



NDLERF

Evaluating drug law enforcement interventions directed towards methamphetamine in Australia

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Monograph Series No. 44

Funded by the National Drug Law Enforcement Research Fund
An Initiative of the National Drug Strategy

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Produced by the National Drug Law Enforcement Research Fund (NDLERF)
GPO Box 2944, Canberra, Australian Capital Territory 2601

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ISBN: 978-1-922009-22-7

ISSN: 1449-7476

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The research on which this report is based was funded by the National Drug Law Enforcement Research Fund, an initiative of the National Drug Strategy.

Contents

Acknowledgements.....	iv
List of Abbreviations/Acronyms	v
Executive Summary.....	vi
Chapter 1: Introduction	1
1.1 Methamphetamine overview	1
1.2 Drug law enforcement and methamphetamine	2
1.3 Research on drug law enforcement against multiple supply chain levels	9
1.4 Summary and conclusions.....	11
Chapter 2: Methodology	13
2.1 Qualitative methods.....	13
2.2 Market indicators: Price and purity.....	14
2.3 Quantitative methods: Economic modelling	15
Chapter 3: Results: Methamphetamine supply chains in Australia: Networks and people.....	30
3.1 Networks, organisations and people involved	33
3.2 International networks of relevance for Australian supply	34
3.3 Domestic networks and organisation of the market	35
3.4 Roles of players within the market	38
3.5 Summary: Networks and organisations	40
Chapter 4: Prices and profits.....	42
4.1 Prices and mark-ups for precursors	43
4.2 Prices and mark-ups for end product	45
4.3 Purity.....	50
4.4 Price and purity: Discussion and conclusions	56
Chapter 5: Results: Methamphetamine supply chains: structure and dynamics	58
5.1 Acquiring raw materials	58
5.2 Manufacture of end product	67
5.3 Distribution of end product	76
5.4 Summary.....	80
Chapter 6: Results: Economic analysis.....	82
6.1 Summary of cost and impact data.....	82
6.2 Initial results.....	83
6.3 Sensitivity to key parameters	84
6.4 Main results.....	85

6.5 Threshold analysis	87
6.6 Summary and implications.....	88
Chapter 7: Discussion	90
References.....	94
Appendix A: Key informants	100
Appendix B: Interview schedule for KI interviews	101
Appendix C: List of cases	105
Appendix D: Estimating the costs of incarceration	106
Appendix E: Different legislation on drugs (methamphetamine).....	108
Appendix F: Estimation for Queensland replacement cost in end product trafficking seizures (domestic)	109
Appendix G: Raw data for precursor prices: International and domestic	111

Figures

Figure 1: Supply chains and drug law enforcement interventions	ix
Figure 3.1: A typical supply chain.....	30
Figure 3.2: Supply chains and drug law enforcement interventions	32
Figure 4.1 Price and weight relationship—crystal form	46
Figure 4.2: Price and weight relationship—non-crystal form.....	49
Figure 4.3: Methamphetamine price by transaction weight (crystal and non-crystal).....	50
Figure 4.4: Methamphetamine purity by weight.....	53
Figure 4.5: Summaries of purity by frequency of seizure weight groups from Victoria Forensic Laboratory 2006–07	54
Figure 4.6: Scatterplot of seizure purity by seizure weight	55
Figure 4.7: Summaries of purity for seizure weight groups from Victoria Forensic Laboratory 2006–07	55
Figure 6.1: Cumulative density functions with $\pm 20\%$ cost data.....	85
Figure 6.2: Cumulative density functions with $\pm 30\%$ cost data.....	86

Tables

Table 2.1: End product and precursor seizures (border): Customs estimate	21
Table 2.2: End product and precursor seizures (border): AFP estimate.....	22
Table 2.3: NSW Police drug budget data	23
Table 2.4: Budget details provided to the research team for clandestine laboratory detections	24
Table 2.5: Summary of estimated methamphetamine expenditure by different law enforcement agencies in 2006–07	24
Table 2.6: Size of seized clandestine laboratories.....	26

Table 2.7: Clandestine laboratory detections (domestic) seizure weights	26
Table 2.8: Seizure weight for each level of intervention in 2006–07.....	27
Table 2.9: Log-linear relationship between weight and price	28
Table 2.10: Precursor purchase price	28
Table 2.11: Monetary value of the loss to illicit drug enterprises due to drug law enforcement interventions in 2006–07	29
Table 4.1: Summary of data on prices and mark-ups for methamphetamine precursors, pre-precursors and reagents—\$ per kilogram	44
Table 4.2: Summary of raw data on prices of methamphetamine (crystal)	45
Table 4.3: Summary of raw data on prices of methamphetamine (non-crystal)	46
Table 4.4: Methamphetamine purity by weight	51
Table 4.5: Price mark-up coefficients β estimations.....	57
Table 6.1: Drug law enforcement budgets for each level of intervention in 2006–07	82
Table 6.2: Seizure weight for each level of intervention in 2006–07.....	82
Table 6.3: Loss to illicit drug enterprises due to drug law enforcement interventions in 2006–07	83
Table 6.4: Initial results: point estimates of cost-to-impact ratio.....	84
Table 6.5: Sensitivity analysis for drug law enforcement budgets in 2006–07	84
Table 6.6: Results of economic analysis (Monte Carlo simulation).....	85
Table 6.7: Main results and key drivers.....	86
Table 6.8: Results of ratio values with $\pm 30\%$ range of cost data.....	86
Table 6.9: Threshold analysis	87
Table F.1: Estimation of methamphetamine seizure weight for QLD	109
Table F.2: Parameter estimates for regression results	110
Table F.3: Estimation of QLD seizure replacement cost at end product trafficking seizures (domestic)	110
Table G.1: Summary of raw data on prices and mark-ups for methamphetamine precursors, pre-precursors and reagents.....	111

Acknowledgements

We are extremely grateful to the Project Reference Group (PRG) members who have provided substantial support in the conduct of this project. The membership of the PRG has included:

Pat Ward, Team Leader, Drug and Alcohol Coordination, NSW Police

Craig Howard, Detective Acting Superintendent, Crime Strategy Group, Victoria Police

Brian Wilkins Detective Superintendent, previously State Drug & Property Crime Group, now Homicide Group State Crime Operations Command, Queensland Police

John Pointing Detective Superintendent, State Drug Squad, Queensland Police (replaced Brian Wilkins on the PRG)

Victoria Linabury, Principal Policy Officer, Policy and Future Strategies, Australian Federal Police

Chris Black, Acting National Manager, Policy and Governance, Australian Federal Police (replaced Victoria Linabury on the PRG)

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Paul Coleman, Manager, Enforcement Priorities, Law Enforcement Strategy Customs (replaced Katherine Cave on the PRG)

Nicholas Winton, Manager, Enforcement Priorities, Law Enforcement Strategy, Customs (replaced Paul Coleman on the PRG)

Our technical advisors Professor Jonathon Caulkins and Professor Peter Reuter provided invaluable guidance in the conduct of this project. Our colleagues Jenny Chalmers and Caitlin Hughes also provided important support during the conduct of the project.

We are also grateful to Detective Inspector Nick Iorfino (Drug Squad, NSW Police), Detective Superintendent Nick Bingham (Drug Squad, NSW Police), Peter McGlynn (WA Police), Amber Migus (ACC), Toni Miceski (ACC), Joanne Gerstner-Stevens and Cate Quinn (Forensic Services Department, Victoria Police) who assisted with data.

This project was conducted between January, 2008 and August, 2010.

List of Abbreviations/Acronyms

ACC	Australian Crime Commission
AFP	Australian Federal Police
ATS	Amphetamine Type Stimulants
CDFs	cumulative density functions
Customs	Australian Customs and Border Protection Service
IDDR	Illicit Drug Data Report
IDRS	Illicit Drug Reporting System
IDU	injecting drug users
KIs	key informants
MTF	Monitoring the Future (USA survey)
OMCGs	outlaw motorcycle gangs
STRIDE	System to Retrieve Information from Drug Evidence (USA data)

Executive Summary

Methamphetamine belongs in the class of stimulant drugs referred to as Amphetamine Type Stimulants (ATS). The category of ATS includes ecstasy, amphetamine and methamphetamine. This research project concerned itself with the amphetamine and methamphetamine class and excluded ecstasy (and henceforth we use the generic term *methamphetamine*). In Australia, methamphetamine is available in three forms—powder, base and crystal. Methamphetamine is associated with significant harms and is an important drug policy priority. The National Amphetamine-Type Stimulants Strategy (2008–2011) (Ministerial Council on Drug Strategy, 2008) articulates the following priority areas in relation to methamphetamine:

- improve community awareness and understanding of amphetamine-type stimulant use and related problems;
- reduce the supply of amphetamine-type stimulants;
- develop specific strategies to prevent and reduce amphetamine type stimulant use; and
- develop organisational and system capacity to prevent and respond to amphetamine-type stimulant problems

This research concerns the second priority area—reducing the supply of methamphetamine. The specific aims of the research were twofold:

- to provide a rich description of the Australian methamphetamine supply chains in order to inform drug law enforcement interventions; and
- to conduct an initial economic evaluation comparing law enforcement interventions directed at the methamphetamine market.

The work focused on the methamphetamine market(s) and supply chains in Australia above the retail level. Previous research (eg McKetin, McLaren, & Kelly, 2005) has examined retail methamphetamine markets in Australia.

Governments and policymakers are interested in determining which interventions are more or less effective than others, such that the scarce funding resources can be allocated in the most efficient manner possible. There is scant research available to law enforcement to guide such decisions. The main impediments to such research are the fundamental methodological challenges inherent in such an undertaking. This project is an attempt to conduct a preliminary analysis comparing the costs and impacts of different types of law enforcement. It is a ground-breaking study as this has not been previously attempted and it should be seen as the initial development of a methodological approach that can be improved upon with subsequent research. The project aimed to determine the relative cost-to-impact ratios of different law enforcement strategies aimed at reducing methamphetamine production and distribution. In an environment focused on efficiency in resource allocation, it is hoped that this research will provide the impetus for further research on the effectiveness of drug law enforcement. As the results of such research accumulate, it is hoped that policymakers will be able to use the information to improve decision making on law enforcement investment.

As with all research, this study has limitations, which we hope will be addressed in future research. The economic results should be read with these limitations in mind.

- This study assessed the difference between four drug law enforcement interventions in terms of the impact (value of seized drugs) against expenditure (government costs). It is not a cost-effectiveness or a cost-benefit study. The results are reported in terms of the ranking of the interventions against each other. This study does not allow one to draw conclusions about the overall efficiency or value for money represented by drug law enforcement. Future research, which builds on this work, could include a cost-effectiveness analysis, between drug law enforcement interventions and across drug law enforcement and other interventions which reduce methamphetamine use (such as drug treatment).

