the social research unit

INVESTING in children

Technical Report

April 2012

Social Research Unit, Lower Hood Barn, Dartington, Totnes, TQ9 6AB **T** (0)1803 762 400 unit@dartington.org.uk, www.dartington.org.uk

Acknowledgements

The Social Research Unit would like to thank Steve Aos, Stephanie Lee, Elizabeth Drake, Annie Pennucci and the rest of the team at the Washington State Institute for Public Policy for their endless support throughout the work process. The Unit would also like to thank the volunteers at Pro Bono Economics and Julian Cox from New Economy Manchester for their assistance during the preparation of the cost-benefit analysis. Finally, this work would not have been possible without funding from Birmingham City Council, Association of Greater Manchester Authorities and the Youth Justice Board.

Table of Contents

List of Tables

1. Introduction

Investing in Children is produced by the Social Research Unit at Dartington (SRU) and provides free and independent advice on the costs and benefits of competing investment options in children's services. It is one of a series of innovations being prepared by the SRU that are designed to put useful evidence into the hands of hard-pressed policy makers, commissioners and practitioners.

Investing in Children will be published on a regular basis. The objective is to provide reliable information independent from government, providers or programme developers. Building on the model developed by the renowned Washington State Institute for Public Policy in the United States (WSIPP), *Investing in Children* has taken an approach to cost-benefit analysis that is consistent across policy areas, cautious in its estimates and relevant to the real world of public and private sector investments in child health and development.

The first two *Investing in Children* reports focus on Youth Justice and Early Years and Education respectively.[1] This Technical Report should be read in conjunction with those reports.

The Technical Report gives a brief overview of the two main approaches used in economic evaluation and summarises the cost-benefit approach originally developed by the WSIPP. It also describes the sources and assumptions that the SRU used in the cost-benefit model to estimate the economic value of programmes and approaches to reduce juvenile delinquency and improve educational outcomes for children.

Future editions of *Investing in Children* will focus on other children's services systems, namely *Child Protection and Social Care*, *Child and Adolescent Mental Health*, and *Public Health*. There will be several reports for each system each year, reflecting:

- Analysis of new interventions for which there is reliable data on impact and cost
- Improvements in the data sources on which the economic model relies
- Changing economic conditions

An updated version of this Technical Report will accompany each report.

[1] These are available at www.dartington.org.uk/investinginchildren.

2. Economic Evaluation

2.1. Cost-Effectiveness and Cost-Benefit Analysis

One way to conduct economic analysis in intervention research is to look at cost-effectiveness that assesses the change in outcomes relative to inputs. In the evaluation of crime interventions, cost-effectiveness studies allow us to determine how many units of an outcome (e.g., crime reduction) you will get for an amount of spending. Cost-effectiveness analysis enables us to compare the relative costs and outcomes (effects) of two or more courses of action by comparing the extra cost of providing the intervention with the extra benefits, such as a point reduction on a certain measurement scale. The results of such economic evaluation can be expressed in terms of the cost-effectiveness ratio. This is defined as the ratio of the change in costs of a therapeutic intervention (compared to the alternative intervention) to the change in effects of the intervention. Put simply, it is the ratio of pounds expended to an outcome obtained. Thus, the consequences of cost-effectiveness analysis are expressed in non-monetary units.

Cost-benefit analysis takes this approach it one step further by putting a monetary value on those units of outcome. In cost-benefit analysis, expected costs are weighed against expected benefits in order to determine whether the course of action is profitable. In the context of social interventions, the technique adds up the value of the benefits of an intervention, and subtracts the costs associated with it. A simple approach to cost-benefit analysis uses only financial costs and financial benefits. A more sophisticated approach, however, puts a financial value on intangible costs and benefits. For example, a cost-benefit analysis of a reduction in smoking would transform a quitter's improved health or longer life into a monetary value. The final product of cost-benefit analysis is the net benefit that is expressed in monetary terms.

Even though both types of analysis include the measurement of the consequences of the intervention or policy, cost-effectiveness analysis determines the change in outcomes relative to spending, whereas cost-benefit analysis determines the overall economic net benefits of the outcome - the difference between valuation of benefits and costs.

2.2. Applications of Cost-Benefit Analysis

There is a considerable amount of interest in cost-benefit analysis. The earliest cost-benefit analyses were developed for policies related to natural resource management and transportation services. A good example of an initiative of cost-benefit analysis in children's services is a study of Perry Preschool Project, which was the first study to quantify the cost and lifelong benefits of early education.[2] This study followed young children from 1962 through adulthood and showed that a well-designed preschool programme increased the potential of high school graduation, stable employment and income. In addition, the study showed that the

[2] Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. Journal of Public Economics, 94, 114-128.

intervention increased the amount of federal taxes paid by adults. Furthermore, the government money was saved over time through participants being less involved in the criminal justice and welfare systems compared to those children who did not participate in the Perry Preschool Project.

More recently, there has been a lot of work on cost-benefit analysis in the field of public health. Several groups, both public and private are working to improve the standards in this field. For example, the RAND Corporation has done a significant amount of work on cost-benefit analysis in the field of early childhood intervention[3] and crime[4]. The MacArthur Foundation has set up the Benefit-Cost Analysis Center at the University of Washington's Evans School of Public Affairs in the US. This is aiming to set standards for cost-benefit analysis to improve the precision of estimates. The National Research Council and the Institute of Medicine in the US have recently published a summary of a workshop held by their Board on Children, Youth, and Families, which examines ways to improve cost-benefit analysis methods so that they can be used to support effective policy decisions.[5] In England and Wales, the Green Book by HM Treasury provides guidance in this area for the public sector.[6]

Most cost-benefit analysis is done *ad hoc* for particular projects. It is used extensively in the private sector. For example, the market valuation of assets such as corporate stock is a very common practice. It is rare to find a systematically developed model that can be used as a tool for policy-making purposes, which covers a range of policy areas and draws them together in the analysis. However, groups such as WSIPP are working to develop models that can be adapted and used internationally for a variety of policy areas.

3. The WSIPP Model

The WSIPP cost-benefit model predicts the impact of competing investment options on child well-being, as well as the costs and economic returns of various portfolios of interventions. The analytic approach generally follows the procedures that James Heckman used in his recent return on investment analysis of an early education programme.[7]

The WSIPP cost-benefit model follows a four-step approach:

1) Evidence is assessed against the highest standards of scientific evidence to determine the effectiveness of programmes and approaches (what works).

---

[3] Karoly, L., Greenwood, P., Everingham, S., Hoube, J., Kilburn, R. M., Rydell, P., Sanders, M., & Chiesa, J. (1998). *Investing in our children: What we know and don't know about the costs and benefits of early childhood interventions*. RAND Corporation MR-898-TCWF, Santa Monica, CA, USA.

[4] Greenwood, P., Model, K., Rydell, P. C., & Chiesa, J. (1998). *Diverting children from a life of crime: Measuring costs and benefits*. RAND Monograph Report, MR-699-1-UCB/RC/IF, Santa Monica, USA.

[5] National Research Council, & Institute of Medicine. (2009). *Strengthening benefit-cost analysis for early childhood interventions: Workshop summary*. A. Beatty, Rapporteur. Committee on Strengthening Benefit-Cost Methodology for the Evaluation of Early Childhood Interventions, Board on Children, Youth, and Families. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

[6] Available at http://www.hm-treasury.gov.uk/d/green_book_complete.pdf

[7] Heckman, *et al., op. cit*.

2) Costs and benefits are calculated, using an internally consistent framework, for Washington State. This produces a ranking of public policy options, similar to how *Which?* magazine ranks the pros and cons of similar consumer products.[8]
3) Where possible, a 'portfolio' analysis reveals how a combination of policy options affects outcomes, costs and benefits.
4) The riskiness of the conclusions is measured by testing how bottom lines vary when estimates and assumptions change.[9]

The SRU is translating this cost-benefit model developed in the US and publishes *Investing in Children* reports on the costs and benefits of competing investment options in children's services. *Investing in Children* has been funded by Birmingham City Council and the Association of Greater Manchester Authorities as part of their continued commitment to squeeze more value from local government investments, and by the Youth Justice Board as it seeks to reduce crime at lower cost to the taxpayer. Pro Bono Economics, an independent charity that matches volunteer economists with charities wishing to address questions around measurement, results and impact, has provided invaluable support.

4. Translation

The SRU values the WSIPP model over alternatives for three main reasons:

- It is cautious in its estimates of potential savings to the public purse; *it does not make rash claims;*
- It has been consistently applied across a range of policy areas; *it uses the same methods to calculate costs and benefits for children in foster care as it does for young people in the youth justice system;*
- It results have been used to inform major policy decisions such as switching resources from prisons to prevention.

However, to reap the full benefits of the Washington model for England and Wales, significant translation work is needed.

First, we examine the rules used in the analysis of 'what works'. WSIPP has a strong reputation for its conservative approach. As well as maintaining a high standard of evidence, any methodological flaws in the included evaluations included are addressed by discounting the estimated effects of programmes and approaches (see section 6 below for further details). The relevance of these decisions to the UK

[8] www.which.co.uk

[9] WSIPP uses the Monte Carlo method, which is a mathematical simulation method for understanding the impact of uncertainty. It allows us to estimate the riskiness of our investment by enabling us to model situations that present uncertainty and play them out hundreds or thousands of times on a computer. Monte Carlo simulation estimates risk by building models of possible results by substituting a range of values – a probability distribution – for any factor that has inherent uncertainty (e.g., programme effect size, discount rates, programme cost, labour market earnings). By randomly sampling from the probability distribution for each variable factor, a new set of summary statistics are produced for each "run" through the simulation. The Monte Carlo method calculates and saves results over and over, each time using a different set of random values from the probability distributions. Once the analysis is complete, the range and shape of the results from individual runs can be examined visually and numerically.

context is considered in the translation bearing in mind that the model converts the effect sizes that summarise the degree to which a programme or approach affects an outcome into units of outcomes that can be monetised.[10]

Second, children's services, youth justice, education, health and benefits in England and Wales differ from those in Washington State, for example in the way in which cases are processed. This has important consequences for the return on investments. The structure of the model was altered to reflect processes in England and Wales.

Third, the data values and inputs of the model are re-estimated to reflect the context of England and Wales, including, for example, the number of people processed through the justice system, the probabilities of different sentences, the unit costs of youth justice services, earnings data by age and education status and the rate of pupils with A-levels.[11]

A piece of software developed by WSIPP is used to enter and store information and run computational routines designed to produce four related cost-benefit summary statistics: net present value; benefit-to-cost ratio; internal rate of return on investment; and measure of risk associated with these bottom-line estimates. An overview of the model, the general approach and characteristics of WSIPP's modelling process, as well as assumptions and computational methods used in the model can be found in Technical Appendix of the WSIPP report from April 2012.[12]

5. Description of Interventions

This section provides a brief summary of each of the programmes and approaches in the 'Youth Justice' and 'Early Years and Education' reports for which cost-benefit results have been calculated. They are presented in alphabetical order.

