 22.2 | | | |
| Honduras | 20.8 | 23.3 | 25.9 | 18.2 | 19.7 | 18.9 |
| Hong Kong | | 18.5 | 25.2 | | 15 | 12.4 |
| Hungary | | 8.2 | 13.4 | | 6 | 2.6 |
| India | 2.6 | 17.6 | 18.2 | | | |
| Indonesia | | | | | 11 | 5 |
| Israel | 27 | 6.9 | 8 | 16.5 | 6.9 | 6.6 |
| Italy | | 17.3 | 18.3 | | | |
| Jamaica | 20.4 | 15.7 | | 17.7 | 7.9 | |
| Japan | 13.4 | 10.4 | 8.8 | 9.6 | 8.6 | 6.9 |
| Korea | | 10.1 | 17.9 | | 8.8 | 15.5 |
| Lesotho | 15.5 | 26.7 | 36.5 | 10.7 | 18.6 | 10.2 |
| Malaysia | | 32.6 | 34.5 | | | |
| Mexico | 18.9 | 20.1 | 15.7 | 11.8 | 14.6 | 11.1 |
| Morocco | | | | 50.5 | 10 | 13 |
| Netherlands | | 8.5 | 10.4 | | 5.2 | 5.5 |
| New Zealand | | 13.8 | 11.9 | | 12.4 | 9.5 |
| Nicaragua | | | | 13.6 | 10.4 | 14.7 |

| | | | | | | |
|----------------|------|------|------|------|------|------|
| Norway | | 7.4 | 7.7 | | 7.2 | 7.5 |
| Panama | 5.7 | 21 | 21 | | | |
| Paraguay | 23.7 | 14.6 | 13.7 | 20.3 | 12.7 | 10.8 |
| Peru | 13.2 | 6.6 | 40 | | | |
| Puerto Rico | 68.2 | 52.1 | 29 | 24 | 34.1 | 15.5 |
| Senegal | 33.7 | 21.3 | | 23 | 8.9 | |
| Singapore | 22.2 | 12.9 | 18.7 | 16.7 | 10.1 | 13.9 |
| South Africa | | | | 22.1 | 17.7 | 11.8 |
| Spain | | | | 7.4 | 8.5 | 13.5 |
| Sudan | | 13 | 15 | | 8 | 4 |
| Sweden | | | 10.3 | | 10.5 | 9.2 |
| Taiwan | 50 | 12.7 | 15.8 | 27 | 12.3 | 17.7 |
| Tanzania | 7.9 | 8.8 | | | | |
| Thailand | 16 | 12.9 | 11.8 | | | |
| The Gambia | 37.1 | 12.7 | | 33.5 | 12.1 | |
| Tunisia | | 13 | 27 | | | |
| Turkey | 1.9 | 8.6 | 16.2 | | | 8.5 |
| United Kingdom | | | | 8.6 | 7.5 | 6.5 |
| United States | | | | | 10 | 12 |
| Uruguay | 27.8 | 10.3 | 12.8 | 21.6 | 8.1 | 10.3 |
| Venezuela | 36.3 | 14.6 | 11 | 23.4 | 10.2 | 6.2 |
| Vietnam | 10.8 | 3.8 | 3 | 13.5 | 4.5 | 6.2 |
| Yugoslavia | 14.6 | 3.1 | 5.3 | 3.3 | 2.3 | 3.1 |
| Mean | 25.5 | 15.6 | 17.0 | 18.2 | 11.6 | 10.4 |

Source: Based on Psacharopoulos and Patrinos (2004), Table A-1
Failed classification from Foreign Policy (2011).

Appendix Table A-4. Cost-benefit values of investment in upper secondary school completion

| Country | Total benefits (\$US 2007) | Net present value | Rate of return (%) | Total benefits (\$US 2007) | Net present value | Rate of return (%) |
|------------|-------------------------------|-------------------|--------------------|-------------------------------|-------------------|--------------------|
| | Private | | | Social | | |
| Australia | 110 032 | 84 479 | 14.4 | 46 632 | 27 518 | 8.6 |
| Austria | 166 386 | 123 931 | 12.3 | 128 205 | 79 637 | 8.7 |
| Canada | 116 248 | 85 382 | 12.2 | 51 178 | 28 204 | 7.1 |
| Czech Rep. | 118 224 | 90 722 | 14.3 | 47 037 | 21 927 | 6.7 |
| Denmark | 90 497 | 61 352 | 13.3 | 99 870 | 59 089 | 8.7 |
| Finland | 57 009 | 27 416 | 7.5 | 40 991 | 18 362 | 7.6 |
| France | 75 341 | 44 544 | 8.7 | 32 221 | -2 501 | 2.7 |
| Germany | 74 370 | 37 908 | 7.4 | 88 089 | 56 680 | 15.6 |
| Hungary | 54 225 | 35 808 | 10.9 | 53 507 | 32 938 | 8.3 |
| Ireland | 104 166 | 75 191 | 9.6 | 71 408 | 43 624 | 7.1 |
| Italy | 110 497 | 71 717 | 7.2 | 81 343 | 42 162 | 5.7 |
| N. Zealand | 107 081 | 72 251 | 9.0 | 54 096 | 33 553 | 8.0 |
| Norway | 153 566 | 111 251 | 13.2 | 91 904 | 46 711 | 7.7 |
| Poland | 51 207 | 34 910 | 10.6 | 26 050 | 6 010 | 4.4 |
| Portugal | 133 074 | 109 618 | 11.5 | 76 420 | 52 629 | 7.7 |
| Slovenia | 82 381 | 61 921 | 12.1 | 48 543 | 22 981 | 6.2 |
| Spain | 67 913 | 52 987 | 9.5 | 26 317 | 7 738 | 4.3 |
| Sweden | 87 328 | 60 477 | 11.7 | 64 944 | 31 056 | 9.7 |
| Turkey | 46 637 | 35 082 | 9.5 | 20 699 | 11 371 | 6.4 |
| UK | 189 781 | 150 982 | 13.5 | 91 815 | 72 161 | 10.1 |
| USA | 228 142 | 201 745 | 21.4 | 102 029 | 70 497 | 10.4 |
| OECD mean | 105 910 | 77 604 | 11.4 | 63 967 | 36 302 | 7.7 |

Source: OECD (2011), Tables A.9.1 and A.9.2

Note: Net present value using OECD's 3% discount rate.