- In this evaluation, the measure of policing impact was the monetary value of seized methamphetamine (or precursor). This is an imperfect impact measure. Drug law enforcement that results in seized product can also impact on the overall capacity of a criminal network.
- This study used the value of seized drugs as the measure to compare law enforcement interventions. However, drug law enforcement may change other financial aspects for drug criminals, such as increase the costs of manufacture and distribution (by seizing assets), increase the risks of arrest and imprisonment (opportunity costs) and increase the operational costs of running a business (costs of new avoidance strategies adopted against drug law enforcement). The aggregate costs are the losses to illicit drug enterprises due to drug law enforcement activities. A comprehensive analysis would include each of these aspects and calculate 'total loss' due to drug law enforcement. However, in this preliminary work, we were not able to cost each of these components and hence used only replacement costs (seizures) to represent the loss.
- There are other important impacts of drug law enforcement interventions—deterrence, public safety and public amenity, and disruptions on other crimes that criminal networks are engaged in that have not been included in this study; future research could adopt the broader, taxpayer (societal) perspective, rather than policing agency perspective.
- In this study, we evaluate the relative impact of discrete law enforcement interventions. However, in reality, law enforcement interventions are likely to exert synergistic effects such that the combined impact of a suite of interventions is likely to be greater than the sum of the impact of individual interventions. Thus, an important caveat to our results relates to the cumulative impact of law enforcement interventions. The current project did not examine the impact of cumulative or multi-pronged interventions.
- There is a substantial lack of data across many areas of illicit drug markets. We had difficulty obtaining methamphetamine price data, information about market structure, police agency budgets and detailed seizure data. Some of these data, such as information about markets, involves ethnographic research. For quantitative data, consideration should be given to the development of data collection systems which would facilitate illicit drug market and law enforcement effectiveness research (eg collection of data which connects price and purity of seizures).
- Our study did not include the relative impact of precursor regulations and the enforcement of these regulations, nor did it include source country interventions conducted by Australian law enforcement.

There is currently very little empirical evidence to guide policy decisions about drug enforcement interventions directed to methamphetamine. In fact, the paucity of research on the effectiveness of law enforcement across all illicit drugs 'continues to pose a major barrier to applying these policies effectively' (Babor, et al., 2010 p. 258.) Decisions about which methamphetamine supply control policy to fund, which policies should receive increased funding, or how to derive the most effective balance of priorities, are currently uninformed by the results of research. There is a clear and pressing need for further research that examines the effectiveness of law enforcement interventions directed at methamphetamine. The current study aims to begin to fill this gap.

Methamphetamine supply in Australia

Figure 1 summarises our findings in relation to methamphetamine supply chains. Methamphetamine is imported into Australia, but is also produced within Australia. Thus, the structure of methamphetamine supply chains in Australia is complicated by both domestic and international production and domestic and international distribution.

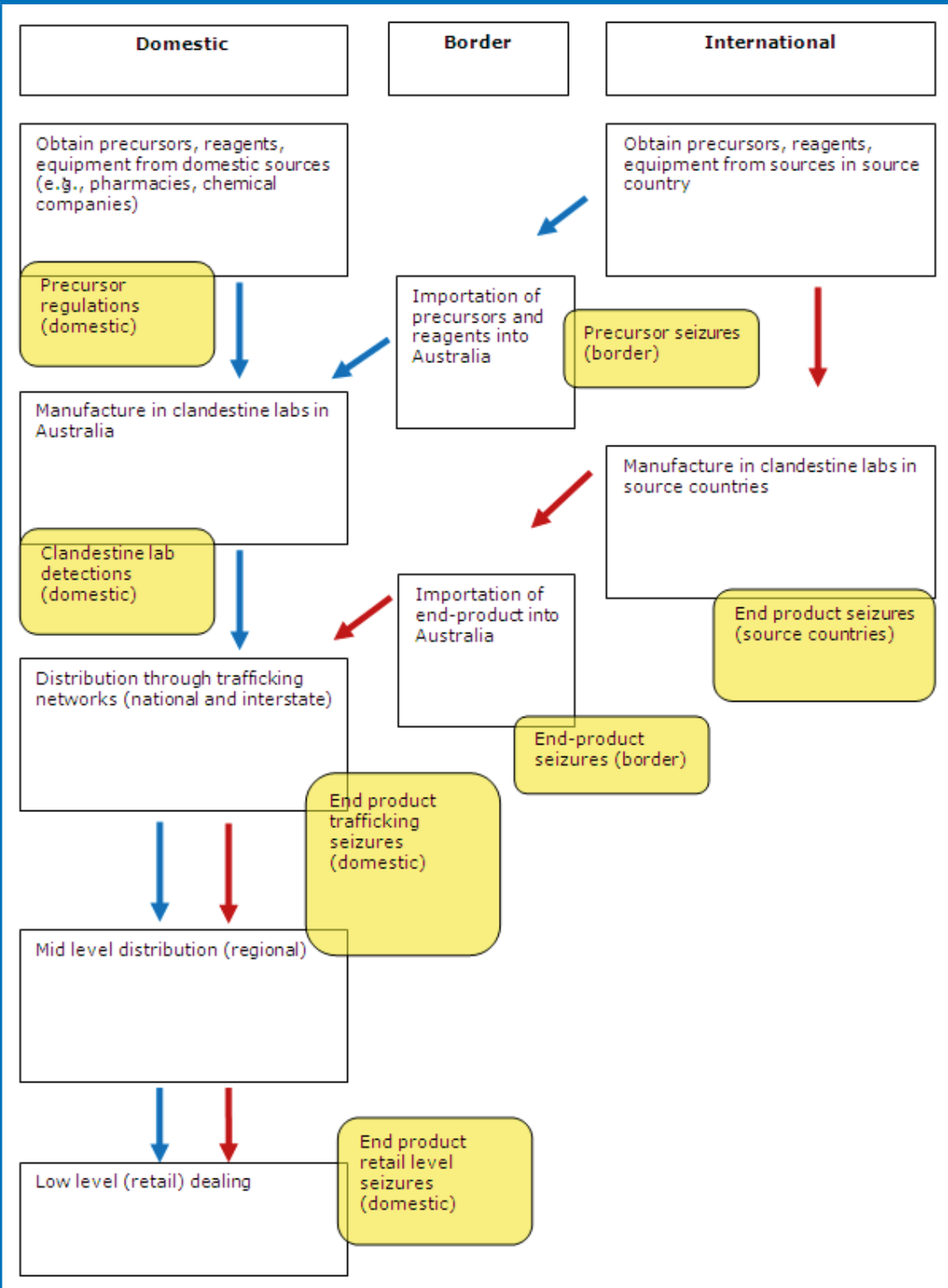
Crystal methamphetamine is mainly imported and then distributed within Australia. Non-crystal methamphetamine (powder and base) is mainly locally produced and is then distributed by a range of criminal networks. There is some evidence of domestic manufacture of crystal and of importation of non-crystal methamphetamine (powder, but not base).

The activities associated with procuring methamphetamine are listed in the white boxes in Figure 1. The associated law enforcement interventions are provided in the yellow boxes. The arrows indicate the relationships between the two supply chains (domestic and international). As can be seen, the supply chains merge at various points (at domestic manufacture, clandestine laboratories and distribution through domestic trafficking networks).

The law enforcement interventions that map onto the different levels of the supply chain can be summarised as:

- End product seizures (source countries)
- End product seizures (border)
- Precursor seizure (border)
- Regulation of precursors (domestic)
- Clandestine laboratory detections (domestic)
- End product trafficking seizures (domestic)
- End product retail level seizures (domestic)

Figure 1: Supply chains and drug law enforcement interventions



Methamphetamine markets: Networks, organisations and people involved

We found evidence of diverse organised crime groups involved in methamphetamine manufacture and trafficking (outlaw motorcycle gangs (OMCGs), multinational syndicates, Asian crime syndicates and so on). These organised crime groups are not confined to any one ethnicity or association and include those of European, Middle-Eastern and Asian backgrounds.

The extent to which these organised crime groups control the entire supply chain, or parts thereof, is unclear. There is evidence of vertical integration within the methamphetamine supply chain (eg OMCGs are involved at all levels of the domestic supply chain from accessing raw materials to retail sales). Alternatively, some groups/individuals are involved at only one level of the supply chain (eg groups that import precursor chemicals but are not involved at any other level). The existence of vertical integration within the methamphetamine market has important policing implications; law enforcement may be more effective when it is targeted at those groups that control several supply chain levels, as the removal of these groups is likely to exert a greater impact on the methamphetamine market compared with groups who are involved at only one level.

We found evidence of cooperation between criminal groups. The effectiveness of law enforcement operations is likely to be enhanced if detailed intelligence is collected on relationships and connections between groups prior to arrests being secured. The additional resources and time spent mapping out these networks may lead to arrests that have a greater likelihood of breaking up several interconnected criminal groups.

Some criminal groups appear to use established techniques and trafficking routes that were once used for other drugs such as heroin. Thus, law enforcement strategies used successfully against heroin are likely to also be effective against methamphetamine.

Multiple and diverse role specialisation is apparent within and across groups. For example, ‘cooks’ possess specialised knowledge and skill and serve an important function. Cooks are therefore difficult to replace in criminal networks. Law enforcement interventions that lead to the arrest and incarceration of cooks are likely to be particularly effective at disrupting the manufacture of methamphetamine.

Criminal groups are involved in diverse criminal activities. Taking out drug dealing enterprises can have flow on effects to other illegal activity. This has important implications for drug law enforcement—simply discouraging these groups from dealing in the drug trade (ie making it less profitable than other illegal activities, rather than not profitable at all) may be sufficient to have them turn to other illegal activities.

The methamphetamine market is characterised by corporate organisational structures (with vertical integration, such as OMCGs), freelance structures (sole operators, such as ‘meth cooks’), and communal organisations tied with common backgrounds/values (ethnically-based organised crime groups). The existence of all three market structures is potentially challenging for police, given the different features. For example, communal organisations rely on relational capital (trust between members) and are therefore hard to infiltrate (eg with undercover operatives) and break. Vertically organised hierarchical structures imply that police attention at the top of the hierarchy is likely to bring greatest results. Freelance structures means that police cannot direct their resources to a particular organisation or chain of supply.

Prices and profits

Three prices exist in the methamphetamine market—prices for precursors, prices for the crystal methamphetamine form and prices for the non-crystal methamphetamine form. Our research on precursor prices reveals that prices of precursors purchased offshore are very inexpensive, whereas within Australia, high prices are paid. This may reflect successful law enforcement efforts at reducing importation of precursor chemicals.

An important feature for any illicit market is the extent of profitability. Profitability is measured by the degree of mark-up in price between two levels of the market. However, we do not have a direct measure of mark-ups per se. An indirect calculation is the quantity discount coefficient, which is derived from the price–weight relationship at different weights. The quantity discount can be calculated on two aspects of price—the changes in the unit price (which reflects the extent of a change in price per standard unit purchased), or the changes in the total price (which reflects margins on total amount sold).

We estimated the quantity discount coefficient for both unit price and for total price across the two methamphetamine forms (crystal and non-crystal). This is the first attempt to conduct such analyses for methamphetamine in Australia.

