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**TRENDS IN THE COST-EFFECTIVENESS OF
ENFORCEMENT ACTIVITY IN THE
ILLCIT HEROIN MARKET, 1979-1990**

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Centre for Health Economics

University of York

February 1994

THE AUTHORS

Matthew Sutton is a Research Fellow and Alan Maynard is Professor of Economics and Director of the Centre for Health Economics at the University of York.

ACKNOWLEDGEMENTS

This paper draws on work commissioned by the Home Office Research and Planning Unit in 1991. Material produced for the Home Office at that time has been updated and reworked to produce this paper. The authors are grateful to Joy Mott and Christine Godfrey for helpful comments made on earlier drafts of this paper. The views and opinions expressed are those of the authors, and not necessarily those of the funders.

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SUMMARY

Between 1979 and 1989, it is estimated that annual expenditure (in real terms) on drug enforcement activity by HM Customs and the police rose by 38% and 74%, respectively. The cost to the taxpayer of drug enforcement activity reached more than £335 million in the financial year 1992/93, 66% of total government expenditure on drug policy (SCODA, 1992). Despite significant increases in anti-drug expenditure, little is known about the economics of illicit drug markets, how enforcement activity affects these markets, the consequent economic and social effects, and as a result, the effectiveness of the enforcement interventions of police and Customs and Excise. This paper considers the range of output measures available, and concludes that, at present, it is only possible to consider intermediate output measures such as the number and weight of seizures, interception rates, the number of people dealt with by the police, Customs and the Courts for offences involving controlled drugs, and the risks imposed by law enforcement agencies on drug smugglers, dealers and users.

The impact of Customs and the police on the illicit heroin market is examined for the period 1979 to 1990. Whilst performance analysis is concerned with measuring efficiency over time, the primary aim of cost-effectiveness analysis is to compare alternatives in order to discover which is the most efficient intervention at a particular point in time. Whilst the drug enforcement activity of both agencies became more cost-effective until 1985, the cost-effectiveness of police activity declined at a much faster rate than that of Customs over the next five years. Over the past decade, changes in the levels of expenditure by enforcement agencies on anti-drug activity have not been related to changes in the cost-effectiveness of their activity. Cost-effectiveness criteria should be central to the process of allocating resources for drug enforcement activity, if the Government is to secure 'value-for-money' in its expenditure.

INTRODUCTION

The evaluation of interventions designed to reduce the misuse of controlled drugs in the United Kingdom is notoriously difficult, primarily because there is no regularly collected data on their consumption (Sutton and Maynard, 1992). Nevertheless, the annual publication of figures on the amount of controlled drugs seized by enforcement agencies is inevitably accompanied by a certain degree of rhetoric. Following the release of HM Customs seizure figures for 1992, the Minister claimed that they indicated drug cartels would not be allowed to succeed, despite their targeting of Western Europe, and that law enforcement efforts were a match for the drug smugglers (The Independent, 20/1/93, 1993; Evening Standard, 19/1/93, 1993). A great deal of faith is placed by some in the effectiveness of enforcement activity in the United Kingdom. Hewett (1987) suggested that better intelligence activities, more co-operation at an international level and new measures such as the 1986 Drug Trafficking Offences Act would ensure the UK was saved from the experience of cocaine in the United States.

Some researchers have described the effectiveness of enforcement activity in certain situations, or made casual remarks about the impact of the police and Customs on illicit drug markets. Fraser and George (1988), for example, described how the police raiding of a social centre, and the subsequent conviction of the local dealers, caused a dramatic change in the level and patterns of drug consumption in that area. Similarly, Crowe (1988) claimed that police activity slowed the growth of the heroin market in Barnet between 1985 and 1986. The most thorough discussion of the interactions between illicit drug markets and law enforcement agencies was undertaken by Dorn *et al* (1992). However, neither this, nor any other study since Wagstaff and Maynard (1988), have explicitly analysed the cost-effectiveness of drug

enforcement activity.

In this paper, an economic approach to the evaluation of drug enforcement activity is outlined, and estimates of trends in the cost-effectiveness of police and Customs interventions are presented. An economic model of the production process of an enforcement agency is described in Section I. In Section II the annual expenditure figures on drug enforcement made available by HM Customs and the police for the period 1979 to 1990 are presented and discussed. A range of intermediate output measures for enforcement activity in the illicit heroin market are presented in Section III, and the merits of each for effectiveness analysis are outlined. There are a number of joint-products of enforcement activity which may be considered measures of intermediate output. Some of these measures require an independent estimate of the annual consumption of illicit drugs in the UK. It has been noted previously that this is only possible in the case of heroin (Sutton and Maynard, 1992). As a result, the analysis must be restricted to the evaluation of enforcement agency intervention in the heroin market.

In Section IV, these expenditure and output measures are brought together for the purposes of cost-effectiveness analysis, and the distinction between cost-effectiveness indices and performance indicators is clarified. The findings are summarised in section V and it is suggested that additional information and research is required. Because of the limitations of the available data, the results can be, at best, indicative rather than authoritative and, as a consequence, public accountability for the £335 million expended on drug enforcement activity is quite limited.

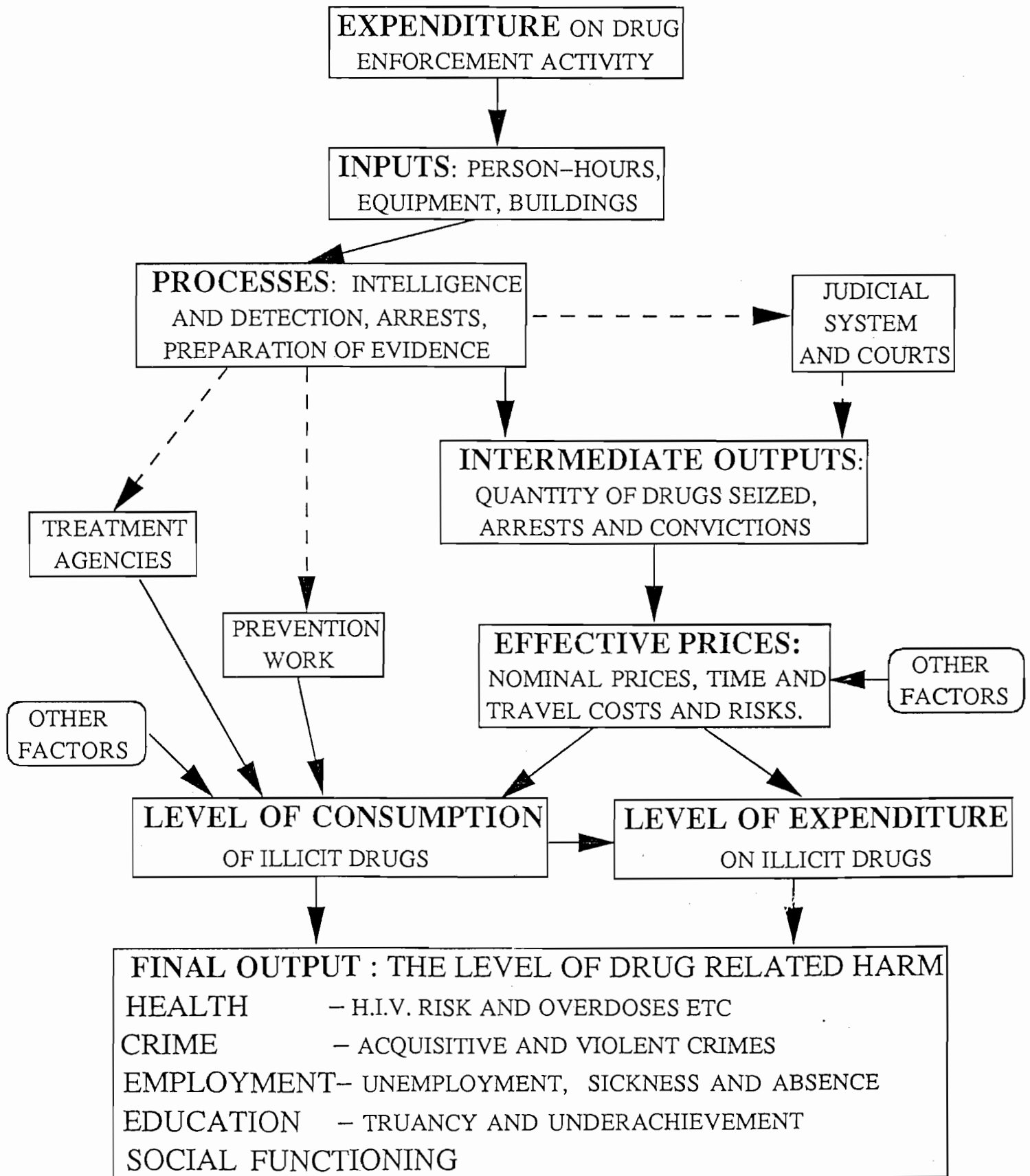
SECTION I: ECONOMIC EVALUATION OF DRUG ENFORCEMENT ACTIVITY

Figure I shows an economic model of the production process of an enforcement agency. The benefits that arise from enforcement activity are difficult to define and even harder to measure. It is not the effect of enforcement activity on actual drug consumption that should be used as the measure of final output, but the uncompensated costs on society which are averted by enforcement-induced changes in illicit drug consumption. These costs result from individuals' use of drugs, and may be borne by those individuals or by society at large. Individual drug users may not take account of these costs in deciding to use drugs. These costs may arise in a variety of ways, including drug-related crime, health problems and employment. Previous attempts to estimate the social costs of addictive substances have included costs to industry, costs to the NHS, costs of criminal activity and pain and distress (Maynard et al, 1987; Rice et al, 1991).