5.1. Youth Justice Interventions

Aggression Replacement Training (ART) is a cognitive behavioural programme for chronically aggressive children and adolescents.

Coordination of Services (COS) provides an educational programme to low-risk young offenders and their parents in order to help to the young people achieve a positive pro-social future.

Drug Courts use comprehensive supervision, drug testing, treatment services and immediate sanctions and incentives to reduce criminal recidivism and substance abuse among young people.

[10] For example, the units of high school graduation might be +0.03, which would indicate three extra percentage points on a high school graduation rate.
[11] Crime data used in the model are for England and Wales.
[12] For data inputs see Lee, S., Aos, S., Drake, E., Pennucci, A., Miller, M., & Anderson, L. (2012). *Return on investment: Evidence-based options to improve statewide outcomes*, *April 2012* (Document No. 12-04-1201). Olympia: Washington State Institute for Public Policy. The full report and Technical Appendix are available at http://www.wsipp.wa.gov/pub.asp?docid=12-04-1201

Functional Family Therapy (FFT) is a structured family-based programme designed to reduce delinquency, violence and other problem behaviours in young people aged 11-18.

Multidimensional Treatment Foster Care (MTFC) involves intensive therapeutic foster care for adolescents displaying chronic antisocial behaviour, emotional disturbance, and delinquency.

Multisystemic Therapy (MST) is a home-based and family-driven intervention for young people aged 12-17 who are displaying serious antisocial or criminal behaviour.

Scared Straight uses organised visits to adult prisons to deter young offenders, or children at risk of becoming delinquent, from involvement in crime.

Victim Offender Mediation gets the victim and the offender sitting down together with a trained mediator in order to determine appropriate restitution for the harm done.

5.2. Education Interventions

Additional Day of Teaching refers to extra instruction time in schools for children aged 5-18, standardised here to represent an extra day.

Bonus for Teachers is a significant cash sum ($5,000 in the US) given to teachers on completing an advanced teaching credential over a 1-3 year assessment process.

FAST (Families and Schools Together) is an eight-week after-school programme for children aged 6-13 and their families.

Good Behaviour Game is a universal classroom management strategy for children aged 6-8 and is designed to improve aggressive/disruptive classroom behaviour and prevent later criminality.

K-12[13] Tutoring by Adults involves using adult community volunteers, often pre-service teachers in training, to provide one-on-one assistance to students typically aged 6-7 who are struggling to learn to read.

K-12 Tutoring by Peers involve students from the same classroom or higher year groups providing one-to-one help – with teacher oversight – to students who are struggling to learn to read.

Life Skills Training is a school-based curriculum that teaches children aged 11-14 social and self-management skills to reduce the risks to them of alcohol, tobacco, drug abuse and violence.

[13] K-12 refers to the US school system and the school grades Kindergarten through to Grade 12 (ages 5-18). Most of the evaluations included in the meta-analysis were of elementary school students, often children aged 6-7.

Parent Involvement Programmes involve teachers training and encouraging parents to engage in planned, structured academic activities with their children at home, often in the form of tutoring.

Quantum Opportunities is a four-year programme in which disadvantaged young people aged 14-18 work with a caring adult on basic skills, personal development, cultural enrichment and volunteering.

Reading Recovery is a structured school-based early literacy intervention involving one-to-one tutoring for struggling readers aged 6-7.

Special Literacy Instruction for English as a Second Language involves a structured, direct instruction approach to teaching reading to students who are learning English as a second language.

Success for All is a whole-school reform model for children aged 4-12, with a focus on helping every child to read at or above the appropriate level for their age.

Tutoring for English Language Learners involves one-to-one tutoring for students who are learning English and focuses on reading.

5.3. Early Years Interventions

Abecedarian provides high-quality, developmentally appropriate childcare and education for young children at risk of developmental delays and school failure.

Early Childhood Education refers to model programmes (Perry Preschool, Abecedarian, and Chicago Parent Child Centers) and larger programmes (Head Start) for low-income children aged 3-4.

High Scope Perry Preschool is a universal early childhood education programme for children aged 0-5.

6. Effect Sizes and Standard Errors

Meta-analytic procedures were used to estimate the effect of programmes and approaches on outcomes. These effects, as well as estimates of the margin of error in these effects were provided by WSIPP.[14,15]

Meta-analysis is a statistical technique for combining the findings from independent studies that have attempted to answer similar questions about effectiveness; for example, does a new crime reduction programme confer significant benefits

[14] Aos, S., Lee, S., Drake, E., Pennucci, A., Klima, T., Miller, M., Anderson, L., Mayfield, J., & Burley, M. (2011). *Return on investment: Evidence-based options to improve statewide outcomes* (Document No. 11-07-1201). Olympia: Washington State Institute for Public Policy. The full report and Technical Appendix I are available at http://www.wsipp.wa.gov/pub.asp?docid=11-07-1201

[15] The meta-analysis of Success for All was carried out by the SRU.

compared with the treatment as usual? Meta-analysis provides a quantitative (statistical) estimate of effectiveness aggregated over all the included studies – an effect size which indicates the impact of a programme or policy in standard units. In general, the meta-analytic methods described by Lipsey and Wilson were used.[16]

The studies investigating the direct effects of the programme or approach on specific outcomes were selected based on whether they met WSIPP's standards of evidence, which focus on the quality of the research methodology, and whether monetary values for the outcomes (e.g., convictions, special education) could be estimated. Studies using random assignment were preferred, but non-randomised trials using control or comparison groups were also included if the groups were matched and any differences were statistically controlled for in the analyses.

In addition to direct programme or approach effect sizes, linked effect sizes were estimated. These are not directly measured in the original intervention evaluation. Linked effect sizes are based on a body of research that measures how one particular outcome is causally related to another outcome to which a monetary value can be estimated. For example, if the programme Functional Family Therapy (FFT) is shown to affect youth offending, and if separately analysed longitudinal research shows that youth offending is causally related to a probability of graduating from high school, then FFT can be assumed to have an effect on high school graduation. Longitudinal studies that establish temporal ordering (first outcome such as youth offending precedes another outcome such as high school graduation) and include measures of other factors that also influence the outcome were preferred. For further details on meta-analyses of linked outcomes see Technical Appendix of the WSIPP report from April 2012.[17]

The studies that met these criteria were entered into effect size modelling software designed by WSIPP. This software was used to code detailed information about the research design, population, study duration, and results of analyses of any outcomes that could be monetised. The software was then used to conduct a meta-analysis of all studies for each programme (e.g., FFT) and approach (e.g., an additional day of teaching) considered in this cost-benefit analysis. It computed a weighted average effect size, standard error as well as an adjusted effect size, which takes into account discounts that were applied.

The discounts were used to estimate an effect size that is more likely to be found in real-world dissemination of the interventions. These discounts were applied to each study individually in the meta-analysis to account for weaker research methodology and other factors that may have inflated the effect size, such as programme developer involvement in the trial. For example, if a developer was heavily involved in the research trial, it is likely that the intervention was delivered with higher fidelity to the model, which cannot be assumed to be the case when the intervention is disseminated more widely. In addition, studies with weaker designs such as non-randomised comparison groups are likely to yield larger effects than those that do

[16] Lipsey, M.W. & Wilson, D. (2011). *Practical meta-analysis*. Thousand Oaks, CA: Sage Publications.
[17] Lee, *et al., op.cit.*, pp. 111-112.

use random assignment. If a trial was conducted with weaker methodology, the resulting effect size was therefore discounted to estimate a more realistic effect for real world delivery. The description of WSIPP's adjustments to effect sizes for methodological quality, outcome measure relevance, developer involvement and laboratory or unusual setting can be found in Technical Appendix of the WSIPP report from April 2012.[18] The most recently published summary of meta-analytic results and the specific discounts that are applied in meta-analyses for the majority of programmes and approaches reviewed can be found in Technical Appendix I of the WSIPP report from July 2011.[19]

7. Cost of Programmes and Approaches

The costs that were used in the cost-benefit analyses were those related to the running costs of the intervention that occur on an on-going basis (see Table 7.1). This is because the estimates looked at the relative costs and benefits over the long term. Three aspects were considered in the calculations of the costs of each intervention: training costs, intervention delivery costs, and supervision costs. These, therefore, do not include start-up costs necessary to introduce the interventions to a new area. Programme developers or local service providers in England and Wales provided some of the readily available intervention unit costs.

A number of programmes or approaches included in this analysis are currently not delivered in England and Wales and thus do not have local cost estimates available. The unit costs of these programmes/policies were obtained by converting the WSIPP unit costs in US dollars into Pounds Sterling using the annual average exchange rate for a year of dollars that the cost was provided in.[20] The exchange rates were obtained from the interactive database of Bank of England.[21] All costs based on US estimates were increased by 25 per cent since a comparison of converted unit costs and available costs for England and Wales showed that unit cost tends to be higher when the intervention is delivered in England and Wales. These converted unit costs of programmes and approaches will be replaced with estimates for England and Wales as soon as they become available.

The unit costs for the rest of the interventions were estimated based on the three elements that follow.

Training

Training costs for interventions were based on the number of hours and average salary per hour for trainers who deliver the training. They also included other costs that occur when delivering training, such as training materials (e.g., manuals) and

[18] *Ibid* , pp. 14-17.
[19] Aos, S. *et.al., op.cit.*
[20] Lee, *et al., op.cit.*
[21] The exchange rates are available at http://www.bankofengland.co.uk/boeapps/iadb/index.asp?Travel=NIxIRx&levels=1&XNotes=Y&C=DMY&XNotes2=Y&Nodes=X4039X4042X4045X33620X3985X3790X3791X3836&SectionRequired=I&HideNums=-1&ExtraInfo=true&G0Xtop.x=36&G0Xtop.y=9

rent for a venue, etc. These costs were sought from developers and commissioners of the interventions if delivered in England or Wales.

Intervention Delivery

Intervention delivery costs were based on the number of hours and average salary per hour for practitioners who deliver the intervention. This was sometimes complicated by the fact that some of the interventions can be delivered by a range of practitioners with different qualifications. In order to overcome this problem and establish average estimates, the proportion of practitioners with different qualifications was estimated and then a weighted average of their salaries was calculated. Developers were encouraged to indicate clearly who should and should not deliver their intervention.

Supervision and Fidelity Monitoring

These costs were based on the number of hours and average salary per hour for professionals who deliver supervision and/or fidelity monitoring. Supervision costs were based on real-life setting estimates. Namely, if certain supervision requirements were designed for an evaluation study only and would not be part of regular practice in real-life settings, then these requirements would not form the basis for cost estimates. At the same time, the estimates were based on what the costs would be to promote faithful delivery of the intervention, to reduce the likelihood of large differences in effect sizes between the trials and the real world.