The results of the regression showed that the quantity discount coefficient β_1 (quantity discount estimate) for total transaction price for crystal methamphetamine was 0.8727 and for the non-crystal form of methamphetamine, it was 0.8453 (if the coefficient is equal to 1.00 then there is no difference between price paid and price sold). The goodness of fit is reasonably high (R^2 above 0.90 in both cases). Comparing the quantity discount coefficient with other drugs in other countries, the Australian coefficient is large, indicative of lower unit price change. This means that running a methamphetamine drug business in Australia may pose lower risks than in the United States, although this is completely suppositional.

Another implication from these results is that methamphetamine seems to be subject to the following pricing rule—for every 10% increase in transaction size, the unit price will fall by 1.21% for crystal form and by 1.47% for non-crystal form. Interestingly, these are smaller than for cannabis (2.5%).

To calculate the mark-ups from the quantity discount coefficient, one needs to know the ‘branching ratio’ (ie how many times the drugs are cut during distribution by one dealer). However, the branching ratio is not known, so we use hypothetical numbers. Thus, for example, with a cut between four to 20 times for the crystal form, the mark-ups can range from 119% (at 4 times) to 146% (at 20 times). If the branching ratio is larger, the mark-ups will be higher.

The regression results can also be used to compare the price of crystal and non-crystal. Those prices vary according to their weight, as expected. Our research shows that price differences between crystal and non-crystal forms of methamphetamine are not large at lower seizure weights, while at higher weights (eg at a weight of a pound (455g)) the crystal form of methamphetamine has a higher price than the non-crystal form (about 1.5 times higher). At higher market levels, this price differential is even greater, with crystal methamphetamine being worth almost double that of non-crystal methamphetamine.

Finally, we were unable to determine whether criminal networks adjust price, purity and/or both in order to maximise profits. Our purity analyses revealed that purity varied greatly across weight. In addition, our analysis did not support the assumption of higher weight associated with higher purity. Furthermore, the data analysed here reinforces that caution needs to be taken when using average purity (which may be highly misleading). Finally, future research should incorporate purity with price, if data which matches purity with price can be obtained.

Market structure and dynamics

According to reports from key informants (KIs), the increasing restrictions on the availability of pseudoephedrine in Australia (eg Project STOP, rescheduling of pseudoephedrine-based products) have resulted in a trend of increasing bulk importations of raw pseudoephedrine. With this shift, the interception of precursors at the border will be a priority for law enforcement agencies. Key informants also reported an increase in the use of pre-precursors within domestic manufacture.

There are multiple sources for precursors and reagents (eg legitimate industry, break and enter, shell companies etc). Techniques and strategies used by criminal groups to obtain the required chemicals are likely to continue to evolve. For example, the use of pre-precursors in manufacture is now growing as the availability of precursors is restricted.

The methamphetamine market is dynamic and constantly changing. For example, when a few ‘cooks’ are imprisoned, their preferred methods are no longer common; but the processes can resurface when cooks with specialised knowledge and skill are released from prison. Pseudo-runners appear to be a declining trend (given Project STOP and other restriction on the availability of pseudoephedrine).

There has also been a trend back to P2P-type methods in response to restrictions on the availability of pseudoephedrine. Drug law enforcement will be required to focus on the precursors and manufacture techniques utilised for P2P manufacture. There is some regional variation in manufacture methods across Australia. This may be to do with ‘cooks’ availability and their preferred method, but the variation also relates to access to chemicals (eg the Nazi method predominates in Western Australia possibly due to ready availability of ammonia). New methods continue to be invented and used within Australia. Law enforcement will continue to rely on intelligence gathering about manufacture methods to keep abreast of new manufacture processes as they emerge.

The shift to importation of raw pseudoephedrine in bulk and the increased use of P2P methods may lead to an increase in the number of large clandestine laboratories in Australia. The dismantling of clandestine laboratories will increasingly rely on successful investigations into organised criminal groups who operate large clandestine laboratories.

The separation of manufacture into discrete steps at different sites may create the impression of small timers but in fact, there is evidence that they can be coordinated by large syndicates which split up the manufacture process as a risk management strategy.

Economic modelling of cost-to-impact rankings for methamphetamine drug law enforcement

For the second aim, we undertook an economic modelling exercise that enabled initial rank ordering of the different drug law enforcement interventions. We built an economic model that compared policing costs with impact, as measured by methamphetamine seizures. The full details of the methods used in the economic modelling are provided in Chapter 2. As noted earlier, there are seven aspects to the methamphetamine supply chain in Australia (see Figure 1); however, the economic model could only cover four of these seven. These were:

- end product seizures (border)
- precursor seizures (border)
- clandestine laboratory detections (domestic)
- end-product trafficking seizures (domestic)

Source country precursor regulations and source country precursor seizures were excluded due to lack of data.

We used a cost-to-impact ratio that represents the average costs associated with the intervention relative to the impact, as measured by the value of the seized drugs. Using the same measure of impact across each of the policing interventions means that we can compare the interventions with each other. The ratio of costs to impact was calculated for each intervention and then rank ordered. The lower the ratio, the better the intervention is relative to the other interventions being assessed on this metric. This last point is important—the ratio of costs to impact is only useful relative to its comparators; it is not a reflection of efficiency or potential cost savings.

The economic model results indicate that the highest ranked intervention, in terms of average costs to impact, was clandestine laboratory detections. Ranked second was end-product trafficking seizures (domestic); third was precursor seizures and the lowest ranked intervention relative to all four was end-product border seizures, however, there is unlikely to be meaningful difference between these last two. This result in favour of clandestine laboratory detections held when we took into account significant data uncertainties. This result

is robust—halving the monetary value of the loss to illicit drug enterprises for clandestine laboratory, does not change the rank order; neither does doubling the clandestine laboratory budgets. The cost-to-impact ratio does not reflect the overall effectiveness of any single intervention. The ratios are only meaningful as a measure of how effective each intervention is compared with the other interventions we have evaluated. As noted at the outset, the economic work is preliminary and provides the basis for significant further research, which may ultimately enable cost-benefit and cost-effectiveness analysis of drug law enforcement.

Future research

Given that this work represents only a first attempt to conduct a comprehensive qualitative and quantitative analysis of the methamphetamine market(s) beyond retail level in Australia, we hope it will be a springboard for further research. The model and methodology used here can be improved and applied to law enforcement directed at other drugs (eg heroin, cocaine). There are many refinements that could be made to the economic model if data were available. This includes assessing the additive effects of law enforcement across levels of the supply chain, using purity-adjusted price, measuring impact as total loss to illicit drug enterprises (rather than only seizure value) and valuing broader impacts such as public amenity. The qualitative findings reinforced the constantly changing nature of the methamphetamine market—drug law enforcement needs to remain abreast of developments in order to maximise effectiveness.

Chapter 1: Introduction

1.1 Methamphetamine overview

Methamphetamine belongs in the class of stimulant drugs, referred to as Amphetamine Type Stimulants. The category of Amphetamine Type Stimulants includes ecstasy, amphetamine and methamphetamine. This research project was concerned with the amphetamine and methamphetamine class (and henceforth we use the generic term *methamphetamine*) and excluded ecstasy. In Australia, methamphetamine is available in three forms—powder, base and crystal. The crystal form (colloquially referred to as *ice*) is the most potent of the forms. Methamphetamine has been a cause for concern in Australia. Alarmist media associated with the ‘ice epidemic’ has been noted (eg ‘a scourge that poses new and urgent risks in our society’; NSW Premiers Office, press release, 19 October 2006; and ‘Police battle crime wave fuelled by [ice]’ Daily Telegraph, 10 December 2006). Despite the impression of increasing methamphetamine problems in Australia, recent use of methamphetamine as measured by the Household Survey (Australian Institute of Health and Welfare, 2008) appears to have remained stable since the early 1990s. The percentage of NDSHS respondents who reported recent use between 1993 and 2007 has ranged between 2% and 3.7% at its peak in 1998. Use among secondary school students (Australian Government Department of Health and Ageing, 2006) has remained stable. A small decline is observable in detainees testing positive to illicit amphetamines as well as recreational drug users (Gaffney, Jones, Sweeney, & Payne, 2010).

Despite the apparently stable trends in use, methamphetamine is associated with significant harms and remains an important drug policy priority. This is demonstrated in the National Amphetamine-Type Stimulants Strategy (2008–2011) (Ministerial Council on Drug Strategy, 2008). The Strategy document articulates the following priority areas in relation to methamphetamine:

- improve community awareness and understanding of amphetamine-type stimulant use and related problems;
- reduce the supply of amphetamine-type stimulants;
- develop specific strategies to prevent and reduce amphetamine type stimulant use; and
- develop organisational and system capacity to prevent and respond to amphetamine-type stimulant problems

The current research project concerns the second priority area—reducing the supply of methamphetamine. The specific aims of the research were twofold:

- to provide a rich description of the Australian methamphetamine supply chains in order to inform drug law enforcement interventions; and
- to conduct an initial economic evaluation comparing law enforcement interventions directed at the methamphetamine market.

To date, no-one has conducted a thorough examination of the methamphetamine market and associated supply chains above the retail level in Australia. The important work by McKetin and colleagues (McKetin & McLaren, 2004; McKetin, et al., 2005; McKetin, McLaren, Kelly, & Chalmers, 2009) sets the background for this project by detailing the retail level of the methamphetamine market in Australia (including use and dealing at retail level).

Drug law enforcement against the methamphetamine market takes a number of forms—Australian police operate outside Australian borders, in collaboration with other police forces, to disrupt drug supply within source countries. Border control (interdiction) seeks to detect entry of illegal drugs and precursor chemicals into Australia. Domestic production occurs at clandestine laboratories around Australia, which are detected and destroyed by police. Trafficking and distribution of methamphetamine is another arena for methamphetamine policing. Finally, police can operate at the retail level of the market, arresting local

dealers. In addition, precursor chemical regulations attempt to restrict the supply of precursor chemicals. In Australia, such regulations are within the purview of law enforcement, having been initiated and put in place by law enforcement agencies working in collaboration with other arms of government. In concert with policing activities, precursor chemical regulation controls aim to interrupt or reduce methamphetamine production.

Moore (1990) contends that

...it is wise to rely on a portfolio of supply reduction programs—not on any single device. Wisdom in managing that portfolio requires adjustments in the balance of efforts in accord with policy objective and information about which programs seem to be working (p. 112).

Indeed, there is much logic in ensuring that drug law enforcement is directed at multiple levels of the methamphetamine supply chain. Furthermore, the various interventions are expected to exert some synergistic effects, such that the total impact is greater than the sum of the discrete impact of the individual interventions.

Unfortunately, there is little research that examines the effectiveness of these different policing activities, let alone research that compares the policing interventions in terms of costs and impact. There is much descriptive research of how law enforcement operates (eg Australian precursor diversion controls (Cherney, O'Reilly, & Grabosky, 2005), clandestine laboratory seizures in the United States (Indiana State Police Department, 1997), and law enforcement interventions in Southeast Asia (Kramer, 2009). However, there are relatively few studies which examine the effectiveness of these strategies.