As Figure I shows, there are a number of stages between the allocation of resources to an enforcement agency and the level of final output achieved. The level of expenditure is determined by the levels of different inputs used, such as person-hours, equipment and buildings. These inputs are employed in various processes such as intelligence and detection activities, arrests, and the preparation of evidence for the Crown Prosecution Service. It is these processes which determine the levels of intermediate output, some of which will depend on the work of other agencies such as the judicial system and courts, and treatment agencies.

Through their influence on illicit drug markets, these intermediate outputs of enforcement activity will affect the total level of drug-related harm. By directly disrupting illicit drug

Figure I: A model of an enforcement agency's production process



markets and imposing additional risks and costs on traffickers and users involved in the market, enforcement agencies can increase the effective prices of drugs throughout the illicit market. Effective prices reflect not only the nominal price of the drug, but also additional costs incurred by both suppliers and users such as time and travel costs, the risks of detection, arrest and conviction and measures taken to reduce these risks. Effective prices of illicit drugs may affect the nature and level of drug consumption and the number of drug users, which will, in turn, affect the level of harm imposed on society. Other police non-enforcement activities, such as prevention work in schools, may also have a direct effect on the level and nature of drug consumption.

A previous attempt to evaluate changes in the cost-effectiveness of enforcement activity was restricted by the lack of data. As a result, Wagstaff and Maynard (1988) evaluated enforcement activity using measures of intermediate output, such as interception rates, rather than trying to relate enforcement activity to final output, the level of drug-related harm. However, many factors will affect the relationship between changes in intermediate output and final output. For example, there appears to be no obvious and simple relationship between the impact of enforcement activity and price. Shapiro (1991) noted the stability of the price of cocaine on the streets despite increasing seizures, and suggested that dealers may have an incentive to keep an artificially high price to maintain the luxury status of the drug. The assumption of a constant positive relationship between intermediate and final output, which is invoked in the evaluation of enforcement activity by intermediate output only, is clearly not without criticism. Since it is not possible to isolate the effect of enforcement activity on final output from the effects of other factors, an evaluation of enforcement activity based on harm reduction is not feasible. It is clear, however, that this approach would be ultimately desirable.

Since the prevention work of the police is a relatively minor activity in resource terms, and multi-agency collaborative initiatives, including the referral of users by the police to treatment agencies, have only recently become more common-place, this analysis is restricted to the more traditional enforcement roles of the police and Customs.

SECTION II - EXPENDITURE BY ENFORCEMENT AGENCIES ON ANTI-DRUG ACTIVITY

Over the last decade, HM Customs and the police adopted different methods of estimating total manpower and expenditure devoted to drug enforcement activity. Analysis of these data is problematic since the figures are not comprehensive, and are difficult to compare over time.

Expenditure by HM Customs on drug enforcement activity

Table I: Expenditure by HM Customs on Drug Enforcement Activity, 1979-1990 (£ million at 1985 factor cost).

Year	Drug-Specific Work		Preventive Work		Expenditure Index
1979	7.9	-	67.2	-	100
1980	8.9	-	62.7	-	95
1981	9.7	-	59.0	-	91
1982	11.0	-	56.4	-	89
1983	12.3	-	54.5	-	88
1984	13.2	-	53.1	-	88
1985	14.9 ^a	23.6 ^a	58.5 ^a	51.1 ^a	97
1986	-	25.9	-	55.7	106
1987	-	30.4	-	58.2	116
1988	-	33.8	-	51.5 ^b	126
1989	-	36.6	-	56.4	138
1990	-	-	-	-	-

a Two sets of figures have been produced for 1985 because of a discontinuity in the way in which these figures are calculated.

b Staff costs were refined in 1988 after the introduction of an operational planning system. The result was a lower staff cost compared to 1987, despite an 8% increase in manpower.

Figures for HM Customs annual expenditure (at 1985 factor cost) on drug-specific work and on preventive work between 1979 and 1989 are shown in Table I. The figures for preventive staff include all full-time equivalent staff employed in preventive work, which includes revenue collection and the enforcement of general prohibitions and restrictions, as well as drug law enforcement. These staff are trained for the detection of drugs and HM Customs maintain

that drugs work is a top priority. However, Customs had not considered it possible to estimate the average proportion of time devoted by preventive staff to drugs work before 1989.

HM Customs expenditure series have been produced for two overlapping time-periods in the past decade (1979-1985 and 1985-1989). The major cause of this discontinuity was a re-classification in 1985 of some staff from preventive work to drug-specific work. Customs drugs-specific expenditure rose continuously over the period (an overall increase of 190%). The amount of preventive expenditure fell continuously from 1979 to 1984 but increased after this time (over the whole period, preventive expenditure increased by 17%¹).

No information is available on what proportion of drugs work is devoted to particular drugs. Wagstaff and Maynard (1988) produced separate expenditure figures for heroin, cocaine and cannabis for HM Customs Investigation Division between 1979 and 1984 (Table 5.3), but these figures have not been made available since 1984.

A working figure can be produced based on the assumption that initiatives against heroin smugglers remain a constant proportion of total drugs work throughout the period, and an assumption concerning the amount of expenditure on preventive work that is attributable to drug enforcement activity. The only information available as to what assumption would be realistic, arises from recent figures supplied by HM Customs and Excise Financial Management Division for the financial year 1/4/89 - 31/3/90. These latest figures differ from previously supplied figures in two major ways. Manpower figures now relate to staff-year

¹ adjusted for reclassification and assuming the unknown real change from 1987 to 1988 to be an increase of 8% (see Table I, Note b).

effort and not staff levels at the year end. Moreover, estimates are made of the element of preventive effort attributable to drugs work. For the 1989 financial year, a figure of 4800 staff years deployed has been estimated. This is approximately equal to the amount of manpower given by the assumption that 90% of preventive manpower effort was devoted to drugs-related work. This constant proportion has been used throughout the period to calculate the Customs expenditure index shown in Table I.

Expenditure by the police on drug enforcement activity

There are three police drug enforcement units: Regional Crime Squads, Force drug squads, and CID and uniformed officers. Figures for total police expenditure on drug-related work are not available, and expenditure has to be estimated for each unit.

Regional Crime Squads

Dedicated drugs wings were created in 1986 in the eight non-metropolitan Regional Crime Squads. However, since non drugs wing officers have continued to undertake some drug enforcement work, it is necessary to estimate both contributions funded from Regional Crime Squad expenditure. Table II shows the available figures for Regional Crime Squad drug expenditure at 1985 factor cost.

Table II: Expenditure by the Police on Drug Enforcement Activity in England and Wales, 1979-1990 (£ million at 1985 factor cost).

Year	Regional Crime Squads			Force Drug Squads	CID and Uniformed Officers	Index ^b
	Drugs Wing ^a	Non-Drugs Wing	Total			
1974	-	-	-	11.4 ^c	-	81
1979	-	-	-	-	-	90
1980	-	-	-	-	-	92
1981	-	-	-	-	-	94
1982	-	-	-	-	-	96
1983	-	-	-	-	-	98
1984	-	-	7.4 ^c	14.2	-	100
1985	-	-	-	16.2	-	113
1986	-	-	-	18.3	-	127
1987	-	-	-	18.8	-	130
1988	4.2	5.2	9.4	18.9	53.6	131
1989	7.6	7.0	14.6	19.3	-	157
1990	-	7.4	-	18.7	-	158 ^d

a Excluding the Metropolitan Police and Scotland.

b Between 1984 and 1988 total Regional Crime Squad and Force Drug Squad expenditure rose by 31.0%. Over the same period, force drug squad expenditure rose by 33.1%. This expenditure index has been calculated as follows:

$$\text{Increase in 1985} = ((16.2 - 14.2) / 14.2) = 14.1\%$$

$$\text{Expenditure index in 1985} = ((14.1 / 33.1) * 31.0) + 100 = 113$$

c Source: Wagstaff and Maynard (1988)

d 1990 expenditure index calculated as follows:

$$\text{Expenditure in 1990} = ((7.4 / 7.0) * £14.6m) + £18.7m = £34.1m$$

$$\text{Expenditure index in 1990} = (34.1 / 21.6) * 100 = 158$$

The expenditure figures relating to drugs wings do not include the squads responsible for London and Scotland since expenditure estimates have not been made available for these regions. The number of detective officers employed in drugs wings by the Regional Crime Squads in Scotland, England and Wales in 1989/90 was 390. An estimate of the total expenditure by Regional Crime Squad drugs wings in 1989/90 was £15.2m (at 1989 factor cost), based on the number of officers employed. However, whilst these figures offer an indication of the magnitude of national expenditure on Regional Crime Squad drugs wings, the figures of 239 officers and £9.3m (at 1989 factor cost) for the eight non-metropolitan

Regional Crime Squads will be used in this analysis, since this is the only comparable information available for 1984 and 1988.