Table 7.1. Intervention Costs for Youth Justice, Education and Early Years Interventions

Intervention	Annual cost	Duration (years)	Year	Source [a, b]
Youth Justice Interventions				
Functional Family Therapy (FFT)	£2,500	1	2010	National Academy for Parenting Research, Institute of Psychiatry, King's College London & Brighton & Hove Youth Offending Service. This cost estimate includes a fully staffed team of qualified systemic family psychotherapists.
Multidimensional Treatment Foster Care (MTFC)	£7,656	1	2010	The cost estimate is based on Curtis (2010, section 6.8, Tables 1 and 2).[c] We have calculated the difference between the MTFC cost per year (£90,044) and the cost of other type of provision for young people with similar needs (£82,388). The cost of other type of provision is based on an average of three provision options presented in Table 2 in Curtis (2010, p. 114).
Multisystemic Therapy (MST)	£9,500	1	2010	The Brandon Centre, UK. This estimate is based on a team of 3 MST therapists who work full time, 1 supervisor who works 3-4 days/week, and a coordinator who works 3 days/week. It includes all salary costs, overhead, training, travel, and the annual license fee. It is based on 10 cases per therapist and 30 cases per year for the team.
Aggression Replacement Training (ART)	£978	1	2008	The WSIPP cost is converted from USD into GBP and increased by 25%.[d]
Drug Court	£1,804	1	2004	The WSIPP cost is converted from USD into GBP and increased by 25%.[e]
Co-ordination of Services	£256	1	2008	The WSIPP cost is converted from USD into GBP and increased by 25%.[d]

Intervention	Annual cost	Duration (years)	Year	Source [a, b]
Victim Offender Mediation	£457	1	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP estimated the costs of victim offender mediation based on the literature reviewed. They also received a cost estimate from the victim offender mediation programme in Clark County Washington. Their final cost estimate is the average of these two costs. The cost includes staff time, benefits, and volunteer time.
Scared Straight	£54	1	2010	The UK unit cost is based on the estimate provided by Foundation 4 Life, which offers prison visits as a crime diversion provision. This estimate includes the cost of a minibus, driver and key worker.
Education Interventions				
Additional Day of Teaching	£657	1	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP estimates for the per-student annual cost of adding one day to the school year were provided by Washington State legislative budget committee staff.
Bonus for Teachers	£1,579	1	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. Washington State provides NBPTS-certified[f] teachers with a $5,000 annual bonus. To calculate a per-student annual cost, the WSIPP assumed that each teacher has an average of three classrooms with an average of 25 students per classroom. This cost estimate does not include the additional bonus provided to teachers who work in high-poverty schools or the private costs teachers incur when they apply for and participate in the certification process.
Families and Schools Together (FAST)	£225	1	2010	Save the Children UK. The cost estimate is based on an assumption that each children's centre or school will run two FAST projects within 12 months. Furthermore, each FAST project will recruit 40 parents and 80 children. Therefore the cost estimate is based on 160 children per year in total.
Good Behaviour Game	£55	2	2010	The cost is based on the estimate provided by Chan *et al*. (2012).[g]
K-12 Tutoring by Adults	£1,116	1	2009	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP cost estimates are based on the following assumptions derived from the programmes described in the studies included in the meta-analysis: on average, the programmes lasted for 8 months, with 63 sessions of about 40 minutes each. The programmes provide 1 to 5 hours of training and typically use unpaid adults volunteering their time. The WSIPP used average teacher salaries (including benefits) in Washington State to compute the value of volunteers' time.
K-12 Tutoring by Peers	£1,036	1	2009	The WSIPP cost is converted from USD into GBP and increased by 25%. To estimate costs, the WSIPP assumed that teachers spend an average of one-half hour per day each week to oversee an 8-week peer tutoring programme, based on the evaluations included in their analysis. The value of teacher time was calculated using average teacher salaries (including benefits) in Washington State.
Life Skills Training (LST)	£7	3	1998	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP cost estimates for materials and per-teacher on-line training are from the LST website (http://www.lifeskillstraining.com). They

Intervention	Annual cost	Duration (years)	Year	Source [a, b]
				also included a per-student estimate for the cost of training teachers. This estimate assumes that each trained teacher provides LST instruction to an average of 375 students over 5 years.
Parent Involvement Programmes	£1,036	1	2009	The WSIPP cost is converted from USD into GBP and increased by 25%. To estimate costs, the WSIPP assumed that teachers spend an average of one-half hour per week to maintain contact with parents during the school year, based on the evaluations included in the analysis. They calculated the value of teacher time using average teacher salaries (including benefits) in Washington State.
Quantum Opportunities Programme	£3,436	5	2006	The WSIPP cost is converted from USD into GBP and increased by 25%. Average cost per youth is $25,000 for five years.[h] The WSIPP put a 30% uncertainty estimate around this figure because the average costs vary widely by site.
Reading Recovery	£1,498	1	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. Reading Recovery is provided for 12 to 20 weeks for ½ hour per day, five days per week. The WSIPP assumed an average of 16 weeks of tutoring with one hour of training. They used average teacher salaries (including benefits) in Washington State to compute the value of tutors' time.
Special Literacy Instruction for English as a Second Language Students	£804	3	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP cost estimate reflects the sum of local, state, and federal dollars allocated per-student (averaged across Washington State school districts) for the 2008-09 school year. All students who qualify for the state Transitional Bilingual Instructional Program (TBIP) receive some form of services, so the comparison group cost is the same as the programme group cost. Because specialised literacy programmes may require supplemental materials and training, the WSIPP added $100 to the cost estimate and increased the uncertainty around the cost estimate to 20 per cent. Source for dollars allocated per-student: Office of Superintendent of Public Instruction.
Success for All	£66	3	2010	*SFA-UK* and *Success for All Foundation*. The cost estimate is based on 250 pupils.
Tutoring for English Language Learners	£2,084	1	2009	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP cost estimates are based on the following assumptions derived from the programmes described in the studies included in the meta-analysis: on average, the programmes lasted for 4.5 months, with 60 sessions of about 25 minutes each. The programmes provide 1 to 3 hours of training. The WSIPP used average teacher salaries (including benefits) in Washington State to compute the value of tutors' time. They assumed that tutoring costs are in addition to regular classroom instruction, for which the cost estimate reflects the sum of local, state, and federal dollars allocated per-student (averaged across Washington State school districts) for the 2008-09 school year. The WSIPP increased the uncertainty around the cost estimate to 20 per cent. Source for dollars allocated per-student: Office of Superintendent of Public Instruction.
Early Years Interventions				
Abecedarian	£11,598	5	2002	The cost is based on the estimates provided by Masse

Intervention	Annual cost	Duration (years)	Year	Source [a, b]
Programme				and Barnett (2002, p.13)[i] and the estimates provided by the developer (USD). The cost was converted from USD into GBP and increased by 25%.
Early Childhood Education	£5,386	2	2010	The WSIPP cost is converted from USD into GBP and increased by 25%. The WSIPP cost is the average per-child payment for Washington State's Early Childhood Education and Assistance Program (ECEAP). (The comparison group cost is the average per-child payment for Washington State's Working Connections Child Care subsidy.) The WSIPP increased the uncertainty around the cost estimate to 25 per cent which reflects the higher per-child costs for the model programmes included in this analysis.
High Scope/Perry Preschool	£2,632	2	2010	The cost is calculated based on estimates provided by the HighScope GB, South Tyneside Early Excellence Children's Centre at Tyne & Wear.

Note. [a] For WSIPP unit costs see Aos, S., Lee, S., Drake, E., Pennucci, A., Klima, T., Miller, M., Anderson, L., Mayfield, J., & Burley, M. (2011). *Return on investment: Evidence-based options to improve statewide outcomes* (Document No. 11-07-1201). Technical Appendix I. Olympia: Washington State Institute for Public Policy.
[b] There is always some uncertainty around programme cost estimates. The uncertainty included in the model around these costs ranges from (+/-) 10-25%. The programme costs are varied in Monte Carlo runs when running cost-benefit analysis to test the model systematically for the riskiness inherent in the single point estimate. For some intervention a comparison group cost for treatment as usual is used when available.
[c] Curtis, L. (2010). *Unit costs of health and social care 2010*. The University of Kent. Personal Social Services Research Unit.
[d] For further details see also Barnoski, R. (2009, December). *Providing evidence-based programs with fidelity in Washington State juvenile courts: Cost analysis* (Document No. 09-12-1201). Olympia: Washington State Institute for Public Policy. Available at http://www.wsipp.wa.gov/rptfiles/09-12-1201.pdf
[e] For further details see also Anspach, D. F., Ferguson, A. S., & Phillips, L. L. (2003). *Evaluation of Maine's statewide juvenile drug treatment court program*. Augusta, ME: University of Southern Maine.
[f] National Board for Professional Teaching Standards: www.nbpts.org
[g] Chan, G.K., Foxcroft, D.R., Smurthwaite, B., Coombes, L., & Allen, D. (2012). *Improving child behaviour management: An evaluation of the Good Behaviour Game in UK primary schools*. Oxford Brookes University, Oxfordshire County Council. Available at http://www.swph.brookes.ac.uk/images/pdfs/research/GBG_UK_Final_Evaluation_Report.pdf
[h] Maxfield, M., Schirm, A., Rodriguez-Planas, N., & Mathematica Policy Research, Washington, DC. (2003). *The Quantum Opportunity Program demonstration: Implementation and short-term impacts*. Mathematica Policy Research, Inc. Available at http://www.mathematica-mpr.com/pdfs/quanimpshort.pdf
[i] Masse, L.N. & Barnett, W.S. (2002). *A benefit cost analysis of the Abecedarian Early Childhood Intervention*. New Brunswick, NJ: National Institute for Early Education Research.

8. Valuation of Outcomes that Affect Crime

This section of the technical report describes mainly the data sources used in the cost-benefit model that estimates the monetary value to taxpayers and victims of programmes and approaches that reduce crime. The current version of the model estimates the value to taxpayers if a crime is avoided, as well as the cost that can be avoided by people who would have been a victim of a crime had the crime not been prevented. To model avoided crime costs from the perspective of taxpayers and victims, life-cycle costs of avoiding six major types of crime and nine types of costs incurred as a result of crime were estimated. In addition to computing monetary values of avoided crime, the model is also used to estimate and count the number of prison beds and victimisation avoided when crime is reduced.

The crime part of the cost-benefit model uses four types of inputs to estimate benefits: per-unit crime costs; sentencing probabilities and resource-use estimates; longitudinal criminological information about different populations who would be eligible for interventions to prevent or reduce youth offending; and estimates of multiple crimes per officially recorded crimes, such as arrests or convictions. This section describes these four broad data sources.