This project focused on law enforcement interventions against methamphetamine above the level of the retail market. The state of the literature on the effectiveness of drug law enforcement at retail level has been extensively reviewed previously (see Mazerolle, Soole, & Rombouts, 2006, 2007a, 2007b, 2007c; Mazerolle, 2005; McKetin & McLaren, 2004; McKetin, et al., 2005; McKetin, et al., 2009).

The only empirical research conducted to date that has examined the effectiveness of drug law enforcement interventions against methamphetamine has evaluated the impact of precursor regulations and precursor seizures, and is set out below. One prevailing view is that the only effective way to control the supply of synthetic drugs such as methamphetamine is via precursor regulation (Costa, 2008). After regulation, we consider the other drug law enforcement interventions, but largely find almost no effectiveness research for methamphetamine. In those cases, we turn to effectiveness research regarding other illicit drugs, notably heroin and cocaine. We excluded research that focused on cannabis.

1.2 Drug law enforcement and methamphetamine

1.2.1 The effectiveness of precursor regulation

In a series of studies, Cunningham, Liu and colleagues (2003a, 2003b, 2005, 2008, 2009) examined the impact of precursor regulations in the United States. Controls of precursors are a supply side intervention that is expected to inflate the retail price of methamphetamine. Production costs of suppliers and manufacturers are increased as the sourcing of precursors becomes more difficult and consequently more costly. One study (Cunningham & Liu, 2005), examined the impact of federal precursor regulations in the United States on methamphetamine arrests in California. Arrests for methamphetamine fell between 31% and 45% following the 1989, 1995 and 1997 regulations targeting large scale manufactures. However, regulations targeting small scale manufacturers had little or no effect on arrests. However, within two to three years of the first two regulations (1989 and 1995), arrests had returned to pre-regulation levels, possibly because manufacturers were able to access precursors in forms which were not yet the focus of regulations. The authors concluded that US Federal precursor regulations may have contributed to the increase in small-scale lab seizures noted in the 1990s.

In a further study, Cunningham and Liu (2003a) found that the 1989, 1995 and 1997 precursor regulations had reduced methamphetamine-related hospital admissions by between 34–48% in California and between

41–71% in Arizona and Nevada, whereas the 1996 regulations had exerted little or no impact on hospital admissions related to methamphetamine. Reuter and Caulkins (2003) offered an alternative explanation. They reviewed a range of data sources (eg retail price, urinalyses of arrestees, treatment admissions) and argued that the effect of the 1997 regulations in the United States may have been modest and that the apparent impact of the 1989 regulations may actually have been due to other factors.

Cunningham and Liu (2008) examined the impact of US Federal precursor regulations on the demand for methamphetamine treatment. Voluntary admissions for methamphetamine treatment decreased following the 1995 and 1997 regulations that targeted large scale manufacturers (39% after the 1995 regulations and 31% following the 1997 regulations). Treatment admissions increased six months following the 1995 regulation, possibly as manufacturers sourced unrestricted pseudoephedrine products. The decrease in admissions following the 1997 regulations was followed by an increase in admissions in 2001, possibly because Mexican manufacturers started importing precursors from other countries.

Cunningham, Liu, and Callaghan (2009) found that methamphetamine purity in the continental United States declined following the 1989, 1995 and 1997 regulations, whereas Canadian regulations instituted in 2003 were followed by an increase in the purity of US methamphetamine. The authors suggest that by the time the Canadian regulations were instituted, Mexican manufacturers had started importing precursors from countries outside the United States, whereas US-based manufacturers had begun to source precursors from Canada. The US-based labs were therefore most impacted by the Canadian regulations. As Mexican labs gained the ascendancy on US-based labs, with increased capacity and purity, the regulations may have contributed to increases in the purity of US methamphetamine.

Cunningham, Liu and Muramoto (2008) also examined the impact of precursor regulations on routes of methamphetamine administration. Prior to the regulations in mid-1990s, snorting dominated methamphetamine admissions. Shortly following the 1997 regulations, injecting, snorting and swallowing all declined. However, smoking methamphetamine declined initially but rebounded to higher levels. Smoking has a relatively high risk of dependence and the authors indicated that the rise in smoking was an area of concern.

In another study of the US precursor regulation experience, Dobkin and Nicosia (2007) examined the impact of the closure of two chemical companies in association with the DCDCA changes. The closure occurred in May 1995—four months later saw the introduction of the 1995 precursor regulations and one year later the 1996 regulations were introduced. The study examined the period between 1994 and 1997. Therefore, in reality, the study examines the cumulative impact of the closure of the chemical companies and the 1995 and 1996 regulations. Immediately following the closure, methamphetamine retail prices increased from \$30 to \$100 per gram (prices reported were not adjusted for purity). However, only four months following the intervention, retail price had returned to baseline (\$30 per gram). Purity initially dropped from 90% to 20%, but within 18 months had increased to 85% of the pre-intervention level. Methamphetamine-related hospital admissions (a proxy for consumption) declined by 50%, voluntary admissions to treatment decreased by 35% and felony and misdemeanour arrests for methamphetamine possession and sale fell by 50% and 25% respectively. Methamphetamine-related hospital admissions, drug treatment admissions and arrests returned to pre-intervention levels over the 18 months following the intervention. The results suggest that large seizures of precursor chemicals can exert a short-term impact (shock) on illicit drug markets and can lead to reduced supply, increased price and reductions in purity, but that the market recalibrates reasonably quickly and any impact is only short-lived.

All of these studies were conducted in the United States. No research was located which evaluated the effectiveness of precursor regulations in Australia.

1.2.2 The effectiveness of interventions against methamphetamine in source countries and at the border (interdiction)

The source countries for methamphetamine for Australia include Canada and southeast Asian countries such as Thailand and parts of China. No research has evaluated the impact of law enforcement efforts specifically for methamphetamine in these source countries. There is tremendous variety in source country interventions (including such diverse measures as alternative development and crop eradication). Some

economic modelling research on the effectiveness of source country control has indicated that eradication programs in source countries may have little impact. For example, Rydell and Everingham (1994) examined four interventions directed at cocaine—three supply-side drug law enforcement interventions (source country interventions, interdiction and domestic enforcement) and one demand-side intervention (treatment of heavy users). Source-country interventions by drug law enforcement agencies were found to be the least cost effective of all the programs examined. By contrast however, Crane et al. were critical of the method used by Rydell and Everingham and concluded that ‘a well conceived source zone interdiction strategy aimed at denying production and transportation to the cocaine industry can be relatively cost effective’ (p. IV-14).

Pietschmann (2004) examined the Taliban ban on opium cultivation in 2001 and found that the ban produced elevations in local opium and heroin prices, in addition to a rise in retail heroin prices in Europe. The study suggests that interventions that deplete supply of raw materials can lead to inflations of retail drug prices.

Clemens (2008) concluded that current eradication programs of poppy in Afghanistan exert little impact on the international supply of heroin. In fact, Clemens estimated that in order bring about a shift in the availability of heroin on world markets, eradication programs would need to reduce cultivated hectares of poppy from the current 193,000 hectares to 80,000 hectares (a decrease of over 40%). Farrell (1998) examined trends in eradication efforts for coca bush, poppy and cannabis plants and found that across all countries and types of crop, the risk of eradication was very small. The average proportion of coca bush and poppy eradicated globally was less than 10% between 1993 and 1994 (Farrell, 1998). More recently, the work of Paoli et al. has demonstrated that the changes in Afghanistan (such as the Taliban ban on opium) produced dramatic but short-lived changes in opium production. By 2002, Afghan production had recovered to mid-1990 levels.

There is some research that evaluates the effectiveness of border interventions against illicit drugs other than methamphetamine, most notably, cocaine and heroin (no specific methamphetamine research regarding interdiction was located).

Smithson, McFadden, and Mwesigye (2005) examined the effects of disrupting large-scale importations of heroin at the border through the activities of the Australian Federal Police (AFP) and partner agencies (eg customs). Specifically, the researchers investigated whether heroin purity at retail level (in the Australian Capital Territory) is predicted by national AFP seizure data. In this study, purity was used as a proxy for supply (higher purity equals greater supply). Time series analyses were used to determine whether a predictive relationship was apparent once sources of error (eg autocorrelation, seasonality effects) were removed. The researchers found that there was an increase in the weight of seizures prior to the decline in heroin supply and that fluctuation in seizure weight and number predicted variations in heroin purity levels. They concluded that this pattern of results suggested that the seizures were impacting supply (and therefore availability) of heroin. Smithson et al. found that seizures increased in magnitude and variability in the first half of 1998, coinciding with ‘substantially increased funding’ (p. 118) to the AFP for drug law enforcement operations. Further, fluctuations in purity predicted fluctuations in seizure activity, which then predicted ‘bounce back’ fluctuations in purity levels. This ‘opponent process’ was revealed for short-term fluctuations around long-term trends. The authors interpret these results to mean that greater supply of heroin generates larger and more frequent seizures and that increased seizures are followed by a partial restoration of supply. Both short- and long-term findings were interpreted as being congruent with the level of AFP seizures, representing the interplay between the total amount of illicit drugs imported into the country and the intensity of drug law enforcement activity. The authors posit that in the long run, large seizures of heroin can lead to reductions in street level supply (indicated by purity reductions) over a period of months or more. However, this kind of analysis needs to be replicated in other states (eg New South Wales, Victoria, Queensland) to determine whether the findings hold for different heroin markets in Australia.

Methamphetamine differs to heroin in that it is both imported and locally produced. In the case of methamphetamine, with two parallel and overlapping supply chains, the impact of intervening against one supply chain (eg importation) may lead to compensation at the other supply chain (eg increased domestic production). The impact of border seizures of methamphetamine on price and purity may therefore be moderated by trends in local production of methamphetamine.

Rumbold and Fry (1999) examined the impact of a seizure of 400kg of heroin (intercepted at the Australian border in Port Macquarie, New South Wales) on the heroin market in Melbourne, Victoria. To evaluate the impact of the seizure, two time periods were compared—a period of four months prior to the seizure and a second period of three months following the seizure. No differences were found when pre-seizure retail prices were compared with post-seizure retail prices (these were prices as reported by drug users and were therefore not adjusted for purity). Similarly, there was no change in heroin purity based on subjective reports of drug users and no change in self-reported availability. There was also no evidence that injecting drug users (IDU) had changed to different drugs after the seizure. Supporting the reports of drug users, KIs from law enforcement and treatment services reported no observed changes in methods used to consume heroin, nor in heroin price, purity or availability. KIs from Victoria Police noted little change in the heroin market pre- to post-seizure and the State Forensic Lab reported consistent heroin purity pre- to post-seizure (based on forensic analysis of purity levels). Furthermore, data on heroin overdoses suggested no change in trend over the study period. Overall, the range of data sources surveyed suggested that the seizure of heroin had exerted no discernible impact on the retail level of the market. Despite the seizure, the price, purity and availability of heroin remained consistent, with no changes in consumption by regular users.

