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Mechanisms and methods for cost-benefit / cost-effectiveness analysis of specific education programmes

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EENEE Analytical Report[1]

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[1] An earlier version of this report was prepared in the context of a Workshop on Cost benefit and Cost Effectiveness Analysis in the Field of Education Policy held in Stockholm, November 12 - 13, 2013. This version of the report was subsequently finalised in the light of discussions at the workshop.

Executive summary

CBA and CEA as tools to improve public policy making and its transparency

- Resources are always scarce and can be used in different ways. Ensuring efficient and effective use of resources is an important aspect of public policies (including in the area of education).
- Cost-benefit analysis (CBA) and cost-efficiency analysis (CEA) are important tools in this respect. They can help informing policymakers and the wider public about the pros and cons of alternative policy options.
- CEA compares the unit costs of various policies targeting one particular outcome. It does not require benefits expressed in monetary terms because it deals with one outcome only. Therefore, CEA does not require translating benefits into an equivalent in monetary terms.
- CBA seeks to take into account, as far as possible, all costs and all benefits (expressed in monetary terms) associated to alternative policy decision and outcomes. It is technically more demanding since it requires benefits to be expressed in monetary terms. But it is more comprehensive analytical tool than CEA because it allows comparing more than one outcome.
- Which one of the two tools, CBA or CEA, is the more suitable approach needs to be assessed on a case-by-case basis depending on policymakers' needs.
- While *private* costs and benefits drive personal incentives and behaviour of individuals, policymakers should have a broader view and also take into account *social* costs and *social* benefits. This report sets out the differences between private and social, and monetary and non-monetary costs and benefits.
- The report also addresses the peculiarities involved when costs and benefits are spread across longer time-spans. It also addresses the issues of opportunity costs, foregone earnings and taxes.

Applying CBA/CEA to the area of education

- It is possible to employ CBA/CEA tools in the field of education, just as for any other area of public policy-making. However, there are specific features in the area of education - that are inherent in the nature of human capital (HC), in contrast to

physical capital. To conduct a sound CBA/CEA, these specific features have to be taken into account.

- Such specific features include the inseparability of HC from human body limiting its tradability; life-long links between HC and economic, social, health and other conditions of individuals; private credit constraints due to market failures due to lack of available collaterals for private loans to support private investment into HC; strong positive impact of personal HC on other members of society; personal riskiness of investment into HC strengthened by common risk-aversion of individuals; difficulties to measure benefits and returns to HC investments. Such features of HC imply specific difficulties requiring special approaches when using general CBA/CEA principles in the area of education programs.
- Education brings many types of non-monetary benefits, ranging from lower school drop-out rates, through lower incidence of crime and better health, to higher and better employment. Many of these non-monetary benefits can be transformed into corresponding monetary values for the purposes of a CBA.
- Existence and accessibility of high-quality data is necessary precondition for crafting good CBA/CEA. In principle, data can come from a range of different sources (such as (i) administrative data sources, regular and ad-hoc statistical surveys; (ii) impact evaluation studies relying, if possible, on experience from ex-ante pilot and experimental versions of the educational programmes; (iii) findings of related studies in the past or in other countries; (iv) experts' assumptions and opinions).

Making good use of CBA/CEA to inform policy-decisions

- Using CBA/CEA to inform policy decisions can involve various risks and misunderstandings (for example, the findings of a specific CBA/CEA may not lend themselves to be transferred to another policy, region or country; scaling up an intervention presents a particular risk, as one has to observe carefully whether there are sufficient similarities in the populations treated, social and legal contexts, types of outcomes, and the form of treatment).
- Drawing policy-conclusions from the results of particular CBA/CEA requires great care. This implies that the outcomes of CBA/CEA have to be explained clearly, including their underlying assumptions, limitations and caveats.
- Although regular use of CBAs/CEAs is important, it still remains only one of many elements in the much broader educational policies formation agenda. CBA/CEAs should therefore complement, rather than substitute, other policy formation tools.

- The creation and regular use of good quality CBAs/CEAs is impossible without a proper evaluation culture. While the analyses can be fostered legally by adopting binding procedural guidelines, a culture of evaluation must run much deeper. It has to be evoked, disseminated, and enforced by middle and high level public officials adequately educated in modern public management. Instrumental in this is also a broader societal push emanating from the ranks of academics and journalists who understand the importance of good public governance.
- Even if the elaboration of a solid CBA/CEA turns out to be constrained by methodological and data difficulties, the process itself is very important. Properly and rigorously crafted CBAs/CEAs help to clarify what costs and benefits are included or neglected from consideration, what their expected time-structure would be, which stakeholders would be expected to incur the costs and benefits, which subgroups would benefit the most, whether and how the pilot programme experience could be scaled-up, and what side- and unintended effects should be taken into account. CBA/CEA can help to develop clearer idea about the intended benefits.
- Conducting CBA/CEA usually requires that a team is set up of experts from different backgrounds. By promoting inter-disciplinary approach, CBA/CEA can act as a useful catalyst for better policy-making.

The usage of CBA/CEA in practice

- In comparison to other public policy areas such as health and employment, CBAs/CEAs in the field of education are still used less frequently.
- The outcome of the search undertaken for the present report suggests that in Europe CBAs/CEAs are used less frequently than in the USA, respectively are less well established.

Open questions and next steps

- It remains to be seen whether a more in-depth review would confirm the preliminary finding that CBA/CEA are used less in Europe. It might turn out that CBA/CEA are carried out in Europe but are made less frequently available or disseminated.

- A comprehensive and more thorough investigation of the usage of CBAs/CEAs and related institutional practices across Member States maybe an appropriate next step.

- If, however, the initial impression was confirmed that, in education, CBA/CEAs are indeed used less in Europe, it would be important to find out more about the underlying causes.
- As this report does not find strong reasons for not applying CBA/CEA in education, such causes might be linked to practical, legal, political or institutional obstacles. In particular, they could be linked to problems at technical level, to problems to finance the necessary research, lack of incentives for researches to engage this kind of exercise, lack of demand among policy-makers lack of awareness and recognition of CBA/CEAs as useful analytical tools. To make full use of the potential that CBA/CEA offer, it is necessary to identify the concrete nature of these obstacles.

The present report is enriched by brief but concrete examples of CBAs/CEAs of educational programs produced across the world, and a rich list of references for further reading on particular issues.

Executive summary [GERMAN]

Kosten-Nutzen-Analyse und Kosten-Effektivitäts-Analyse als Instrumente zur Verbesserung politischer Maßnahmen und deren Transparenz

- Ressourcen sind stets knapp und können auf unterschiedliche Weise genutzt werden. Ein wichtiger Aspekt politischer Maßnahmen (auch im Bereich Bildung) ist, die effiziente und effektive Nutzung von Ressourcen sicher zu stellen.
- Kosten-Nutzen-Analysen (KNA) und Kosten-Effektivitäts-Analysen (KEA) sind wichtige Instrumente hierfür. Sie können politische Entscheidungsträger und die Öffentlichkeit über Vor- und Nachteile von alternativen Politikoptionen informieren.
- KEA vergleichen die Stückkosten von verschiedenen politischen Strategien, die ein bestimmtes Ergebnis zum Ziel haben. Da nur eine einzige Zielgröße betrachtet wird, müssen die Nutzendimensionen nicht in monetären Größen ausgedrückt werden.
- KNA versuchen, soweit möglich, alle (in monetären Größen ausgedrückten) Kosten und Nutzen, die mit einer politischen Entscheidung und deren Ergebnissen einhergehen, zu berücksichtigen. KNA sind technisch anspruchsvoller, da hierfür alle Nutzendimensionen in monetären Größen ausgedrückt werden müssen. Im Vergleich zu KEA sind sie das umfassendere Instrument, da sie erlauben, mehr als ein Ergebnis zu vergleichen.
- Welcher der beiden Ansätze, KNA oder KEA, passender ist, muss von Fall zu Fall auf Basis der Interessen der politischen Entscheidungsträger entschieden werden.
- Während *private* Kosten und Nutzen persönliche Anreize und das individuelle Verhalten steuern, sollten politische Entscheidungsträger einen weiteren Blick haben und auch *soziale* Kosten und Nutzen berücksichtigen. Dieser Bericht definiert die Unterschiede zwischen privaten und sozialen sowie zwischen monetären und nicht-monetären Kosten und Nutzen.
- Der Bericht behandelt auch die Besonderheiten, die auftreten, wenn Kosten und Nutzen über eine längere Zeitspanne entstehen. Er betrachtet außerdem damit verbundene Opportunitätskosten, Verdienst- und Steuerausfälle.

Die Anwendung von KNA/KEA im Bildungsbereich

- Es ist möglich, KNA/KEA genauso wie bei der Bewertung jeder anderen politischen Maßnahme auch im Bildungsbereich anzuwenden. Es gibt jedoch Besonderheiten im

Bildungsbereich, die auf die spezifischen Eigenschaften von Humankapital (HK) im Vergleich zu physischem Kapital zurückgehen. Um gute KNA/KEA durchzuführen, müssen diese Besonderheiten berücksichtigt werden.

- Solche Besonderheiten umfassen: die Untrennbarkeit von Humankapital vom menschlichen Körper, was die Übertragbarkeit von HK verhindert; lebenslange Verbindungen zwischen HK und wirtschaftlichen, sozialen, gesundheitlichen und anderen Voraussetzungen von Individuen; private Kreditbeschränkungen durch Marktversagen, das auf mangelnde Sicherheiten von Privatkrediten für private Investitionen in HK zurückgeht; ein starker positiver Einfluss von persönlichem HK auf andere Mitglieder der Gesellschaft; das persönliche Risiko in HK zu investieren, was durch eine allgemeine Risikoaversion verstärkt wird und Schwierigkeiten, Kosten und Nutzen durch HK Investitionen zu messen. Solche Besonderheiten des HKs bringen spezifische Herausforderungen mit sich, die besondere Ansätze erfordern, wenn man allgemeine KNA/KEA für die Evaluierung von Bildungsprogrammen benutzt.
- Bildung geht mit vielen Arten von nicht-monetärem Nutzen einher, angefangen bei einer niedrigeren Schulabbruchsrate, über niedrigere Kriminalität und besserer Gesundheit, bis hin zu mehr und besserer Beschäftigung. Viele dieser nicht-monetären Nutzendimensionen können in entsprechende nicht-monetäre Werte übertragen werden, um eine KNA durchzuführen.
- Die Existenz und der Zugang zu hochwertigen Daten ist eine notwendige Voraussetzung für eine gute KNA/KEA. Im Prinzip können Daten aus vielen unterschiedlichen Quellen kommen (beispielsweise aus (i) administrativen Datenquellen, regelmäßigen und ad hoc Umfragen; (ii) Wirkungsstudien, die wenn möglich auf Basis von Erfahrung von einer Pilot- und Versuchsstudien zu Bildungsprogrammen durchgeführt wurden; (iii) Ergebnisse aus verwandten Studien in der Vergangenheit oder aus anderen Ländern; (iv) Annahmen und Meinungen von Experten).

Gute Anwendungen von KNA/KEA zur Unterstützung politischer Entscheidungsfindung

- Die Anwendung von KNA/KEA zur politischen Entscheidungsfindung kann zu verschiedenen Risiken und Missverständnissen führen (z.B. können die Ergebnisse einer spezifischen KNA/KEA nicht auf eine andere Maßnahme, Region oder ein anderes Land übertragen werden; eine Maßnahme hochzurechnen, birgt ein besonderes Risiko, da ausreichend Ähnlichkeiten in der Bevölkerung, auf die die

Maßnahme abzielt, dem sozialen und rechtlichen Kontext, der Art der Ergebnisse und der Form der Behandlung bestehen müssen).

- Um politische Empfehlungen aus den Ergebnissen einer bestimmten KNA/KEA zu ziehen, müssen diese sorgfältig durchgeführt werden. Das bedeutet, dass die Ergebnisse und auch die Annahmen, Einschränkungen und Vorbehalte der KNA/KEA genau erklärt werden müssen.
- Obwohl eine regelmäßige Anwendung von KNA/KEA wichtig ist, sind KNA/KEA nur eins von vielen Instrumenten zur Bewertung von Bildungspolitik. KNA/KEA sollten deshalb andere Instrumente zur Bewertung von Politikoptionen ergänzen, anstatt sie zu ersetzen.
- Die Durchführung und reguläre Nutzung von hochwertigen KNA/KEA ist nur zusammen mit einer guten Evaluationskultur möglich. Während die Analysen rechtlich durch verfahrensorientierte Richtlinien verbindlich gemacht werden können, muss eine Evaluierungskultur viel tiefer gehen. Sie muss von Beamten des mittleren und höheren Dienstes mit einer guten Ausbildung in moderner öffentlicher Verwaltung durchgesetzt werden. Hilfreich ist auch ein gesellschaftlicher Druck, der von Akademikern und Journalisten ausgeübt wird, die die Wichtigkeit von guter öffentlicher Staatsführung erkennen.
- Selbst wenn die Durchführung einer soliden KNA/KEA durch methodologische Hindernisse und Datenschwierigkeiten eingeschränkt wird, ist der Prozess der Durchführung an sich sehr wichtig. Gut und sauber durchgeführte KNA/KEA können klar machen, welche Kosten und Nutzen berücksichtigt oder vernachlässigt werden, was ihr zu erwartender Zeithorizont wäre, welche Interessenvertreter von den Kosten und Nutzen betroffen wären, ob und wie die Erfahrungen aus Pilotprogrammen hochgerechnet werden könnten, und welche unerwarteten Folgen oder Nebeneffekte berücksichtigt werden sollten. KNA/KEA können dabei helfen, eine klarere Vorstellung vom zu erzielenden Nutzen zu entwickeln.
- Die Durchführung einer KNA/KEA erfordert gewöhnlich ein Team aus Experten mit unterschiedlichen Hintergründen. Dadurch, dass KNA/KEA einen interdisziplinären Ansatz fördern, können sie als nützliche Katalysatoren für bessere politische Maßnahmen sorgen.

Die praktische Durchführung von KNA/KEA

- Im Vergleich zu anderen Politikbereichen wie Gesundheit und Beschäftigung, werden KNA/KEA im Bildungsbereich immer noch seltener genutzt.