Estimates of the proportion of time devoted to drugs work by non-drugs wing officers have been provided by the Co-ordinator of the Regional Crime Squads for 1988, 1989 and 1990. Estimates of total manpower and net expenditure per officer for each non-metropolitan Regional Crime Squad are provided by CIPFA police actuals statistics (CIPFA, 1989; 1990; 1991). Using these figures, full-time equivalent drug-specific manpower estimates can be derived for each Regional Crime Squad. In a similar way, drug-specific net expenditure can also be derived for non-drugs wing Regional Crime Squad officers. The final expenditure estimates at 1985 factor cost are given in Table I.

Force Drug Squads

Expenditure estimates for the number of officers employed in police force drug squads in England and Wales are shown in Table II. This series rises continually over the period 1984 to 1989 at an average rate of 6% per annum, but appears to have fallen in 1990. However, should a constabulary fail to notify Her Majesty's Inspectorate of Constabularies of the number of officers in their drug squad, the figure is not estimated but omitted from the total. Therefore, the number of force drug squad officers may be underestimated in particular years or all years. In addition, the use of average net expenditure per police officer may underestimate the true expenditure of force drug squads, if the rank of drug squad officers and the use of support staff and overhead costs is greater than the average for the force.

CID and Uniformed Officers

Although all police forces have drug squads and often form divisional and sub-divisional drug teams, other CID and uniformed officers also get involved in drugs work. Typically their involvement will occur in investigating possession offences rather than supply offences.

No estimates of the total time spent on drug enforcement activity by all CID and uniformed officers not specifically employed in drugs work are available. Wagstaff and Maynard (1988) used data provided by the Research and Planning Section of Cheshire Constabulary on the estimated number of man-hours devoted to drugs cases in 1984. This man-hour estimate was based on an assumed six hours per drug-related case. There are two defects in using national statistics for the number of convictions for drug offences to calculate the number of man-hours devoted to drugs cases. First, figures for the numbers of convictions for drug offences may distinguish between convictions resulting from police and Customs investigations, but no information is provided on the number of convictions resulting from CID and uniformed officers' efforts. To base manpower estimates on the total number of persons convicted of drug offences resulting from police investigations would 'double-count' the manpower involved in Regional Crime Squads and Force drug squads.

A more fundamental defect in this approach is that this estimate adopts an assumption of constant police cost-effectiveness. One purpose of this paper is to analyse how the cost-effectiveness of the police has changed over the past decade. The proportion of investigations when no conviction results, and the amount of time devoted to each successful case, will change over time. To base resource-use estimates on a constant estimate of six hours per successful case would mean that by definition the police would maintain a constant level of

cost-effectiveness.

The only apparently independent estimates of the amount of time devoted to drugs work by CID and uniformed officers has been provided for the Cheshire and Sussex constabularies in 1988/89. Based on an assumption of a 40 hour week and 47 weeks worked per year the estimates of the number of hours expended by CID and uniformed officers on drugs work can be translated into an estimate of the number of full-time equivalent officers. The proportion of the police workforce which these figures represent can then be used to predict the average proportion of police manpower devoted to drugs work in all the police forces in England and Wales. These low and high estimates offer a range of 1800 to 2200 full-time equivalent officers working on drugs-specific work in England and Wales in 1988/89. Expenditure estimates on drugs work by CID and uniformed officers based on average expenditure per officer suggest an estimated budget of £55-65 million in 1988 (at 1988 factor cost).

These figures demonstrate the importance of the work undertaken by CID and uniformed officers in terms of the total resources which they utilise. At 1988 factor cost, Regional Crime Squads used an estimated £13.6m of resources and Force drug squads £21.4m in the 1988/89 financial year. Expenditure on the drugs work of CID and uniformed officers is the largest component of police drug enforcement expenditure and yet the least is known about this element and no indication of the extent to which it has changed over the decade is available.

Estimates of the total expenditure on drugs-work by the police, 1979 to 1990

It has been demonstrated that little is known about actual expenditure by the Police on drugs work. As there is no information available on how the level of expenditure on drugs work of CID and uniformed officers changed over the period 1979 to 1990, resource use by the police has had to be estimated, based on the changes in resource use by Regional Crime Squads and force drug squads and Table II shows our expenditure estimates.

Because it is the degree of change in the expenditure figures, and not their magnitude, which is important for cost-effectiveness analysis over time, a total expenditure index has been constructed showing the proportionate change from year to year. From 1984 to 1988 total Regional Crime Squad and force drug squad expenditure on drug-related work rose by 31%. The proportion of this total increase which has arisen each year has been estimated using the figures for force drug squad and Regional Crime Squad expenditure where available (see Table II, footnotes b and d). Before 1984, the only force drug squad expenditure figure available was for 1974 when it was 81% of its 1984 value. The total expenditure index for the police has been estimated based on this total growth rate, and steady growth throughout the period.

The composition of drug enforcement expenditure

The only year in which estimates are available of the total level of expenditure on drug enforcement is the financial year 1988/89. The composition of drug enforcement expenditure in terms of Customs and the three police units is illustrated in Figure II based on the estimates for that year. It is estimated that Customs and the police expend approximately the same amount on drug enforcement work, with approximately 63% of police expenditure arising through the work of CID and uniformed officers.

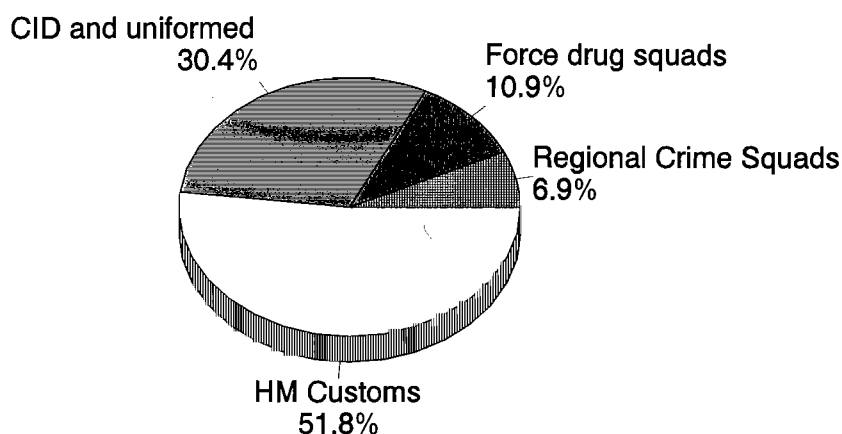


Figure 2: The composition of drug enforcement expenditure, 1988/89 (Total=£197.1m)

SECTION III - OUTPUT MEASUREMENT

Several measures of the intermediate output of drug enforcement agencies in the illicit heroin market are outlined below, along with a description of their advantages and limitations: the number of heroin seizures; the quantity of heroin seized; the heroin interception rate; convictions for heroin offences; the total number of months in prison given to heroin traffickers and users; the risks faced by heroin smugglers, dealers and users; and asset seizures from heroin traffickers.

The number of heroin seizures

The Home Office Statistical Department publishes information annually on the number of seizures of controlled drugs made by the police and Customs (Home Office, 1992). The problem inherent in the use of the number of seizures as a measure of enforcement output lies in the fact that this gives no impression of the composition of these seizures in terms of their importance. It is possible to divide Customs seizures into those made at the import level of the market, and those occasions when an individual is apprehended importing drugs for their own use or the use of their close friends, using 50g as a 'cut-off' point. In a similar way, it is possible to divide police seizures into those made from dealers and those made from end-users by assuming seizures of less than 1g to have been for personal use only. Figures for import-level seizures and seizures from dealers may be considered more useful since they may not be misleadingly inflated by an increasing number of insignificant seizures. Nevertheless, it is still possible for some movement down-market to increase the number of 'significant' seizures whilst decreasing the actual amount of drugs seized.

The quantity of heroin seized

A better indicator of the impact of enforcement than the number of heroin seizures is the total *quantity* of heroin seized, and thereby prevented from entering the illicit market-place. The total amounts weight of heroin seized annually by the police and Customs are given in the appropriate rows of Tables III and IV for the period 1979-1990.

The seizures attributable to Customs include only those detected and seized by Customs in the UK. Some shipments that are detected in illegal transit are not seized in the UK, but allowed to continue to their destination to be dealt with by the enforcement agencies in that country. In addition, some drugs may be seized abroad by foreign enforcement agencies based on intelligence information supplied by Customs. These shipments may have been destined for the UK market.

Trends in the total amount of heroin detected by Customs show little difference from trends in the amount actually seized by Customs. The figures for detected heroin vary considerably from year to year, and information is not available concerning the level of heroin seized by Customs based on intelligence information from abroad. Since it is impossible to determine what importance these detections should be given in the analysis of Customs intermediate output, it seems reasonable to continue to base analysis on the actual amount seized by Customs.

The interception rate

The problem with using the number and quantity of drug seizures as indicators of the

intermediate output of enforcement activity is that increases in both measures may well coincide with a decrease in effectiveness. If the total quantity of drugs supplied to the UK increases then the total quantity of drugs seized by enforcement agencies will also need to rise if the same impact on illicit drug markets is to be maintained.