In a methodology similar to that used by Rumbold and Fry, Wood et al. (2003), examined the impact of a large seizure of 'pure heroin' in Vancouver, Canada. Specifically, the researchers' aims were to determine the impact of the seizure on retail price, availability, IDU behaviour and the incidence of heroin overdose. To evaluate the impact of the seizure, the researchers compared two samples of IDUs:

- those surveyed 30 days before and 30 days after the seizure, and
- those seen 60 days before and 60 days after the seizure.

The researchers also examined data from IDU participants in six successive two week periods after the seizure. Based on the results, the researchers concluded that the seizure exerted no impact on the use of heroin by IDUs, price of heroin, or availability when compared 30 days before and 30 days after the seizure. The results held when the researchers extended the pre- post-seizure periods to 60 days. As there was no change in overdoses, methadone use, or reported source of drugs at 60 days, the researchers concluded that there had been no changes in purity associated with the seizure. This conclusion was supported by the findings of Health Canada's Drug Analysis Services, which reported no decrease in purity of heroin when purity in the three months before the seizure was compared with purity in the three months after the seizure. The researchers concluded that there had been '...no beneficial public health effects of Canada's largest ever heroin seizure. In our view, the most plausible explanation is that the seizure had no significant effect on the supply of heroin in this locality' (p. 168).

Wood et al. (2003) suggest that there may have been a confounding and unmeasured factor that contributed to the findings. For example, suppliers may have drawn on compensatory shipments to make up for drug losses to seizures. Alternatively, the seizure may have led suppliers to reduce the purity of heroin in order to ensure availability. However, there is little support for this latter hypothesis from the available data—there were no decreases in overdoses or in total heroin consumed and no change in methadone use over a 12 week period (these variables have been associated with street level heroin purity (Bach & Lantos, 1999; Darke, Kaye, & Ross, 1999). Again, the generalisability of these findings to synthetic drugs like methamphetamine is not known. Further research is needed to specifically examine the impact of border interventions against methamphetamine.

Studies like the one conducted by Wood et al. and Rumbold and Fry, which evaluate the impact of a single seizure event, do not take into account the cumulative impact on the market of multiple seizures, particularly multiple seizures against one syndicate or network. While single seizures of illicit drugs may exert little or no impact on drug markets, the cumulative impact of many seizures may exert a measurable effect on the typical market indicators such as price, purity and availability. Future research is required to examine the cumulative impact of seizures on traffickers (eg by establishing replacement costs) and to evaluate the impact of the arrest and incarceration of the key players in a syndicate or network, which may disrupt supply more significantly than seizures of drugs.

Research conducted by Weatherburn and Lind (1997) aimed to determine whether large-scale seizures of heroin influence the price and/or purity (including price per pure gram) of retail-level heroin. All seizures above one kilogram recorded by state and federal police across Australia were included in the study. As the study aggregated seizures by domestic and federal police agencies, it is not possible to parse out the contribution of border seizures compared with domestic (eg wholesale level) seizures. Therefore, this study was an evaluation of multiple law enforcement interventions (border and domestic) across supply chain levels. The researchers also examined the impact of the seizures on the availability of heroin at retail level (and the impact of arrests of users on treatment commencement; however, this latter outcome will not be discussed here). The Sydney suburb of Cabramatta was selected as the site for retail price and purity monitoring due to the large proportion of arrests in New South Wales and in particular in Cabramatta, and because drug law enforcement agencies reported that Cabramatta was a major centre for high purity 'rock' heroin. Time series analysis was utilised with a cross-correlation procedure. No relationship was found between the amount of heroin seized and the price, purity and availability of heroin at retail level in Cabramatta. The results suggest that seizures of heroin do not drive retail price increases by creating supply shortages. The authors conclude that 'attempts to increase the street price of heroin by creating a shortage of the drug, at least in Australia, would seem to have failed' (p. 567).

The authors posit three possible explanations for these null findings:

- the quantities of heroin seized by drug law enforcement may represent a small proportion of the total quantity imported such that the seizures do not impact on heroin price, purity and availability at retail level (the authors had previously calculated heroin seizures account for between 3.7% and 17.2% of that consumed; Weatherburn & Lind, 1995);
- importers may import sufficient quantities of heroin to compensate for expected losses to seizures; and
- a large proportion of imported heroin may have been destined for Australian markets in areas other than Sydney (and within Sydney, suburbs other than Cabramatta).

As a caveat to their conclusion, the authors opine

The knowledge that heroin importers and distributors are regularly arrested and imprisoned must engender a perception among those involved in importation and supply that there are risks associated with their activity. They will seek to be compensated for accepting these risks and the scale of that compensation can be expected to be reflected in the retail price of heroin. This suggests that drug law enforcement agencies may be able to influence the street price of heroin by manipulating the risks associated with importation and distribution, even if they cannot influence the price by restricting the supply of heroin (Weatherburn & Lind, 1997, p. 567).

Therefore, price increases may still be affected by drug law enforcement by increasing extant risks or creating novel risks for traffickers for which financial compensation is demanded. The study did not evaluate this possibility. This hypothesis could be examined by evaluating the impact of drug law enforcement intervention on risks posed to dealers and on the manufacture and distribution costs which flow from these risks.

No research is available that examines the impact of large seizures on methamphetamine price, purity etc. Given the different supply chain for methamphetamine compared with heroin (eg heroin is made available in Australia only by importation, whereas methamphetamine is imported and locally manufactured), it is not known to what extent the results of the above research can be generalised to methamphetamine.

Overall, the results suggest that intervening at the border, at least against heroin, is ineffective in raising prices and reducing availability at the retail level. However, one exception to this otherwise ubiquitous finding is the Australian 'heroin drought', a sudden and large reduction in retail availability, which had some longevity. Although there are divergent views about the genesis of the drought, one prevailing opinion is that it was result of law enforcement interventions against a criminal group involved in heroin importation (Hawley, 2002; Reuter & Trautmann, 2009).

Early in 2001, there was a sudden and dramatic reduction in the supply of heroin in New South Wales, Victoria and South Australia (Day, Degenhardt, & Hall, 2006). A number of factors have been suggested as working

synergistically to affect the heroin shortage in Australia. First, increased funding to the AFP and Customs in 1998–99 enhanced the capacities of these agencies to investigate illicit drug trafficking, including enhanced cooperation with regional police agencies (Degenhardt, Reuter, Collins, & Hall, 2005). Second, key individuals involved in the importation and distribution of heroin in Australia were arrested (Degenhardt, Reuter, et al., 2005; Weatherburn, 2003). Third, an increase in seizures was made at the Australian border (Degenhardt, Roxburgh, & Barker, 2005; Weatherburn, 2003). Additionally, there may have been economic factors at play—low profits were a feature of the Australian heroin market, and finally, reduced supplies in source countries in the Myanmar region (Degenhardt, Reuter, et al., 2005) may have contributed. It has been suggested that these factors combined to increase the risks inherent in the importation of heroin to Australia (Degenhardt, Reuter, et al., 2005; Weatherburn, 2003). According to Degenhardt et al. (2005), a combination of drug law enforcement success and low profits in Australia, alongside reduced supplies in source countries which made it more difficult replacing heroin lost to seizures, rendered Australia a less attractive destination for heroin traffickers. The results suggest that when criminal organisations export illicit drugs to multiple destination countries, any one of these countries can deter export to them by increasing risks and seizures to a level that no longer makes that country viable as a destination.

The shortage was accompanied by changes in other market indicators. The price of heroin increased (Day, et al., 2006; Dietze, et al., 2004) and there were reductions in purity, availability and use (Day, et al., 2006; Dietze, et al., 2004). The weight and number of border seizures of heroin were lower following the shortage. The heroin shortage also witnessed reductions in the rates of both non-fatal overdoses (Day, et al., 2006; Hawley, 2002) and overdose deaths in New South Wales and Victoria (Day, et al., 2006; Dietze, et al., 2004; Weatherburn, 2003). Although the heroin market has since stabilised (Day, et al., 2006), the price of caps has not returned to pre-2001 levels and purity remains low, suggesting long-term changes in the heroin market as a result of the reduction in supply.

The decline in ambulance call-outs in Victoria almost exactly paralleled what would be predicted by a simple constant elasticity model driven by purity adjusted prices (Moore, 2005c). According to some scholars and law enforcement agents (Degenhardt, Reuter, et al., 2005; Hawley, 2002; Weatherburn, 2003), the heroin shortage in Australia demonstrated that under some circumstances, law enforcement interventions can produce supply restrictions and therefore the availability of illicit drugs; but can also increase purity-adjusted price, which can reduce consumption levels.

1.2.3 Interventions targeting clandestine laboratories and domestic trafficking of methamphetamine

Clandestine laboratories are a key aspect of methamphetamine production. No research was found that examines the effectiveness of law enforcement interventions that target the manufacture of methamphetamine. Separate searches were conducted using combinations of the following search terms ‘manufacture’, ‘clan lab’, ‘clandestine lab’, ‘methamphetamine’, ‘ecstasy’ and ‘effect’. No studies that evaluated the effectiveness of interventions targeting the manufacture of synthetic drugs were located.

No studies were located that directly evaluated the effectiveness of domestic trafficking law enforcement interventions against methamphetamine. There is some research that examines domestic enforcement against other (plant-based) drugs, specifically heroin and cocaine. This research is reviewed next and the four studies reviewed all find that domestic law enforcement is generally ineffective in increasing price and restricting availability of cocaine and heroin. Due to the lack of research on the effectiveness of domestic law enforcement against synthetic drugs, the applicability of these findings to methamphetamine is currently a matter for conjecture.

Prunckun (2007) examined the relationship between domestic drug law enforcement intensity and the price and purity of heroin in Australia. In this study, price and purity were used as a proxy measure for supply. In this conceptualisation, a strong correlation between price and purity could indicate that there is plentiful supply and that drug law enforcement interventions are therefore ineffective. Conversely, a negative price-

purity correlation would occur when availability is low (eg high price and low purity) and would be indicative of effective drug law enforcement. Price and purity data was sourced at two market levels—street/retail level and commercial/wholesale level. Any differential between the two on the outcome measure would inform determinations regarding which level of the supply chain against which drug law enforcement is most effective.

For each quarterly period, a 'national average price' and a 'national average purity' was calculated. At the commercial market level, no correlation was found between price paid by dealers per ounce and purity. A possible explanation, posited by Pruncken (2007), is that buyers will purchase at the asking price regardless of purity. At the retail level, there was a moderate positive correlation between price and purity, leading Pruncken to conclude that while this was indicative of some deterrent effect, overall, it suggested that supply-side policy was ineffective in reducing supply of heroin. The study was flawed in both concept and data source. The study used average price and average purity (from the Illicit Drug Data Report (IDDR)), which were not matched per transaction, but were instead aggregated across Australia to produce a national average. Given the variety of price and purity across Australia, such aggregation appears unwise and may result in a 'washing out' of effects. Given the poor data, the conclusions regarding law enforcement effectiveness should be given less weight compared with studies with more rigorous design and better quality of data (eg matched price and purity per transaction).