- Dieser Bericht zeigt, dass KNA/KEA in Europa seltener genutzt werden als in den USA, beziehungsweise weniger gut etabliert sind.

Offene Fragen und nächste Schritte

- Es bleibt zu sehen, ob eine tiefer gehende Literaturübersicht die vorläufigen Ergebnisse bestätigen kann, dass KNA/KEA in Europa weniger genutzt werden. Es könnte sein, dass KNA/KEA in Europa genauso oft durchgeführt werden, aber dass die Ergebnisse seltener veröffentlicht und verbreitet werden.
- Eine umfassende und gründlichere Untersuchung der Anwendung von KNA/KEA und verwandten institutionellen Praktiken in Mitgliedstaaten kann ein nächster Schritt sein.
- Wenn, allerdings, der anfängliche Eindruck bestätigt wird, dass KNA/KEA im Bildungsbereich in Europa weniger genutzt werden, wäre es wichtig die unterliegenden Gründe herauszufinden.
- Da dieser Bericht keine starken Argumente gegen die Anwendung von KNA/KEA findet, könnten diese Gründe mit praktischen, rechtlichen, politischen oder institutionellen Hindernissen verbunden sein. Sie könnten besonders auf Probleme bei der technischen Umsetzung, der Finanzierung, dem Mangel an Anreizen für Forscher, solch eine Untersuchung durchzuführen, einem Mangel an Nachfrage von politischen Entscheidern und einem Mangel an Bewusstsein und Anerkennung für KNA/KEA als nützliches Analyseinstrument herrühren. Um das volle Potential von KNA/KEA zu nutzen, ist es notwendig, die konkrete Art der Hindernisse zu identifizieren.

Dieser Bericht wird durch kurze, aber konkrete Beispiele von KNA/KEA zu weltweiten Bildungsprogrammen und einer ausführlichen Liste an Referenzen für eine weitere Lektüre zu besonderen Themen, ergänzt.

Executive summary (FRENCH)

Des rapports coûts-bénéfices et couts-efficacité comme instruments pour améliorer l'élaboration des politiques publiques et leur transparence

- Les ressources sont toujours limitées et peuvent être utilisées dans des mesures différentes. L'efficacité et l'efficience de l'utilisation de ces ressources est un aspect très important des politiques publiques (y compris dans le domaine de l'éducation).
- Les rapports coûts-bénéfices (RCB) et couts-efficacité (RCE) sont des instruments importants pour cela. Ils peuvent aider à informer les décideurs et le grand public des avantages et inconvénients des alternatives politiques.
- Les RCE comparent les coûts unitaires des différentes politiques visant un résultat en particulier. Ils n'exigent pas de bénéfices exprimés en termes monétaires puisqu'ils concernent seulement le résultat.
- Les RCB cherchent à prendre en considération tous les coûts et bénéfices (exprimés en termes monétaires) associés aux décisions politiques alternatives et aux résultats. C'est techniquement plus exigeant que les RCE, mais plus compréhensible puisque permettant de comparer plus d'un seul résultat.
- La détermination de quel instrument – RCB ou RCE – sera le plus convenable doit se faire au cas par cas selon les besoins des décideurs.
- Alors que les coûts et bénéfices *privés* dirigent les motivations personnelles et le comportement des individus, les décideurs devraient avoir un point de vue plus large considérant également les coûts et bénéfices *sociaux*. Ce rapport expose les différences entre coûts et bénéfices sociaux, monétaires et non-monétaires.
- Ce rapport montre aussi les particularités apparaissant quand coûts et bénéfices s'étalent sur un laps de temps relativement long, ainsi que les questions de coûts d'opportunité, de pertes de revenus et d'impôts.

Utilisation des RCB/RCE dans le domaine de l'éducation

- Il est possible d'utiliser les outils RCB/RCE dans le domaine de l'éducation comme dans tous les autres domaines de politique publique. Cependant, le domaine de l'éducation présente des caractéristiques particulières – tenant du capital humain (CH), opposé au capital physique. Pour faire un RCB/RCE solide, il faut tenir compte de ces caractéristiques.

- Ces caractéristiques comprennent l'inséparabilité entre le CH et le corps humain, qui limite la capacité d'échange ; les liens tout au long de la vie entre le CH et les conditions économiques, sociales et sanitaires ainsi que d'autres conditions des individus ; les contraintes de crédits privés liées aux défaillances du marché qui sont causées par le manque de garanties disponibles pour des crédits privés pour l'investissement privé dans le CH ; un fort impact positif du CH personnel sur les autres membres de la société; un risque personnel d'investir dans le CH qui est fortifié par l'aversion au risque commun des individus; des difficultés de mesurer les bénéfices et les retours des investissement dans le CH. Ces caractéristiques du CH mènent à des difficultés spécifiques qui exigent des approches spéciales si on utilise des principes standards de RCB/RCE dans le domaine de l'éducation.
- L'éducation amène beaucoup de types de bénéfices non-monétaires, passant par un taux d'abandon scolaire plus bas, moins de criminalité, une meilleure santé et un meilleur emploi. Beaucoup des bénéfices non-monétaires peuvent être transformés dans des valeurs monétaires en vue d'un RCB.
- L'existence et l'accessibilité de données de bonne qualité est une précondition nécessaire à la rédaction d'un bon RCB/RCE. En principe, les données peuvent venir de différentes sources (comme par exemple (i) des sources de données administratives, des enquêtes statistiques périodiques et ad hoc ; (ii) des études d'évaluation d'impact basées, si possible, sur une expérience des versions ex-ante et expérimentales d'un programme d'éducation ; (iii) des résultats des études déjà conduites dans le passé ou dans d'autres pays ; (iv) des hypothèses et opinions des experts).

Faire bon usage des RCB/RCE pour informer les décideurs

- Utiliser des RCB/RCE pour informer des décisions politiques peut mener à des risques divers et à des malentendus (par exemple, la conclusion d'un RCB/RCE spécifique ne peut pas être transférée à une autre politique, région ou pays ; l'élargissement d'une intervention présente un risque particulier, de la même manière qu'on doit observer avec précaution si les populations traitées, les contextes sociaux et légaux, les types de résultats et le forme du traitement sont suffisamment similaires).
- Déduire des conclusions politiques des résultats d'un RCB/RCE particulier exige un grand soin. Ceci implique que les résultats des RCB/RCE doivent être présentés clairement, ce qui inclut des explications des hypothèses sous-jacentes, des limitations et des mises en garde.

- Malgré l'importance de l'utilisation régulière des RCB/RCE, ils restent un élément parmi de nombreux autres dans l'ordre du jour beaucoup plus large de la formation des politiques éducatives. Les RCB/RCE devraient donc compléter les autres instruments de formation de la politique, plutôt que de s'y substituer.
- La création et l'utilisation régulière de RCB/RCE de bonne qualité sont impossibles sans une culture d'évaluation propre. Tandis que les analyses peuvent être encouragées légalement en adoptant des directives procédurales obligatoires, la culture d'évaluation doit être approfondie. Elle devrait être évoquée, disséminée et appliquée par des fonctionnaires de niveaux moyen et haut adéquatement éduqués dans le domaine de la gestion publique moderne. Une large poussée de la société, émanant des rangs des universitaires et des journalistes comprenant l'importance d'une bonne gouvernance publique, peut aussi contribuer à ce but.
- Même si l'élaboration d'un solide RCB/RCE s'avère être freinée par des difficultés méthodologiques et des difficultés de données, le processus lui-même est très important. Des RCB/RCE correctement et rigoureusement conçus aident à clarifier quels coûts et bénéfices sont inclus ou négligés de l'analyse, quelle structure temporale serait attendue, quels acteurs devraient encourir les coûts et les bénéfices, quels sous-groupes en bénéficient le plus, si et comment le programme pilote pourrait être élargit, et quels effets secondaires et involontaires devraient être considérés. RCB/RCE peuvent aider à développer une idée plus concrète des bénéfices prévus.
- Réaliser un RCB/RCE normalement exige une équipe d'experts avec des bagages différents. En promouvant des approches interdisciplinaires, les RCB/RCE peuvent être un catalyseur utile à l'élaboration de politiques meilleures.

L'utilisation des RCB/RCE en pratique

- Comparé aux autres domaines des politiques publiques comme la santé ou l'emploi, les RCB/RCE sont encore moins souvent utilisés dans le domaine de l'éducation.
- Le résultat de la recherche conduite ici suggère que les RCB/RCE sont moins souvent utilisés en Europe qu'aux Etats-Unis, c'est-à-dire, ils sont moins établis.

Questions ouvertes et étapes suivantes

- Il reste à voir si une synthèse plus en profondeur pourrait confirmer la conclusion préliminaire que les RCB/RCE sont moins souvent utilisés en Europe. Il pourrait

apparaitre que des RCB/RCE sont réalisés en Europe mais moins mis à disposition ou diffusés moins fréquemment.

- Une enquête complète et plus profonde, sur l'usage des RCB/RCE et les pratiques institutionnelles liées dans les Etats membres, pourrait être une prochaine étape judicieuse.
- Si, cependant, les impressions initiales que les RCB/RCE sont moins souvent utilisés dans l'éducation se confirmaient, il serait important d'investiguer les causes sous-jacentes.
- Comme ce rapport ne trouve pas de raisons fortes pour ne pas utiliser des RCB/RCE dans l'éducation, ces causes peuvent être liées à des obstacles pratiques, légaux, politiques ou institutionnels. En particulier, elles pourraient être liées à des problèmes d'un niveau technique, à des problèmes de financement, à un manque de motivation des chercheurs pour s'engager dans ce genre d'exercice, à un manque de demande des décideurs, à un manque de sensibilisation et de reconnaissance des RCB/RCE comme instruments analytiques utiles. Pour tirer pleinement parti du potentiel offert par les RCB/RCE, il est nécessaire d'identifier la nature concrète de ces obstacles.

Ce rapport est enrichi d'exemples brefs mais concrets de RCB/RCE de programmes d'éducation produits partout dans le monde, et d'une riche liste de références pour une lecture supplémentaire liée aux questions particulières.

INTRODUCTION

Resources, whether public or private, are always scarce. Moreover, available resources can be always used in different ways to reach the same goal, and saved resources can be also used for a plethora of alternative aims. Ensuring efficient and effective use of resources is thus an important aspect in the role of public policies, including those in the area of schooling and education.

Tackled from another perspective, public servants – and policymakers and politicians – should be and are subject to growing pressure to present evidence to show that programmes funded from public resources deliver desired outcomes at reasonable costs. As a result, they have to justify the programmes they propose, implement and operate. In this respect cost-benefit (CBA) and its simpler counterpart cost-effectiveness analysis (CEA) are important and useful elements of responsible and evidence-based policy-making.

CEA compares the unit costs of various policies targeting one particular outcome. It does not require expressing benefits in monetary terms because it deals with one outcome only. It is limited to taking into account the costs and the intended benefit. CEA does not require translating benefits into an equivalent in monetary terms.

CBA seeks to take into account, as far as possible, all costs and benefits (expressed in monetary terms) associated to a specific policy decision. Is the technically more demanding since it requires benefits to be expressed in monetary terms. But it is more comprehensive analytical tool than CEA because it allows comparing more than one outcome via their rates of returns.

Publicly managed and/or supported educational and training programmes can be seen as an investment: money is spent to secure better outcomes in the future and/or mitigate poor past outcomes, and to avoid future expenditure on remedial interventions (avoidance of future costs). Well-crafted CBAs not only support choice and the operation of more efficient and more effective policies, but also enhance substantive policy discussions and public consultations.

Despite various limitations imposed by the complexities of life, a CBA tend to provide valuable information when choosing among different solutions, demonstrating a solution's worth. It can be used when evaluating programme improvements, continuation or replication. CBAs have their natural limitations since there are always aspects that can be resolved only through the policymaker's subjective judgment, or through a process of politically revealed preferences (Adler, Matthew; Posner, E. A., 2001). In addition, mutual comparisons of findings presented by different CBAs tackling very similar educational programs in different locations or different times can be very

limited as a result of differences in the surrounding societal, economic, and legal environment.

Even if CBA results are not conclusive and do not produce precise enough and comprehensive information about the actual costs, benefits and returns of a policy intervention, it is a very useful tool: it exerts pressure to define policy objectives in a clear and operational way, to communicate policy intentions, to clarify the scale and scope of the policy's expected effects. It also helps taking into account all related costs and benefits. This can help avoiding the risk that policy decisions are biased by a over-focus on the intended (positive) results of a programme, while neglecting or ignoring other effects.

General exposition

In business, CBAs are standard and widespread. Before investing in new machinery, or building a new warehouse, the firm uses a CBA to compare the expected costs with the expected benefits of the activity. If the overall benefits sufficiently exceed the overall costs, the firm will likely go ahead with the project. If the costs are greater than the benefits and/or high risks and uncertainties are involved, the firm does not engage in the particular activity. If there are more profitable investment options, a CEA is used by the firm to help it choose the most suitable one. The same principles apply to educating people. Adam Smith's (Smith, 2009) The *Wealth of Nations,* published in 1776, already contains the seed of a CBA applied to education and training, as presented in textbox 1.

Box 1. The origins of cost-benefit analysis of education

"…a man educated at the expense of much labor and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labor, will replace to him the whole expense of his education…"
Adam Smith [1776] (Smith, 2009)

Following the so-called "human capital revolution in economic thought" originating at the University of Chicago in the early 1960s, education has been seen by economists as an investment, similar to investment in physical capital (like machinery, technology, buildings). Educating a person entails a series of costs during schooling, and yields a series of benefits to the graduate and to the society at large over his or her lifetime (Mincer, 1958) (Schultz, 1961) (Becker, 1975). Costs and benefits are therefore the key elements of each CBA. A CBA evaluates the costs and benefits of a given policy in order to inform decision makers about the desirability of that given intervention or investment. In a CEA, the benefits can be expressed in non-monetary units (for instance, increase in test scores), and it compares the costs of different ways of reaching a required outcome.

It should be emphasised that viewing education as investment does not deny its pedagogical, cultural or consumption attributes, which should also be considered when analysing the role of education in modern societies. The purpose of this report, however, is to offer a complementary viewpoint provided by economic analysis, to be used simultaneously with other important insights, in order to enrich policy decisions regarding education and schooling in the never-ending effort to improve people's lives.