An exogenous increase in the number of transactions and/or the average amount of heroin exchanged in each transaction (such as would be brought about by an increase in demand) will tend to increase both the number and quantity of seizures, as it becomes more probable that chance detections will be made and that investigated individuals will be involved in the heroin market.

Alternatively, the number and quantity of seizures may indicate a decrease in enforcement agency output when in fact the opposite is the case. The deterrent effect of enforcement activity may well decrease the total quantity of heroin shipped to the UK, by forcing importers to use more expensive modes of importation. If through the vigilance of enforcement action the total quantity of heroin shipped to the UK is reduced, then a reduction in the quantity of heroin intercepted would be expected, since it is now less probable that a chance detection will occur, and that an investigated importer will be involved in importing heroin.

Similarly, crude seizure data may respond perversely to increases in effectiveness. For example, Fraser and George (1988) described how the police destroyed the established trading network for heroin by raiding the retail distribution centre in one town in 1986. As a result of this police action, the amount of heroin consumed in the area fell dramatically and the 'die-hard' users were forced to travel to buy supplies from elsewhere or to adopt a house-dealing

system with a reduced number of transactions, probability of detection, sizes of stocks and transactions, and an increased effective price to consumers. The success with which the police reduced the size of the heroin market will have been reflected in a much lower number and quantity of seizures in the following years. This should not be seen as a decline in the effectiveness of police activity.

Wagstaff and Maynard (1988) produced a model of the relationship between enforcement activity and other important factors in the evaluation of effectiveness. Enforcement activity affects seizures directly, but it also affects seizures indirectly through a deterrent effect on shipments. An increase in enforcement activity will clearly have a direct effect on the number and quantity of seizures, but also an indirect effect if increased activity deters any number of heroin shipments. The net effect will depend on the strengths of these two effects.

Ideally, econometric models of these relationships and the effects of factors independent of enforcement work, such as changes in demand for illicit heroin, would be modelled. In the absence of this information enforcement impact can be measured in terms of the interception rate, rather than the number or quantity of seizures. The interception rate gives the quantity of heroin seized as a fraction of the estimated total quantity shipped. It is positively related to seizures and inversely related to shipments.

Overall therefore, an exogenous increase in shipments affects the interception rate in two ways (i) a direct (negative) effect because the interception rate is the ratio of seizures to shipments and (ii) an indirect (positive) effect through increasing the probability that drugs will be seized. The interception rate is a better choice of indicator for evaluation since it will not tend to indicate perverse changes in output following a change in the quantity of heroin

shipped. The seizure rate is also of interest as it indicates the average risk of seizure of a shipment faced by importers each year.

Table III illustrates how police interception rates have been calculated. The method requires an estimate of the amount of illicit heroin consumed annually in the UK. The estimates used are taken from a previous study (Sutton and Maynard, 1992), and are based on the number of heroin addicts notified to the Home Office. There have been a number of changes in the figures collected by the Home Office and a number of assumptions have been made to estimate a consistent time-series (see Sutton and Maynard (1992) for details). A national notified to total addict multiplier of seven has been used throughout the period 1979 to 1990. This figure was estimated using the results of several local prevalence surveys undertaken in 1985. There is insufficient information to suggest that this multiplier changed significantly over the period 1979 to 1990. Estimates of the number of regular heroin users have been translated into national consumption estimates allowing for a declining percentage receiving heroin on prescription, and assuming a frequency of use of 7.5 months/year (Hartnoll and Lewis, 1984). A number of studies have given estimates of the average daily dosage of regular heroin users. Hartnoll and Lewis' (1984) estimate of 0.25g, which was used in a previous study of cost-effectiveness (Wagstaff and Maynard, 1988), is at the low end of the range of currently available estimates (Sutton and Maynard, 1992). This may be due to an increase in the popularity of smoking as a preferred means of administration (Parker et al, 1988). A figure of 0.33g has been used in this study, based on a ratio of eight non-dealing users of 0.25g per day to one retailer using one gram per day.

Table III: Police Heroin Interception Rates, 1979-1990.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Estimated amount of heroin consumed in the UK (Kg, at retail purity) ^a	1487	1677	2119	2890	4163	5722	5145	5010	4829	5695	6632	7693
Purity (%) ^b												
Retail	39	39	44	52	52	40	34	27	32	37	38	38
Distribution	60	60	59	64	58	52	52	35	30	37	38	38
Estimated amount of heroin consumed in the UK (Kg, at distribution purity)	966.6	1090.1	1580.3	2348.1	3732.3	4401.5	3364.0	3864.9	5150.9	5695.0	6632.0	7693.0
Police seizures (Kg)	1.6	1.8	7.6	10.3	20.3	49.0	32.2	43.7	45.6	24.3	20.8	26.9
Estimated quantity of heroin reaching the distribution level of the market (Kg, at distribution purity)	968.2	1091.9	1587.9	2358.4	3752.6	4450.5	3396.2	3908.6	5196.5	5719.3	6652.8	7719.9
Police Interception Rate (%)	0.17	0.16	0.48	0.44	0.54	1.10	0.95	1.12	0.88	0.42	0.31	0.35

a Source: Sutton and Maynard (1992)

b Source: Drugs Intelligence Laboratory. Retail purity figures are based on the average purity of police seizures weighing less than one gram until 1987, and greater than one gram but less than an ounce after 1987. Distribution purity estimates are based on the weighted average purity of police seizures weighing greater than one gram until 1985, and on un-weighted averages after 1985.

Since the majority of police seizures are made at the distribution level of the market, national consumption estimates at retail purity must be adjusted for the change in purity between the distribution and retail levels of the market, in order to calculate appropriate estimates of the total weight reaching the distribution level. The purity levels estimated for each level of the market are based on forensic analysis of different sizes of seizures.

In 1980, for example, the purity of illicit heroin was estimated to have been 'cut' from 60% at the distribution level of the market to 39% at the retail level (Table III). Therefore, the 1677 Kg estimate of the amount of heroin consumed at retail purity would have weighed only 1090 Kg at the distribution level. The total quantity reaching the distribution level of the market is given by the sum of the estimated quantity consumed in the UK (at distribution purity) and the weight of heroin seized by the police. The police interception rate is simply the weight of heroin seized by the police divided by the estimated quantity of heroin reaching the distribution level of the market.

As shown in Table III, it has been estimated that the police interception rate peaked over the period 1984 to 1986 at around 1%, before falling to around 0.3% by 1990.

Table IV shows how Customs heroin interception rates have been calculated in a similar way to those for the police. Customs interception rate is estimated to have peaked in 1985 at just over 10% declined over the period 1986 to 1988, before rising to almost 10% once more in 1990.

Table IV: Customs Heroin Interception Rates, 1979-1990.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Estimated quantity of heroin reaching the distribution level of the market (Kg) ^a	968.2	1091.9	1587.9	2358.4	3752.6	4450.5	3396.2	3908.6	5196.5	5719.3	6652.8	7719.9
Purity (%) at distribution level ^a at import level ^b	60 62	60 62	59 64	64 70	58 66	52 61	52 61	35 47	30 34	37 41	38 47	38 53
Estimated quantity of heroin successfully imported (Kg, at import purity)	936.9	1056.6	1463.8	2156.3	3297.8	3793.9	2895.2	2910.6	4585.2	5161.3	5378.9	5535.0
Quantity of heroin seized by Customs (Kg)	43.3	36.4	85.8	185.1	215.9	312.6	334.2	179.2	190.0	211.4	330.6	575.8
Estimated quantity of heroin shipped to the UK (Kg, at import purity)	980.2	1093.0	1549.6	2341.4	3513.7	4106.5	3229.4	3089.8	4775.2	5372.7	5709.5	6110.8
Customs interception rate (%)	4.4	3.3	5.5	7.9	6.1	7.6	10.3	5.8	4.0	3.9	5.8	9.4

a Source: Table III

b Source: HM Customs and Excise. Based on the weighted average purity of Customs seizures. In 1990, the figure excludes one seizure of 204Kg of heroin at 72% purity.

Convictions for drugs offences

As well as directly disrupting the heroin market through the seizure of supplies of heroin, law enforcement agencies also disrupt the supply of heroin indirectly through the arrest and conviction of heroin smugglers, dealers and users. Therefore, the number of offenders dealt with annually is an alternative jointly-produced intermediate output of enforcement agencies, by which their activity can be evaluated.

The Home Office publishes annual figures for the numbers of persons dealt with by being found guilty, cautioned or settled by compounding for the unlawful import and export, supply and possession of controlled drugs (Home Office, 1992).

The number of persons dealt with for the illegal export or import of heroin has fluctuated around an increasing trend since 1979 (see Table V). The majority of these cases are handled by Customs. The number of individuals dealt with for unauthorised possession (users) and the unlawful supply or possession with intent to supply (dealers), however, reached a peak in 1985 and has fallen since (see the appropriate rows of Tables V and VI). It is difficult to interpret these figures as the number of offenders dealt with in a year does not indicate the importance of these particular convictions in impeding the overall supply of heroin.