DiNardo (1993) examined data on domestic drug law enforcement interventions in the United States and drug price using two sets of data—the System to Retrieve Information from Drug Evidence (STRIDE) and data from the Monitoring the Future (MTF) project. The STRIDE database contains information on the weight and purity of each seizure and each purchase of illicit drugs by undercover police. The MTF is a representative sample of high school seniors in the United States that surveys use of licit and illicit drugs.

The STRIDE price data was used to determine the 'real' price of cocaine (corrected to Consumer Price Index). Seizure data was utilised to measure the 'extent' or intensity of law enforcement interventions. DiNardo used ANOVA, controlling for state and year effects, to determine that the impact of seizures on cocaine price is small and non-significant. In regression equations, law enforcement was not found to significantly influence either cocaine price or the demand for cocaine. DiNardo also found a negative relationship between seizure weight and price, and a positive relationship between seizure weight and quantity consumed, suggesting that drug law enforcement interventions are directed at market areas in which the problem is most severe; as DiNardo puts it: 'enforcement merely mirrors demand' (p. 63). That is, price is lowest where demand is lowest and domestic drug law enforcement interventions occur where demand is highest.

DiNardo offers two explanations for the failure to find a significant effect of domestic drug law enforcement interventions on cocaine price. The first explanation is that drug seizures represent a very small and insignificant proportion of the total cost of supplying illicit drugs. This issue could be (partially) overcome by studying in more detail the composition of costs borne by dealers (as per the risks and prices model; Reuter & Kleiman, 1986) to more fully evaluate the impact of the costs of replacing drugs that are lost to seizure, in addition to costs (eg compensation for risks, avoidance costs). The second explanation is that seizures of cocaine in the STRIDE database may not be correlated with effective drug law enforcement activity. The use of multiple datasets that evaluate drug law enforcement interventions at different levels of the supply chain could be used to evaluate the differential impact of a range of drug law enforcement interventions. A further limitation of the study lies in its use of surveys of high school seniors to estimate consumption. There are problems with the use of these data (eg the extent to which consumption patterns among high schools seniors is 'typical' of all users), which could be improved by the use of national representative samples.

Yuan and Caulkins (1998) examined domestic law enforcement directed at higher market levels (ie high-level drug dealers) and specifically focused on heroin and cocaine supply. These interventions aim to increase the costs imposed on dealers and thereby inflate retail prices and subsequently reduce overall consumption. The authors used a short-run shortage model (ie supply shortage leads to increased price leads to decreased consumption) to predict that enforcement-driven reductions in price should be of a magnitude similar to the total variation in prices such that price changes caused by drug law enforcement could be identified. The study was an evaluation of retail price variation caused by supply shortage, rather than price variations which occur as a result of the operation of the risks and prices 'tax'.

Using STRIDE, seizures and undercover purchases can be measured in four different ways—by weight, pure weight, dollar value and number. The researchers found no evidence that changes in price were associated with changes in intensity of law enforcement as measured by Granger-causality. Granger-causality is a statistical technique used to evaluate whether one set of time series data (eg seizures of illicit drugs) can be used to predict another set of time series data (eg retail price). As the authors note, Granger causality is designed to handle two variables and can provide misleading results when an unmeasured third variable is involved. On the other hand, changes in enforcement were found to ‘Granger-cause’ changes in price only when seizures were measured in terms of number. The result suggests that there is no relationship between the weight, pure weight, or value of drugs seized by drug law enforcement and price increases. The researchers conducted follow-up analyses and determined that ‘changes in wholesale cocaine prices respond significantly and negatively to changes in cocaine seizures and changes in heroin seizures. Changes in heroin prices respond significantly and negatively to changes in cocaine seizures and changes in wholesale cocaine prices’ (Yuan & Caulkins, 1998, p. 272). Overall, the results suggest that domestic drug law enforcement interventions are not effective at raising the price of heroin and cocaine.

One further study (Kuziemko & Levitt, 2004), using economic modelling techniques, found that a 300% increase in arrests of cocaine dealers resulted in a 5–15% inflation in cocaine price and no reduction in availability. The increase in price was considered a ‘small return’ on such a large investment by law enforcement. The study examined both the certainty and severity of punishment for drug offences. An increase in the certainty of punishment of one standard deviation (250 additional arrests per 100,000) was associated with a 12–22% increase in the (purity adjusted) retail price of cocaine. Conversely, an increase in severity was mixed, with a one standard deviation increase (in probability of going to prison; 8 percentage points higher) associated with between 2% lower and 9% higher retail prices. Using arrest rates per capita and proportion of arrests that resulted in incarceration for 1985–1996, Kuziemko and Levitt (2004) estimated that changes in drug policy between 1985–1996 lead to cocaine prices that were 5–15% higher. Using elasticity of demand estimates, they further estimated that increases in retail prices had reduced consumption of cocaine between by up to 20%.

1.3 Research on drug law enforcement against multiple supply chain levels

Some research has evaluated law enforcement interventions targeted at multiple points along the supply chain for illicit drugs. However, none of these studies looked specifically at methamphetamine, nor at any type of synthetic drug. In fact, the studies focus on either heroin or cocaine exclusively.

Two studies have evaluated the differential effectiveness of drug law enforcement interventions that were directed at different points in the supply chain (Crane, Rivolo, & Comfort, 1997; Rydell & Everingham, 1994) and one of these also evaluated supply-side versus demand-side interventions (Rydell, Caulkins, & Everingham, 1997). Rydell and Everingham (1997; Rydell & Everingham, 1994) examined four interventions directed at cocaine—three supply side drug law enforcement interventions (source country interventions, interdiction and domestic enforcement) and one demand-side intervention (treatment of heavy users). Source country interventions include the eradication of coca leaf and seizures of coca base, paste and powder in source countries. Interdiction included operations by the US Customs Service, Coast Guard, the military, and Immigration and Naturalisation Service, which target attempts to import cocaine into the United States and aim to seize assets and cocaine. Domestic enforcement is operated by federal, state and local law enforcement agencies and aims to arrest and incarcerate dealers.

Using drug law enforcement budget data, Rydell and Everingham (1994; 1997) estimated the law enforcement spending for source country interventions (\$0.9 billion) interdiction (\$1.7 billion), domestic enforcement (\$9.5 billion) and drug treatment (\$0.9 billion). As each program produces different outputs (eg seizures for interdiction, decreases in consumption for treatment), all program outputs were converted into a common metric—consumption as reflected by the number of heavy and light users over a 15 year timeline. The researchers developed a model that incorporated multiple supply curves and demand curves (for different market levels), and the four interventions. The model was run four times, once for each intervention, and

expanding the budget by a sufficient magnitude in the first 'projection year' to reduce discounted cocaine consumption over 15 projection years by 1% of total consumption. Treatment was found to be the most cost-effective intervention. Domestic enforcement cost seven times the cost of treatment to secure a comparable reduction in consumption. Interdiction cost 1.5 times as much as domestic enforcement and source country interventions cost twice the amount of interdiction. Source-country interventions by drug law enforcement agencies were therefore found to be the least cost effective of all the programs examined. The researchers concluded that treating heavy users is more cost effective than supply control programs (especially source country control and interdiction).

Research by Crane, Rivolo, and Comfort (1997) focused on two types of drug law enforcement interventions in the United States:

- interdiction in the source zone, that is, the primary coca growing countries and distribution channels to Columbia where cocaine is manufactured; and
- interdiction in the transit zone or transport routes between South America and the United States (mostly the Caribbean, Central America, and Mexico).

The study evaluated the impact of these interventions on cocaine prices using STRIDE data. Based on estimated price change and price elasticity of demand for cocaine (nominal value of -0.5), the quantity of demand reduction was estimated. Then researchers calculated cost effectiveness of source-zone interdiction as the expenditure required to achieve a 1% decrease in the demand for cocaine. In estimating the required expenditure to be between \$13 million and \$25 million per year, the authors concluded that 'a well conceived source zone interdiction strategy aimed at denying production and transportation to the cocaine industry can be relatively cost effective' (p. IV-14). Using the same method, they calculated the cost-effectiveness ratio for the entire interdiction efforts (transit- and source-zone interdiction). It would cost \$30–60 million per year to bring about 1% decrease in demand for cocaine. Therefore, source zone interdiction was found to be more cost effective than total interdiction (source zone plus transit zone taken together).

Furthermore, they compared results with the estimates from Rydell and Everingham (1994). Source country control is more cost effective than interdictions (entire) and treatment. For source country control efforts alone, the estimate is between 30 and 60 times less than the budget figure derived by Rydell and Everingham (1994).

Crane et al. (1997) were critical of the study conducted by Rydell and Everingham on a number of fronts and argued that the limitations in the Rydell and Everingham study account for the incongruent findings. First, Crane et al. argue that the modelling methodology used by Rydell and Everingham was incomplete. Specifically, Crane et al. argue that Rydell and Everingham relied on total amounts of seizures of cocaine to estimate the effectiveness of source country control. In illicit drug markets, as distance from the source increases, the value of the seized product and the costs of replacement increase, such that seizures are likely to underestimate the effectiveness of source country interventions relative to interventions proximally closer to retail level. Crane et al. (1997) also point out that whereas some drug law enforcement interventions aim to seize drugs, interventions in source countries are not primarily directed at drug seizures, but rather at disrupting and inflating the costs of production and distribution. This impact will therefore not be reflected in outcome measures based on seizure weight. Second, according to Crane et al., Rydell and Everingham erred in assuming an additive pricing structure for cocaine. Crane et al. argue that available evidence suggests that the cocaine market shows a multiplicative rather than additive price transmission structure and that the consequence of incorrectly assuming an additive model is that drug law enforcement action closer to source countries (and consequently further from the retail market) is modelled as having no substantive impact on retail prices. Crane et al. (1997) further argue that Rydell and Everingham included inappropriate costs in their estimate of expenditure on source country control, which artificially inflated the costs of the intervention and therefore reduced the apparent cost effectiveness of source country interventions.

The divergent results of Crane et al. and Rydell and Everingham are explained by the different methodologies used and are reconciled in Caulkins et al. (2000). While Rydell and Everingham found that interdiction was more cost effective than source country interventions, Crane et al. determined that source zone interventions were more cost effective than interdiction. In the Crane et al. study, a change in cocaine price over a fixed time period was assumed to have been the results of interdiction. The study looked at the impact of law

enforcement when the cocaine market is in a state of flux. By contrast, the Rydell and Everingham study examined the impact of law enforcement interventions when the illicit market is stable. Rydell and Everingham employed more sophisticated mathematical modelling, which included the financial impact of law enforcement interventions on criminals (eg conviction, sentence) and translated this into increases in retail price and changes in cocaine consumption.

As the supply chain structure for different drugs in different countries diverge, law enforcement interventions at different supply chain levels may be differentially effective across drugs and across countries. The extent to which the findings of Rydell and Everingham and Crane et al. will generalise to methamphetamine, with a very different supply chain structure, is thus far unknown. We pick up this issue in Chapter 7 where we examine the extent to which our results match those of these previous researchers.