Appendix Table A-5. Education quantity, quality and per capita income

| Country | Years of schooling | School quality (Mean PISA) | Quality-adjusted years of schooling | Per capita income (\$US) |
|-------------|--------------------|----------------------------|-------------------------------------|--------------------------|
| | S | Q | S* | Y |
| (1) | (2) | (3) | (4) | (5) |
| China * | 8.2 | 577 | 9.4 | 6725 |
| Hong Kong | 10.4 | 546 | 11.3 | 31704 |
| Finland | 10.0 | 543 | 10.8 | 24344 |
| Singapore | 9.1 | 543 | 9.9 | 28107 |
| Korea | 7.1 | 541 | 7.6 | 19614 |
| Japan | 11.6 | 529 | 12.3 | 22816 |
| Canada | 11.4 | 527 | 12.0 | 25267 |
| N. Zealand | 12.7 | 524 | 13.3 | 18653 |
| Taiwan | 11.3 | 520 | 11.8 | 20926 |
| Australia | 11.8 | 519 | 12.2 | 21732 |
| Netherlands | 11.0 | 519 | 11.4 | 24695 |
| Switzerland | 9.9 | 517 | 10.2 | 25104 |
| Estonia | 11.8 | 514 | 12.1 | 19951 |
| Germany | 11.8 | 510 | 12.1 | 20801 |
| Belgium | 10.5 | 509 | 10.7 | 23655 |
| Poland | 9.9 | 501 | 9.9 | 10160 |
| Norway | 12.3 | 500 | 12.3 | 28500 |
| UK | 9.6 | 500 | 9.6 | 23742 |
| Denmark | 10.1 | 499 | 10.0 | 24621 |
| Slovenia | 8.9 | 499 | 8.9 | 18170 |
| Ireland | 11.6 | 497 | 11.6 | 27898 |
| France | 10.5 | 497 | 10.5 | 22223 |
| USA | 12.2 | 496 | 12.1 | 31178 |
| Hungary | 11.7 | 496 | 11.5 | 9500 |
| Sweden | 11.6 | 496 | 11.5 | 24409 |
| Czech Rep. | 12.1 | 490 | 11.9 | 12868 |
| Portugal | 8.0 | 490 | 7.8 | 14436 |
| Slovak Rep. | 11.2 | 488 | 10.9 | 13033 |
| Austria | 9.5 | 487 | 9.3 | 24131 |
| Latvia | 10.6 | 487 | 10.3 | 14816 |
| Italy | 9.5 | 486 | 9.2 | 19909 |
| Spain | 10.4 | 484 | 10.1 | 19706 |
| Lithuania | 10.9 | 479 | 10.4 | 11342 |
| Croatia | 9.0 | 474 | 8.5 | 8904 |
| Greece | 10.7 | 473 | 10.1 | 16362 |

| | | | | |
|---------------|------|-----|------|-------|
| Russian Fed. | 9.7 | 469 | 9.1 | 9111 |
| Israel | 11.3 | 459 | 10.4 | 17937 |
| Turkey | 7.0 | 455 | 6.4 | 8066 |
| Serbia | 9.2 | 442 | 8.1 | 3620 |
| Chile | 10.2 | 439 | 8.9 | 13185 |
| Bulgaria | 9.9 | 432 | 8.5 | 8886 |
| Uruguay | 8.6 | 427 | 7.3 | 9893 |
| Romania | 10.4 | 427 | 8.8 | 4895 |
| Thailand | 7.5 | 422 | 6.3 | 8750 |
| Mexico | 9.1 | 420 | 7.7 | 7979 |
| Trinidad & T. | 9.6 | 414 | 8.0 | 21314 |
| Jordan | 9.2 | 402 | 7.4 | 5702 |
| Brazil | 7.5 | 401 | 6.0 | 6429 |
| Colombia | 7.7 | 399 | 6.1 | 6330 |
| Kazakhstan | 10.4 | 399 | 8.3 | 11245 |
| Argentina | 9.3 | 396 | 7.4 | 10995 |
| Tunisia | 7.3 | 392 | 5.7 | 6103 |
| Indonesia | 6.2 | 385 | 4.8 | 4428 |
| Albania | 9.9 | 384 | 7.6 | 2741 |
| Qatar | 6.1 | 373 | 4.6 | 7179 |
| Panama | 9.6 | 369 | 7.1 | 6675 |
| Peru | 9.0 | 368 | 6.6 | 5388 |
| Kyrgyzstan | 8.7 | 325 | 5.7 | 2835 |

Source:

Col. (2), from Barro and Lee (2010).

Col. (3), based on OECD (2010). Mean 2009 PISA score on reading, mathematics and science

Col. (4) = [Col. (2) x Col. (3)] / 500.

Col. (5), from Maddison (2010)

Note: */ China PISA score refers to Shanghai.