The increasing numbers dealt with for illegal import or export of heroin could imply three different scenarios: (i) over the twelve-year period the number of people dealt with for the illegal importation of heroin has tended to increase, with no change in terms of their importance to the supply of illicit heroin in the UK or (ii) increasing focus by Customs on small-scale importers of heroin, with more being dealt with but no increase in impact on the

illicit heroin market or (iii) despite an increasing focus by Customs on large-scale importers and an increase in the numbers dealt with, so that these figures *understate* the true increases in impact achieved by Customs.

Similarly, it may well be that instead of achieving increasing impact on the heroin market over the period 1979 to 1985, that the police were apprehending an increasing proportion of small-scale dealers who were quickly replaced (Bean and Wilkinson, 1987), with no improvement in effectiveness in the disruption of the heroin distribution system. Furthermore, the decreasing numbers of individuals dealt with for supply offences from 1986 to 1990 may well not indicate a fall in police impact, but reflect an increased targeting of a smaller number of large-scale dealers. Therefore, if the police were to move 'up-market' and target larger scale dealers, this would be reflected in a fall in this measure because there are fewer of them, but this may have a greater impact on the market.

A crude indicator of the proportions of more serious traffickers, dealers and users dealt with is the number sentenced to immediate custody. There has been a rise in the proportion of heroin importers sentenced to immediate custody (from 80% in 1984 to 89% in 1990), but a fall in the proportion of dealers and users sentenced to immediate custody (dealers: from 77% in 1984 to 68% in 1990; users: from 30% in 1984 to 16% in 1990).

However, the sentencing of offenders to immediate custody is a crude indication of an individual's importance, and will reflect sentencing policy as well as the importance of the individual to domestic distribution. A more sensitive measure of the importance of those individuals apprehended is required for this analysis. An immediate custodial sentence may be given to a wide variety of heroin traffickers and users, not just those of prime importance.

An inflation in the numbers sentenced to immediate custody may reflect an increase in the number of only marginally important traffickers being dealt with, and may even disguise a fall in the number of more important traffickers being dealt with.

Total number of months of prison sentence given to offenders

An alternative indicator of the former importance of convicted individuals to the illicit heroin market and the total level of heroin-related harm in the UK is the length of prison sentence to which they are sentenced. The total number of months of prison sentence given to offenders could also be used, therefore, as a measure of the intermediate output of enforcement agencies.

There have been changes in the way in which the figures for the average length of prison sentences were calculated over the decade. Despite the discontinuities in the data, it does appear that increases in the number of smugglers dealt with by Customs have not been made at the expense of reductions in their importance to the heroin market. The years which have given rise to increases in the number sentenced to immediate custody, also give the greatest totals of months sentenced, since there is little or no decline in the average length of prison sentences.

The mean length of sentences for supply, intent to supply and possession offences involving heroin vary quite widely from one year to the next, and show no particular trend over the period. There is a slight downward trend in mean length of sentence from 1986 to 1989, comparable with the decreasing proportion of those dealt with being sentenced to immediate

custody over this period. As a result of the steadily falling numbers of dealers and users sentenced to immediate custody, the total lengths of prison sentences also fall from 1985. The raw data on the number of offenders dealt with for supply and intent to supply offences suggests that there seems to have been no increased targeting of large-scale dealers to contradict the indication that Police output has fallen since 1985.

Indicators such as the proportion of offenders sentenced to immediate custody for supply offences and the length of prison sentences are not independent indicators of the importance of those dealt with. The length of prison sentence that an individual receives will reflect partially the Court's belief as to their importance in the heroin supply market. In addition however, the sentence will reflect any criminal history of the individual, and the amount of heroin involved in the case. The durability of this measure of the importance of those dealt with will depend partly on general trends in sentencing policy. Judgements in the cases of *Aramah* in 1983 and *Bilinski* in 1987 established guidelines for the sentencing of convicted smugglers (see Dorn *et al* (1992, Chapter 10) for a review of trends in the punishment of drug traffickers). Sentencing policy will vary not only from court to court, but also over time.

Risks faced by drug offenders

In addition to the problems concerning the appropriateness of average prison sentence lengths as indicators of importance, there is an additional disadvantage with the use of the total number of months sentenced as an indicator of output. In assessing the effectiveness of enforcement agencies it is necessary to allow for external factors in illicit drug markets. Annual national consumption estimates suggest that the size of the heroin market has grown

for much of the decade (Table III). To meet the demands of the growing market, an increasing supply of heroin will have had to be imported. The growing market in heroin will have involved an increase in the number of importers, couriers, dealers and users. To a certain extent, the increased demand may have been met by increasing the quantity transferred in each transaction, but there may also have been an increase in the number of individuals involved.

Any change in the size of the heroin market will change the probability that a given number of offenders will be dealt with by the enforcement agencies. Furthermore, the level of enforcement activity may indirectly affect the number of offenders which they manage to deal with, since the level of enforcement will affect both consumption and the direct risks faced by those involved in the heroin market.

To take account of these factors, enforcement effectiveness should be evaluated by the risks which it places on those involved. The risks faced by traffickers and users can be measured in terms of each type of offender's probability of being dealt with, and being sentenced to immediate custody, and their estimated expected time in custody per year. The estimate of the expected time in custody per year is the most appropriate measure since it is the product of the risk of being dealt with, the risk of being sentenced to immediate custody and the average length of prison sentence for that category of heroin-related offence. This figure is the amount of time in prison implicitly traded-off by individuals involved in the illicit heroin market for twelve months regular use of heroin or heroin trafficking. The indicators of the risks faced by heroin smugglers, dealers and users can be calculated provided an estimate is available of the numbers of different types of offenders involved in the heroin market each year. In this paper, estimates have been made based on fieldwork studies and the

characterisation of the market offered by Lewis *et al* (1985). At a micro-level, this model of the market may be simplistic (Dorn *et al*, 1992), but the assumptions are likely to be more appropriate for the national level. Tables V, VI and VII outline how the risks facing smugglers, dealers and users have been calculated, and detail the sources and nature of the assumptions required.

Table V: Risks imposed on heroin smugglers by Customs enforcement activity, 1979-1990

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Estimated quantity of heroin shipped to the UK (Kg, at import purity) ^a	980.2	1093.0	1549.6	2341.4	3513.7	4106.5	3229.4	3089.8	4775.2	5372.7	5709.5	6110.8
Estimated number of heroin smugglers ^b	261	291	413	624	937	1095	861	824	1273	1433	1523	1630
Number of heroin smugglers dealt with	65	95	106	109	214	207	197	207	265	198	358	220
Estimated percentage of heroin smugglers dealt with	24.9	32.6	25.7	17.4	22.8	18.9	22.9	25.1	20.8	13.8	23.5	13.5
Total number of months in prison to which heroin smugglers were sentenced ^c	-	-	-	-	-	11122	14280	12558	17360	12144	21708	14112
Estimated expected time in custody per heroin smuggler per year ^d	-	-	-	-	-	10.2	16.6	15.2	13.6	8.5	14.3	8.7

a Source: Table II

b Based on the estimated quantity of heroin shipped to the UK, and assumptions of 1.5 Kg per shipment (equal to the average size of Customs seizures from 1984 to 1990) and 2-3 shipments per trafficker per year.

c The product of the number of, and average length of sentence given to, individuals sentenced to immediate custody for the illegal import or export of heroin. These figures were not available before 1984.

d Equal to the total number of months in prison to which heroin smugglers were sentenced divided by the estimated number of heroin smugglers.

Table VI: Risks imposed on heroin dealers by police enforcement activity, 1979-1990.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Estimated number of regular heroin users ^a	12221	13786	17416	23750	34219	47033	42288	41178	39694	46812	54508	63234
Estimated number of active heroin dealers ^b	1509	1702	2150	2932	4225	5807	5221	5084	4900	5779	6729	7807
Number dealt with for heroin supply or intent to supply offences	72	144	184	237	295	652	1092	781	666	574	392	386
Estimated percentage of active heroin dealers dealt with	4.8	8.5	8.6	8.1	7.0	11.2	20.9	15.4	13.6	9.9	5.8	4.9
Total number of months in prison awarded for heroin supply or intent to supply offences ^c	-	-	-	-	-	25773	37362	30253	22133	18201	10627	12281
Estimated expected number of months in custody per active heroin dealer ^d	-	-	-	-	-	4.44	7.16	5.95	4.52	3.15	1.58	1.57

a Source: Sutton and Maynard (1992).

b The estimated number of active dealers is based on the assumption that retailers are also drug users and that there are eight non-dealing users for every retailer, as indicated in the fieldwork research of Hartnoll and Lewis (1984), Bean and Wilkinson (1987) and Fraser and George (1988). It is also assumed that there are nine retailers for every wholesaler/distributor (see Wagstaff and Maynard, 1988).

c Calculated as for heroin smugglers in Table V (see note c). Figures not available before 1984.

d Calculated as for heroin smugglers in Table V (see note d).