Poret (2003) evaluated two levels of drug law enforcement interventions—those that target consumers and aim to reduce demand, and those that target sellers and aim to constrict supply. Poret argued that the largest costs incurred by dealers are the costs incurred by the risk of detection, arrest, conviction and punishment. Poret further argued that the risks are greatest where the average quantity distributed is lower and the corresponding number of transactions is higher (depending on the level of the supply chain that is occupied by the dealer). The aim of the modelling exercise conducted by Poret was to evaluate the impact of drug law enforcement interventions on wholesale and retail price. Poret created a model of the drug market as a three-stage ‘game’ involving traffickers, retailers and consumers. First, Poret evaluated the impact of drug law enforcement interventions directed only at retail level dealers. According to the model, the costs incurred by retail level dealers are inflated as the probability of arrest rises due to increasing drug law enforcement intensity (and because of the high number of transactions). Higher level traffickers (who sell to retail level dealers) increase the wholesale price in response to increased retail level enforcement and to insure themselves against the commensurate potential for a reduction in demand.

On the basis of the outcomes derived from the models, Poret argued that drug law enforcement interventions have indirect effects above and beyond an impact on supply. For example, retail dealers and higher level dealers can respond to changes in drug law enforcement intensity by modifying the quantity of drugs distributed or the number of transactions they complete. Poret’s model also demonstrated that the level of the supply chain at which drug law enforcement intervenes can have unexpected indirect effects:

According to our results, when the authority pursues the retailers and if the probability of arrest at the time of a transaction is relatively high, an increase of the unitary sanction leads to a retail price fall and thus induces a rise of the number of consumers, which is opposite to the objective of anti-drug policy. (Poret, 2003, p. 482)

The results suggest that it is important to evaluate drug law enforcement interventions separately across the supply chain as the risks and associated costs borne by dealers vary as a function of market level.

1.4 Summary and conclusions

Supply reduction is an essential aspect of controlling and containing the problem of methamphetamine. Currently, there is little law enforcement research specifically addressing methamphetamine markets, with the notable exception of precursor regulations (which are outside the policing mandate).

There is clearly a paucity of research on the effectiveness of law enforcement interventions that target methamphetamine. Irrespective, results regarding law effectiveness in one country (eg Denmark) may not hold for another country (eg Australia) due to different local conditions, the nature of international borders and other factors. Although there is some research that evaluates the impact of law enforcement interventions against heroin and cocaine at different supply chain levels, the impact of law enforcement against synthetic drugs like methamphetamine may be very different to the impact of law enforcement interventions against plant-based drugs such as heroin, cocaine and cannabis. It is possible that law enforcement interventions that are typically utilised against plant-based drugs may be less effective, as there is no botanical product to target and no geographical distance between manufacturing sites and consumers (Costa, 2008).

Prior research on the effectiveness of interventions against methamphetamine is restricted to a small handful of studies that evaluate the impact of statutory regulations restricting precursor availability on the supply, retail price and purity of methamphetamine. The findings suggest that the regulations exert a short-term positive impact on these indicators but that the impact is only temporary. Criminal groups appear able to flexibly respond to such regulations and to compensate so as to continue manufacture and distribution of methamphetamine. Furthermore, these are not law enforcement interventions per se.

Drug law enforcement directed towards cocaine has been the subject of effectiveness research. The results of Rydell and Everingham suggest that domestic law enforcement interventions were the most cost effective, followed by border interventions and source-country interventions. However, using a divergent methodology, Crane et al. (1997) demonstrated that source zone interventions against cocaine can be a cost-effective supply-control policy. Given the different supply chains for plant-based illicit drugs (such as cocaine) from synthetic illicit drugs (such as methamphetamine), results found for the effectiveness of law enforcement directed at cocaine should not be generalised to methamphetamine.

The conduct of research on the effectiveness of drug law enforcement is hampered by a range of issues. One fundamental issue is that the usual 'gold standard' test of efficacy or effectiveness is randomised controlled trials. These are largely not feasible for drug law enforcement interventions. Aside from this, the data required for analyses of effect or impact are largely absent. For example, in Australia, consistent good quality data on illicit drug price and purity, essential for outcome measures using retail price, is unavailable. Estimations of market size, critical to the interpretation of law enforcement outcome measures such as the amount of drugs seized, are impossible due to the absence of data. Second, causal links between increased law enforcement intensity and outcomes such as illicit drug price and purity are open to multiple interpretations, given the substantial unmeasured intervening variables. Third, as demonstrated, there is a paucity of actual research that uses designs that permit causal attributions.

A further challenge for both law enforcement agencies and for interpreting research on drug law enforcement effectiveness is what has become known as the 'balloon effect'. The term uses a partly inflated balloon as a metaphor for the drug problem—if you squeeze the balloon at one end, the air (representing the drug problem) simply moves to the other end of the balloon. The balloon effect can manifest both within countries and across countries. Interventions at one part of drug supply chains leads to a shift to another part. For example, border enforcement against a particular trafficking route or method stimulates traffickers to try alternate routes and methods (Caulkins, Larson, & Rich, 1993; Reuter & Trautmann, 2009). In the case of methamphetamine, law enforcement interventions against manufacture for example, may cause shifts in the method or location of manufacture, but may exert no impact on total production and availability (Reuter & Trautmann, 2009).

There is currently very little empirical evidence to guide policy decisions about drug enforcement interventions directed toward methamphetamine. In fact, the paucity of research on the effectiveness of law enforcement across all illicit drugs 'continues to pose a major barrier to applying these policies effectively' (Babor, et al., 2010 p. 258.) Decisions about which methamphetamine supply control policy to fund, which policies should receive increased funding, or how to derive the most effective balance of priorities, are currently uninformed by the results of research. There is a clear and pressing need for further research that examines the effectiveness of law enforcement interventions directed at methamphetamine. The current study aims to begin to fill this gap.

In the first instance, we sought to provide a comprehensive description of how the methamphetamine market(s) operate in Australia (above retail level). We drew conclusions about the implications for policing interventions from this comprehensive analysis of the methamphetamine market and supply chains. Second, we sought to develop the first economic model that compared different drug law enforcement interventions for methamphetamine.

The next chapter describes the methodology employed for this project across both the qualitative and quantitative components. Chapters 3, 4 and 5 provide the results of our analysis of the Australian methamphetamine supply chains, networks and market structures, and production and distribution characteristics. Chapter 6 provides the economic modelling results and Chapter 7 draws conclusions.

Chapter 2: Methodology

This study combines qualitative methods with quantitative methods. The focus was on methamphetamine, not the broader class of ATS, which includes ecstasy. Ethics approval for the project was obtained from the UNSW Ethics Committee. This study was conducted between January, 2008 and August, 2010.

2.1 Qualitative methods

The qualitative component was the descriptions of the methamphetamine market(s) and supply chains. We used three data sources to thoroughly document the methamphetamine supply chains—KIs from law enforcement, published literature (peer review, grey literature and conference papers) and judges' sentencing comments in methamphetamine cases.¹

Key informants:

The researchers approached a total of 24 potential KIs and requested their participation in the study. Thirteen KIs agreed to participate, signed relevant consent forms and were interviewed. They are listed in Appendix A. Members of the NDLERF Project Reference Group were asked to recommend relevant experienced law enforcement officers as potential KIs. From the initial pool of KIs, some KIs recommended other individuals with expert knowledge. In one jurisdiction, the research section of the police recommended KIs for that jurisdiction. The final group of KIs were drawn from the following domestic and federal law enforcement agencies—WA Police, NSW Police, Victoria Police, Queensland Police and the AFP. Due to statutory prohibitions on the release of information by customs agents, no KIs were from the Australian Customs Service.

All interviews were conducted by telephone. Interviews were audio recorded and were later transcribed to ensure accurate collection of data. Interviews ran for between 35 and 90 minutes, were semi-structured and covered the following topic areas (the interview schedule is attached as Appendix B)—the domestic supply chain (obtaining precursors within Australia, delivery of precursors to manufacture sites, manufacture of methamphetamine, distribution through trafficking networks, transport, mid-level distribution) and the international supply chain (obtaining precursors offshore, importation of precursors to Australia, delivery of precursors to manufacture sites offshore, manufacture of methamphetamine off shore and importation of end-product to Australia). In the case of Customs, the interview schedule was sent to the Project Reference Group member from Customs and information that answered the various questions was sourced, and authority provided for release of this information to the researchers.

Literature search:

Databases from several fields were searched including criminology, psychology, health, law, politics and government and included published and unpublished material. The specific databases included—Humanities and Social Sciences, Drug Database, CINCH (Australian Criminology Database), APAFT, Australian Federal Police Digest, APAIS (Health) and Health and Society Database. In addition, a 'Metasearch' database search was conducted via the University of NSW Library website. Searches were also conducted using the Google and Google Scholar Internet search engines.

For all searches, combinations of the following keywords were used: *methamphetamine*, *methylamphetamine*, *amphetamine*, *ATS*, *precursors* as single word searches and combined with *supply chains*, *networks*,

¹ Unfortunately, our intention to interview incarcerated drug dealers (convicted for the manufacture, trafficking, dealing or importing methamphetamine) could not proceed because we were unable to secure ethical clearance from the prisons to conduct the interviews.

markets. Previous papers, reviews and bibliographies were consulted as a source of potential literature. We also used proceedings of the Australian Chemical Diversion Conference.

One of the researchers read through all the abstracts of located articles and articles were selected for more detailed review if they contained information about the manufacture and distribution of methamphetamine either internationally or within Australia and if they concerned drug law enforcement effectiveness.

Judges' sentencing comments

Judges sentencing remarks provide information on price and purity for various deal weights. The sentencing comments of judges in two states were examined. At the time of research, judges sentencing comments were accessible online for both New South Wales and Queensland, so these two states were selected. The sentencing comments of judges in New South Wales are located on the Lawlink NSW website (<http://www.lawlink.nsw.gov.au/>) and those for Queensland are located on the Supreme Court of Queensland library website (<http://www.sclqld.org.au/>). Each website facilitates keyword searches of reported cases from all courts and includes the full text of sentencing comments from the Queensland Supreme Courts.

We conducted a search for NSW cases between 1999 (the date of data available online) and May 2009 for the following criminal courts—District Court, Supreme Court and the Court of Criminal Appeal. We also conducted a search of Queensland judgements between 2000 and 2009 for the Supreme Court (Court of Criminal Appeal). The aim of the searches was to retrieve criminal cases that involved the manufacture, distribution, trafficking and importation of methamphetamine. Inclusion/exclusion criteria were applied to select relevant cases from those located using the basic keyword search. Cases were excluded if they involved only convictions for possession of methamphetamine, or where they only involved convictions for property or violent crimes committed while under the influence of methamphetamine. Cases were included if they involved convictions for the manufacture, distribution, trafficking or importation of methamphetamine. Sixty-one cases met the criteria (3 from the Supreme Court, 4 from the District Court and 54 from the Court of Criminal Appeal). These 61 cases were then reviewed and relevant details extracted for inclusion in this report. The list of cases is provided at Appendix C.