Although investment in human capital is in many respects similar to investment in physical capital, there are also several important differences. These stem from the way costs and benefits are conceptualised and measured. In particular:

- the additional human capital (skills) acquired thanks to investment (into education) cannot be separated from the human body and cannot be resold on the market independent of the body as physical capital or against the free will of an individual;

- throughout a person's entire life, the same human capital is closely linked to many human activities other than market work (production of goods and services), such as non-market work (i.e. household chores), leisure, socialising and other activities;

- it is much more complicated to borrow for investment into human capital because, compared to mortgages, it is much more difficult for individuals to issue guarantees using their own human capital as collateral;

- education has strong positive spillover effects on other members of society;

- investment into education is risky from an individual's perspective. While larger institutional investors can easily diversify the risk they take when they realize investment in physical capital, the scope for diversification at the level of individuals is quite limited;

- human capital is much more difficult to measure because its market price (i.e. wages and earnings) is a less reliable proxy of its actual value. Moreover, human capital has numerous outcomes that cannot be monetized.

SECTION A: ESSENTIALS OF COST-BENEFITS ANALYSIS

A cost-benefit analysis (CBA) is the most demanding and the most comprehensive approach assessing costs and benefits. Simpler and less demanding variants of CBA can be employed too, but at the expense limited answers they provide. While all methods require the assessor to know the proposal's full cost, not all necessarily require knowledge of its full benefits.

Box 2. Simple example of a CBA insight on class - size reduction policy

Consider a policy aiming to improve the quality of teaching by lowering class sizes. The direct costs of such a policy will be higher expenditures on teachers' salaries, because a greater number of teachers will be needed. Additionally, more classrooms or even schools might be needed, entailing even further investment and operation costs. A class-size reduction from 25 to 20 pupils means a sizeable 20% decrease, which implies demand for an additional 20% of teachers. The additional costs can be borne either by taxpayers or parents, depending on whether the schools' operation is financed from tax-revenues or from private tuition fees. There are no indirect private costs involved, assuming that lower class-size is not connected with any change in the study-time load of pupils. When we consider the private pecuniary benefits of such a policy, we would primarily consider higher net earnings for the pupils in the future. Social pecuniary benefits would include their future net private earnings, plus additional tax revenues. Savings on future social welfare payments should be added to the calculation. More details on class-size reduction are provided in Box 3 and 11.

A.1 Typology of educational programmes

Although one can find various classifications of educational programmes, for the purpose of this review we will differentiate between the following:

General programmes representing nationwide pre-primary, primary, lower and upper secondary, tertiary education and life-long learning. Related CBAs commonly evaluate partial system reforms such as extending (or shortening) the duration of individual schooling stages, shifts in school enrolment ages, changes in class-sizes. As we will describe later, such large nationwide reforms have effects on general equilibrium that are difficult to measure and hard to incorporate into CBA/CEAs. Given that this report

focuses mainly on special educational programmes, we will refer to only a few such cases.

Special programmes targeting particular population groups, such as children from lower socio-economic backgrounds, foreigners, gifted children, the mentally or physically disadvantaged, the unemployed, or particular problems, such as early school-leaving. Use of CBA/CEAs in these cases is simpler than in the case of general programmes, and these serve as very appropriate and desirable tools for evidence-based policy formation.

Educational interventions leading to specific modifications to educational processes. For example, the introduction of e-tablets or other educational tools, the modification of the performance grading scheme, the introduction of classroom assistants, testing or other monitoring tools.

A.2 Costs and benefits

Two types of educational costs should be distinguished, *direct and indirect*. *Direct costs* refer to expenses like public expenditure on teacher's and administrative salaries, school buildings, teaching equipment, and so on. They also include the money that parents spend on incidental schooling expenses, e.g. books and writing materials, and tuition fees (if charged). However, tuition should not be counted twice if the schools use tuition-based revenues to finance the school's operation.

Indirect costs refer to what a working-age student could have earned in the labour market if he/she was not attending school. In an agricultural setting, it would refer to lost production because the student is not in the field. Economists commonly use the term *forgone earnings* for this. In other words, while studying, people are giving-up other activities, which include not only work on the market, but also work at home, and leisure. The opportunity cost related to the most valued of all the possible forgone activities should be counted towards the indirect costs. Foregone earnings are an important feature of any CBA reflecting the opportunity cost of studying. Foregone earnings correspond to the amount of earnings an individual gives up when devoting time to studies instead of earning in the labour market.

Education benefits refer to the extra earnings or extra productivity of a more educated person relative to a less educated one. Since benefits generated by education do not necessarily relate only to higher productivity and earnings, measuring education benefits has been a perennial debate in the economics of education literature (Card, 1998, 2001).

Education costs and benefits should also be considered from the perspective of whether they are *private* or *social*.

Private costs only include schooling expenses that are incurred by an individual. This includes, for example, tuition fees, expenditures on school related materials (*private direct cost*), and foregone earnings after tax (*private indirect cost*). Note that private direct costs do not include expenditures that are incurred by individuals anyway, irrespective of education, such as spending on food and housing. If education is provided for free from the standpoint of individuals, as is frequently the case, the only costs in a private cost-benefit calculation are foregone earnings.

Social costs include all costs of schooling, irrespective of who is paying for it: an individual, other individuals, or taxpayers via public budgets. This means that private costs are always counted as a part of social costs.

Private benefits are typically measured by the increase in net earnings (after tax) due to educational treatment. In case of a general education programme, typical treatment would mean a more educated worker will earn more, relative to a less educated worker. Comparison of monetary benefits commonly refers to adjacent levels of education. For example, university graduates versus secondary school graduates.

Social benefits are typically measured by incremental before-tax earnings due to educational treatment. This way of counting social benefits is due to the essence of taxes as redistributive transfers, as noted in case of social costs. Ideally, one wants the social benefits of educational treatment to include education *externalities,* capturing the indirect impact of educationally treated individuals relative to those that are not. A typical example of an externality is an increase in earnings of the low-skilled because of a rise in the number of highly educated workers. However, as will be explained later, educational externalities are very difficult to measure (McMahon, 2000) and their quantification for CBA frequently presents a problem.

A.3 Cost-benefit measures

Two cost-benefit measures have been computed or estimated in the literature, each answering a different question. The *private rate of return* compares the costs and benefits of education as incurred and realized merely by the educated individual. The private rate of return is closely linked to the behaviour of individuals in seeking different

levels and types of education and making their own participation decisions. Private returns should be taken into account when designing educational policies to stimulate desirable, and limit undesirable, behaviour in the individuals to be educated (or their parents). Naturally, the future private returns of current educational investments are frequently uncertain.

The social rate of return compares costs and benefits from the whole country or society's point of view. Social rates should be considered when formulating education policies regarding, e.g. the expansion or contraction of different levels and types of education, or the introduction of some special public educational programme.

CBA should consider both social and private returns. If social returns exceed private returns, as is frequently the case especially when positive externalities count towards benefits, then the individuals do not have strong enough incentives to invest in their education at socially optimal levels (we discuss some of the positive externalities associated with educational interventions below). Therefore, the degree of difference between the private and the social rate of return is an important economic argument for public subsidization of education. Public subsidisation can lower private costs, making private returns higher and fostering personal incentives to continue in education – at a level which is socially optimal. Another way to reap social returns is to make education mandatory, as is the case for primary and lower schooling in all developed countries.

A.4 The essence of CBA

The essence of CBA is the comparison of all costs and benefits related to the programme considered. In the most general form, the costs and benefits of an educational intervention (programme) from the societal point of view (net social benefits) can be summarized as follows:

Table 1: Comparing costs and benefits to society

Net monetary benefits to society =	+	*savings to government*
	+	*benefits to participants*
	+	*benefits to rest of society*
	-	*public costs*
	-	*private costs of the programme*

An educational programme is considered profitable if the net monetary benefits to society (the sum of all terms on the right-hand side in Table 1) are positive.

An alternative measure to evaluate the profitability of an educational programme is its rate of return. The meaning of this measure is the same as that of the rate of interest in a savings account, stocks, bonds or other assets generating returns. The rate of return has the advantage that it does not depend on the size of the programme, unlike the total difference between costs and benefits. Rates of return can be used to compare the desirability of alternative educational programmes designed to achieve the same goal, or to compare the profitability of the most profitable programme to other ways public funds can be spent – for example, reducing government spending, which implies lower borrowing and lower debt service costs. It should also be noted that the actual values of the costs and benefits listed in (1) have to be adjusted for the time-period when those costs and benefits are actually incurred. This is done by expressing streams of costs and benefits over time using their so-called *present values* (a detailed description of the underlying calculus is provided in Appendix 1).

A.4.1 Short-cut method of estimating returns to education

As an illustration, we present a short-cut method of estimating returns to investment in education. Consider the decision of a BA graduate, driven only by his/her personal (private) monetary considerations, as to whether to invest in an additional year of education to get an MA degree, at a public university charging no tuition. The prospective MA student has to contemplate and compare the costs and benefits associated with his/her "project". Subscript **m** denotes MA graduates, **b** marks BA graduates (the control or comparison group). The computation assumes that the individual's earnings (**W**) will not change with age (the expected age-earnings profiles of the MA graduate and of the control group are flat).

The only costs (private costs) to the student would be indirect, represented by his/her foregone earnings during the year of MA studies. This is assuming that he/she would not be able to work during his/her MA studies. Foregone earnings are approximated by what he/she would earn as a BA graduate, say €20 000 net per year ($\mathbf{W_b}$). On the benefits side, the student expects to make approximately €25,000 per year ($\mathbf{W_m}$) on average as an MA graduate, i.e. €5 000 per year more relative to the BA graduate, over his/her lifetime.

The annual benefit of €5 000, and a lump-sum cost of €20 000, yield a 25% private annual rate of return on investment into MA education. The logic of this calculation is similar to that of saving €20 000 in a bank generating annual interest €5 000, corresponding to a 25% interest rate. In this particular case, the student's study plan

seems to be a very attractive option from the private point of view, at least compared to most other investment options commonly available to individual investors.

The *social rate of return* in this case is simply according to the logic explained in the previous section:

$$social\ r = \frac{W_m - W_b}{W_b + C_d} = \frac{25000 - 20000}{20000 + 25000} = \frac{5000}{45000} = 0{,}09 = 9\% \qquad (1)$$

where $\mathbf{C_d}$ is the annual direct cost of MA studies (covered by the government from taxpayers' revenues), say €25 000 per year. In such a case, because public costs are taken into account in additional to private cost ($\mathbf{W_b}$), the social rate of return would be approximately 9%, i.e. lower than the private rate of return at 25%. But 9% is still a very solid rate of return taking into account that in case of solid public finances, governments can borrow money at much lower rates.

Further details about the concept of rate of return, and a comprehensive international survey of empirical studies, can be found in Psacharopoulos & Patrinos (2004).

SECTION B: SPECIFIC FEATURES OF EDUCATION PROGRAMMES

In this section we provide more detailed insights on the various features and problems analysts have to deal with when crafting CBAs for educational programmes, and special ones in particular. We also provide numerous textboxes documenting examples of real CBAs.

B.1 Costs of educational programmes

Common CBAs elaborated by enterprises usually deal with pecuniary, i.e. monetary costs only. These represent the costs of inputs (like machinery, material, energy, workers, rents). In the case of education, the costs considered are similar but should also include both direct as well as indirect cost - including foregone earnings, as explained in section A.

B.2 Outcomes and benefits of educational programmes

Depending on the nature and goals of a particular educational programme, a wide range of outcomes can be affected. A CBA should distinguish between interim and final outcomes and preferably consider final outcomes. When some final outcomes are not or cannot be measured, proxy interim outcomes should be considered instead. For example, while individual's skills are usually an interim outcome through which final goal is achieved (such as employment or earnings), skill could serve as a proxy if future employment and earnings cannot be measured.

According to the principles presented in section A, as programme benefits, one should always consider only *the increase* (addition, increment) to baseline benefits (and costs). One should also carefully distinguish between increase in net benefit and increase in gross salary (involving taxes and social insurance contributions by employers and employees) as explained in section A, clarifying the difference between private and social rates of returns.

In the following we provide a basic review coupled with some examples. In Table 1 we offer a typology of outcome types, considered separately for children and adults.

Table 2: Basic typology of schooling outcomes

Outcomes that can be affected by educational treatment (programme)	
Child Youth Outcomes	Behavioural / Emotional
	Cognitive
	Education
	Health
	Anti-social / Risky behaviour
Adults outcomes	Family functioning
	Education
	Economic
	Health
	Crime and substance abuse

Source: Karoly, 2012.

Note that many educational outcomes listed are not expressed in monetary values. Even among economic outcomes, only earnings are measured in monetary terms; employment-related outcomes are not.

B.2.1. Employment outcomes

Higher earnings are typical labour market outcome of educational interventions. In this respect, use of monetary quantities in an education-related CBA is straightforward, as has been shown in section A. Although compared to other outcomes it is relatively easily measurable, it should be kept in mind that the benefits have to be measured in terms of additional productivity, additional earnings and additional taxes collected.

For numerous training programmes, higher employability is the main goal. This goal is important per se, even if the impact of education on earnings is taken into account. This is because unemployment or non-employment translates into reduced personal wealth and frequently implies higher costs for the government due to higher benefits paid and higher costs of social assistance. In such cases, the benefits of the educational treatment considered in the CBA should include reduced unemployment and other benefits which will not have to be paid, thanks to higher employment.

A rigorous CBA should also reflect phenomena such as the duration of unemployment spells, the quality of future jobs (part-time or full-time, skills matching, and cumulative

Box 4. On stimulation of adult education

Based on Stenberg & Westerlund (2012), Stenberg (2011), and Stenberg, de Luna & Westerlund (2011)

Examining the returns of adult education among different skills and age groups in Sweden, Stenberg et al. find that the structure of the target population has substantial impact on the success of the programme. While they find some positive effects for individuals with low skills, they do not find that investing into adult education of the low-skilled meets the CBA test overall.

The results are starkly different, however, when adult education is provided to workers with a higher skills base. For women, the annual earnings return stands at 8-10%, whereas for men it is around 3-4%. The net present values are positive for all specifications, with returns ranging from 5.7 to 30.3%. The authors conclude that the benefits for society exceed the costs to such an extent that they can cover any potential losses from adult education for the low skilled.

