Economic Analysis: A Brief Guide for Crime Prevention Practitioners

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A. An introduction to economic analysis

Resources are always limited and decisions have to be made as to how to allocate them. In the context of crime prevention, economic analysis is about how limited resources have been used and might be better used to yield improved social outcomes.

Economists have devised a range of techniques to assess the returns on resource usage in the private, public and voluntary sector. An extended document laying out the foundations of economic analysis and some forms it can take is available from Manning et al. (2015). Expert advice will be needed for all but the most basic analysis, and so the aim of this brief paper is to make you an intelligent consumer of such work, to alert you to the basic ideas, and to describe some options for the forms economic analysis can take and the uses to which it can be put.

The key question is always that of determining how and where more might be got for the same or less investment. All uses of resources involve 'opportunity costs'. Opportunity costs comprise those uses to which resources could otherwise be put. Resources could be put to cars, buildings, staff or technology. Buildings might be used for one purpose or another. Volunteer time on a project could be put to earning a salary, to leisure or to some other voluntary activity. Police resources could be spent on patrol, efforts at detection, fostering neighbourhood watch or efforts to catch people speeding or some combination of these. And so on. Economic analysis is about helping you to make informed, evidence-based choices that will yield the best return.

What goes into estimating both the costs and benefits of a given activity is crucial to economic analysis, and putting numbers to costs and benefits can be challenging. Analysing the significance of findings and working out their implications, especially when there are winners and losers, is tricky conceptually and practically. This work requires the use of models that will be unfamiliar to the layperson. There are many traps for the unwary, which is again why advice is needed to make sure that assumptions are valid and techniques sound.

Ideally, the aim is to move towards 'Pareto efficiency,' a condition where no further changes in allocation will yield an advantage to one person that is not offset by making anyone else worse off. This is easier said than done! Indeed, where implemented policies affect diverse populations, Pareto efficiency will often be impossible to achieve in practice. Improvements, however, (Pareto) will be possible to achieve and from an economic perspective, an intervention is said to be "Kaldor-Hicks" efficient if there are *net social benefits*. That is, if benefits are experienced by some sections of society and those benefits exceed any costs experienced by others. It is on this latter criterion that many forms of Economic Analysis (e.g. Cost Benefit Analysis, see below) are based.

Section B briefly outlines the major forms of economic analysis that can be used, and provides some examples. Section C describes a costing tool developed as part of the activities of the What Works Centre for Crime Reduction that is intended to assist in the collection of the costs of existing interventions, and to help estimate those likely for future ones.

B. Forms of economic analysis

There are four main methods of economic analysis (EA): cost-savings; cost-effectiveness; cost-utility and cost-benefit. They all begin with the monetised costs of intervention (the pound sterling cost of activities are estimated), but set these against different types of result, as indicated below.

The following summaries briefly describe each form of economic analysis with a boxed example. Table 1 provides further examples for the interested reader. As a practitioner, you need to know that these different forms of analysis exist, and to decide which form is most practicable and useful for you in your circumstances.

Because the same cost information will be required in all cases, a costing tool (see Section C) has been developed for you.

Cost-Savings Analysis (CSA)

CSA examines whether a programme's or policy's funding is self-sustainable by assessing its costs and potential savings. Box 1 gives an example.

Box 1: Example of CSA

Weatherburn, Froyland, Moffatt, and Corben (2009) use CSA to estimate the potential effect of reducing the rate at which prisoners return to custody. They compare two types of policies. The first aims to reduce the rate at which offenders are re-imprisoned, while the second aims to reduce the number of new Indigenous sentenced prisoners. The authors developed a mathematical model, which assumed that the number of people in the criminal justice system at any given time is the sum of those entering custody for the first time and those returning to the system after a delay. Using data from the Australian Bureau of Statistics 2008, they estimated the average number of incoming prisoners, average time spent in custody by new and returned prisoners, and the length of time between release and return to custody. According to their model, a 10% reduction in the re-imprisonment rate would reduce the prisoner population by an estimated 829 inmates, producing an estimated annual saving of AUD$28 million per year. A comparable reduction in new sentenced prisoner rates, on the other hand, would reduce the prison population by 673 inmates, producing an estimated saving of approximately AUD$23 million per year. Thus, the authors conclude that a reduction in the rate at which prisoners return to custody results in substantial potential savings in prison costs and prison numbers – a saving of around AUD$5 million more than strategies to reduce the sentencing of new offenders.