8.1. Types of Crime

In this model, we used the following crime categories: violence against the person, sexual offences, robbery, property offences, drug offences, and summary offences (excluding motoring offences). Property offences were based on a weighted average of the probability of burglary and theft (and handling stolen goods when the latter was combined with the theft category and it was not possible to separate the two types of offences). These categories were used as they were the best match between those used by the WSIPP model and official statistics published by the Home Office and the Ministry of Justice.

8.2. Unit Costs of Criminal Justice Resources and Victimisations

The majority of unit costs were extracted from and estimated based on the technical paper on the cost of a cohort of young offenders to the criminal justice system by the National Audit Office (NAO).[22,23] Unit costs for adult community sentences and post-custody supervision were based on estimates from the Ministry of Justice payment by results pilot 'Justice Reinvestment'. Unit cost for youth community sentences were calculated based on data provided by Birmingham Youth Offending Service. See Table 8.1 for these unit costs.

Police

The unit costs of police are adjusted to reflect the cost per arrest based on marginal operating costs.[24] The cost of an arrest was calculated in reference to the number of persons arrested.[25] Since it was not possible to break down the cost by type of offence, the same unit cost was applied to all types of offences. It should be acknowledged that the estimates made available by the Home Office reflect the number of persons arrested rather than arrests. Thus, the cost estimate in Table 8.1 is likely to overestimate the average cost per arrests.

Courts

The unit cost of court was calculated based on the marginal cost estimates per court event (in 2008/09 prices) published in the NAO technical paper for both under- and over-18s.[26] Based on these estimates, a weighted average unit cost of court was

[22] National Audit Office (2011). *The cost of a cohort of young offenders to the criminal justice system*. Technical Paper. London: National Audit Office. (See Figure 8)
[23] The following report was also considered as a resource: Home Office (2005). *The economic and social costs of crime against individuals and households 2003/04*. Home Office Online Report 30/05. Available at http://webarchive.nationalarchives.gov.uk/20110218135832/rds.homeoffice.gov.uk/rds/pdfs05/rdsolr3005.pdf
[24] NAO technical paper, *op.cit.*, p.18.
[25] Povey, D. (Ed)., Mulchandani, R., Hand, T., & Panesar, L.K. (2011). *Police Powers and Procedures England and Wales 2009/10*. 2nd Edition. Home Office Statistical Bulletin 07/11. London: Home Office. Available at http://www.statewatch.org/news/2011/may/uk-police-powers-ho-11.pdf
[26] NAO technical paper, *op.cit.*, p.18.

computed using the proportion of offenders sentenced by age (under- and over-18s) and offence group as the weighting. These data for weighting were taken from 2010 sentencing tables published by the Ministry of Justice.[27]

Youth Community Supervision

The unit cost of youth community supervision was calculated as the weighted average cost based on the indicative cost estimates for typical disposals for young offenders. These estimates were taken from the NAO value for money report on the youth justice system in England and Wales.[28] The prevalence of different disposals for young offenders was provided by Birmingham Youth Offending Service.

Youth Custody

The unit costs of youth custody were calculated as the average marginal operating costs per offender per year for under-18s. The figures in the NAO technical paper were presented per month served in prison, and these were adjusted to get to average annual costs.[29]

Youth Supervision Post-Custody

The unit costs of youth supervision post-custody were calculated as the average marginal operating costs per offender per year using the average time spent in community supervision and an average cost per person. These estimates were adjusted to represent a full year of community supervision and thus an average annual cost. Data were not located for under-18s, so figures for adult offenders were used instead.[30] When data for youth post-custody supervision become available, these figures will be replaced in future updates.

Adult Community Supervision

The unit costs of adult community supervision were calculated as the average marginal operating costs per offender per year. Costs for specific court order requirements and the number of offenders receiving them were provided by the Association of Greater Manchester Authorities (AGMA).[31] These costs were adjusted according to the average community sentence duration to estimate the cost for one full year per offender. We acknowledge that these costs may not be representative of average costs for England and Wales. Therefore, these costs will be replaced with more representative estimates when such data become available.

---

[27] Ministry of Justice, Criminal Justice Statistics, England and Wales 2010, Sentencing Tables, Table A5.5. Available at www.justice.gov.uk/downloads/statistics/...stats/sentencing-tables.xls; Property offence estimate includes burglary as well as theft and handling stolen goods.

[28] National Audit Office (2010). *The youth justice system in England and Wales: Reducing offending by young people*. Report by the Comptroller and Auditor General. London: The Stationary Office.

[29] NAO technical paper, *op.cit.,* p.18.

[30] The Association of Greater Manchester Authorities (AGMA), data are based on estimates from the Ministry of Justice payment of results pilot 'Justice Reinvestment'. The costs data are for all the local authorities that are included in this Ministry of Justice's payment by results pilot. This includes all 10 Greater Manchester local authorities - Bolton, Bury, Manchester, Oldham, Rochdale, Tameside, Trafford, Salford, Stockport, Wigan; this also includes 5 London boroughs - Croydon, Lambeth, Lewisham, Hackney, Southwark.

[31] *Ibid.*

Adult Custody

The unit costs of adult custody were calculated as the average marginal operating costs per offender per year for over-18s. The NAO figures were presented per month served in prison, and these were adjusted to get to average annual costs.[32]

Adult Supervision Post-Custody

The unit costs of adult community supervision sentences were used for the costs of supervision post-custody (see above).[33]

Victim Costs

Both tangible and intangible victim costs were taken from the Home Office report on the economic and social costs of crime against individuals and households 2003/04.[34] This report provides figures for the emotional and physical impact on victims. However, these costs are only based on road accidents for violent crime, and a question from the British crime survey for property crime. It also specifically excludes any valuation of the fear of crime, so these figures may be underestimates.

Other resources were also considered. The NAO technical paper on the Cost of a Cohort of Young Offenders to the Criminal Justice System could not be used because it did not include victim costs. McCollister and colleagues present tangible and intangible costs based on US data only, which are not necessarily applicable to the UK (e.g. US medical costs, US jury awards).[35] The Victim Support report on The Cost of Crime from January 2011 used the same figures from the Home Office report but adjusted these estimates using the GDP deflator (as given by HM Treasury) to reflect inflation between 2003 and 2009 and updated recorded crime rates.[36] However, this is essentially what is done in this model. The Criminal Injuries Compensation Authority (CICA) Criminal Injuries Compensation Scheme 2008 was also considered, but it breaks costs down by type of injury rather than by offence.[37]

[32] NAO technical paper, *op.cit.*, p.18.
[33] AGMA, *op.cit.*
[34] Home Office, *op.cit.*, Table 2.1.
[35] McCollister, K. E., French, M. T., & Fang, H. (2010). The cost of crime to society: New crime-specific estimates for policy and program evaluation. *Drug and Alcohol Dependence*, 108, 98-109.
[36] Report available at http://www.victimsupport.org/Aboutus/News/2011/01/Economic-impact-of-crime
[37] CICA Scheme available at http://www.justice.gov.uk/downloads/guidance/compensation-schemes/cica/am-i-eligible/Criminal%20Injuries%20Compensation%20Scheme%202008.pdf

Table 8.1. Criminal Justice Sector Costs and Victim Costs

Per Unit Costs	Violence Against the Person	Sexual Offences	Robbery	Property Offences	Drug Offences	Summary Offences excluding motoring
Police	1,668	1,668	1,668	1,668	1,668	1,668
Courts	11,871	10,194	3,040	3,7254	2,394	619
Youth Community Supervision	6,626	6,626	6,626	6,626	6,626	6,626
Youth Custody	58,776	58,776	58,776	58,776	58,776	58,776
Youth Supervision Post-Custody	3244	3244	3244	3244	3244	3244
Adult Community Supervision	3244	3244	3244	3244	3244	3244
Adult Custody	28,404	28,404	28,404	28,404	28,404	28,404
Adult Supervision Post-Custody	3244	3244	3244	3244	3244	3244
Victim Costs (tangible)	3,004	5,378	1,612	454	0	0
Victim Costs (intangible)	5,472	22,754	3,048	269	0	0

Note. Police per-unit cost reflects the cost per arrest (specifically, per person arrested due to data limitations). Court per-unit cost reflects the court cost per person convicted. Supervision and custody per-unit costs reflect the cost per offender per year. Victim per-unit cost reflect the cost per actual crime as measured by (for example) the British Crime Survey (BCS), rather than those as recorded by the police.

8.3. Criminal Justice Resource Use

Once a person is convicted for an offence, sentencing policies and practices in England and Wales affect the use of different criminal justice resources. This section of the report describes inputs that indicate how criminal justice resources are used in response to crime. Thus, in addition to per-unit crime costs described above (section 8.2), the crime model uses sentencing probabilities and resource-use estimates to work out the benefits of interventions that aim to reduce offending.

Probabilities

The model uses the probabilities of different sentences given different crimes (see Table 8.2). These sentencing probabilities were obtained from the Ministry of Justice Sentencing Tables 2010.[38]

Youth Community Supervision

These figures are based on the Ministry of Justice Sentencing Tables 2010, Table A5.34. For example, if a young offender is convicted of robbery, there is a 73 per cent chance of being provided community supervision (e.g., intensive supervision and surveillance programmes).

Youth Custody

These figures are based on the Ministry of Justice Sentencing Tables 2010, Table A5.24. For example, if a young offender is convicted of robbery, there is a 22 per cent chance of receiving a custodial sentence.

[38] Ministry of Justice, Criminal Justice Statistics, *op.cit.*

Youth Supervision Post-Custody

These estimates are based on scenarios provided by the Greater Manchester Probation Trust in which a sentence length of less than 12 months leads to no probation supervision and a sentence length of greater than 12 months leads to some amount of probation supervision (see next section on years of use per resource for further details). Based on these estimates, for example, if a young offender is convicted of robbery, there is a 100 per cent chance of receiving post-custody supervision. We acknowledge that Greater Manchester estimates may not be representative of probabilities for England and Wales. Therefore, these estimates will be replaced with more representative estimates when such data become available.

Adult Community Supervision

These figures are based on the Ministry of Justice Sentencing Tables 2010. They were calculated by taking a weighted average of community sentences probabilities for 18-21 year olds and for 21+ from Table A5.34, using the number sentenced for each offence in each age group from table A5.5 as the weighting. For example, if an adult offender is convicted of robbery, there is nearly a seven per cent chance of being provided community supervision (e.g., intensive supervision and surveillance programmes).

Adult Custody

These figures are based on the Ministry of Justice Sentencing Tables 2010. They were calculated by taking a weighted average of custody probabilities for 18-21 year olds and for 21+ from Table A5.24, using the number sentenced for each offence in each age group from table A5.5 as the weighting. For example, if an adult offender is convicted of robbery, there is an 82 per cent chance of receiving a custodial sentence.