The authors caution against excessive optimism about the power of adult education, concluding that "it works better for those transitioning from mid to high level skills, whereas there might be more efficient ways than formal education to increase the productivity of low skilled adults."

duration of non-employment spells). But this requires information relating to the longer-term impacts of the educational treatments, which is typically more difficult to obtain (see below).

B.2.2 Non-labour market outcomes

Unlike business investment, CBAs of educational interventions have to deal extensively with outcomes lacking explicit monetary expression. To illustrate the richness of such outcomes in education, Table 2 reviews various benefits stemming from early childhood programmes. Note that the benefits considered are not only those accrued by children alone, but also those accrued by their parents.

Table 3: Typology of Benefits from Early Childhood Programmes

	Child	Parent
Emotional and cognitive development	• Improved behaviour • Increased IQ	• More satisfactory parent-child relationship • Better home environment
Education	• Higher promotion rates • Reduced special education • Increased graduation rates	• Increased educational attainment
Work, welfare, crime	• Increased employment and income • Lower welfare use • Fewer arrests	• Increased employment and income • Lower welfare use
Health	• Less child abuse • Fewer ER visits	• Improved family planning • Reduced substance abuse

Source: Karoly, Kilburn, & Cannon (2005)

Converting non-monetary outcomes into monetary terms is challenging. Nevertheless, in many instances, there are ways to attribute monetary values to non-pecuniary phenomena. For example, research studies show that better pre-school and primary school education leads to lower incidence of future criminal behaviour among the individuals involved. A decrease in the incidence of crime due to better education can be translated into financial benefits such as: lower public expenditure on police, courts and prisons or lower private expenditure for private safety measures taken by the citizens. However, certain other non-pecuniary dis-amenities, such as those related to citizens' fear and lower contentment when there are high crime rates, cannot be easily expressed in monetary terms. Yet, even in such cases, one can guess at the perceived psychological costs by estimating the virtual monetary compensation individuals would require so as to accept a higher incidence of crime. Or, to put the question differently: how much

money would an individual be willing to pay to decrease the incidence of crime? Such information can be obtained either from an opinion survey or from observing the actual precautionary behaviour of people who face risks. For example, the price households are willing to pay to insure their housing against robbery can be used to determine the lower bound of the perceived private benefit from a lower robbery rate. Similarly, the lower bounds of private benefits can be imputed from accident precautionary expenditures. A large body of empirical research in the area of the value of life provides a range of estimated benefits people attribute to higher life and health security as revealed by their willingness to pay for various types of insurance (Viscusi & Aldy, 2003 and Viscusi, 1993).

A typical non-skill, but skill related educational outcome is a drop-out rate and the incidence of early school leaving. Since these phenomena have important social implications they are being considered as an important outcome by CBAs. Examples of more in-depth CBA of school dropouts are those of Belfield & Levin (2007) and Levin et al. (2006).

As another example of non-monetary outcomes, consider an intention to introduce special curricula explaining to pupils the dangers of smoking, alcohol, and drugs. Such a plan would generate additional costs in terms of additional teachers and pupils' time (opportunity costs) and possibly some direct costs related to the teaching material, assuming that impact on other school operation costs would be negligible. On the side of benefits, one should consider lower private and public expenditures on sickness due to better future life styles of pupils when adult. Such benefits (i.e. savings as costs with a minus sign), private or public, can be turned into meaningful monetary terms and entered into CBA formulas.

In particular, public savings in health expenditures can be calculated from information on lower incidence of sicknesses and the related costs of their treatment. The lower bound of private costs can be expressed by direct private costs of sickness (expenses on drugs and medical treatment incurred by individuals) plus foregone earnings due to sickness, lower productivity or lower employability. Using opinion surveys among sick adults, one can estimate the shadow price of health improvement, which indicates how much the individuals would be willing to pay to regain their health.

The actual means of imputing monetary values to non-monetary benefits depends on the particular educational programme and the surrounding environment. Therefore, we do not aspire to provide a more concrete recipe here. However, once monetary values have been attributed to non-monetary costs and benefits, carrying out a CBA becomes a more or less straightforward exercise.

B.2.3 Skills outcomes

There are many skills one can consider within the basic dichotomy of cognitive and non-cognitive skills, manual and other skills. We do not review them here because it is a very complex topic dealing with numerous scientific fields. What is important for a CBA is whether certain skills are the final goal of a policy or whether a particular skill is a prerequisite.

B.2.3.1 Cognitive skills

Box 5. Non-monetary benefits – costs of crime reduction

Based on Heckman, Moon, Pinto, Savelyev, & Yavitz (2010)

Heckman et al. confine their evaluation to the costs and benefits vis-à-vis. the future criminal behavior of individuals. They calculate internal rates of return and benefit-to-cost ratios for the PPP using various assumptions and estimation methods. They set the victim cost associated with a murder at $4.1 million, which includes the statistical value of life, and at $13,000, which is set to the victim cost of assault to avoid the problem that a single murder might dominate the evaluation. As concerns the sensitivity of estimated returns to the way crimes are categorized, they compare results from two aggregation schemes: “Separated" and “Property versus Violent Crimes." They perform sensitivity analysis of estimates to the choice of alternative extrapolation/interpolation procedures. They concluded that a substantial portion of benefits is due to crime reduction by the PPP.

They point out that “valuing the effect of this reduction in terms of costs and benefits is not a trivial issue, given the difficulty of assigning reliable monetary values to non-market outcomes. The available data provide a full record of arrests, convictions, charges, and incarcerations for most of adolescence and adulthood of pupils. The total social cost of a crime is calculated as a product of the social cost per unit of crime and the incidence. To assign relevant monetary values to criminal activities, they compute the unit cost of each type of crime, which is broken down into two components (victimization costs and criminal justice system costs) using estimates in existing literatures as well as various administrative data.”

We pay special attention to cognitive skills, which are the most common outcome of educational treatments, are relatively easier to measure, and about which there are numerous available data sources.

Within the EU, the most important, widely-known and frequently disputed sources of information on skills are the international survey projects PISA, PIRLS, TIMSS (all testing pupils) and (S)IALS, PIACC (testing adults). On top of these international surveys, some countries conduct their own surveys or nationwide monitoring of achievements. Their usefulness for CBAs depends heavily on the particular type of survey and educational programme considered, and we do not discuss these in detail.

The advantage of achievement-measuring international survey projects like PISA is their professional design and collection, and the opportunity they offer for the comparison of results both over time and internationally, despite occasional critique.[2] A CBA that considers only the impact on measurable skills may understate or overstate the expected benefits of a possible reform if other important skills are not considered. But the existing shortcomings of international surveys like PISA might be, and in some cases already are, supplemented by national surveys.

Box 6. Happiness and well-being

Quoted from Adler & Posner (2008)

"A growing body of research on happiness or subjective well-being (SWB) shows, among other things, that people adapt to many injuries more rapidly than is commonly thought, fail to predict the degree of adaptation and hence overestimate the impact of those injuries on their SWB, and, similarly, enjoy small or moderate rather than significant changes in SWB in response to significant changes in income. Some researchers believe that these findings pose a challenge to cost-benefit analysis and argue that project evaluation decision procedures based on economic premises should be replaced with procedures that directly maximize SWB. This view turns out to be wrong or, at best, premature. Cost-benefit analysis remains a viable decision procedure. However, some of the findings in the happiness literature can be used to generate valuations for cost-benefit analysis where current approaches have proved inadequate."

[2] Using data from surveys such as PISA, one cannot easily identify the causal link between educational treatment and outcome; the scores recorded only partially capture the range of skills that governments and societies expect from education.

There are different ways of translating improved skills (measured by test scores or other achievement measures) into monetary values as inputs for a CBA. To do so, one needs to know the relationship between achievement measures and earnings. If such a relationship is quantified, skills increases can be turned into monetary values in terms of additional earnings and additional taxes paid. A very comprehensive example of a real CBA of this type is provided by (Woessmann & Hanushek, 2011), and is reviewed in textbox 9.

Box 7. Universal Childcare and Children's Long-Run Outcomes

Based on Havnes & Mogstad (2009)

As documented by (Karoly L. A., 2012), a growing body of CBAs of early childhood programmes has been prompted by the increased demand for results-based accountability when allocating public and private sector resources.

In the mid 1970s, Norway introduced universally accessible childcare, which created 17 500 new childcare places and produced 6 200 additional years of education. While the reform introduced universal childcare, its actual implementation was left to local governments, thus producing large variation in the coverage for children aged 3-6. Data relating to the effects of this reform could be used to identify the impact of childcare on adult outcomes at ages 30 and 33.

The reform positively affected children's educational attainment (decreased their drop-out rate by 6 percent and increased their likelihood of attending college by 7 percent) and labor market participation, as well as reducing welfare dependency. Importantly, most of the wage benefits accrued to girls, which implies that universal childcare might contribute towards closing the gender gap. Furthermore, it also turns out that most of the educational effect went to children with low-educated mothers; universal childcare can thus be said to contribute to intergenerational mobility.

Using a back-of-the-envelope calculation, the authors find that the reform was cost-effective compared to other types of public child-development investment, and had a highly positive effect on the children's monetary situation, with a payoff of approximately USD 25 000 for every additional childcare place. Given that their calculation only takes private benefits into account, they conclude that real benefits of the reform were probably even greater.

However, one does not always need to know the relationship between skills and earnings in order to provide good policy advice. If a policymaker's goal is to increase pupils' skills at the lowest costs, then the task is to find the cheapest form of educational

treatment while benefits are set as constant. In this case, one has to only link the various proposed educational treatments to their relevant costs.

Woessmann & Hanushek (2011) provide an example of this approach. They consider the impact of increased skills on long term GDP growth (the net total benefit being the increment on GDP accumulated during the next 80 years). They do not consider the actual costs of educational reforms needed to increase pupil's achievement. Instead, they show the volume of benefits and stipulate that governments should consider all the possible structural reforms whose costs would not be above the present value of benefits – the PV of future flow of GDP increment. Given that the estimated benefits are notably

Box 8. On the benefits of schooling reforms: impact of improved education on long-term economic growth

Based on Hanushek & Woessmann (2010) and Hanushek & Woessmann (2011)

In their several studies, Hanushek and Woessmann review the role of education in promoting economic growth, with a particular focus on the role of educational quality. They conclude that "there is strong evidence that the cognitive skills of the population – rather than mere school attainment – are powerfully related to long-run economic growth. The relationship between skills and growth proves extremely robust in empirical applications. The effect of skills is complementary to the quality of economic institutions. Growth simulations reveal that the long run rewards to educational quality are large, but also require patience."

They show that "cognitive skills can account for growth differences within the OECD, whereas a range of economic institutions and quantitative measures of tertiary education cannot. Under the growth model estimates and plausible projection parameters, school improvements falling within currently observed performance levels yield very large gains." In the CBA framework, the present value of OECD aggregate gains by 2090 could be as much as $275 trillion, or 13.8% of the discounted value of future GDP for plausible policy changes. "Extensive sensitivity analyses indicate that, while different model frameworks and alternative parameter choices make a difference, the economic impact of improved educational outcomes remains enormous. Interestingly, the quantitative difference between an endogenous and neoclassical model framework - with improved skills affecting the long-term growth rate versus the steady-state income level - matters less than academic discussions suggest."

greater than the reasonable costs of reforms, i.e. the internal rate of return is much

higher than the discounting rate (interest rate of governmental borrowing), the benefits, if counted properly across an adequately long time span, can be tens or hundreds of times greater than the costs.

B.2.3.2 Non-cognitive skills outcomes

Non-cognitive skills include abilities such as attention, planning, emotional maturity, empathy, interpersonal skills, verbal and non-verbal communication and numerous others. As Friedman, Krueger, & Heckman (2005) document, pupils and adults with more developed non-cognitive skills are better (more easily) able to develop their cognitive skills. However, this does not necessarily work the other way around. Non-cognitive skills influence the overall behaviour of a person. Unfortunately, non-cognitive skills are usually much more difficult to measure than cognitive skills, some of which are commonly and relatively easily measured using tests and grades.

Since individuals' non-cognitive skills can be developed by properly shaped and targeted educational interventions, and because they develop most intensively early in individuals' lives, growing attention is now being devoted to such educational programmes and to the evaluation of their impacts by ex-post CBAs (an ex-post CBA is such that follows real implementation of a program using real data generated).

B.3 Time dimension of benefits

A CBA counts the future costs and benefits of a proposed programme in terms of their so-called *present values*, which are effectively lower than their actual values. The difference between actual values in the future and their present values depends on the rate of discount used. The higher rate of discounting used, the lower the probability that a CBA will find the investment programme profitable. Here we complement the stylised general approach with several more detailed insights into various peculiarities related to the time dimension of the impacts of educational programmes. Further details on present values are presented in Appendix 1.

Expenditures on education generate a stream of benefits in the long run, and educational costs are therefore frequently considered to be a form of investment. A typical empirically documented example shows a positive relationship between an additional year of initial education for a young pupil, and that same pupil's higher earnings during their active adult lifetime. Since costs and benefits generally accrue over different time periods - costs typically accrue in earlier stages, while benefits accrue later - it might take several decades for the cumulative savings from a policy to exceed the accumulated costs. An inadequately short time horizon in CBAs might thus lead to suboptimal investment in education, as the true benefits of a policy intervention might not become apparent until a significant period of time had elapsed.

Inefficiencies from underinvestment also happen on the individual level. As with other types of investment, both public and private returns from education are frequently accompanied by uncertainty. And because individuals are in principle risk averse, this uncertainty as to a programme's future benefits (returns to education) lowers their propensity to invest privately in education. However, a properly elaborated CBA can reflect such risks by incorporating social and private returns to education. The findings of such a CBA can guide policymakers to consider and adopt additional measures which either decrease the degree of uncertainty (e.g. provision of better career advice to pupils and their parents to better inform their educational decisions; provision of tuition-fee-free higher education or low risk students' loans) or increase the private return to education (e.g. provision of study grants to students from weak socio-economic backgrounds, who are typically less informed and more risk- averse due to weak financial backing by their parents).