One drawback of CSA is the difficultly in placing monetary values on some types of benefit, such as quality of life and feelings of safety. It is crucial to be explicit about who exactly gains from any savings identified (e.g. the individual or the criminal justice system). Otherwise, the results may be misinterpreted as estimates of savings to *society* as a whole, even though they may speak only to *organisational* costs and potential savings.

Cost-Effectiveness Analysis (CEA)

CEA assesses the cost of delivering a particular output or impact on crime. For example, the number of "treatments" applied, the number of custodial sentences increased or reduced, or the number of crimes prevented could be estimated and the cost for each gauged. A CEA evaluation is thereby used to identify the costs incurred to produce a given unit of effect such as the reduction of 10 burglaries, the treatment of 10 offenders, or the installation of burglar alarms in 10 homes.

CEA allows interventions to be compared to find out which produces the same effects at lowest cost. CEA is particularly useful for comparing alternatives with a small number of objectives such as reducing one or two types of crime, or delivering a particular form of intervention. However, when objectives are numerous (e.g. reducing 10 different types of crime of varied severity) or when measures of effectiveness are multiple, the interpretation of findings becomes difficult. Therefore, this method is recommended when objectives are focused and measures of effectiveness or outcome are comparable across the alternatives being considered. What is important to note with respect to measures of cost effectiveness is that only quantitative differences in effect costs are estimated (e.g. programme one delivers the same outcome as programme two but at half the cost), not measures of the value of the effect itself (e.g. Manning, 2013). Box 2 gives an example of CEA.

Box 2: Example of Cost Effectiveness Analysis

McCollister, Inciardi, Butzin, Martin, and Hooper (2003) use CEA to examine Delaware's CREST programme for criminal offenders. CREST is a six-month corrections- and community-based multistage substance abuse treatment programme for drug-involved offenders. The study authors measured programme effectiveness as "…the number of days reincarcerated during the period 18-months post-release from prison" (p.391). They compared CREST programme participants (587 participants) with standard work release participants (249 participants), and participants who completed the aftercare component of CREST (209 participants) with those who completed the work-release element only (378 participants). The CEA compared the costs associated with each programme and the number of days reincarcerated over the follow-up period.

McCollister et al. estimated that for CREST participants the average programme costs were US$1937 and effectiveness was over 30 (29%) fewer days incarcerated over the follow-up period relative to standard work release. This suggests "…the CREST programme reduced incarceration for criminal offenders at an average cost of US$65 per day" (p.389). The CREST plus aftercare programme was US$935 more expensive than CREST work release-only programme and the effectiveness difference was 49 (43%) fewer days incarcerated. Findings indicate, "…by adding an aftercare component to the CREST work release programme, a day of incarceration is avoided at an average [additional] cost of US$19 per day" (p.389).

When used to estimate the cost of intervention per unit of treatment (e.g. per offender or, for place-based interventions, (say) per 1000 households), CEA provides a way of comparing the cost of intervention across different types of programme. Studies that focus on this unit of analysis (as opposed to crimes prevented) do not incorporate estimates of the benefits of such treatments (this is not the intention) but provide policy-makers with a standardised way of comparing programmes in terms of the costs of implementation. This will be vital for practitioners faced with budget constraints, who have to select between alternative interventions.

Cost-Utility Analysis (CUA)

CUA compares programmes in terms of their costs and perceived utility. 'Utility', in this context, refers to the satisfaction an individual obtains from one or more outcomes. This might include improvements in their perceptions of personal safety or quality of life. Because such utilities are difficult to measure in monetary terms, alternative indicators have been developed. Quality-Adjusted Life Years (QALYs) are frequently used in health evaluations. They comprise a standardised measurement of the extent to which an intervention is perceived to affect a person's quality and quantity of life (Gold, Siegel, Russell, & Weinstein, 1996). In CUA, such a non-monetary metric is used to compare programme outputs, while pounds sterling is used to measure the inputs, or cost of the programme.

CUA can be used for single or multiple outcomes and for general as well as programme-specific activities (Boardman et al., 2006). It is difficult to operationalize in criminal justice, where its application has been limited. Moreover, individuals find the idea unfamiliar: it has been difficult to value non-market goods such as happiness or security in valid, reliable or standardised ways.

Box 3: Example of Cost Utility Analysis

Dijkgraaf and colleagues (2005) use CUA to compare medical co-prescription of heroin with prescription of methadone alone for heroin addicts. The authors use data from existing methadone maintenance programmes in six cities in the Netherlands. In the experimental group 193 received methadone (maximum 150 mg a day) plus heroin (maximum 1000 mg a day) three times a day, seven days a week, over a 12-month period. In the control group 237 participants received methadone (maximum 150 mg a day) once a day, seven days a week, over 12 months. Psychological and medical care was offered as usual. The EuroQol EQ-5D questionnaire - which requires respondents to answer questions on their mobility, self-care, usual activity pain/discomfort, anxiety and depression - was used to estimate Quality Adjusted Life Years (QALYs). EuroQol EQ-5D provides a simple descriptive profile and a single index value for health status that may be used to calculate a 'utility' value.