Adult Supervision Post-Custody

These estimates are based on scenarios provided by the Greater Manchester Probation Trust in which a sentence length of less than 12 months leads to no probation supervision and a sentence length of greater than 12 months leads to some amount of probation supervision (see next section on years of use per resource for further details). Based on these estimates, for example, if an adult offender is convicted of robbery, there is a 100 per cent chance of receiving post-custody supervision.

Table 8.2. Probabilities of Criminal Justice Resource Use

Probability Resource Use	Violence Against the Person	Sexual Offences	Robbery	Property Offences	Drug Offences	Summary Offences (Excluding Motoring)
Youth Community Supervision	0.80	0.80	0.71	0.74	0.49	0.64
Youth Custody	0.12	0.16	0.22	0.06	0.04	0.02
Youth Supervision Post-Custody	1.00	1.00	1.00	0.00	1.00	0.00
Adult Community Supervision	0.29	0.23	0.07	0.30	0.19	0.10
Adult Custody	0.35	0.62	0.82	0.26	0.17	0.03
Adult Supervision Post-Custody	1.00	1.00	1.00	1.00	1.00	0.00

Years of Use per Resource

In addition to sentencing probabilities, the average number of years various criminal justice resources are used were estimated for each of the crime categories (see Table 8.3 below).

Youth Community Supervision

As it was not possible to locate data for youth, adult data from Greater Manchester were used (see 'adult community supervision' below). Based on these estimates, for example, if a young offender is convicted of robbery, the average number of years that they receive community supervision is 0.65 years, which translates into nearly eight months of community supervision. If data for youth community supervision become available, these figures will be replaced in future updates.

Youth Custody

These figures were extracted from the Ministry of Justice Sentencing Tables 2010, Table A5.21.[39] Months of immediate custody reported in the table were divided by 12 to get the estimate in years. In order to estimate the actual length of stay, the resulted estimates were divided by two because offenders typically serve half of the sentence in custody.[40] Based on these estimates, for example, if a young offender is convicted of robbery, the average number of years that the offender spends in custody is 0.7 years that translates into nearly eight and a half months of community supervision.

Youth Supervision Post-Custody

Similarly to youth community supervision, adult data from Greater Manchester are used here (see 'adult supervision post-custody' below). For example, if a young

[39] *Ibid.*

[40] For an average length of immediate custody see Table 2m in the Ministry of Justice publication on sentencing. Available at www.justice.gov.uk/downloads/.../sentencing-stats-09-supp-tables.xls
For an indication of time served in prison see the Ministry of Justice's Offender management caseload statistics (annual) (NS). Available at http://www.justice.gov.uk/statistics/prisons-and-probation/omcs-annual

offender is convicted of robbery, the average number of years that the offender receives community supervision after serving the sentence is 0.7 years, which translates into nearly eight and a half months of post-custody community supervision. If data for youth community supervision become available, these figures will be replaced in future updates.

Adult Community Supervision

The sentence lengths for community sentences are based on data from the Greater Manchester Probation Trust on average lengths of community orders for each type of crime. The sentence lengths were estimated by calculating a weighted average of the duration of community orders in months, weighted by the number of offenders per offence for both successful and unsuccessful sentences. For example, if the adult offender is convicted of a sexual offence, the average number of years that they receive community supervision is 2.04 years.

Adult Custody

These figures come from the Ministry of Justice Sentencing Tables 2010, Table A5.21. Months of immediate custody were divided by 12 to get the estimate in years and weighted 18-20 year olds and 21+ using the number who committed each offence from Table A5.5. These estimates were divided by two given that half of the sentence is typically served in custody and half is served in the community.[41] Based on the resulted estimates, for example, if an adult offender is convicted of robbery, the average number of years that the offender receives community supervision is 1.56 years.

Adult Supervision Post-Custody

Adult post-custody supervision estimates are based on the following scenarios provided by the Greater Manchester Probation Trust:

- Sentence length of less than twelve months: no probation supervision provided.
- Adults with sentence length of between twelve months and four years: generally let out of prison halfway through their sentence and spend remainder of sentence on licence with Probation supervision.
- Adults with sentence length of more than four years: minimum custody length usually specified by the judge.
- Adults with life sentences: parole board agrees on a release date, they remain under the supervision of the probation service for at least ten years (at which point the probation service may make a case that supervision is no longer required).
- Indeterminate Public Protection sentences: sentence length not set, release determined by parole board. If released always remain under the supervision of the probation service.

It has to be acknowledged that the estimates displayed in Table 8.3 do not take into account the years of resource use by those who have life sentences or those who

[41] *Ibid.*

have a sentence length of more than four years. Thus, some of the figures in Table 8.3 are likely to underestimate the actual years of resource use.

Table 8.3. Years of Use per Criminal Justice Resource

Number of Years of Use Per Resource	Violence Against the Person	Sexual Offences	Robbery	Property Offences	Drug Offences	Summary Offences (Excluding Motoring)
Youth Community Supervision	0.76	2.04	0.65	0.60	0.56	0.65
Youth Custody	0.65	1.30	0.70	0.19	0.63	0.19
Youth Supervision Post-Custody	0.65	1.30	0.70	0.00	0.63	0.00
Adult Community Supervision	0.76	2.04	0.65	0.60	0.56	0.65
Adult Custody	0.75	2.04	1.56	0.31	1.27	0.10
Adult Supervision Post-Custody	0.75	2.04	1.56	0.31	1.27	0.00

Change in the Length of Stay for Each Subsequent Sentence

In Washington State, the sentence for a crime is based on the seriousness of the offence and the offender's criminal history. The Washington State Sentencing Guidelines Commission publishes a grid showing the sentence by seriousness and the number of previous convictions.[42] In all, the sentence length (in years) for a given crime increases as criminal history increases. The model accounts for these lengthening sentences, which enables us to estimate the effect of increasing trips through the criminal justice system on sentence length. In the translated version of the model we set the value of change in the length of stay for each subsequent sentence for both adults and juveniles to zero, as there is no evidence to support a systematic increase in subsequent sentence lengths in England and Wales. Sentence length is up to the judges' discretion.

Age when a Juvenile is First Tried in Adult Courts

The age at which a youth is considered an adult varies for specific types of crimes in Washington State. The model is designed to take that into account. In England and Wales, under no circumstances would a juvenile (that is, someone under the age of 18 years) be sent to an adult prison; although they may be tried in Crown Court, they would not be allocated any adult criminal justice resources. Thus, the age when a juvenile is first tried as an adult is set to 18 years in the translated version of the model since this is when young people start to use adult resources for sentences.

[42] Sentencing manuals available at http://www.cfc.wa.gov/SentencingPublication.htm

8.4. Crime and Victimisation Rates

Number of Recorded Crimes

These figures come from the Home Office Statistical Bulletin 2010/11 July 2011, Table 2.04 (see Table 8.4 below).[43]

Table 8.4. Total Recorded Crimes

Victimisation	Total Violence Against the Person Offences	Sexual Offenses	Robbery	Burglary	Theft	Total Offenses Against Vehicles
Number of Recorded Crimes	821,957	54,982	76,179	522,640	1,078,727	449,681

Percentage of Actual Crime Recorded

These figures were calculated by dividing the Home Office Statistical Bulletin 10/11 (Table 2.04) data on recorded crime by the British Crime Survey figures for the same crimes (Table 2.01 extended).[44] For sexual offences, as the British Crime Survey did not include these, the percentage in Washington State was used (see Table 8.5).[45]

Table 8.5. Percentage of Actual Crime Recorded

	Violence Against the Person	Sexual Offences	Robbery	Burglary	Theft	Offenses Against Vehicles/Vehicle-related theft
Per Cent of Actual Crime Recorded	0.37	0.31	0.31	0.70	0.33	0.38

Total Number of Convictions

This is the total number of court events resulting in a conviction (see Table 8.6 below). These figures are obtained from the Ministry of Justice Sentencing Tables 2010, Table A5.5.[46] The estimate for property crimes includes data on burglary as well as theft and handling stolen goods. It has to be acknowledged that the Ministry of Justice estimates reflect the number of offenders convicted at court rather than convictions. The offender will appear as convicted only of the most serious offence he/she committed at the crime event. However, no other sources were identified for convictions and therefore the figures used in the model are likely to underestimate the total number of convictions.

[43] Chaplin, R., Flatley, J., & Smith, K. (Eds.) (2011). *Crime in England and Wales 2010/11. Findings from the British Crime Survey and police recorded crime* (2nd Edition). Home Office Statistical Bulletin 10/11. London: Home Office. Available at http://www.homeoffice.gov.uk/publications/science-research-statistics/research-statistics/crime-research/hosb1011/hosb1011?view=Binary

[44] *Ibid*.

[45] Lee et al., *op.cit.*, p. 52.

[46] Ministry of Justice, Criminal Justice Statistics, *op.cit.*

Total Number of Counts

The WSIPP cost-benefit model takes into account the total number of counts.[47] There may be more counts than convictions if offenders are convicted of more than one crime at one court event. For these figures, WSIPP data were used to come up with the ratio of counts to convictions and then the same ratio of counts to convictions was applied to England and Wales conviction rates (see Table 8.6).[48]

Percentage of Other Crimes per Conviction

This is a way to estimate how many actual crimes were committed by the convicted offenders. A value of one indicates that all unrecorded crimes were committed by the convicted offenders and a value of zero indicates that none of them were. The model currently uses the estimates that WSIPP uses, as these are relatively conservative (see Table 8.6).[49] A multiplicative factor is applied to adjust for the likely possibility that there are multiple victimisations per conviction. Another resource that was considered was Table 1 in a paper by Cohen and Piquero published in 2009.[50] However, these data are largely based on US sources.

Table 8.6. Conviction Data

	Violence Against the Person	Sexual Offences	Robbery	Property Offences	Drug Offences
Total Number of Convictions, Adult and Juvenile	44,458	5,772	8,514	144,829	50,385
Total Number of Counts, Adult and Juvenile	59,048	10,118	13,607	135,384	Not required for model
Per Cent of Other Crimes per Conviction	0.2	0.2	0.2	0.2	Not required for model

Total Number of Arrests

Arrest data is obtained from the Home Office Statistical Bulletin Police Powers and Procedures England and Wales 2009/10, Table 1B (see Table 8.7 below).[51] The estimate for property crimes includes data on burglary as well as theft and handling stolen goods. It has to be acknowledged that the estimates available from the Home Office reflect the number of persons arrested rather than arrests. Thus, the figures in Table 8.7 are likely to underestimate the total number of arrests.