Table VII: Risks imposed on regular heroin users by police enforcement activity, 1979-1990.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Estimated number of regular heroin users ^a	12221	13786	17416	23750	34219	47033	42288	41178	39694	46812	54508	63234
Estimated number of non-dealing regular heroin users ^b	10863	12254	15480	21111	30417	41807	37589	36603	35284	41611	48452	56208
Number dealt with for heroin possession offences	364	533	582	735	1139	1912	2464	1643	1528	1323	1155	1136
Estimated percentage of regular heroin users dealt with	3.4	4.3	3.8	3.5	3.7	4.6	6.6	4.5	4.3	3.2	2.4	2.0
Total number of months in prison awarded for heroin possession offences ^c	-	-	-	-	-	8511	9788	7862	5546	4926	2873	2083
Estimated expected number of months in custody per regular heroin user per year ^d	-	-	-	-	-	0.20	0.26	0.21	0.16	0.12	0.06	0.04

a Source: Sutton and Maynard (1992).

b The estimated number of non-dealing users is based on the assumption that retailers are also drug users and that there are eight non-dealing users for every retailer, as indicated in the fieldwork research of Hartnoll and Lewis (1984), Bean and Wilkinson (1987) and Fraser and George (1988).

c Calculated as for heroin smugglers in Table V (see note c). Figures not available before 1984.

d Calculated as for heroin smugglers in Table V (see note d).

Asset seizures

A more recent joint-product of drug enforcement activity has been the confiscation of the financial benefits accrued from drug trafficking. The 1986 Drug Trafficking Offences Act (DTOA) enables drug enforcement agencies to seize assets associated with drug trafficking, or purchased using the proceeds of drug trafficking.

Enforcement agencies propose a 'benefit' to the Court which represents the value of assets that the agency believes to be associated with drug trafficking. The Court will determine the 'benefit' after consideration of the evidence from the defence. The annual totals of these benefits may represent in theory the value of the drug related assets of those convicted. A confiscation order is then made which takes account of the probability of seizing the assets identified in the benefits. Once the confiscation orders have been made the assets identified can then be seized.

There has been a sharp rise in the total value of confiscation orders and the number of confiscation orders made by the Police since the introduction of the DTOA in January 1987. In 1987 approximately 6% of those sentenced for drug trafficking offenses were ordered to pay confiscation orders. In 1988 this had increased to 13%. The average value of confiscation orders also increased from £4,300 in 1987 to £12,600 in 1988, with a range of £10 to £768,100 in 1988. The large variance in the value of confiscation orders indicates that these orders are made against those involved in drug supply at different levels of the market, and that actual 'benefits' may differ significantly from the orders made, consequently little interpretation should be made from the average value of confiscation orders.

Asset seizures will increase the expected costs of a given risk of detection and conviction. This will increase supply costs of domestic distribution as the expected value of direct risks faced by suppliers increases. However, it is unclear what proportion of the value of confiscation orders is actually seized. The value of confiscation orders may significantly overestimate the increased expected cost of detection and conviction since the introduction of the DTOA.

SECTION IV - A COST-EFFECTIVENESS ANALYSIS OF DRUG ENFORCEMENT ACTIVITY

Cost-effectiveness analysis versus performance analysis

The distinction between performance indicators and cost-effectiveness indices is important. Performance indicators are traditionally presented as the number of units of output per unit of input. Cost-effectiveness indices, on the other hand, are more naturally thought of as measures of the level of cost over the level of output, ie. 'the cost per unit of output'. However, a cost-effectiveness index is not merely the reciprocal of a performance indicator. Rather, the objective of cost-effectiveness analysis makes its measurement more definite. The conventional aim of cost-effectiveness analysis is the comparison of competing policy options at a certain point in time, rather than the evaluation of changes in the performance of agencies over time.

A number of external factors which affect the impact of enforcement agencies on illicit drug markets need to be controlled for in the analysis of performance. First of all, it is important to acknowledge the influence that the level of international traffic will have on the ability of Customs to maintain a certain interception rate or level of risks faced by traffickers. If the volume of international traffic has steadily increased throughout the decade then the probability of chance detection of drugs, and the possibility that an investigated import operator will be involved in drug trafficking, will have become steadily smaller, given the same level of drug smuggling. Thus, it will have become increasingly difficult for Customs to maintain the same seizure rate or impose the same risks on importers. To a less obvious extent these comments are also relevant for police enforcement activity, if there is an increase

in the size of the population. The concern here is with relative performance and not the intermediate output of enforcement. If the volume of international traffic has increased, then it remains reasonable to suggest that Customs needs to maintain a constant seizure rate or impose the same level of risk in order to have the same impact on drug markets. However, it would seem unreasonable to expect Customs to maintain this level of intermediate output using the same level of real resources. The extent to which this is the case depends on the proportion of seizures and arrests which arise through random spot-checks, the extent to which the volume of exports and imports on the popular drug routes increases and the nature of intelligence work.

A further consideration for performance analysis concerns the relative costs of each unit of output. Economic theory suggests that, through economies of scale, production of each marginal unit of output will become less and less costly as production expands. However this phenomenon will occur only up to a certain point, at which the marginal unit of production will become increasingly costly. As the costs of the production of different levels of enforcement output are analysed therefore, consideration should be given to whether average costs per unit of production are falling (rising) over and above efficiency gains that would be expected through (dis-)economies of scale.

Additional factors which will affect the intermediate output of enforcement agencies include legal and sentencing policy changes, and increasingly sophisticated techniques which may be adopted by traffickers and users. A final consideration for performance analysis focuses on the components of enforcement costs. Enforcement work includes intelligence and detection, actual arrest and the subsequent work to ensure prosecution. It has been suggested that if the quantity of heroin shipped and the number of offenders rises then, *ceteris paribus*, it will have

become more probable that seizures and arrests will be made. In terms of the costs incurred by enforcement agencies, the maintenance of a certain quantity of seizures and numbers dealt with will involve lower intelligence and detection costs. There are no reasons to believe, however, that the actual costs of arrest and the subsequent work to ensure conviction will decrease. Consideration of the costs of enforcement work indicates that an analysis of performance based on seizure rates and risks faced by traffickers and users is biased *against* enforcement agencies when the level of shipments *increases*. If the total quantity of drugs seized and the numbers dealt with do not rise in line with an increase in the size of the market, then enforcement is having less impact on drug markets. However, under these conditions, it is not reasonable to suggest that agencies should maintain constant impact for the same level of expenditure.

The extent to which these biases will influence the analysis will depend on the relative size of the change in the heroin market, and the proportions of total costs made up by costs that vary with the quantity seized and the numbers dealt with (such as costs of arrest and subsequent costs incurred to ensure conviction), and those that reflect the size of the drug market (such as intelligence and detection costs). For example, if 100% of enforcement costs were intelligence and detection costs then performance analysis based on seizure rates and the risks imposed on traffickers and users would be an impartial analysis of enforcement activity. However, if 100% of enforcement costs were made up of the costs of actually arresting traffickers and users and the provision of evidence for the Crown Prosecution Service then performance analysis based on the total quantity of drugs seized and the numbers dealt with would be an unbiased way to evaluate activity.

In contrast, when investigating the relative *cost-effectiveness* of alternative policy options, it is important to include, rather than exclude, external factors which may influence the level of output. If enforcement agencies are to maintain the same level of impact on illicit drug markets, and particularly on drug prices, then they must hold constant the interception rate and degree of risk their activity imposes on traffickers, dealers and users, regardless of external changes in the market. If the size of the market increases and enforcement agencies cannot maintain the same impact on drug markets for the same level of costs, this may not indicate deteriorating performance but certainly indicates a decline in the cost-effectiveness of their activity. For this reason, a cost-effectiveness analysis can be based solely on relative measures of output, such as interception rates and the risks faced by individuals involved in illicit drug markets.

Since data relating to the effects of different enforcement, prevention or treatment strategies are not available, it is impossible to compare enforcement activity with other approaches to reducing the level of drug-related social costs. Furthermore, since measures of enforcement intermediate output, such as seizures and arrests, cannot be related to changes in final output in the form of increases in prices, reductions in drug consumption or drug-related social costs, it is impossible to compare the effectiveness of Customs and police enforcement activity even in general terms. Nevertheless, it is possible to estimate how the relative cost-effectiveness of police and Customs has changed over the last decade.

Estimated trends in the cost-effectiveness of drug enforcement activity, 1979-1990

Analysis in Sections II and III has produced estimates of the costs and outputs of enforcement activity in dealing with the illicit heroin market over the period 1979 to 1990. The cost information was found to be incomplete, especially in the case of the police, but expenditure indices were estimated based on the limited information available. Enforcement activity can be considered to be producing three joint-products in the form of the seizure of illicit supplies, the arrest and conviction of drug traffickers and users and the confiscation of assets under the Drug Trafficking Offences Act (1986). However, since the actual value of assets confiscated under the DTOA is not known, analysis of enforcement performance will be restricted to seizures of drugs and the arrest and conviction of offenders.

Crude data on seizures and the number of drug offenders dealt with are inappropriate as measures of enforcement effectiveness since they did not allow for exogenous changes in the heroin market and may respond perversely to output. The interception rate (representing the average risk that the transfer of drugs at different levels of the market will be seized in any one year) and the risks faced by drug traffickers and users are better indicators of the impact which enforcement activity has on the heroin market.

There are no models of the behaviour of individuals involved in the illicit heroin market and it is impossible to determine whether seizures or the arrest and conviction of drug traffickers and users is the most important product of enforcement activity. There is no research to indicate the effect of either on drug prices, consumption or overall harm, and consequently output indicators for seizures and convictions cannot be synthesised.