The costs included the maintenance programme costs (materials, consultations, and inpatient stays), direct personal costs of health related travel and indirect costs of law enforcement and damage to victims. The authors concluded that the co-prescription of heroin and methadone saved approximately €12,793 per patient per year with an associated 0.058 more QALYs per patient per year. "Over one year, mean QALYs per patient ….were significantly higher for experimental than control patients with a mean difference of 0.058 (p. 3). QALYs are expressed in terms of "years lived in perfect health", so half a year lived in perfect health is equivalent to 0.5 QALYs (Gold et al., 1996). Thus, medical co-prescription of heroin was found to be cost-effective compared to methadone maintenance treatment alone, and may have also had a small positive impact upon recipient's perceptions of quality of life.

Cost-Benefit Analysis (CBA)

CBA calculates the overall costs and benefits associated with a given programme or policy. This is achieved by monetising all possible costs and benefits, whether these be financial or otherwise. In principle CBA can be used to gauge which programmes represent the best overall value, expressed in monetary terms. CBA is useful when more than one outcome is considered essential in the analysis, or if the natural outcomes of the interventions being examined are dissimilar (for example crimes

prevented, health improved, lives saved and achievements in education, although the individual decision maker such as yourself will rarely if ever have to deal with so bewildering an array of outcomes).

CBA comprises the most comprehensive analysis of alternatives with respect to potential outputs. However, translating outcomes such as lives saved into monetary terms is problematic. Moreover, in practice CBA is less than comprehensive, including only those costs and benefits that are easy to assess, thereby missing important but unquantifiable outcomes. What CBA does offer, when it is possible and within its acknowledged limits, is an evidence base for making comparisons between some fixed and specified number of alternatives (including the pre-intervention status quo) amongst which you (as a practitioner) might wish to choose.

Box 4: Example of Cost Benefit Analysis

Yeh (2010) employs CBA in relation to home detention and electronic monitoring (EM), which involves the use of ankle bracelets to track parolees and probationers. Conventionally violent offenders must serve a minimum of 85% of their sentence in prison, while nonviolent offenders must serve a minimum of 67%. Yeh (2010) estimates the effect of sentencing all felony offenders to serve 50% of their sentences in prison, followed by a period of home detention and EM equal to 50% of their sentences, with home detention and EM extended for an additional period equal to conventional periods of parole (p.1092).

Based on results from Padgett, Bales and Blomberg's (2006) study, Yeh estimates that EM deters 94.7% of crimes that would otherwise be committed by parolees. Using data from a national survey of state prison inmates, Yeh (2010) calculates the costs and benefits of the averted crimes that the analysis suggested would be committed by parolees over the course of one year in the absence of the new policy (50/50 policy). To ensure that the estimated costs were comparable, analyses were conducted assuming that the intervention was implemented in the year 2008.

The analysis suggested that approximately 781,383 crimes would be prevented by the intervention and that the social value of this annual reduction in crime would be US$481.1 billion. Meanwhile, the annual cost of monitoring all parolees and probationers in 2008 would be approximately US$37.9 billion. According to these estimates, the monetised benefits would thus be 12.7 times (US$481.1/US$37.9) the costs of implementation. This cost-benefit ratio of 12.70 suggests that society would gain US$12.70 for every dollar expended on the proposed programme. Yeh thus concludes that EM and home detention could be an effective policy to reduce crime and produce large social benefits. Such a cost-benefit ratio can, of course, be compared to other CBA ratios for other interventions to determine which provides the most "bang for the buck".

Table 1 provides further examples of the four different types of EA discussed above.