When considering long-term impacts, a CBA should reflect that a great deal of skills (e.g. non-cognitive) are generated in repetitive, multiplicative processes. In this way, the skills acquired thanks to one time-limited educational intervention will foster further acquisition of other skills in the future. Therefore, analysts using CBAs should investigate to what extent any inputs from impact evaluation studies (Schlotter, Schwerd, & Woessmann, 2009) or assumptions about future benefits they are using in their analysis have taken into account such multiplicative phenomena. This also implies that the true overall benefits are revealed only many years or even decades after an educational intervention. In such cases, the impact of education cannot be plausibly predicted or estimated based on historical data. Since policymakers cannot wait so long, explicitly stated subjective assumptions and probabilities have to be employed instead.

Another matter to be given due attention is the temporary flow of benefits. Some short-term retraining programmes that provide skills to operate special technology for temporary use, will have some time-limited effects only for the lifetime of the particular technology. If this temporality is not properly reflected in a CBA, that CBA will exaggerate the suitability of the programme in question.

B.4 Baseline

Almost any educational treatment (policy) can be compared to the status quo, i.e. to the situation without treatment. Note that in a dynamic environment, such as when demographic changes alter the size of the pupil population, the autonomous development scenario without any intervention could also be considered as the status quo. In texts, the term *baseline scenario* is frequently simplified as *a baseline* or *initial conditions*.

Baseline scenarios do not necessarily have to be costless. For example, a country facing the prospect of demographic decline in the youth population can consider schooling reforms such as schools mergers and school-size restructuring across schooling levels. The baseline scenario in this case represents the autonomous developments without policy intervention, for example a substantial drop in school size (pupils per schools) and growing costs per pupil due to the fixed costs of school operation. In this case, the baseline scenario represents autonomous developments generating growing costs per pupil. The concept of the baseline of a programme (i.e. the case w/o intervention) is

Box 3. Long-term effects of different class sizes in Swedish primary schools.

Based on Fredriksson, Öckert, & Oosterbeek (2013)

Taking advantage of natural variation in class size because of maximum class size rules in Sweden, Fredriksson et al. find that smaller class sizes have a long-lasting positive effect on wages and earnings. They examine a 5-10% sample from cohorts born in 1967, 1972, 1977 and 1982 and find that smaller classes for the last three years of primary school (ages 10 to 13) help improve cognitive and non-cognitive test scores for 14-year-olds, increase cognitive test scores at ages 16 and 18, and are beneficial for completed education and wages at age 27 to 42. Each one-pupil reduction in class size brings a 0.7 percent increase in wages. The positive benefits of small class sizes accrue entirely to families with above median income (for this group, a one-pupil reduction brings 1.3 percent increase in wages), which might have to do with the nature of Swedish wage-setting institutions. While the effect on cognitive skills does not vary by income, smaller classes only have an effect on non-cognitive skills among students with high-income parents.

A reduction in class size from 25 to 20 pupils yields an internal rate of return of 18.6 percent. The authors conclude that even if the costs were double, reducing class-sizes would still be a worthwhile investment.

closely associated with the notion of a comparison group (see below).

B.5 Data inputs to CBA

The quality and reliability of CBA findings and follow-up policy guidance depend heavily on the quality of the data used. More precisely, they rely on the precision and comprehensiveness of costs and benefits data available. When small-scale pilot projects or impact evaluation studies do not provide the necessary data inputs, expert estimates or assumptions have to be made. Such assumptions and estimates should, however, be accompanied by well-grounded justification (e.g. references to existing studies) so that they may be questioned during later rounds of policy, political and public debates. Even so, it should be openly admitted that the scale, scope and quality of CBA data inputs is often less than ideal. In the following section, we review numerous problems that are closely related to the quality of data inputs for CBAs on education.

B.6 Prospective vs. retrospective CBA

Policymakers can use CBAs both *prospectively* and *retrospectively*. The former refers to the case when a policy is being considered as a new option or as an alternative to incumbent policies. In this case, the CBA informs the policymaker's decision as to whether a particular policy should or should not be implemented. An accompanying CEA then helps to decide which specific type of policy (treatment) should be chosen to achieve the goals set. In such cases, detailed information about the actual costs and benefits of the policy is not available, because the policy has not yet been implemented. Expert-based estimates of costs and benefits have to be employed, possibly based on pilot runs of the intended policies.

A retrospective (ex-post) CBA, on the other hand, is used when the continuation of an existing educational policy comes into question. The advantage of a retrospective CBA is that the policy's costs and at least some of its benefits are known with a higher degree of certainty than in the case of prospective CBAs. Note that according to the principles of good administration, each policy should be subject to ex-post evaluation after some time from its implementation.

B.7 Causal impact evaluations

A very good source of information for a CBA is the findings of *causal impact evaluations* (Schlotter, Schwerd, & Woessmann, 2009). Causal impact evaluations identify and quantify the causal links between educational treatment and outcomes. Causal impact analyses distinguish between the real (causal) impacts of an intervention on outcomes and any spurious (environmental) associations. The reliable quantification of a programme's causal impact requires that its outcomes are quantifiable both with and without the programme. Experimental (Gurgand & Bouguen, 2012) and non-

experimental (matching, discontinuity design, quasi-experiments) approaches can be used, depending on the type of the educational programme. If allowed for by the character of the particular educational programme and if there is sufficient time, a pilot run of the educational programme with a properly designed impact evaluation should be considered highly preferable. In other cases, non-experimental methods can be used.

B.8 Partial treatments and general equilibrium effects

Each CBA must distinguish between the *direct effects* of the educational treatment on the targeted population and its *general equilibrium effects*. For example, the direct effect of widening access to tertiary education will be higher earnings (measured by private returns to education) of those who got access to tertiary education. The general equilibrium effect works via overall higher supply of tertiary educated workforce: i.e. higher supply decreases returns to education (through a lower premium for all tertiary educated). In this case, the general equilibrium effect works against the direct effect. Both effects can, however, also work in the same direction. For example, the higher supply of tertiary educated workforce to the market can in the longer-term also lead to skills-based upgrades in technology employed in the production process, further increasing tertiary educated workers' returns to education.

As another example of general equilibrium effects, consider a schooling reform that aims to decrease class-size in primary schools so as to improve the quality of education. Such a reform would also increase demand for certified teachers in the country. If the pool of certified teachers is limited, some schools will not be able to hire new teachers and will have to extend the workloads of their current teachers. This general equilibrium effect would imply additional expenditures (costs) due to increasing teachers' salaries to attract new teachers into the profession or to pay incumbent teachers over-time premiums. The reform might also create the need for new classrooms, and therefore the construction of new school buildings or the rental of space. General equilibrium effects of this sort have to be incorporated into CBAs otherwise the estimated returns on such reforms would be upwardly biased.

In sum, a rigorous CBA should carefully assess the potential for general equilibrium effects. In the case of nationwide reforms, general equilibrium effects are present almost as a rule, but their scope is difficult to predict, and CBAs have to be based on experts' assumptions. In the case of special educational programmes and educational interventions, general equilibrium effects are less likely to appear, and are not usually so strong, so it is much easier to predict them and incorporate them into a CBA.

B.9 Scaling-up

Although ex-ante pilot testing of intended educational programmes (see below) is a very useful and recommended tool, one should be aware that the impacts and functioning of small-scale pilot programmes may not necessarily correlate enough with those of a larger, full-scale and permanent programme. Deaton (2009) discusses in greater depth the common reasons why small-scale projects operate in a way that is substantially different from their large-scare versions. The reasons are numerous and always specific to each programme; we provide only examples.

The presence of general equilibrium effects (see above) is a natural reason for programme results differing when the programme is scaled up. Another discrepancy appears when educational institutions and individuals invited to participate in pilot testing are not typical representatives of the population that will be involved when the programme is scaled-up. Typically, schools participating in the pilot might have better attitudes towards collaboration and have better internal organization, thus producing overly optimistic results. In other words, pilots are frequently not able to cover a heterogeneous pool of institutions and people. Third, the organization and supervision of a small-scale pilot project is much easier than a scaled-up version involving many subjects.

A CBA should consider the possible effects of scaling-up, either directly in the computation of programme returns, or at least in the form of an explicit discussion if the effects are difficult to predict.

B.10 Sensitivity analysis

Any CBA is based on numerous assumptions about certain costs, benefits, duration patterns and other parameters. While some of these assumptions are quite plausible and reliable, some could be rather uncertain. For example, it is quite difficult to get a reliable estimate of the impact of adding a grade to lower-secondary education. Even if such estimates are available in the empirical literature, they vary widely. To reflect such uncertain assumptions, a CBA should compare cost-benefit results for alternative values, typically lower and upper bounds, of such uncertain parameters. This provides policymakers with a better idea about the most likely range of net returns. Such an exercise is called sensitivity analysis.

Box 9. Teachers' Quality

Based on Hanushek, Eric A. (2011)

Teacher effectiveness can have a sizable economic impact. Alternative valuation methods are based on the impact of increased achievement on individual earnings and on the impact of low teacher effectiveness on economic growth through aggregate achievement. The study concludes that "a teacher one standard deviation above the mean effectiveness annually generates marginal gains of over $400 000 in present value of student future earnings with a class size of 20. Alternatively, replacing the bottom 5-8 percent of teachers with average teachers could move the U.S. near the top of international math and science rankings, with a present value of $100 trillion."

B.11 Institutional and environmental effects

Even relatively small differences in a programme's design or staffing could dramatically affect its impacts and therefore the conclusions of a CBA as well. Additionally, it is often the case that the actual impact of particular educational policies and treatments depends on the surrounding and institutional conditions. For example, the mere presence of a teacher's assistant in the classroom does not guarantee a positive impact on pupils' achievements. This is because a productive teacher-assistant partnership requires good coordination and task-division between those two. Effective collaboration is an outcome of longer term learning-by-doing by both teacher and assistant.

B.12 Affected groups

B.12.1 Average vs. marginal treatment group

It is frequently assumed that a particular educational intervention has the same impact on all individuals in the population considered, irrespective of their characteristics. In real life, just the opposite is true – the intervention will have heterogeneous impacts. As an example, consider the impact of expanding access to tertiary education. After the expansion, the additional slots are probably not occupied by average college students. It could well be the case that these slots are occupied by students from the lower tail of the aptitude distribution. Therefore, the returns to tertiary education from these marginal (additional) graduates will likely be lower than the average returns to tertiary education observed from the existing population of students before the expansion was implemented.

The introduction of college student grants or loan schemes offers another example of heterogeneous impact. If such a scheme targets potential students with a high study aptitude who could not otherwise afford college studies due to insufficient private resources, the return to tertiary education from these marginal students can exceed the return from an average existing student.

As a third example, consider a retraining scheme for the unemployed. The impact of such a scheme (and probably its costs as well) will be different for voluntary participants

Box 10. The limitations of CBAs

The interaction of educational treatment with environmental conditions limits the transferability of a CBA not only from one country to another but also from place to place within a country. Contextual factors influence both the costs and the benefits of a programme, and as a result can affect key final conclusions about its desirability. What typically changes the outcomes is when a different population is affected, when the programme is implemented in an area with different costs, or when the programme is implemented under a different institutional regime.

These are also reasons why it is difficult (or impossible) to conduct CBAs that allow comparisons across countries. Even if they consider the same issue, using the same methodology, they may not lead to comparable results, because a one-size-fits-all approach cannot reflect the variation in institutional factors. While inspiration from outside approaches and good practices can be valuable, attention should be paid to differences in institutional and other external conditions. Pilot runs of intended programmes, or at least their ex-post evaluations (including CBAs) are highly recommended prior to the adoption of such programmes into a new context.

than for participants forced to participate by the counselling officer. Finally, a policy which makes pre-school expenses income-tax deductible will lower the tax duty of working parents without helping socio-economically weak children and parents with low or zero income tax base.

In all our examples, the returns are not homogenously distributed across individuals and therefore using average treatment effect as input in a CBA would lead to under- or overestimation of the actual profitability of the intervention considered.

B.12.2 Impacts on related groups

The participants in educational interventions – children or adults – are not necessarily the only affected groups. In many cases, the impact also translates to parents, siblings, descendants (multi-generational effects), peers (classmates of the targeted children), neighbours (nearby residents of the targeted families), and so on. The policy impact on the wellbeing of these populations is frequently not easily measurable and cannot be inserted into a CBA. However, if it can be reasonably assumed that a particular benefit is zero or positive, the estimated net present value in a CBA of educational intervention can be considered to represent the lower bound estimate.

B.12.3 Unintended side effects

Proposals for new educational policies frequently fail to consider their side and unintended effects. Since unintended effects usually also imply some costs and losses, efforts should be made to identify or predict these, and to incorporate them into the CBA. If not, the CBA provides biased results and can lead to misleading recommendations or policy decisions. Although experienced policymakers communicating with people in the educational field are able to predict numerous side effects, we recommend that a pilot run be used for this purpose whenever possible.

For example, retraining schemes are used to upgrade or provide new skills to the unemployed to foster their future employability. However, the availability of subsidized retraining can motivate some employed workers (or their employers) to become unemployed so as to become eligible for cost-free retraining. This unintended incentive would increase unemployment, resulting in higher expenditure on unemployment benefits. If those additional unemployed are also provided retraining, this can further increase expenditures on training, or reduce the funds available for the training of those who were involuntarily unemployed.

Another typical unintended policy effect appears when an educational initiative increases the teaching or study load of a particular subject (say maths) with the aim of improving particular skills. Such proposals frequently neglect the fact that the increased teaching or study load in one subject reduces the time or effort devoted to other subjects (say languages).

Special caution is needed when using high-stake tests as data sources for CBA. Numerous unintended side effects have been documented when results are linked directly to directors' or teachers' remuneration or promotion (Figlio, 2006) (Jacob, 2005).

A carefully crafted CBA should strive to take possible side effects into account and incorporate all corresponding costs and losses. Needless to say, many side effects are difficult to predict in advance without detailed knowledge of the institutional base.

B.13 Probabilities, risks, and uncertainties

Educational outcomes are frequently uncertain and materialize in the future with a certain probability. Some examples: only some of the unemployed who were provided with retraining will find productive employment; teachers' assistants in classes help some, but not all, pupils who were lagging behind; increased pay or additional training for teachers helps some, but not all, to improve their teaching. In all such cases, the expected impact of an intervention should be taken into account in a CBA.