Figure III indicates how the cost-effectiveness of Customs drug enforcement activity changed over the last decade relative to 1979. The cost-effectiveness indices are given by the ratio of expenditure to a measure of intermediate output. Since no estimates are available of the level of drug enforcement expenditure devoted to the heroin market, it is not possible to calculate the cost per unit of output. Trends in cost-effectiveness are indicated by changes in cost-effectiveness indices from the base year 1979.

The implications of changes in cost-effectiveness indices over time may seem counter-intuitive. Since cost-effectiveness indices are calculated as the level of expenditure divided by the level of output, increases represent deteriorations in cost-effectiveness and decreases represent improvements in cost-effectiveness. Changes in the cost-effectiveness index relating to the risks faced by heroin smugglers are based on changes in the ratio of Customs drug enforcement expenditure to the estimated percentage of heroin smugglers dealt with until 1985. From 1985, this index reflects changes in the ratio of Customs expenditure to the estimated expected time in custody per trafficker per year.

The cost-effectiveness index based on Customs expenditure and the heroin interception rate declined steadily from 1980 to 1985. This is a similar result to that found previously by Wagstaff and Maynard (1988; see Table 5.13). The indicated fall in the cost per unit of Customs output over this period illustrates the extent to which Customs' seizures of heroin became a preferred policy option over this time. Between 1985 and 1988 there was a large deterioration in the cost-effectiveness of Customs activity, indicated by the rising cost-effectiveness indices for both the interception rate and the risks faced by smugglers, but in 1989 this trend was reversed.

Figure 3: Trends in cost-effectiveness of Customs drug enforcement activity, 1979-1989 (1979=100)

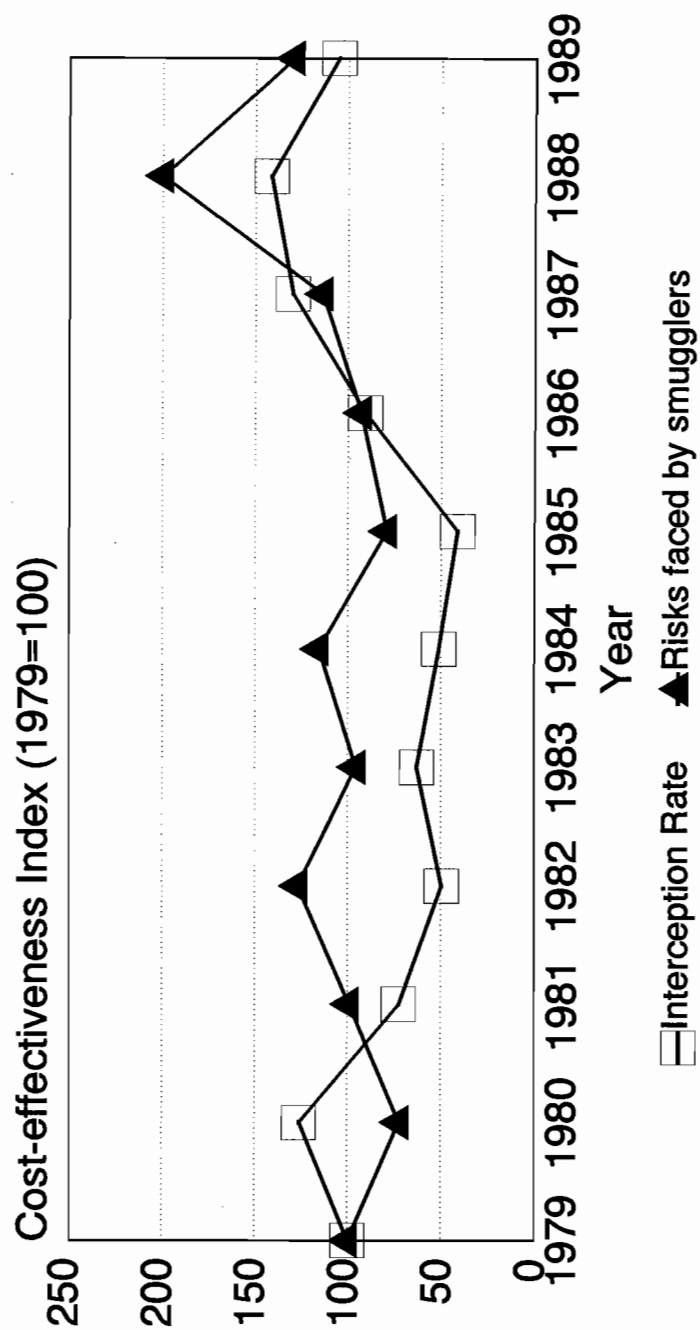
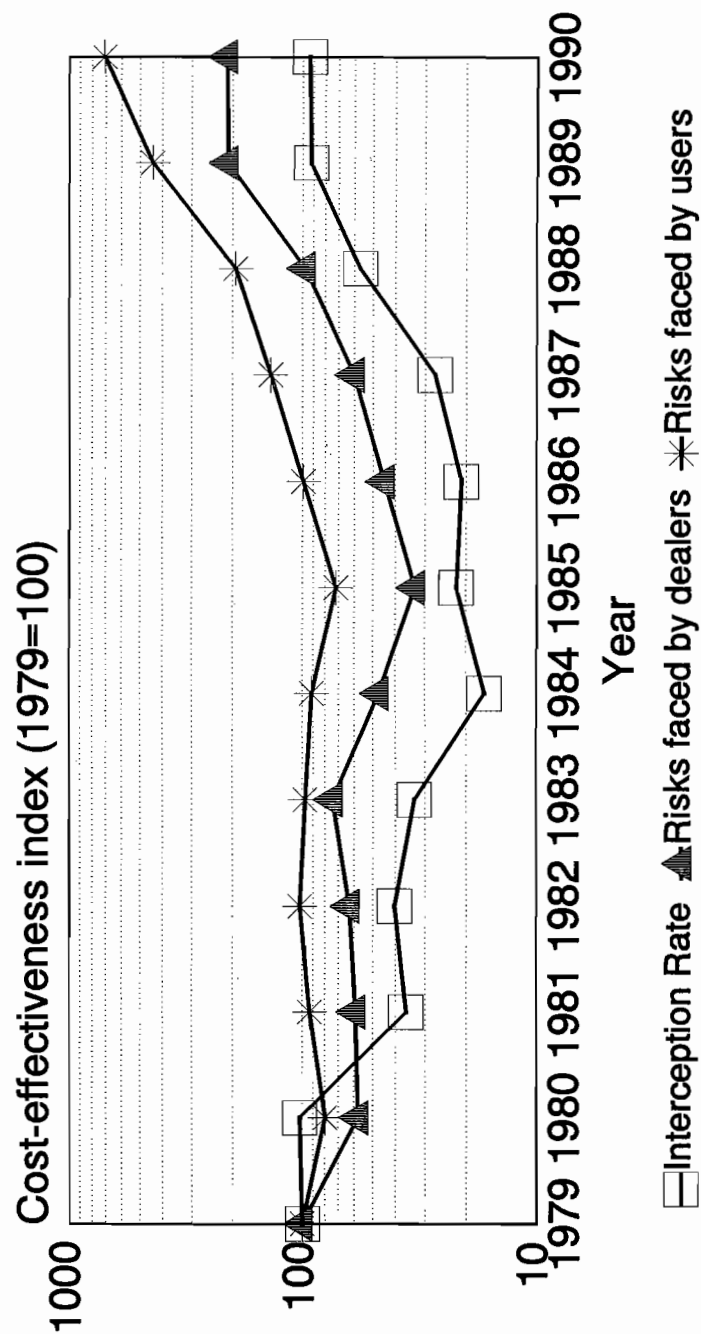


Figure IV presents a similar analysis for seizures of heroin and the risks faced by dealers and users as a result of police activity. The trends in these indices are rather similar to those for Customs, with the first half of the decade being a time of cost-effectiveness improvements followed by a decline during the latter half of the period. However, the logarithmic scale of this graph rather obscures the greater magnitude of the changes in police cost-effectiveness. For example, by 1984 the cost per unit of impact achieved by police seizures of heroin had fallen to just 17% of its 1979 level. Conversely, the cost per level of risks faced by users increased almost ten-fold over the period 1985 to 1990.

As a result of ignorance about the importance of the different joint-products of enforcement activity in determining the price of heroin in the illicit market, it is not possible to combine the cost-effectiveness ratios for each agency to give overall indices for Customs and the police. However, the available indices do give ranges for an overall index. The cost per unit of Customs output fell by between 20 and 60% over the period 1979 to 1985, whilst the cost per unit of police output fell by between 30 and 80% over the same period. Thus whilst enforcement activity became more cost-effective over this period, it is not possible to assess changes in the relative cost-effectiveness of the drug enforcement activity of Customs and the police. Over the period 1985 to 1989, however, whilst the cost per unit of Customs output rose by between 65 and 150%, the costs per unit of police output rose by between 320 and 530%. Thus, over the period 1985 to 1989, despite becoming less cost-effective in absolute terms, Customs activity became considerably more cost-effective relative to police activity.