Table 8.7. Arrest Data

	Violence Against The person	Sexual Offences	Robbery	Property Offences	Drug Offences
Total Number of Arrests, Adult and Juvenile	456,916	36,885	32,698	387,486	121,010

[47] A count is a statement of a different alleged crime; each separate charge in a criminal action.
[48] Lee et al., *op.cit.*, p. 52.
[49] *Ibid.,* p.52.
[50] Cohen, M. A., & Piquero, A. R. (2009). New evidence on the monetary value of saving a high risk youth. *Journal of Quantitative Criminology*, 25, *1*, 25-49.
[51] Povey, D. (Ed)., *op.cit.*

8.5. Populations

This section looks at reoffending rates and the timing of offences for the populations that will be receiving the interventions. This criminological information (base rates) for different populations is used to estimate the long-term impacts of evidence-based programmes and approaches on crime. Specifically, the effect sizes indicating intervention impact are applied to these base rates to compute the change in monetisable units.

The translated model only includes three populations: the general population, a low-income (high risk) population, and young offenders. The model currently uses WSIPP data for two of the populations that have been reanalysed to match England and Wales crime categories (e.g. murder and aggravated assault were combined to create a category of Violence Against the Person). The low-income population data were calculated using a regression coefficient for the effect of poverty on crime to adjust the base conviction rate in the general population over the life-course (see Table 8.8).[52]

Crime Probability

For the recidivating young offenders, the data refer to a cohort of 83,000 young offenders who committed their first proven offence in 2000, in England and Wales. The offending behaviour of this cohort was examined for the period 2000 to 2009.[53]

For the non-offender populations, the probability of obtaining a conviction over the life course (35 years) was calculated from a 1974 birth cohort in Washington State (N=78,517).[54] The WSIPP model is designed to use the probability of being convicted for a certain type of crime using a ranked order of seriousness. The mutually exclusive categories from most serious to least serious in the WSIPP model include: murder, sex, robbery, assault, property, drug, and misdemeanour. In order to match the England and Wales data with the model requirements, the probability of being convicted for the most serious type of crime in the follow-up period was calculated, using a rank order of seriousness (from most to least serious: violence against the person, sexual offences, robbery, property offences, drug offences, and summary offences). We acknowledge the limitations of such rank order of seriousness in the context of crime data for England and Wales. For example, violence against the person category may include crimes that could be considered less serious than sexual offences.

Primary Proven Offences

Primary proven offence is the most serious offence committed in one criminal event and the focus of the judicial process. The estimate used in the model is the average number of primary proven offences per offender during the follow-up period, organised by the most serious offence committed in that period. This estimate aims to capture the average number of "trips" through the criminal justice system.

[52] Data provided by WSIPP.
[53] NAO technical paper, *op.cit*.
[54] Data provided by WSIPP.

Volume of Offences

Offenders may have multiple offence convictions for each "trip" through the system. In order to capture this, the model uses the average number of total offences per conviction, including both primary and secondary offences. For the general population, UK cohort studies were considered to get offending rates, but the necessary data are not available from any studies that were identified in searches, usually because the offending rates were based on self-report and were not presented by type of crime.

Timing

For those persons convicted, a probability density distribution for each of the offender and non-offender populations was computed which indicates when convictions are likely to happen over the follow-up period. For density distribution parameters see Table 8.9.

Table 8.8. Criminological Information for Different Populations

	Violence Against the Person	Sexual Offences	Robbery	Property Offences	Drug Offences	Summary Offences (Excluding Motoring)
Young Offenders						
Crime Probability	0.35	0.11	0.03	0.32	0.12	0.18
Average Number of Proven Offences	8.42	6.14	8.29	5.49	3.01	1.98
Average Volume of Offences	1.79	1.72	1.80	1.68	1.40	1.23
General Population						
Crime Probability	0.07	0.02	0.02	0.15	0.05	0.69
Average Number of Proven Offences	1.37	1.13	1.60	2.42	2.80	2.25
Average Volume of Offences	1.22	1.34	1.19	1.33	1.22	1.15
Low-Income Population						
Crime Probability	0.07	0.02	0.02	0.18	0.05	0.66
Average Number of Proven Offences	1.37	1.13	1.60	2.42	2.80	2.25
Average Volume of Offences	1.22	1.34	1.19	1.33	1.22	1.15

Table 8.9. Density Distribution Parameters for Different Populations

	Young Offenders	General Population	Low Income Population
Distribution Type	2	6	6
Parameter 1	0.13	10.64	10.64

Parameter 2	-0.04	15.46	15.46
Parameter 3	0	38.42	38.42
Parameter 4	0	0	0

9. Valuation of Outcomes that Affect Labour Market Earnings

There are several outcomes in the cost-benefit model that are partially monetised with labour market earnings. In the current version of the translated cost-benefit model, the outcomes that are, in part, monetised with labour market earnings are: high school graduation (which is equated with the attainment of A-levels in the translated model); standardised student test scores; and number of years of completed education.

9.1. Earnings Data

The model makes use of average personal income from earnings by age of each person and by educational status based on the highest level completed.

Earnings data were derived from the Labour Force Survey (LFS, year 2010, Quarter 1-4, wave 1). We calculated average earnings per person by single year of age in England and Wales (see Table 9.1). Earnings were estimated for the following educational status groupings:

- the total population – the Labour Force Survey sample including 18-65 year olds in England and Wales
- those who did not report attaining A-level but had other qualifications (e.g., GSCEs, NVQ level 1 and 2) and no qualifications
- those who reported attaining A-level and other equivalent qualifications;
- those who reported having higher education but had not completed an undergraduate degree
- those who reported attaining an undergraduate degree or higher qualifications (e.g., masters degree, doctorate).

Before creating these educational status groupings we tested whether the attainment of A-level qualifications best compares to the attainment of high school diploma in the US. Using for example the attainment of 5 GSCEs as a cut-off point did not suit the model's requirements, since people with 5+ GCSEs earn less on average than those who have fewer than 5 GCSEs.

The groupings were created using variable 'Highqual8' in the LFS dataset. Survey respondents who were missing qualifications were filtered out of the analysis as well as people who were under 16 years of age.

As for earnings, the earnings from both the main and second job were included into the annual gross salary. Survey respondents who were inactive (according to the

International Labour Organization definitions[55]) were filtered out of the analysis. The average earnings reported are for all people (i.e., employed and unemployed) at each age, not just for those with earnings (Table 9.1). Thus, these data take into account both earnings of the earners and the rate of labour force participation.

Table 9.1. Annual Earnings by Age (18-65) of Persons in the Labour Force Survey (2010 data)

Age of Person	Total Population	Less than A-level	A-level and equivalent	Higher education	Undergraduate degree or higher
18	£6,526	£4,236	£4,336	£7,267	£8,112
19	£9,250	£6,429	£7,244	£6,814	£6,656
20	£10,469	£6,388	£8,975	£6,096	£9,018
21	£11,581	£7,864	£9,698	£10,298	£8,870
22	£13,785	£9,089	£11,946	£17,106	£9,922
23	£15,243	£10,544	£12,850	£15,055	£14,635
24	£17,150	£10,272	£15,723	£14,170	£17,487
25	£17,950	£11,024	£14,798	£14,031	£21,472
26	£19,116	£12,294	£16,240	£18,136	£21,795
27	£20,203	£13,629	£17,444	£19,838	£23,663
28	£21,623	£14,114	£17,541	£18,346	£24,999
29	£22,380	£14,670	£18,769	£18,413	£27,972
30	£22,887	£15,038	£18,058	£19,405	£28,258
31	£26,544	£21,256	£21,366	£21,718	£29,216
32	£25,120	£14,380	£19,813	£21,826	£30,874
33	£24,801	£14,910	£20,608	£23,248	£31,939
34	£26,476	£14,761	£21,020	£21,545	£34,912
35	£27,285	£15,834	£20,794	£23,548	£36,134
36	£28,561	£17,132	£21,927	£25,903	£37,112
37	£27,431	£16,756	£22,146	£25,500	£36,017
38	£26,609	£14,868	£20,627	£26,769	£37,915
39	£26,965	£16,074	£23,341	£26,577	£38,662
40	£26,335	£17,037	£22,197	£28,119	£35,967
41	£26,781	£17,902	£23,725	£28,320	£38,243
42	£27,283	£16,912	£25,955	£24,410	£38,806
43	£29,402	£19,011	£22,938	£30,327	£48,005
44	£27,135	£16,826	£23,319	£28,289	£38,580
45	£27,342	£17,808	£22,857	£25,789	£40,684
46	£27,792	£18,366	£22,769	£28,393	£39,486
47	£26,843	£18,444	£22,144	£24,987	£39,769
48	£27,305	£18,667	£23,764	£25,119	£38,922
49	£26,976	£16,626	£22,911	£28,055	£41,345
50	£29,046	£16,402	£22,195	£44,083	£39,125
51	£27,425	£16,929	£21,098	£26,915	£43,090
52	£25,583	£16,392	£21,624	£25,380	£39,417
53	£25,986	£15,064	£21,393	£31,067	£36,183
54	£25,460	£16,195	£25,642	£27,258	£39,808
55	£26,041	£15,581	£26,524	£23,097	£39,501
56	£24,318	£14,806	£20,970	£24,172	£41,892
57	£22,941	£14,843	£19,400	£25,784	£34,148
58	£25,025	£16,997	£22,890	£27,445	£37,153
59	£22,056	£15,681	£20,449	£23,964	£32,773
60	£22,458	£14,313	£21,265	£27,256	£33,450

[55] International Labour Organization - employment definitions available at http://www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/employment-and-unemployment/lang--en/index.htm

Age of Person	Total Population	Less than A-level	A-level and equivalent	Higher education	Undergraduate degree or higher
61	£20,522	£15,644	£17,979	£23,367	£28,957
62	£19,598	£15,358	£20,173	£20,169	£27,196
63	£18,881	£13,999	£16,387	£16,317	£27,723
64	£20,995	£14,416	£20,895	£22,874	£38,902
65	£12,722	£10,993	£15,239	£14,931	£9,084

From these five annual earnings streams probability density distributions were fitted using Palisade Corporation's *@Risk* software to select the probability distribution with the lowest root mean square error. For all five series we found the best probability distribution to be a beta distribution. The four beta distribution parameters (Alpha, Beta, Lower Bound, Upper Bound) are shown in Table 9.2. These beta distributions are used to allocate the sum of all cross-sectional total earnings reported for all ages for the particular education cohort. See Technical Appendix of the WSIPP report for further details.[56]

Table 9.2. Beta Distribution Parameters

Beta Distribution Parameters	Total Population	Less than A-Level	A-Level and Equivalent	Higher Education	Undergraduate Degree or Higher
Alpha	1.5145	1.4049	1.4303	1.4303	1.6747
Beta	1.3871	1.249	1.2415	1.2415	1.3117
Lower Bound	17.454	17.706	17.785	17.785	17.479
Upper Bound	66.615	66.279	66.173	66.173	65.092

9.2. Parameters Related to Earnings Data

Growth Rates in Earnings

Considering that the LFS earnings data are cross-sectional and the cost-benefit analysis reflects life-cycle earnings, it is important to estimate the long-run real rate of escalation in earnings for each of the five groups.