For a plethora of aforementioned reasons, pilot and other experimental studies in education, which provide information on impacts for CBAs, should be designed, if possible, such that they are sufficiently similar to their functioning in real-word (external validity). As reviewed in detail by Druckman et al. (2011), experiments should be designed with four things in mind: (i) a proper population should be treated, which resembles the population to be treated by the real program, (ii) the experiment should be done in a similar social context, (iii) the outcomes measured should closely resemble the outcomes of actual interest, (iv) the treatment should be similar, including in size.

Admittedly, there is an ongoing academic debate about the limits of experimental studies. In this debate, Deaton (2009) and partly also Heckman and Urzua (2009), have presented arguments against the excessive and inappropriate use of experimental and quasi-experimental methods in empirical work. They specifically question the increased use of instrumental variables and of randomized experiments.

Box 11. Heterogeneous impacts of class size reduction vs. alternative policies

Based on Whitehurst & Chingos (2011)

The study by Whitehurst et al. examines the impact of class size reduction on student learning, for whom, and under what circumstances. The evidence on class size reduction is mixed. While some studies like project STAR in the USA have shown large positive effects of reduced classes (disputed by Hanushek 1999), some other studies such as Hoxby (2000) have found limited or no improvement from smaller classes.

Whitehurst & Chingos (2011) note that "very large class size reductions, in the order of 7 - 10 fewer students per class, can have significant long-term effects on student achievement and other outcomes. These effects seem to be largest when introduced in the earliest grades, and for students from less advantaged family backgrounds.

Even in cases where class size reduction is found to have positive returns, it should be carefully compared with other options that aim to improve classroom teaching. For instance, instead of investing in smaller classrooms, a policymaker might decide to increase teachers' salaries – thus motivating current teachers and attracting more qualified people into teaching. Alternatively, small classes might be used for teachers who are new to the teaching profession; as they later gain experience, they might be equally – or even more – effective in larger classes."

B.14 Choosing between alternative policies and tools

To compare the relative costs and outcomes of two or more policies, a cost-effectiveness analysis (CEA) is used. A CEA allows one to identify the most economically efficient way to achieve a given objective, e.g., to choose between class size reduction and alternative policies aiming to improve pupils' achievements.

The simpler technical character of a CEA, compared to a CBA, lies in the fact that it does not require monetary expression of the outcomes, which is frequently a problem to calculate. A typical indicator provided by a CEA is the ratio of costs associated with a particular policy measure (nominator) and with the gain (denominator), such as increased test scores, a decrease in the drop-out rate, lower incidence of criminal behaviour, lower incidence of drug addiction, or lower incidence of teenage pregnancies.

The comparative nature of a CEA very well serves the requirements of a Regulatory Impact Assessment (on RIA see the next section) to consider alternative policy tools for achieving a given goal. Several of the questions that can be answered by a CEA are reviewed in textbox 12.

Box 12. Questions a CEA can answer

Quoted from "EU Evaluation Toolkit"

• "How much does a programme or a measure cost compared with the cost of a particular component of its objective?

• Is it preferable to invest resources into one intervention, to the detriment of another, in order to achieve the target?

• What kind of intervention or group of interventions yields the best outcomes for the final objectives and available resources?

• How can the use of resources be optimised, given competing needs between programmes?

• At what level of additional investment will the chosen intervention clearly give an improved outcome?"

SECTION C: INSTITUTIONAL STRUCTURES REQUIREMENTS

Box 13. Regulatory Impact Assessment (RIA)

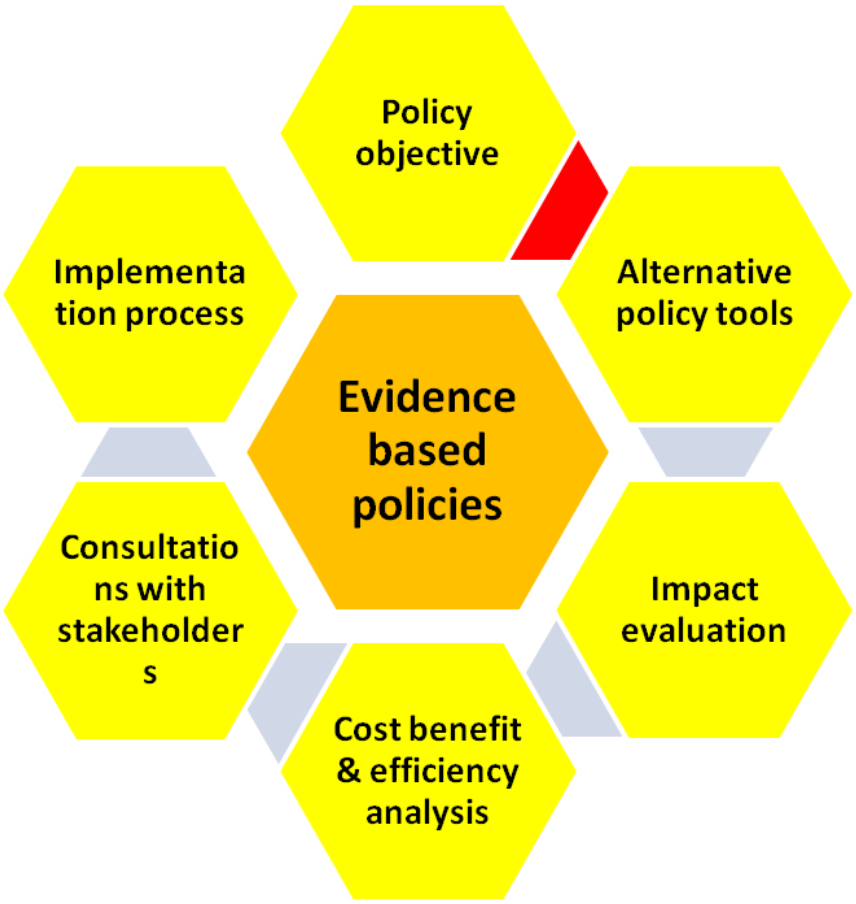
"Regulatory Impact Assessment (RIA) is a systemic approach to critically assess the positive and negative effects of proposed and existing regulations and alternatives. Encompassing a range of methods, RIA is an important element in an evidence-based approach to policy making" (OECD, 2012). An adequately realized RIA process (and the resulting report) for each educational programme "underpins governments capacity to ensure that regulations are efficient and effective in a changing and complex world".

The RIA principles, in some form, have already been adopted by almost all the OECD members. On the other hand, RIA processes in many OECD countries are still suffering numerous procedural and analytical setbacks, and the RIAs accompanying many important policies are done rather pro-forma than seriously. CBAs, together with policy causal impact evaluations, provide important inputs for RIAs. In this way, CBA can be seen as an indispensable component of well-functioning public governance.

C.1 Regulatory impact assessment

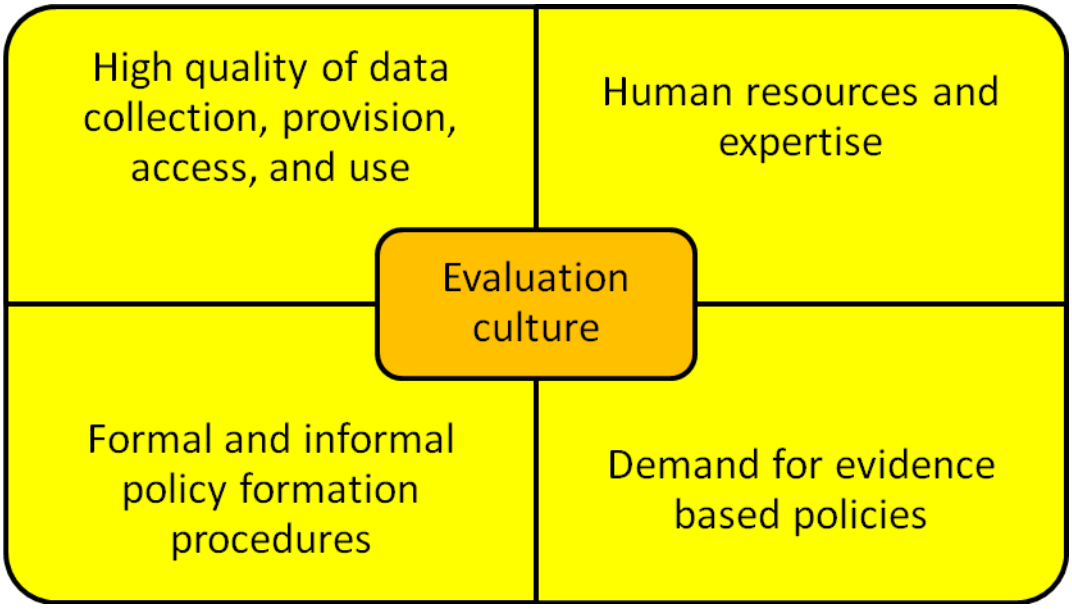
For the purposes of this report, institutional structures mean the country-specific and complex environment of legal rules, guidelines, common procedural practices, and institutions such as ministries and governmental and non-governmental agencies, where policies are invented, designed, tested, ex-ante evaluated, implemented and ex-post evaluated. Although institutional structures across individual Member States differ a lot, the principles of good public governance apply generally in all.

Figure 1: Sequencing of policy design



The principles of RIA emanate from real-life experience that effective and efficient public administration should be steeped in a culture of evaluation and evidence-based policymaking. Such an evaluation-based culture consists of a complex framework of both formal rules and informal staff attitudes and expectations, and it must ideally permeate the entire environment of a public institution. In such an environment, it is commonly and at all levels understood that each new policy or programme needs to be carefully designed, possibly pilot tested, consulted with affected stakeholders, and its pros and cons carefully evaluated ex-ante. In addition, an evaluation-based culture implies a wide understanding that the actual contribution of an incumbent policy has to be re-examined at some point (or several points) after its implementation. Without a strong culture of evaluation, the implementation of evidence-based policies involving CBA in public administration is very difficult, if not impossible.

Figure2: Components of policy evaluation culture



A culture of evaluation can be fostered legally by adopting binding procedural guidelines, but this is by far not enough. The culture of evaluation has to be evoked, disseminated, and enforced by middle and high level public officials adequately educated in modern public management. Important in this is also a broader societal push emanating from the ranks of academics and journalists who understand the importance of good public governance.

Even if the elaboration of a solid CBA turns out to be constrained by some serious methodological and data difficulties, the CBA process itself is very instrumental in fostering the pragmatism of expert and even public dialogue about the policies in question. Properly and rigorously crafted CBAs help to clarify what costs and benefits are included or excluded from consideration, what their expected time-structure would be, which stakeholders would be expected to incur the costs and benefits, which subgroups would benefit the most, whether and how the pilot programme experience could be scaled-up, and what side- and unintended effects should be taken into account.

C.2 Data, experiments, and impact evaluations

As we have already stressed, a good CBA/CEA requires good data inputs. Those inputs can be ideally provided (i) by impact evaluation studies relying, if possible, on experience from ex-ante small-scale pilot versions of the educational programmes; (ii) by the findings of other related studies in the past or in other countries; or (iii) by experts' assumptions.

If possible, small-scale pilot evaluations are the ideal method for securing a proper impact evaluation framework which provides grounds for quantified estimates of policy impacts. In such pilot studies, the treatment and comparison groups can be defined intentionally and the true causal impact of the educational intervention reliably identified. It should be noted that pilot-based experiments may require explicit legal stipulations, either in schooling laws or in terms of more general legislation.

In many cases, however, pilot evaluations are not feasible. The obstacles can be either the short time available or the minimum scale of the policy being too large. The former obstacle is frequently present due to the political cycle – there is only a relatively short time window available to a new government to implement new policies from scratch, before their term in office may end. This time constraint is most stringent in countries that experience sizeable discontinuities in political leaderships such that the new political representation does not or cannot smoothly continue in the policy formation sequencing that was started by the previous representation. Such discontinuities are more common in countries with poorly designed or absent civil servant acts, which are a precondition of stable, efficient and professional state administrative services. As for the problems with a policy's minimum scale, teachers' salaries provide a cogent example: teachers' salary increases might be difficult to pilot on a small scale, due to envy from other colleagues. Furthermore, in some countries, pilot studies are still precluded by the non-existence of necessary legal stipulations to allow for them.

The alternative to pilot versions of educational programmes are studies using data generated by existing programmes and advanced econometric techniques which, under some conditions, could sidestep the absence of intentional ex-ante designed experimental data. Such studies are more easily available in countries with a developed R&D sector in the behavioural social sciences including economics, sociology and, psychology. Countries that lack particular empirical studies can rely on meta-studies of existing studies carried out abroad. These can help to identify the reasonable range of policy impacts based on the findings of different studies in different countries, times and situations.

Needless to say, existing evaluations vary vastly in terms of their quality. Poor evaluations should not be considered as real evaluations and should be avoided by policy practitioners. While one can hardly expect that policymakers will be able to produce good quality evaluations on their own, it may be plausibly expected that competent policymakers be able to identify between good and poor evaluations and spot important efficiencies in them.

Advances in the use of CBAs in the educational area go hand in hand with the general quality of academic research institutions in a country, i.e. human resources, and also with the academic research community's access to empirical data. Huge differences persist across MSs in the extent to which administrative and other data collected by various bodies within public administration are made accessible for basic academic and policy-oriented research. In many MSs, improvements on these fronts could substantially foster the adoption of modern evidence-based policy making.

Box 14. On meta-studies

Based on Hanushek & Rivkin (2006)

Hanushek & Rivkin (2006) refer to meta-studies surveying existing estimates of the effect of teachers' salaries and of teachers' characteristics on student performance. They stress that "[T]he most remarkable is the finding that a master's degree has no systematic relationship to teacher quality as measured by student outcomes. This immediately raises a number of issues for policy, because advanced degrees invariably lead to higher teacher salaries and because advanced degrees are required for full certification in a number of states." Similarly, they document that there is no strong evidence that salaries are a good measure of teacher quality. "Overall, the studies show that salaries are more likely to be positively related to student achievement than negatively. Nonetheless, only a minority is statistically significant." Evidence on the range of estimated impacts documented by those meta-studies would be an important input of a CBA and CEA in particular evaluating educational policies aiming to increase the quality of teachers and teaching.