Figure 4: Trends in cost-effectiveness of police drug enforcement activity, 1979-1990
(1979=100)



Enforcement activity in other illicit drug markets

Assertions concerning the cost-effectiveness of enforcement activity have been based purely on interventions in the heroin market. However, clearly the drugs work of enforcement agencies covers the illicit use of all drugs, and enforcement agencies may switch the focus of their activity from one drug to another from year to year, depending upon which drugs are seen as the "main problems". Therefore, in earlier sections when it has appeared that the effectiveness of enforcement activity in the heroin market had deteriorated, it is quite possible for this to arise as efforts are switched away from the heroin market. Similarly, enhanced impact in the heroin market may not represent true gains in cost-effectiveness, but a concentrated focus on the heroin market, and therefore compensating deteriorations in effectiveness in other drug markets. As a consequence, time trends in the impact of enforcement agencies in illicit markets for different drugs may have an inverse relationship.

Because estimates of the consumption of illicit drugs other than heroin are not available (Sutton and Maynard, 1992), output measures such as interception rates and the risks faced by offenders cannot be considered. Therefore, the quantity of drugs seized and the number of months in prison to which offenders have been sentenced will be analysed.

The quantity of other drugs seized

The quantity of heroin seized by Customs increased over the period 1980 to 1985, fell by almost 50% in 1986, but has increased steadily since (see Table IV). The increase of 662% in the amount of heroin seized between 1979 and 1985 is coincident with a 118% increase

in the weight of cocaine seized, but a 18% decrease in the weight of cannabis seized. There has been a decrease in the total weight of illicit drugs seized by Customs. However, the relative increases in the amounts of heroin and cocaine seized are far larger than the relative decrease in the weight of cannabis seized. Furthermore, it is likely that some drugs will cause more harm to society, such that smaller increases in the weight of Class A drugs seized may be considered more important than decreases in the amount of Class B drugs seized. Nevertheless, it is clear that basing analysis of performance on the weight of heroin seized over this period will *overstate* the achievements of Customs. The bias involved in concentrating on interception rates for heroin is indeterminate since it is not possible to estimate trends in the importation of cocaine and cannabis.

The weight of cocaine seized annually increased after 1984, and whilst the weight of cannabis seized annually fluctuated, the total was still greater in 1990 than in 1985. As a result, an analysis of Customs impact on illicit markets in all drugs would be likely to find less fluctuation in performance and cost-effectiveness than has been outlined for intervention in the illicit heroin market alone.

The quantity of heroin seized by the police displays three fairly distinct phases. From 1979 to 1984, the weight of heroin seized by the police increased 30-fold, and then remained relatively constant until 1987, when the weight of heroin seized fell to a level maintained until 1990 (see Table IV). The increase in heroin seizures over 1979 to 1984 was not matched by Police activity in the cocaine and cannabis markets. Over the years 1984 to 1986 seizures of all drugs varied widely, except for the continual increase in amphetamine seizures from a very low level. During the period 1987 to 1990, when the weight of heroin seized by the police declined, an increased amount of all of the three other drugs was seized. Thus, the 41%

decline in the amount of heroin seized may well reflect the targeting of illicit drugs other than heroin.

The total number of months of prison sentence awarded to drug offenders

The wide variation in the total number of months in prison awarded to heroin smugglers, is also seen in the prison sentences of those smuggling cocaine and cannabis. This suggests that the total picture of the Customs dealing with drug smugglers may be considerably different from that presented earlier.

The total length of prison sentences given to dealers and end-users of heroin declined by 52% and 79% respectively, over the period 1985 to 1990. For other drugs, such as cocaine and cannabis, the deteriorations are less marked. The analysis of police cost-effectiveness in terms solely of their impact on the illicit heroin market is likely to suggest a more marked deterioration in police impact than if the analysis could be extended to all drugs. However, these figures do reinforce the belief that the disruption of domestic drug markets through the arrest and conviction of illicit drug dealers and users has declined since 1985.

CONCLUSION

It is perhaps the paucity of data concerning drug markets and enforcement activity which is the greatest obstacle for an economic analysis to overcome. Customs annual expenditure figures have been produced for the whole decade, but discontinuities in the way in which these figures were calculated, uncertainty over the amount of preventive work that is directed towards illicit drugs and the lack of estimates of the proportion of time devoted to different drugs required simplifying assumptions to be made. Information on police expenditure is limited, and there is no indication of how the largest component of its costs, the work of CID and uniformed officers, changed over the period.

Further limitations arise because of a lack of research on the economic behaviour of traffickers and users in illicit drug markets. In particular, it is not known how consumption and price patterns change as a result of changes in the impact of enforcement activity. Consequently, an evaluation of enforcement activity must adopt intermediate outcome measures, and thereby implicitly assume a constant positive relationship between enforcement activity and drug-related harm. It is not difficult to hypothesise examples where this may not be the case.

From available figures it can be estimated that Customs expenditure on drug enforcement activity rose by 38% in real terms over the period 1979 to 1989, despite consistently falling until 1983. In contrast, estimates of police expenditure on drug enforcement activity rose consistently over the decade to 74% more than its 1979 value (see Table II). However, trends in enforcement output have not followed the same patterns. The estimated Customs heroin interception rate (the proportion of the total amount of heroin shipped to the UK which is

seized by Customs) rose for most of the decade, but fell between 1985 to 1988 at the time of the largest increases in expenditure. Measures of the outcome of enforcement activity by the police show a consistent trend over the decade. Improvements in impact were recorded over the period 1979 to 1985, but the heroin interception rate and the risks their activity imposed on heroin dealers and users fell consistently since 1985.

Some of these changes may be indicators of switches in enforcement focus between different drug markets. It seems that changes in the success of Customs intervention in the heroin market were more marked than they were in other markets, such as those for cocaine and cannabis. As the weight of heroin seized by the police declined over the period 1987 to 1990, increased amounts of cocaine, cannabis and amphetamines were intercepted. Nevertheless, the disruption of domestic drug markets through the arrest and conviction of dealers and users by the police certainly declined over the latter half of the decade.

In Section III it was emphasised that cost-effectiveness indices are distinct from performance indicators. Whereas performance analysis attempts to provide an adjusted and, in some sense, reasonable account of the efficiency of enforcement agency work over time, cost-effectiveness analysis usually aims to discover which alternative is the most efficient intervention at a particular point in time. Whilst external factors are excluded from performance analysis, they are implicitly included in cost-effectiveness analysis. The degree of purity-dilution or 'cutting' that takes place between the import and distribution levels of the heroin market is estimated to have increased from 3% to 28% over the period 1979 to 1990 (see Table IV). As a result, the quantity of heroin at the distribution level of the market will have increased at a greater rate than the quantity at the import-level of the market (see Tables III and IV). Therefore, it will have been more demanding for the police to maintain their impact on the

heroin market than for Customs. Such a consideration is relevant to a cost-effectiveness analysis of different enforcement activity options. This external factor will, *ceteris paribus*, have made Customs intervention in the heroin market increase in cost-effectiveness relative to that of the police.

The cost and output information was combined in Section III to provide a cost-effectiveness analysis of drug enforcement activity. The results of the analysis of interventions in the heroin market showed that whilst both agencies made cost-effectiveness gains until 1985, the greater rapidity of decline in police cost-effectiveness meant that Customs cost-effectiveness made relative gains despite also deteriorating at this time. The decline in police cost-effectiveness over the latter half of the decade is measured by the rise in the cost per unit of output of between 320 and 530%.

There are two consequences of this study that should be emphasized: the need to extend evaluation down the production process to consider measures of final output rather than intermediate output (see Figure I) and the need for recognition of cost-effectiveness criteria in the resource allocation process.

At present, evaluation is confined to consideration of enforcement agencies activity without regard to how enforcement activity and illicit drug markets interact. This study has demonstrated that even detecting changes in the cost-effectiveness of enforcement agencies is severely hampered by a lack of data. However, by making many assumptions, some movements in the relative cost-effectiveness of enforcement activity by the police and Customs can be estimated. Nevertheless, whilst it may be possible to assert that Customs activity has made gains in cost-effectiveness relative to the police, it is impossible to suggest

which may be the more cost-effective either originally or at present. The extension of an understanding of the effects of (different types of) enforcement activity on drug price, consumption patterns and the extent of harm caused by illicit drug use is of paramount importance, but impossible given data paucity.

The range of data available has been reduced since the previous study of cost-effectiveness by Wagstaff and Maynard (1988), which covered the period 1979 to 1984. Since this time the real level of resources devoted to drug enforcement activity has continued to rise and resources have continued to be allocated on what appears to be an ad hoc basis without adequate monitoring. For example, over the period 1985 to 1989, whilst police cost-effectiveness was declining at a much faster rate than that of Customs, the expenditure by both agencies on drug enforcement work rose at approximately the same rate of 40%. If policy-makers are to maximise the impact on drug-related harm of the estimated budget of £335 million devoted to drug enforcement activity each year (SCODA, 1992), the involvement of cost-effectiveness criteria in the resource allocation process must be facilitated and realised. If large sums of public money are to be spent on enforcement in illicit drug markets, its managers should be accountable and this is impossible if adequate data are not collected.

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