A search of the literature indicates that the average annual growth rate in real earnings for the UK between 1979 and 2009 was just over 2 per cent. For example, the Institute for Fiscal Studies produced a report called 'Poverty and Inequality in the UK: 2011'.[57] Section 2.2 states that between 1979 and 1996, the annual growth rate in real earnings was 2.1 per cent at the mean. Between, 1997 and 2010 this decreased slightly to 1.9 per cent as a consequence of the economic crisis, which has produced higher inflation, rising unemployment and slower growth in incomes on average.

[56] Lee et al., *op.cit.,* pp. 22-23.

[57] Jin, W., Joyce, R., Phillips, D. & Sibiteta, L. (2011). *Poverty and Inequality in the UK: 2011*. Institute for Fiscal Studies. ICF Commentary C118. Available at http://www.ifs.org.uk/comms/comm118.pdf

A report published by the Department for Trade and Industry in 2006 indicates that between 1995 and 2005 private sector real earnings grew at an annual average of 2.75 per cent, while public sector real earnings grew at an annual average of about 2.35 per cent (see Section 2 and Figure 2 of the document).[58]

Furthermore, the Office for National Statistics produced a report on Labour Market Statistics for February 2012.[59] In the 'Earnings' section, the mean of the 'earnings annual growth rate for total pay including bonuses' was calculated as 2 per cent in December 2011. This indicates that the 2 per cent estimate is still current and fits a longer-term trend for the UK's average annual growth rate in real earnings.

Average annual growth rate in real earnings averaged just above 2 per cent for much of the last 30 years, but this has decreased recently due to the economic recession. In light of this, and to use conservative rather than optimistic estimates, the translated cost-benefit model uses a 2 per cent rate for the average annual growth rate in real earnings. The same parameter was set for earnings for all groups because the review of the research does not provide separate estimates for each of the educational status groupings in the model.

Employee Benefits

The LFS data are for earnings and do not include employee benefits associated with earnings. In order to measure these additions to earnings, we include an estimate of the ratio of total employee compensation to wage and salaries. This estimate was computed using data from Table J1 in a statistical bulletin Quarterly National Accounts, Q3 2011 published by the Office of National Statistics.[60] Specifically, data for the year 2010 were used to calculate the ratio of benefits to wages and salaries by dividing the sum of wages and salaries and employers' social contributions by wages and salaries only. This resulted in an estimate of 1.21, which means that employers' social contributions form 21 per cent of employee benefits and earnings.

Total wages and salaries include categories such as "Total PAYE income", "Statutory Sickness & Maternity Pay", "Pay Below Tax Threshold" (very low earnings), "Profit Related Pay" (bonuses, stocks and shares payments), "Payroll Giving Scheme" (charity contributions) and "Employees' Contributions to Superannuation Funds" (pension schemes). In terms of social contributions, the "Employers' Contributions to Social Security" covers the National Insurance Scheme, the National Health Service, and the Redundancy Fund.[61]

In order to estimate the annual rate of growth in the benefit ratio of total employee compensation to wage and salaries over the long term, first, the annual ratios for

---

[58] Fitzner, G. (2006). *How have employees fared? Recent UK trends*. Employment Relations Research Series No 56 Department of Trade and Industry. Employment Market Analysis and Research. Available at http://www.bis.gov.uk/files/file27472.pdf

[59] Office for National Statistics. (2012). *Labour market statistics: February 2012*. Statistical Bulletin. Available at http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/february-2012/index.html

[60] Available at http://www.ons.gov.uk/ons/rel/naa2/quarterly-national-accounts/q3-2011/index.html

[61] Office for National Statistics. (2000). *Gross National Income Inventory of Methods, UK Gross National Income (ESA95) Inventory*. Available at http://www.ons.gov.uk/ons/rel/naa1-rd/gross-national-income-inventory-of-methods/uk-gross-national-income--esa95--inventory/index.html

1997 to 2010 were computed using data from the statistical bulletin series Quarterly National Accounts published by the Office of National Statistics. These estimates were then plotted and a curve (linear trend line) was fitted to these data. The resulting equation was used to compute a forecast of the annual rate growth in the benefit ratio over the 40-year interval. The annual ratio of benefits to wages and salaries (1.21) and the average projected growth rate (0.004) were entered into the model.

The earnings series is then used in the cost-benefit model to estimate labour market-related benefits of a number of outcomes.[62]

10. Model Inputs for Education Outcomes

Evaluations of education interventions often assess outcomes such as student test scores, years of education, graduation rates, special education, or grade retention (i.e., child kept back a year or repeating a year). The cost-benefit model developed by the WSIPP includes a number of education-related parameters to estimate the benefits of these education outcomes (see Table 10.1 below). The same parameters were entered for all students and for low-income students due to difficulties in identifying separate estimates for low-income populations.

10.1. Education Parameters

The Relationship between Gains in Student Test Scores and Labour Market Earnings

Many intervention programmes measure gains in student standardised test scores as outcomes. To evaluate these outcomes, the model contains a parameter and standard error to measure how a one standard deviation gain in test scores relates to a percentage increase in labour market earnings. The standard error for this input is used in Monte Carlo simulations.[63] A decision was made to use the parameter that WSIPP found in their review of the research on this topic.[64]

The Relationship Between Gains in Years of Education Completed and Labour Market Earnings

To evaluate outcomes that measure gains in educational attainment, the model contains a parameter and standard error to measure how an extra year of education relates to a percentage increase in labour market earnings. WSIPP reviewed a number of studies on the topic and estimated this figure by taking the median of the estimates in these studies.[65] Even though the WSIPP review includes estimates relevant for the UK [66], a wider body of literature was reviewed to obtain an estimate

---

[62] Lee et al., *op.cit.*, p. 25.
[63] *Ibid.,* pp. 126-127.
[64] *Ibid.,* p. 83.
[65] *Ibid.*
[66] Harmon, C., & Walker, I. (1995). Estimates of the economic return to schooling for the United Kingdom. *The American Economic Review*, *85* (5), 1278-1286.

specific to the UK. In a review of research, a median of nearly a 10 per cent increase in labour market earnings per additional year of education completed was found (with a standard error of 0.03).[67]

The Standard Deviation in the Number of Completed Years of Education

Some intervention programmes measure gains in years of education as outcomes.[68] To evaluate these outcomes, the model contains a standard deviation to measure how a one standard deviation in years of education relates to a percentage increase in labour market earnings. Data from the International Social Survey Programme 1985–1995 were used to calculate the standard deviation in the number of years of education attained (1.46 years) by employed individuals aged 21–59 in the year of interview.[69]

The Rate of Pupils with A-levels

The WSIPP cost-benefit model contains a user-supplied parameter of the high school graduation rate. In the translated model, the high school graduation was equated with the attainment of A-levels (and equivalent qualifications). Both high school graduation and attainment of A-levels require a similar number of years of study and are required qualifications to enter undergraduate study. An estimate of 54.2 per cent was used in the model based on the provisional data on Level 2 and 3 attainment by young people in England by age 19 published by the Department for Education.[70]

The Relationship Between A-levels and Labour Market Earnings

In the WSIPP model, there is a parameter to reflect the degree of causation between the observed earning differentials for high school graduates and non-graduates. The WSIPP's entries for the maximum, mode, and minimum values are set to one which indicates that all of the difference in observed earnings is due to the possession of a high school diploma. This parameter is modelled as a triangular probability density distribution.[71] WSIPP's estimates are based on the work of Rouse[72] and Heckman et

---

[67] The figure was estimated by taking the median of the estimates in Bonjour, D., Cherkas, L., & Haskel, J. (2002). *Returns to education: Evidence from UK twins*. Discussion paper 3354. Queen Mary, University of London, Department of Economics. Centre for Economic Policy Research; Dearden, L. (1998). *Ability, families, education and earnings in Britain*. Working Paper 98/14. London: Institute for Fiscal Studies; Harmon, C., & Walker, I. (1995). Estimates of the economic return to schooling for the United Kingdom. *The American Economic Review*, *85* (5), 1278-1286; Harmon, C.P. & Walker, I., (1997). *Selective schooling, school quality, and labour market returns*. Keele Department of Economics Discussion Papers (1995-2001) 97/06, Department of Economics, Keele University; Harmon, C. & I. Walker, I. (1999). The marginal and average return to schooling. *European Economic Review, 43* (4-6), 879-887; Harmon, C. & Walker, I. (2000). Returns to the quantity and quality of education: Evidence for men in England and Wales. *Economica, 67*(265), 19-35; Harmon, C., Oosterbeek, H., & Walker, I. (2003). The returns to education: Microeconomics. *Journal of Economic Surveys, 17*, 2, 115-156.

[68] There are currently no programmes in the model that measure years of education.

[69] Trostel , P., Walker, I., & Woolley, P. (2002). Estimates of the economic return to schooling for 28 countries. *Labour Economics*, *9*, 1-16.

[70] Department for Education. (2011). *Level 2 and 3 attainment by young people in England measured using matched administrative data: Attainment by age 19 in 2010 (provisional)*. Statistical First Release 04/2011. Available at http://www.education.gov.uk/rsgateway/DB/SFR/s000995/index.shtml

[71] See also Lee et al., *op.cit.,* p. 126-127.

[72] Rouse, C. E. (2007). *Consequences for the labor market*. In C. Belfield & H. M. Levin, (Eds.), The price we pay: Economic and social consequences of inadequate education (pp. 99-124). Washington, DC: Brookings Institution Press.

al[73]. The same value was used in the translated model implying that there is a strong causal relationship between any observed differences in earnings that is due to the attainment of A-levels.

10.2. Education Resource Use

The model can also calculate the value of two other educational outcomes: years of special education and grade retention. The inputs entered into the model include the cost of a year of special education, the year in which the special education costs per year are denominated, and the estimated average number of years that special education is used, conditional on entering special education. Also, the age when special education provision is assumed to be first provided is entered. In addition, the model requires an estimate of the marginal cost of a year one year of education and the year in which these dollars are denominated.

Repetition of a school year

The value for a proportion of pupils in state-funded schools who have been kept back or repeated at least one school year during the period up to Year 11 was set to 0.0001 since repeating a grade is not a common practice in the education system in England and Wales.[74] The average number of years repeated for those retained was set to 1.

Special Education

The model contains a parameter of the percentage of students with special educational needs (SEN). The estimate used in the model is 20.4 per cent (including both pupils with and without statement in state-funded schools).[75] The average number of years of special education for SEN pupils was set to 10 considering that the majority of children are identified as having special education needs when they start school and receive relevant support throughout their school years.[76] The average age when children are first identified with SEN was set to 5 as the statistics tend to show that a large proportion of pupils start using SEN provision in year 1 when they are 5 years old.[77]

Cost of a regular school year and SEN provision

The cost of one year of regular education was estimated to be £5,187 (2010 pounds). An overall cost per pupil was calculated (all pupils) using the cost estimates from

[73] Heckman, J., Lochner, P., & Todd, P. (2008). Earnings functions and rates of return. *Journal of Human Capital, 2,* 1, 1-31.