If even meta-studies are not available to assist in the estimation of the range of programme impacts, then a CBA has to be based on the mere assumptions of its author about actual policy impacts. This is still preferable to any policy design approach that is not backed by explicitly stated expected benefits compared to expected costs.

D. CONCLUSSIONS

1. The usage of CBAs/CEAs in Europe in the field of education

We found rather rare infrequent use of CBAs and CEAs in Europe in the field or education (at least in comparison with the US). Possible explanation is that many CBA/CEAs are carried out for internal purposes and are not widely publicised and disseminated. To get more clarity on this question, it would be necessary to explore it in-depth using approaches which are beyond those used for this analytical report.

2. Suitability of CBAs/CEAs-methods for the education area and possible benefits

Our review did not find any reason for not applying the CBA/CEA-approaches in the area of education. CBAs/CEAs can be usefully applied in the area education as in other areas of public policies. There is no feature inherent in the nature of education that would preclude applying CBAs/CEAs to this area *per se*.

Moreover, wider use of CBAs/CEAs can be fruitful in various ways. The most obvious one is that it can foster better informed policymaking. Applying CBA principles to specific policy or programme exercises desirable pressures to define policy objectives clearly, and at an early stage of the policy design. It also helps triggering a reflection about causal relations, intended effects and about how to measure them. In this sense it promotes clarity and transparency.

Another important positive effect of applying a CBAs/CEA-approach is that it better scrutinizes costs and helps avoiding decisions driven by objectives while underestimating underlying costs structures.

Working on CBAs/CEAs can also work as a catalyst, as it brings together experts with different backgrounds. Such multi-disciplinary approach is likely to improve the design of the policy or programme.

3. Problems and limitations

A conduct of a sound and credible analysis in the field of education frequently meets number of difficulties. These difficulties have different origins. Some of them are of principal nature, some of them are the same as for any other CBA (such as how to translate non-monetary benefits into monetary terms), and some are linked to the specific features of education (typically, uncertainty about cause-effect relations; long time-lags between intervention and outcomes). These challenges need to be taken seriously but do not seem to be unsurmountable.

Some of the difficulties are of practical nature. This applies in particular to the availability of data (legal obstacles or non-existence of data). Another common problem

is that there are no internationally accepted standards for designing and conducting CBAs/CEAs, meaning that it is necessary to stipulate assumptions on an ad hoc basis.

All such difficulties have an impact on the quality of CBAs/CEA and findings, including their robustness and usefulness to draw operational conclusions. Such limitations and caveats have to be stressed in each CBA/CEA explicitly, and they have to be *explained* so that possible users (including policy-makers) understand exactly limits of particular CBA/CEA.

Drawing conclusions from CBAs/CEAs for policy-decisions is a process that requires great care. For example, up-scaling a successful pilot project to a fully-fledged programme might not deliver the desired results. Transferring the findings from a CBA/CEA in one region or country to another might be misguided if local contexts differ. Rather than providing grounds to quick jumping to policy-conclusions, CBA/CEAs help painting a more nuanced and differentiated picture. They deliver material, information and structured grasp of a problem supporting policy related decisions. Making good and full use of CBAs/CEAs is easier in the environment of an overall culture of evidence-based policy-making.

Private and public resources are always scarce and can be always used in different ways. Ensuring efficient and effective use of resources is thus an important aspect of public policies, including those in the area of education. In this respect, CBAs/CEAs are important tools for informing both policymakers and the wider public about the desirability and suitability of various policy options.

Educational programmes can be viewed as a special kind of investment project: resources (i.e. money, effort and time) are invested to secure private and public, financial and non-financial, benefits in the future or to mitigate poor outcomes to avoid future expenditure on remedial interventions.

Furthermore, well-crafted CBAs/CEAs not only support the informed choice, adoption and operation of more efficient and more effective education policies; they also enhance substantive policy discussions and public consultations, which are important components of functional evidence based policy making.

D.1 Summary of the findings on CBAs and its use

Education policies have many specific features emanating from specific attributes of human capital. These attributes have to be taken into account when elaborating particular CBAs/CEAs. Unlike business investment, educational interventions frequently involve outcomes (benefits) that lack explicit monetary expression. However, there are ways to transform such non-monetary benefits into corresponding monetary values which can then be employed by a CBA.

The findings of CBAs/CEAs that look at small-scale programmes, experimental or pilot projects should not be extrapolated mechanically to large-scale program operations.

There are many dimensions in which small-scale programs do not properly mimic the reality of the large-scale implementation of a program. Similarly, as a result of differences in legal, social and economic environments, it is almost always difficult, if not impossible, to transfer CBA/CEA findings from one country to another, or from one point in time to another. However, comparison of CBA/CEA approaches focused on similar educational programs can be of some relevance, or at least inspiring.

A significant amount of existing criticism of CBAs/CEAs targets shortcomings for which they are not responsible. In fact, it is the rigorous analytical approach inherent in CBA/CEA that frequently reveals shortcomings in the accompanying process. Policy measures without clearly defined objectives are a typical case in point.

With the exception of general analytical principles, there are no detailed internationally defined standards for designing and conducting CBAs/CEAs. This makes numerous assumptions look arbitrary and creates insecurity among researchers, whose work is easily open to criticism on methodological grounds. This occasionally, but mistakenly, becomes a reason for not conducting CBAs/CEAs.

CBAs/CEAs are not stand-alone tools. They are only an element of a broader policy formation process. While CBAs/CEAs need to be complemented by other tools and methods, it is always preferable to perform a CBA/CEA for an educational policy or program than not. Even if it turns out that the CBA/CEA cannot provide definite answers to questions about the actual costs, benefits and returns of a policy intervention, the CBA/CEA can nevertheless be very useful tool for communicating the policy's intentions, clarifying the scale and scope of the policy's expected effects, and ensuring that all possible costs and benefits are incorporated into further considerations relating to the policy in question.

For CBAs/CEAs to become a regular element of policy-making processes in a country, there needs to be what we call an evaluation culture, which involves: access to high quality input data, necessary human resources and expertise, formal and informal policy formation procedures in place, and real demand for evidence based policies.

Evaluation of the desirability of particular educational interventions in a country requires that: (a) evidence-based policies are institutionalized and built into standard administrative processes, (b) there is awareness among higher levels of public administration and society as a whole that evidence-based policies are necessary for the successful implementation of education programmes, and (c) there is sufficient intellectual, information and data capacity for the use of evidence-based policies.

D.2 Open questions

It is still not clear to what extent EU Member States make use of CBAs/CEAs in the area of education for policy planning, monitoring and evaluations. If a future more comprehensive survey than ours confirms our observation that in most Member States CBAs/CEAs are used only sporadically, rather than regularly, for policy-making, it will be necessary to explore the key obstacles to their broader, regular and effective use. This should be the next step in the search for ways to overcome existing obstacles and asses the ways in which assistance and coordination at the EU level could be most helpful.

We have identified systematic shortcomings and gaps in the availability of inputs for CBAs/CEAs, i.e. information and data in particular. Longitudinal survey studies following individuals from early ages (or from before educational treatment) and their families for a sufficiently long time period are still rare in many Member States. At the same time, some Members States have a long tradition in carrying out such surveys and can provide valuable experience.

In some Member States, in particular those which have joined the EU during the last decade, various legal and technical barriers continue preventing wider use of rich and valuable administrative data for CBAs/CEAs. Examples from a growing number of more advanced Member States have proven that it is possible to adopt technical and legal arrangements such that analysts and scientists can touch upon individual data without compromising anonymity and security standards and regulations.

In some Member States, including many more recent EU entrants, there is another important barrier to the faster adoption of CBAs/CEAs into policy formation processes. It is the lack of experts in the public sector with sufficiently deep knowledge and experience of the use (if not elaboration) of CBAs/CEAs in connection with educational programs, the functioning of public institutions, and policy design procedures. The education and training of new experts in the area is proceeding slowly, partly because universities do not offer adequate programs, and/or because careers in the public sector are not attractive enough compared to careers in business.

D.3 Implications for policies at the EU level

Admittedly, opinions on the role of CBAs are far from unanimous and there persists a notable difference between Europe and the United States. In their widely read and very detailed discussion on the roles and setbacks of CBAs, Adler, Matthew; Posner, E. A. (2001) scrutinize CBAs from the legal, economic, and philosophical perspectives. They conclude with a somewhat simplifying but concise opinion that in the USA “CBA is widely used as a governmental tool though academics remain sceptical”. Our overview of the use of CBA in the EU in the area of education suggests that there, the CBA/CEA are not used so often and not regularly.

The limited use of CBAs/CEAs in EU Member States in the area of education points to the risk that most educational reforms are implemented without sufficient prior (ex-ante) and ex-post analysis, hence they are not sufficiently evidence-based. Wider use of good quality CBAs/CEAs would surely be a step in the right direction to improve policy-making in the area of education within EU-Member States.

EU Member States are fully responsible for the design, implementation and operation of their educational system, policies and programs. Member States differ widely in terms of the institutional and social environments in which education and training are performed. Moreover, Member States employ different approaches in public governance structures. Nevertheless, efficiency and effectiveness of educational policies is the goal of all Members States, and principles of good public governance are not country specific.

There are numerous ways in which coordination, assistance, and support at the EU level could help Member States to overcome existing barriers and obstacles improving their policies, including regular use of CBAs/CEAs. These include:

- Supporting mutual consultations of policy-makers sharing experience with the use of actual CBAs/CEAs and their findings.
- Listing links to completed CBAs/CEAs in Member States at central web site. The EU could help to pool evidence in the form of a data bank on "what works". This could promote mutual learning. Examples include the Electronic Library of the ERIC Clearinghouse on Educational Management.[3]
- Making advice available on what type of data should be gathered to improve CBA/CEA inputs.
- Communication between schooling ministries and Eurostat could be fostered to better utilise the capacity of regular sample surveying in all Member States such as the Labour Force Survey and Survey of Income and Living Conditions. Similarly, there is scope for greater use of youth skills surveys, such as PISA, TIMSS, and PIRLS or those of the adult population such as PIACC.
- EU assistance can be instrumental in enhancing the necessary human resources in Member States, i.e. experts able to produce good quality CBAs/CEAs in education. The support might include support for special training courses for public administrators at international level, the design of university courses for students, and life-long training for policymakers.

[3] https://scholarsbank.uoregon.edu/xmlui/handle/1794/3112

- Twinning and other forms of mutual learning among Member States could be supported to enhance and spread the use of CBAs/CEAs in the field of education. Such mutual learning should bring together both experts who produce CBAs/CEAs and policymakers who use them.
- Within the EU2020 strategy and its trimesters, an annual recommendation could be issued to Member States to adopt CBAs/CEAs as a regular component of consideration of new educational programs and measures. In particular, in case of larger EU co-funded programs, the elaboration of a CBA/CEA could be made mandatory or at least strongly recommended. It should be also required that such CBAs-CEAs are subject to public expert scrutiny.
- As there are no international quality standards for conducting CBAs and CEAs, some guidance could be developed at international level (for example with the help of the OECD).
- The EU could also help to establish: (1) an overview portfolio of analytical tools to improve the efficiency of education programs, (2) a survey relating to whether such tools are used systematically or on an ad hoc basis (for example a mapping exercise).
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Appendix 1: Calculation of CBA/CEAs

Returns to education

We introduce the notion of the *rate of return to investment* into education by a very simplistic example considering the costs of investment incurred in the 1st period and benefits reaped in the 2nd period. In the 1st period, educational investment is realised, implying costs $\mathbf{C_1}$. Benefits from the investment, $\mathbf{B_2}$, are reaped in the 2nd period. For an investment to be meaningful its benefits must exceed its costs so that $\mathbf{B_2 > C_1}$. The annual rate of return to the investment is a value of parameter **r**, which equalises both sides so that $\mathbf{B_2 = C_1(1+r)}$ or alternatively, $\mathbf{B_2/(1+r) = C_1}$. If benefits were to be reaped only in the 3rd period, the formula would be expressed as $\mathbf{B_3/(1+r)^2 = C_1}$, where **r** still represents annual (if the time unit used is a year) rate of return to investment. In a more general case when benefits are reaped during **T** periods, the formula combines all the terms as

$$B_2/(1+r) + B_3/(1+r)^2 + \ldots + B_T / (1+r)^T = C_1 \qquad \text{(A1.1)}$$

Reverse cost-benefit approach

The reverse *cost-benefit approach* amounts to asking the question: given the total costs of the educational investment, what level of annual benefits **B** would produce a given rate of social return (25%, for instance) on the investment? This can be stated as (notation is established in section B of the main text): *Annual benefit = 0.25*(total education cost)* or, in this case:

$$B = (W_m - W_b) = (0.25)(W_m + C_d) \qquad \text{(A1.2)}$$

Although rough, these calculations can be made easily and can instigate further analyses on how to reduce the costs or increase the benefits to possibly justify a particular education programme. On the other hand, the *short-cut method* is in many cases too simplistic and inferior to more elaborate approaches. In the next section we present various weaknesses of the short-cut method and present possible solutions and methodological approaches.

Elaborate (full-discounting method)

The costs and benefits associated with a particular educational treatment occur at different points of an individual's lifetime, as already captured by the formula A1.1. The multiplication by a discount factor $\mathbf{1 / (1+r_o)}$ is called *discounting*. Note that typical values of $\mathbf{r_o}$ are in the range 0.01 - 0.10, the typical values of the discount factor are somewhat smaller than one. Discounting allows us to transform future costs and

benefits to their *present value* (PV). For example, if benefits $\mathbf{B_2}$ and costs $\mathbf{C_2}$ are realised in the 2nd period, their present values (as of the 1st period) can be computed as

$$PV(B_2) \equiv d * B_2; \quad PV(C_2) \equiv d * C_2 \quad where \quad d \equiv \frac{1}{1+r_o} \qquad \text{(A1.3)}$$

The discount rate is usually the interest rate at which governments can borrow money on the financial market for public investments. Discounting reflects an economic principle that saving money (presently) generates positive returns in the future. Therefore, a euro to be possessed in a year's time has a lower value now than a euro possessed now. This is so because the latter can generate its owner interest $\mathbf{r_o}$ during the forthcoming year, but the former cannot.