Table 1: Example crime-related studies using the four different types of EA methods

	Cost Savings	Cost Effectiveness	Cost Utility	Cost Benefit
Author	Weatherburn et al. (2009)	Cowell, Broner, and Dupont (2004)	Dolan and Peasgood (2007)	Bowers, Johnson, and Hirschfield (2004)
Article	Prison Populations and Correctional Outlays: The Effect of Reducing Re-Imprisonment	The Cost-Effectiveness of Criminal Justice Diversion Programs for People With Serious Mental Illness Co-Occurring With Substance Abuse	Estimating the Economic and Social Costs of Fear of Crime	Closing Off Opportunities for Crime: An Evaluation of Alley-Gating
Year	2009	2004	2007	2004
Outcome targeted	Recidivism	Criminal behaviour	Fear of crime	Burglary
Sample size	NA	t1 = 93, c1 = 92, t2 = 301, c2 = 308, t3 = 111, c3 = 120, t4 = 65, c4 = 35	Total sample= 967	106 district housing blocks containing around 362 residual properties. 3178 gates installed.
Length of treatment and follow-up	NA (treatment 1- t1), 12 months (treatment 2 – t2)	18 Months (t1 and t2), 3 months + 12 Months (t3 and t4)	Immediate fearful response	6-12 months 2-3 years
Type of Treatment	t1=reducing the rate t2= reduction in the rate of new prisoners	t=jail diversion program, c=no diversion program	No intervention	t=installation of hardwearing gates in alleyways, c=no gates
Results	A 10% reduction in the overall re-imprisonment rates would reduce the prison population by more than 800 inmates, saving $28 million per year. Reductions in the number of new sentenced prisoners is also beneficial, but less so.	For every 1-point improvement in the Colorado Symptom Index (CSI), an additional $1,236 of resources was used by the jail diversion programme.	Given a NICE value of a QALY of £30,000, the monetary loss attributed to immediate health loss from the fear of crime is £19.50 per person, per year.	Cost-benefit ratio 0.96:1 and 1.86:1 (after two years, there was an estimated return of £1.86 for every £1 spent in terms of social benefits).

C. Estimating costs of an intervention

At first sight, estimating costs might seem straightforward. It is not. Indeed, many estimates of costs are highly misleading. For example, they may neglect volunteer costs and/or the costs of existing staff diverted into a project and/or set-up costs and/or the costs of accommodation provided to house those working on an initiative and/or the administrative overheads incurred in running a project. A fully costed project needs estimates of all elements, even where they are not obvious at first sight, because all costs could be put to alternative uses (and because all costs *may* be fundamental to the successful implementation of an intervention). Where vested interests are at stake it can be all too easy to leave out or add in costs that will make an initiative appear more or less economically worthwhile. This is a further reason for drawing on an independent expert to help with economic analysis.

A few key terms may help you think more clearly about the costs of initiatives being considered or evaluated. Total costs, as the name suggests, comprise all the obvious as well as more hidden costs involved in a programme or project.

Types of investment included in total costs include 'direct costs' (including 'variable explicit costs,' such as staff and supplies and 'fixed explicit costs,' such as space and utilities); 'indirect costs' (such as overheads including administrative costs); and hard-to-measure 'intangible costs,' (such as inconvenience or fear of crime). Total costs can also be computed by adding fixed costs (those that are constant regardless of level of activity) to variable costs (those that change with levels of activity or output). Those types of costs are required to estimate 'marginal costs' (the cost of the next unit of output or outcome) and 'average costs' (the mean cost at any given level of output, which will clearly vary with output level).

At present, we have rather limited information on the costs of crime reduction interventions, which hampers evidence-based decisions on what to do about crime problems. A costing tool has thus been developed to provide a straightforward but comprehensive format for assembling the information relating to the costs of a programme or interventions. This should be completed in advance to try to estimate what costs will be, and also as a programme is developed and delivered to capture actual costs.

The costing tool consists of two parts. Part One uses traditional costing techniques such as those employed in the HM Treasury Green Book (2003). It allows all input-relevant cost data to be entered into the tool to calculate total expenditure on one or more interventions/programmes (across all years of the intervention), and/or to compare the average annual expenditure before and after the introduction of an intervention. As data will not always be available on costs, Part Two uses a combination of traditional methods for calculating the costs of an intervention (i.e. those techniques employed in Part One) and other techniques that allow cost estimates to be made in the absence of reliable accounting data. Where reliable data are at hand Part One of the tool should be used.

We will not describe the tool in detail here as our intention is to provide an overview of what it contains and enables the user to do rather than to describe how to use it. For the latter, the reader is referred to the tool itself and Manning et al. (2015). For simplicity, we will discuss only Part One of the tool here.

Basics

The tool is comprised of a number of different screens or "tabs". The first requires the user to specify general information about an intervention, including the categories of cost information to be captured (including direct capital costs, operating costs, and indirect costs), and the duration over which these costs were or are to be incurred.