[74] Eurydice (2011). *Grade retention during compulsory education in Europe: Regulations and statistics*. European Commission: Education, Audiovisual and Culture Executive Agency (EACEA P9 Eurydice). Available at http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/126EN.pdf

[75] Department for Education. (2011).Special Educational Needs Information Act: An analysis 2011. (See Table 1.1.) Available at http://www.education.gov.uk/rsgateway/DB/STR/d001032/index.shtml

[76] Local authority data were used to make this assumption, e.g., Analysis of Statutory Assessment, and School Census data relating to Special Educational Needs provided by Greater Manchester.

[77] Birmingham data on the count of pupils with SEN provision by year group was examined which indicated that a large proportion of pupils start using SEN provision in year 1 when children are 5 years of age.

"Benchmarking tables of LA planned expenditure: 2011-12" (per capita gross table) using average mean figures for all England local authorities.[78]

The cost of one year of education for a student with SEN provision was estimated to be £6,575 (2010 pounds). Again, this cost was estimated based on data from the benchmarking tables of LA planned expenditure. The per capita cost figures were assessed to establish which of the cost elements relate to SEN. As these are costs averaged across all pupils (including those without SEN), the costs were reapportioned to those pupils with SEN (statemented and non-statemented pupils). These costs were then divided by the number of SEN identifiers to establish the cost of SEN provision (£1,388). The net cost of one year of education per pupil with SEN provision was computed by adding the cost of a year of regular education (see above) and SEN provision (£6,575).

It has to be acknowledged that these estimates are total costs, not marginal costs. Some elements of the cost breakdown are not directly proportional to the number of SEN pupils (e.g., central administration, assessment and information functions). Furthermore, this is an average cost estimate. The exact costs for an individual pupil will depend on the type of SEN (e.g., learning disability, behavioural difficulty, physical disability). So any costs saved by a specific intervention that only targets one of the areas could be much higher or much lower than the given estimate.

For any programme or approach under consideration that measures (a) high school graduation, (b) gains in student standardised test scores, or (c) increases in the number of years of education achieved either directly or indirectly via a "linked" outcome, the LFS earnings data and other parameters are used to estimate the expected gain in life cycle labour market earnings. The model can also calculate the value of years of special education and grade repetition. For further details on the valuation of earnings from high school graduation, test scores and number of years of education as well as valuation of changes in the use of special education and grade retention see the technical appendix of the WSIPP report published in April 2012.[79]

[78] Available at http://www.education.gov.uk/childrenandyoungpeople/strategy/financeandfunding/section251/a00197971/benchmarking-2011-12

[79] Lee et al., *op.cit.*, pp. 84-87.

Table 10.1. Model Inputs for Education Outcomes

Education Parameters	All Pupils	Low Income Pupils
Gain in lifetime earnings from a 1SD increase in test scores (Mean)	0.118	0.118
Gain in lifetime earnings from a 1SD increase in test scores (Standard error)	0.03	0.03
Gain in lifetime earnings from one extra year of education (Mean)	0.099	0.099
Gain in lifetime earnings from one extra year of education (Standard error)	0.032	0.032
Standard Deviation for number of completed years of education	1.475	1.475
Percentage of pupils who have achieved A-levels	0.747	0.747
Causal link between graduating from high school and lifetime earning gains (Max)	1	1
Causal link between graduating from high school and lifetime earning gains (Mode)	1	1
Causal link between graduating from high school and lifetime earning gains (Min)	1	1
Percentage of pupils in state-funded schools who have repeated at least one school year during the period up to year 11	0.0001	0.0001
Average number of years repeated, for those retained	1	1
Percentage of pupils in state-funded schools with special educational needs (SEN)	0.204	0.204
Average number of years of special education for those who receive special education	10	10
Average age when children are first identified with SEN	5	5
Cost of one year of special education per pupil in state-funded schools	6575	6575
Year of pounds for cost of special education services	2010	2010
Cost of one year of regular education per pupil in state-funded schools	5187	5187
Year of pounds for cost of regular education	2010	2010

Note. [a] Graduation from high school was equated to attaining A-levels in our analysis.

11. Other Parameters

In addition to the parameters discussed in the previous sections, the model uses a number of additional inputs to compute benefits and costs.

11.1. Base Year for Monetary Denomination

The model contains many price and monetary values that are each denominated in a particular year's monetary values. In order to express all monetary values in a common year, a base year is selected. When the model runs, all monetary values entered into the model are converted to the base year values with the price index (see below) chosen by the user. The base year is set to 2010.

11.2. Discount rates

The model uses a range of real discount rates to compute net present values. The discount rates are applied to all annual benefit and cost cash flows and economic impacts arising in future years are converted to present values. The model uses low (2 per cent), modal (3.5 per cent), and high (5 per cent) discount rates in computation. These discount rates are the same as the ones WSIPP applies and

reflect the rates recommended by Moore and his colleagues.[80] The model discount rate gets used when the model is run in non-simulation mode. However, in Monte Carlo simulation, each run randomly draws a discount rate from a triangular probability density distribution with the low, modal, and high discount rates defining the triangle. For further details on discount rates see the WSIPP 2012 report.[81]

11.3. GDP Deflator

As indicated above, many of the monetary values in the model are denominated in different years' monetary units that the model converts to the base year, set to be 2010 in this version of the model. A GDP deflator that is produced by the Treasury from data provided by the Office for National Statistics (ONS) is used in the model.[82]

11.4. Tax Rates

The cost-benefit model uses average tax rates for several calculations. The household total effective tax rate of 32.9 per cent, provided by ONS, is used in the model to capture how much tax an individual pays, as a proportion of total income.[83]

12. Limitations

There are a number of limitations to the model translation that need to be acknowledged, the key ones have been described below.

It has not always been possible to locate the data for England and Wales that the model requires. In some cases, local authority data were used which may not be representative for other parts of England and Wales For example, for the crime model, it was not possible to locate information on the duration of youth community sentences. The years of resource use estimates for adults that were provided by the Greater Manchester Probation Trust were therefore applied to youth as well. Furthermore, the estimates provided by the Trust may not be representative estimates for England and Wales. The crime part of the model translation is also limited by the way that the available data are categorised, so some estimates are based on averages that may include quite a large amount of variation (e.g. violence against the person is a large category of crime that includes murder, assault and minor violent offences).

In other cases, Washington State data were used, although this was only in rare cases. For example, it was not possible to locate suitable data for the baseline rates of crime for the general population and a low-income population over the lifetime

[80] Moore, M. A., Boardman, A. E., Vining, A. R., Weimer, D. L., & Greenberg, D. H. (2004). "Just Give Me a Number!" Practical Values for the Social Discount Rate. *Journal of Policy Analysis and Management, 23* (4), 789-812.
[81] Lee et al., *op.cit.,* p. 101.
[82] Available at http://www.hm-treasury.gov.uk/data_gdp_fig.htm
[83] Office for National Statistics. (2011). *The effects of taxes and benefits on household income, 2009/2010.* Statistical Bulletin. Available at http://www.ons.gov.uk/ons/rel/household-income/the-effects-of-taxes-and-benefits-on-household-income/2009-2010/index.html

for specific crimes. It was therefore necessary to use WSIPP figures for these, adjusting for the types of crimes that were used in the translated model. Furthermore, some of the educational interventions are specifically designed for low-income populations who tend to have different base rates for certain outcomes such as high school graduation and special education. In the translated version of the model, the same parameters were entered for both 'all students' and 'low-income students' due to difficulties in identifying separate estimates for low-income populations.

There are limitations to the unit costs used in the model. For example, the unit cost of an arrest was calculated in reference to the number of persons arrested rather than the number of arrests. This is likely to result in the overestimation of the average cost per arrest. As indicated above, a large proportion of unit costs were extracted from, and estimated based on, the technical paper on the cost of a cohort of young offenders to the criminal justice system by the National Audit Office.[84] These unit costs come with limitations that affect the cost estimates. For further details on the cost estimates and assumptions made around the unit costs see Appendix One of the NAO report.[85] Furthermore, for education part of the model, it was not possible to identify marginal cost for both one year of regular education and special education, so total costs were used instead. This means that any costs saved by a specific intervention that targets one of these outcomes could be much higher or lower than the given estimate.

There are likely to be other system costs or benefits that could be monetised in each policy area that are not taken into account (e.g., additional services that are provided to offenders, indirect social benefits of crime prevention such as increased property values in areas with reduced crime rates). However, this will yield more conservative estimates as it means that the benefits are underestimates of the true benefits of each programme or approach.

Capital costs are not included in system costs at this stage. For example, a substantial decrease in crime could potentially lead to the closure of prison wings or entire prisons. However, it was assumed that the programmes and approaches that were reviewed would not be disseminated on a large enough scale to affect capital costs.

Many of the interventions measure high school graduation as one of the outcomes that is valuated in the WSIPP cost-benefit model by estimating the expected gain in life cycle labour market earnings. In the translated model, the high school graduation was equated with the attainment of A-levels and equivalent qualifications. Even though these educational levels are similar considering that both are an entry requirement to enter undergraduate study, we were not able to identify a body of research to support the fact that these interventions increase the attainment of A-levels in England to the same degree that they increase the high school graduation

[84] NAO technical paper, *op.cit.*

[85] *Ibid.*

rate in the US. A similar limitation applies to the assumption made about the degree of causation between the observed earning differentials for people who attain A-levels and people who do not. Currently, this relationship is modelled using an assumption based on US data that suggests a strong causal relationship between any observed differences in earnings, which is due to the high school graduation.

The costs of the interventions were either (a) provided by the programme/approach developers/commissioners, (b) estimated based on available information on the likely costs of dissemination in England and Wales, or (c) converted from US estimates published by WSIPP into Pounds Sterling. When commissioned in specific areas, the actual costs are likely to vary from these estimates depending on local conditions. This is likely to be particularly true for the start-up costs of setting up a new intervention as more training and capital costs may be needed at the outset.

In order to improve the accuracy of our cost-benefit estimates, we will continue to improve both intervention unit cost estimates and data inputs relevant for estimating monetary benefits that are described in this report.

Investing in Children has been funded by Birmingham City Council and the Association of Greater Manchester Authorities, and by the Youth Justice Board. Pro Bono Economics, an independent charity that matches volunteer economics with charities wishing to address questions around measurements, results and impact, has provided invaluable support.

The analyses and views presented are those of *Investing in Children*, not the funding organisations. Further funds are sought to continue the supply of free and independent investment advice for children's services.

Social Research Unit, Lower Hood Barn, Dartington, Totnes, TQ9 6AB **T** (0)1803 762 400 unit@dartington.org.uk, www.dartington.org.uk