Using discounting, two equivalent indicators in terms of assessing the profitability of an education policy, are used in the practical application of CBA/CEA: the *net present value* and *the internal rate of return (IRR).*

Net present value (NPV) represents the difference between the sum of all present values of all benefits generated and all costs incurred over time by an educational programme:

$$NPV(B-C) \equiv \sum_{t=0}^{T} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{T} \frac{C_t}{(1+r)^t} \qquad \text{(A1.4)}$$

Investment into the programme is desirable (profitable) if the corresponding PV is positive at the selected rate of return **r**.

Internal rate of return (IRR) relates the stream of costs and benefits in such a way that IRR represents a hypothetical annual percentage return per euro invested. Then, the IRR of an investment is the discount rate at which the PV of the benefits stream equals the PV of the costs. The IRRs of different educational treatments can be compared mutually and also to other investment options, such as putting money into a bank account to generate mere interest (or not borrowing the money, to save on borrowing interest). The IRR has been the most popular measure in the empirical literature because, being a percentage, it is easily comparable across educational alternatives, countries and alternative discount rates.

Referring to the example of the MA student given in the main text, the full discounting method allows for a more elaborate approach, reflecting a more realistic world. In particular, this method allows for the reality that costs and benefits have different values over time, as empirically observed average age-earnings profiles have the general inverse U-shape.

According to (A1.4), the private rate of return to an investment in a given level of education in such a case can be estimated by finding the rate of discount $\mathbf{r_o}$ that

equalizes the stream of discounted benefits (on the left-hand side) to the stream of costs (on the right-hand side) at a given point in time. In the case of a university education (BA plus MA) lasting five years, for example, the formula is:

$$\sum_{t=1}^{42} \frac{(W_u - W_s)_t}{(1+r_0)^t} = \sum_{t=1}^{5} (W_s + C_u)_t (1+r_0)^t \qquad \text{(A1.5)}$$

where $\mathbf{(W_u - W_s)_t}$ is the earnings differential at time **t** between university and secondary school graduates. $\mathbf{(W_s + C_u)_t}$ represents the sum at time **t** of direct costs of the university education $\mathbf{C_u}$ (tuition fees, books), and the student's indirect costs $\mathbf{W_s}$ (foregone earnings). Although in this more general case the formula for $\mathbf{r_o}$ cannot be expressed from A1.5 explicitly, spreadsheet's tools are readily available to make computations like this easy.

The net present value method is a mirror image of the elaborate method. Instead of solving for the internal rate of return $\mathbf{r_o}$, a criterion discount rate **i** is used to compare the costs and the benefits of the investment at a given point in time,

$$\text{NPV} = \sum_{t=1}^{42} \frac{(W_u - W_s)_t}{(1+i)^t} - \sum_{t=1}^{5} (W_s + C_u)_t (1+i)^t \qquad \text{(A1.6)}$$

The choice of the discount rate value should reflect the cost of borrowing, which should reflect the expected risk of the investment. Typically, the interest rate of long-term government bonds has been used as the discount rate, because such bonds have been (and are still) perceived as relatively safe investments.

The advantage of the aforementioned approach is that it can be used to compare spread and varying costs and benefits of any educational intervention. While it is the fundamental base of all CBAs, each educational intervention (programme) has specific features requiring its adequate modifications.

Appendix 2: Cost-benefits in the framework of human capital (Mincerian) model

There is special application of CBA, based on the human capital theory, which is applicable mainly in the evaluation of general educational programmes.

Human capital theory explains the observed relationships between earnings on the one hand and years of education and of an individual's experience on the labour market on the other. Employing the principles of forgone earnings, the relationship between the logarithm of wages (**logW**) and years of schooling (**S**), years of labour market experience (***X***) and its square ($\mathbf{X^2}$) can be found such that

$$\log W_j = \alpha + \beta S_j + \gamma_1 X_j + \gamma_2 X_j^2 \qquad \text{(A2.1)}$$

where subscript **j** identifies individuals. This is called an earning function, also known as the *Mincer equation* (Mincer 1974). [4] In the equation, the coefficient on years of schooling, β, can be interpreted as the *average private rate of return to (from) one additional year of schooling*. It represents the percentage increase in earnings due to an additional year of education. The estimates across the world range between very low 1-3% to very high 10-20%. It can be shown that the meaning of this rate is the same as that of the **r** introduced in the initial section: the shortcut method based formula postulates that the increase in wages $\mathbf{W_1 - W_0}$ due to an additional year of education equals forgone earnings, $\mathbf{W_0}$, times return **r**, so that $\mathbf{W_1 - W_0 = r\,W_0}$ or equivalently $\mathbf{(W_1 / W_0) = 1 + r}$. This implies that $\mathbf{\log (W_1 / W_0) = \log(1+r) \sim r}$. Note that for one additional year of education S ($\Delta S=1$), according to #22, $\mathbf{\log(W_1/ W_0) = \log(W_1) - \log(W_0) = \beta}$ and it implies equivalence between coefficient $\boldsymbol{\beta}$ and **r**.

Years of labour market experience **X** in A2.1 is an innate component of the human capital model reflecting that human capital is formed after school, in the form of on-the-job training. The costs of on-the-job training represent forgone earnings due to time spent in on-the-job training. Term $\mathbf{X^2}$ with coefficient $\boldsymbol{\gamma<0}$ captures the fact that on-the job-training is more intensive at the beginning of an individual's career, so that returns to this investment diminish with years of labour market experience.

The Mincerian version of the human capital model assumes that forgone earnings are the only cost of education and training born by the individual, and that other direct costs are zero. Therefore, coefficient $\boldsymbol{\beta}$ only measures the private rate of return. If the estimated value of this coefficient is available, the *earnings function method*, also known as the *Mincerian* method of CBA, can be used.

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[4] Jacob Mincer (*1922, +2006), a famous economist who established key pillars of human capital theory in the 1960's and the 1970's.

Formula A2.1 does not distinguish between different levels of schooling and therefore assumes that returns to a year of education are the same irrespective of the actual schooling level. A more flexible specification, the so-called *extended earnings function*, substitutes a series of zero-one indicator (dummy) variables for **S**, corresponding to discrete educational levels achieved,

$$\log W_i = \alpha + \beta_p D_p + \beta_s D_s + \beta_u D_u + \gamma_1 X_i + \gamma_2 X_i^2 \qquad \text{(A2.2)}$$

where **D** is zero-one (the dummy) variable for the subscripted level of schooling - primary, secondary and university, respectively. The private rates of return within particular levels of education can then be calculated from the extended earnings function A2.2 by the following formulas:

$$r_p = \frac{\beta_p}{S_p}, \quad r_s = \frac{\beta_s - \beta_p}{S_s - S_p}, \quad r_u = \frac{\beta_u - \beta_s}{S_u - S_s},$$

where $\mathbf{r_p}$, $\mathbf{r_s}$, $\mathbf{r_u}$ are the rates of return to primary, secondary and university schooling, respectively. This calculation resembles the *short-cut method* in that the rate of return is computed as a ratio of a constant annual benefits flow to the total education cost for attaining the next level of education.

The parameters of equations A2.1. and A2.2 are commonly and frequently estimated by researchers in all developed countries, providing estimates of rates of return parameters (for a comprehensive meta-study survey see (Psacharopoulos, 1994)). The advantage of the Mincerian way of estimating the returns to education is that it can smooth out and handle low-count cells[5] in an age-earnings profile matrix by level of education. The disadvantage is that it requires a larger sample of individual observations, rather than pre-tabulated mean earnings by level of schooling. In the following section we provide more details about the peculiarities of econometric estimations.

Data requirements of the Mincerian approach

For the Mincerian approach to cost-benefit analysis from the social viewpoint, data are also needed on the resource cost of schooling. On the direct cost side, data are needed on what institutions and individuals spend on educational treatment. Such information is usually derived by dividing total expenditure on a given level of education by the number of individuals treated. Investment expenditure - spending to acquire inputs with longer-term use - has to be incorporated to the proportion of individuals whose benefits are considered.

[5] 'Low counts' refers to a small number of observations in the sample of individuals being used to estimate the equation.

The minimum data necessary to conduct a cost-benefit analysis of education from a private viewpoint consists of a matrix of earnings by age and level of education. In the case of established educational programmes in member states, information on individual earnings can be obtained from the SILC annual survey of households and their individuals, which is also provided in a standardised form by Eurostat for all EU member states.

The vast majority of the literature on Mincerian cost-benefit analyses of education have used the above mentioned basic data set. However, there are also many studies that have used additional variables to control for factors other than schooling that may determine earnings, such as differential ability or socioeconomic background. Depending on the availability of data, additional variables and sophisticated econometric techniques have been used to deal with the so-called simultaneity (or chicken-egg) problem, i.e. the possibility of earnings determining income rather than the other way around (see below).

Issues in the estimation of Mincerian returns to education

Ability

In the 1970s, the adjustment to the gross earnings differential that drew the most attention was that for differential ability between two groups of graduates, often known as the "filter" or "screening" hypothesis (see Arrow 1973). But again, extensive research, starting from the work of Griliches (1977) to that of natural experiments using identical twins who had been separated early in life (Ashenfelter and Krueger 1994) has shown that the ability correction is not empirically validated; hence, it has been dropped in contemporary practice (Ashenfelter and Rouse 1998, Rouse 1999).

Simultaneity

Instrumental variables (IV) estimates of the Mincerian returns to schooling have been used to correct for the downward bias in least-squares estimates caused by the simultaneity between schooling and earnings. One example is the use of compulsory school attendance laws. Harmon and Walker (1995) use changes in the educational distribution of individuals caused by the raising of the minimum school-leaving age in the United Kingdom to provide instruments for schooling. This provides a good experiment, because individuals who would otherwise have left school early stay on because of the changes in law. The findings show a large and negative bias in the least-squares estimate of the schooling-earnings relationship, providing further evidence of

the downward bias in OLS estimates of the returns to schooling found in other studies (Angrist and Krueger 1991).[6]

Family Background

Casual empiricism may suggest that what appears to be a Mincerian return to investment in education is in fact a rent derived from one's socio-economic origins. At the theoretical level, this issue was addressed early on by Becker (1972) who noted that if parents' education influences children's earnings, this is due to the fact that better off parents invest more in the education of their children. Thus, the effect of family background is nothing other than an intergenerational effect of human capital.

At the empirical level, several studies have included measures of family background in the Mincerian earnings function, finding minimal effects on the returns to education. For example, Bedi (1997) found that in Honduras the inclusion of parental education in the earnings function reduces the overall rate of return to investment in education from 12.1 to 11.3%. Altonji and Dunn (1996), using sibling pairs from the United States Panel Study of Income Dynamics, find mixed evidence on whether parental education raises the return to education. Using a sample of Australian twins, Miller, Mulvey and Martin (1995) found no evidence that the returns to education are overestimated by the non-inclusion of family background factors. Münich (2013) estimated Mincerian returns to education in all EU countries using data from the Survey of Income and Living Conditions (SILC 2011), which contained ad-hoc module reporting on parental education. The findings are in line with the findings of the aforementioned studies on non-EU countries.

Direct Productivity

Perhaps the ultimate test for documenting the true benefits of education is to directly observe the productivity of workers with different levels of schooling. Beyond econometric shadow pricing, or observation shadow pricing, there is an immense line of work relating education to physical farm productivity. For example, Jamison and Lau (1982) found that, on average, the difference between zero and four years of schooling among farmers results in a 10% increment in production. Rosenzweig (1995) and Foster and Rosenzweig (1996) have shown that primary education has an impact on farmers adopting new high yield varieties. In India, for example, high-yield-variety use had an 18

[6] EENEE (2009) Analytical Report No. 5 to the European Commission contains a rich description of econometric problems and solutions on the subject.

percent greater effect on the per-area profitability for farmers with primary schooling, compared to farmers with no schooling (Rosenzweig, 1996).

School Quality

A standard criticism of empirical estimates of the Mincerian returns to education is that such returns refer to the quantity of schooling, saying nothing about school quality. Several studies have shown the importance of school quality in determining earnings (e.g., Behrman and Birdsall 1983, Bedi 1997). This is not really a critique of the rate of return literature – rather it points to an omission due to the difficulty of collecting information on school quality.

Yet a counter-argument is that rates of return to investment in education, as conventionally estimated, by definition refer to the average level of quality across all schools in the sample. So, if school quality is important in determining earnings, improving school quality must yield even higher returns to education.

Sample selectivity

Ideally, a rate of return to investment in education should be based on a representative sample of the country's population. But in reality this is the exception rather than the rule. This is problematic when the estimated rates of return are based on a survey of firms – rather than households – because firm-based samples are highly selective. In order to control survey costs, such samples focus on large firms with many employees. Second, the questionnaire is typically filled in by the payroll department rather than by the individual employee. Typically, this approach leads to the use of samples concentrated only in urban areas (as in Knight and Sabot, 1987).

Another problem occurs when rate of return estimates are based on samples that include civil servants. This is a problem because public sector wages typically do not reflect market wages. On average, the inclusion of civil service pay flattens the earnings differentials giving lower returns among those working in the public sector (see Psacharopoulos, 1983). Of course, in many countries – although fewer now than in the past – the majority of university graduates end up in public sector employment. However, rate of return estimates based on civil service pay are useful in private calculations regarding the incentives set by the state to invest in education and opt for employment in the public sector.

Methodology

A less serious problem occurs when wage effects are confused for returns to education. Mincer (1974) has provided a great service and convenience in estimating returns to education by means of the semi-log earnings function. However, for the sake of that

convenience, many researchers use the raw coefficients of education in the extended (dummy-form) function to report returns to education, whereas these are wage effects.

Another methodological limitation, despite Becker's (1975) warning, is that many researchers feel obliged to throw in the regression regardless of what independent variables they seem to have in the data set, including occupation. In effect, this procedure leads to stealing part of the effect of education on earnings that comes from occupational mobility.

Externalities

A social rate of return should ideally include the externalities associated with education. The earnings of educated individuals do not reflect the external benefits that affect society as a whole but are not captured by the individual. Such benefits are known as *externalities* or *spillover benefits*, since they spill over to other members of the community. They are often hard to identify, and even harder to measure. In the case of education, some have succeeded in identifying positive externalities, but few have been able to quantify them. If one could include externalities, then social rates of return may well be higher than private rates of return on education.

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