Accounting for inflation

The cost of an intervention in the year (say) 2000 may be quite different to the cost of the same intervention in 2015 as *inflation* will lead to increases in the costs of inputs (e.g. staff time etc). Similarly, a given amount of money (say £10,000) that is to be invested at some future date may have a different value in the present due to the fact that the value of money changes over time and because there will be uncertainty as to future cash flows. In economic analysis, the technical term for dealing with this is *discounting*. The second screen thus allows the user to specify how the tool should estimate the costs of intervention after accounting for inflation and discounting.

Who bears the costs?

The costs of the intervention may be borne by a variety of agencies and/or actors. Failing to capture the costs not met by the police (or the primary agency delivering an intervention) may underestimate the true costs of intervention, and/or lead to an incomplete picture of which agencies may be needed to deliver an intervention either in terms of financial or other forms of support. Consequently, the third screen requires the user to specify on whom each of the identified costs falls.

Dealing with uncertainty

Not all estimates of cost will be accurate, and there will be variation in the accuracy of estimates across cost categories (e.g. salaries, equipment, accommodation). Consequently, using an HM Treasury (2014a) methodology, the tool allows the user to indicate how confident they are in each cost provided. The tool then calculates an average estimate of the costs of the intervention, and the best and worst case scenarios after accounting for uncertainty in the data. These provide an estimate of the interval (e.g. from £200,000 to £250,000) within which the true cost of intervention is likely to fall.

In addition, while data regarding the costs of implementing an intervention (e.g. CCTV surveillance) in one context (e.g. a rural area with few transit links) may be available, the costs associated with implementing the same intervention in other contexts (e.g. inner city areas with transit hubs) may not. This may be problematic as the cost of implementation may differ widely across contexts and may make an intervention affordable in some but not all situations. For this reason, the tool includes functionality that enables the cost of implementation to be estimated in new contexts for which data are not currently available. To do this, the tool uses economic techniques and a combination of available data and expert judgement to compute an estimate of the interval within which the costs of implementation are likely to lie for a given scenario.

Summaries of costs

Having input the available data, the tool provides the best and worst case estimates of the costs of intervention and details how these vary over time (by year), across cost categories, and for direct, indirect and intangible costs. Figure 1 provides a summary of an example of the cost estimates for a violence prevention programme that involves

the installation of new CCTV cameras and collaboration between the police, A&E, council and other staff.

Summary of the tool

Informed by economic theory, the tool enables the costs of an implemented intervention to be captured through the detailed collection of data regarding direct, indirect and intangible costs. As any estimates of costs will contain some uncertainty, the likely best and worst case cost scenarios are computed. The second part of the tool, not discussed in detail above, also allows a practitioner to estimate the cost of replicating an intervention in a different context, or under different conditions, which are likely to impact upon costs. The method applied enables this costing to be generated even when detailed data are unavailable. Those interested in the approach taken for the second part of the tool are refered to Manning et al. (2015).

Figure 1: Summary of cost estimate of a violence prevention programme

COSTS	Annual Costs	Best-case Estimate	Worst-case Estimate
Capital Costs			
Plant and Equipment			
Set up expenses			
CTV installation and maintenance	£31,119	£31,119	£31,119
Operating Costs			
Intervention-related staffing expenses			
Wages for Existing Employee			
Police analyst	£2,149	£2,108	£2,194
Licensing sergeant	£747	£733	£762
Chief inspector	£717	£703	£731
Lisensing officer	£308	£302	£314
Other staffing expenses			
Wages for Existing Employee			
A&E receptionist	£709	£695	£723
Junior IT staff	£341	£335	£348
Senior IT staff	£2,087	£2,046	£2,127
IT manager	£250	£246	£255
A&E consultant	£646	£634	£659
A&E senior consultant	£4,764	£4,672	£4,857
Victim support manager	£234	£230	£239
NTE coordinator	£220	£216	£224
Council workers	£24,127	£23,659	£24,595
Other administrative expenses			
Utilities			
Barriers and signage	£277	£257	£296
Other Costs			
A&E consultant travel expences	£80	£74	£86
Indirect Costs			
Glassware replacements	£10,200	£9,493	£10,907
TOTAL COSTS	£78,975	£77,522	£80,436

D. Summary

The aim of this note was to familiarise the reader with key approaches to economic analysis (EA) that can inform an evidence-based approach to what works to reduce crime. Key ideas have been briefly discussed, and examples of EA techniques illustrated. Fundamental to any EA is the collection of the costs of intervention, and so a costing tool (freely available) has been developed to assist in this exercise. This tool is intended to facilitate the systematic collection of the various costs associated with an intervention or programme (or the status quo), and to provide a detailed summary of what these costs are, how they might vary over time, and who bears them. It is our hope that this will help to improve understanding of the costs of crime reduction interventions, something that is currently rather limited.

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