2.2 Market indicators: Price and purity

An important feature of any comprehensive description of a drug market is detail on prices, weights, purity and mark-ups. We undertook a comprehensive summary of all methamphetamine price data and where possible matched purity data. Our goal was to locate as much information and data as possible in order to specify the prices at the various levels of the supply chain. There are reasonably good Australian data on the retail prices paid on the street for methamphetamine (including its various forms—powder, base crystal) but for the higher levels of the supply chain, the information is patchy. The following data sources were used.

Illicit Drug Data Report

Data relating to drug prices in each state and territory are collected and compiled by the Australian Crime Commission (ACC) and reported in the IDDR. Price data are collected from each of the police jurisdictions (state and federal) and are based on information supplied by covert police units and police informants. Between 1996–97 and 2002–03, these data were compiled on a quarterly basis (July–September, October–December, January–March, April–June). Since the 2003–04 report, price data have only been reported as annual aggregates, not quarterly. With IDDR data, we documented the price at each reported weight across all jurisdictions. The IDDR was an especially important data source for the price of crystal methamphetamine, whereas for non-crystal methamphetamine, we had multiple data sources other than the IDDR.

Illicit Drug Reporting System

The Illicit Drug Reporting System (IDRS) monitors the price, purity, availability and patterns of use of heroin, methamphetamine, cocaine and cannabis (Black, et al., 2008). The IDRS consists of interviews with a group of people who regularly inject drugs, also known as IDUs. Participants are drawn from the capital cities of Australia.

Price data for methamphetamine, self-reported by IDUs, are reported in three forms—powder, bases and crystal. It is important to note that information from the IDU participants is not representative of illicit drug use, but is indicative of emerging trends. The price data only reflect the purchase price of methamphetamine by IDUs who live in Australian capital cities. As the IDRS is based on interviews with retail level users (including some user-dealers) the national IDRS only includes prices for weights between 0.1 gram and one gram.

Judges' sentencing comments

The sentencing remarks of judges provide information of price and purity for various deal weights. Price and purity were retrieved from judges sentencing remarks in New South Wales and Queensland. It should be noted that the main limitation of this data source is that we are sampling price and purity data only from the population of transactions that resulted in a conviction. It is possible that transactions that result in a conviction are somehow different from those that do not. We know nothing about transactions that occur that do not result in arrest/conviction.

For the judges sentencing remarks, we listed every mention of a drug weight that was associated with a purchase price. Transactions recorded in the sentencing comments of judges did not note whether the transaction involved crystal methamphetamine or non-crystal methamphetamine (ie powder or base). So, for all prices recorded in the sentencing comments of judges, the price, weight and purity were entered into the table for non-crystal methamphetamine. Judges' comments were the only source of price data from which purity could be extracted in connection with price and weight of transacted methamphetamine. That is, we were able to extract data on the price of X weight with Y purity. These data are not readily available elsewhere. For example, although the IDDR lists prices for methamphetamine and purity for methamphetamine, these are listed in separate tables and there is no way of linking price, weight and purity together using this source. The comments of judges are therefore valuable for calculations of price per pure gram, which is the one valid way of comparing prices across levels of the supply chain.

Victorian forensic data

We requested seizure data for Victoria (number, weight, purity) for methamphetamine seizures for the 2006–07 financial year. We selected Victoria Police data as the Forensic Services Department analyse purity for every seizure by Victoria Police. Other jurisdictions (eg New South Wales) analyse seizure purity only in instances where such data are required for legal processes (eg contested hearings).

Aside from describing the prices at various weights, we also conducted analysis to examine the relationships between the price and weight. Quantity discounts can be calculated from price–weight data, which provides a proxy for the extent of price mark-ups across the market. The method is based on the assumptions of a power law between transaction size (weight) and transaction price (total cost). The results of the various price, weight, purity analyses are described in Chapter 4.

2.3 Quantitative methods: Economic modelling

2.3.1 Measuring the outcomes of drug law enforcement

Measuring the outcomes of drug law enforcement presents considerable challenges. The structures of drug markets are complex, often with extensive supply chains consisting of multiple levels. These challenges are exacerbated by the limited research into how drug markets work. As a consequence there are theoretical and

methodological debates over the best approaches to assessing the effectiveness of drug law enforcement (Dorn, Bucke, & Goulden, 2003; Roberts, 2006).

The impact of drug law enforcement has been measured through changes in market indicators (price, perceived purity, availability), drug-related crime rate (drug seizure, arrests, other related crime rates) and health-related harms (hospital admissions, drug-related deaths, treatment numbers). However, drug law enforcement also has impacts that are difficult to measure. These include deterrence effects (discouraging new entrants to the market and discouraging new drug use), public safety and public amenity, and broader impacts on other crimes that criminal networks are engaged in (eg dismantling a drug network may also by default dismantle a gun smuggling activity or disrupt money laundering by that group). It is challenging to measure those latter impacts. How can 'deterrence' —the absence of something happening—be measured? In addition, for an economic model, each impact needs to have a monetary value. Valuing (pricing) deterrence or public safety is extremely difficult. As a result, economic models of policing impact tend to focus on measurable market indicators. We likewise have focused on those, but note that this is a limited perspective on law enforcement outcomes, which excludes effects such as public safety and deterrence, and means that we underestimate the overall societal impact of drug law enforcement.

From a supply reduction perspective, the most important drug law enforcement activities are seizures, arrests and criminal sanctions. Seizures refer to seizures of end products and precursors/reagents, clandestine laboratories and other manufacturing equipment and assets. Arrests refer to arrests of drug manufacturers, importers and distributors/traffickers at multiple levels of the supply chain. The typical sanction for 'providers' is incarceration but suspended sentences of imprisonment, non-custodial sentences and fines are also used.

One way of measuring these law enforcement activities is to use the costs that these activities represent to the criminals engaged in these activity. Drug law enforcement may increase the costs of manufacture and distribution (by seizing products and assets), increase the risks of arrest and imprisonment (which will be transformed to price of drugs) and increase the operational costs of running a business (costs of new avoidance strategies adopted against drug law enforcement). The aggregate costs are the losses to illicit drug enterprises due to drug law enforcement activities. A comprehensive analysis would include each of these aspects and calculate 'total loss' due to drug law enforcement. However, we were not able to cost each of these components and hence use only replacement costs (seizures) to represent the loss.

Before discussing using replacement costs as a proxy of total loss to illicit drug enterprises, we need to elaborate the components of losses. According to Rydell and Everingham (1994), supply control programs impose financial sanctions directly. Therefore, the costs imposed by law enforcement interventions can be estimated in the following equations (revision based on (Rydell & Everingham, 1994, p. 62)):

$$\begin{aligned} \text{Financial losses} &= \text{replacement costs of products seized/clan lab detected by police/assets forfeiture} + \\ &\quad \text{risks of arrests/convictions} + \text{avoidance costs.} \\ &= [(\text{quantity of drug/precursors seized} \times \text{price purchased}) + \text{replacement of equipments and operational} \\ &\quad \text{costs} + \text{asset forfeiture}] + \text{value of risks of being arrested/convicted} + \text{costs paid to avoid being caught.} \end{aligned}$$

The equations summarise that the losses incurred to the illicit drug industry can be separated into three parts—total asset loss which include the replacement cost of end product/precursors which are seized by drug law enforcement agencies, the loss of equipment, operational expenses forgone (such as airline tickets, equipment costs) and asset forfeiture; the opportunity costs for the drug offenders for being arrested or in prison (including risk premiums); and 'avoidance costs', which are the costs borne by producers/traffickers in production, processing or distribution to avoid being caught by law enforcement agencies.

Replacement costs are the main component of asset loss. Other components (replacement of equipment, operational costs and asset forfeiture) are apparently relatively small compared with the replacement costs. Replacement costs can be estimated through seizure weight of end product/precursor and the associated purchase price. In other studies (McFadden & Mwesigye, 2001), retail prices are used to calculate the value of drug seizures. However, it is not appropriate to use retail price in our approach to replacement cost estimation because we are only assessing higher market levels. What matters is how much it would cost drug dealers/traffickers to replace the drugs seized.

The opportunity costs (the second component, see above) are the risks of arrests and convictions and are embedded in labour costs. The labour costs are comprised of not only forgone alternative occupational opportunities, but the risks of imprisonment and the expected violence/danger from others. Drug law enforcement interventions impose risks of arrests and convictions and therefore increase the labour costs. Opportunity cost can be used here to measure the risks of arrest and imprisonment. Assessing opportunity costs is fundamental to assessing the true cost of law enforcement activities to drug producers/dealers, where there is no explicit accounting or monetary cost (price) attached to those actions. The estimation of opportunity cost of wage loss for incarceration was not able to be conducted for this project due to data limitations. However, we provide some details of how these calculations could proceed in Appendix D.

Avoidance costs (the third component) is incorporated into operational costs. Drug dealers may incur costs to take extra precautions to avoid being detected by drug law enforcement agencies. For example, they may buy multiple mobile phones, purchase security equipment, disguise clandestine laboratories, or bribe officials. These types of costs are very difficult to estimate. We had hoped to conduct interviews with incarcerated dealers in order to derive estimates of these types of costs, however, we were unable to obtain ethical clearances.

We are therefore left with replacement costs (value of seizures) as the impact measure for drug law enforcement for the economic model. The risks and prices framework provides some degree of comfort in this singular focus on seizures. Based on the study of 'risks and price' (Reuter & Kleiman, 1986), seizures drive up costs for illicit drug enterprises by imposing replacement costs, risks of being arrested/incarcerated and avoidance costs. To the extent that replacement cost of seizures is proportional to the other costs incurred as a result of law enforcement intervention (ie risk premiums and avoidance costs), seizure values are a reasonable proxy. In other words, law enforcement interventions that generate larger replacement costs will generate larger avoidance costs and risk premiums. Provided that the differential between replacement costs and the other costs do not vary across law enforcement interventions, then the use of replacement costs of seizures as a proxy for total losses imposed by law enforcement across interventions seems reasonable (especially given that this is not an efficiency or cost-effectiveness study).

As noted above, seizure data are only one of the output measures that can describe drug law enforcement effectiveness in combating the drug market. Seizures are directly collected from drug law enforcement agencies. They are presented as number and weight of seizures, and reflect police activity as well as the state of the market. The advantages of using seizure data are obvious—it is a simple measure, available and well-understood (Willis, Homel, & Gray, 2006). We know that drug law enforcement does much more than seize drugs, but seizure data are the best currently available source of evidence about impact.

2.3.2 Overview of economic modelling approach

The general method to measure the economic impact of drug law enforcement activities was to collate drug law enforcement expenditure data and assess that against the impact that the law enforcement activities have on illicit drug enterprises (at the market level), as measured through seizures. In particular, the monetary measure of this impact is the value of lost product (ie product that is seized). We outline the general method used for modelling first. This is followed by the method we used to derive estimates of government drug law enforcement spending (Section 2.3.3). Finally, we detail the method for deriving 'loss to illicit drug enterprises' as measured by the replacement cost of drugs seized by law enforcement agencies.

We use a cost-to-impact ratio that represents the average costs associated with the intervention relative to the impact, as measured by value of the seized drugs. While the impact is measured in monetary terms (the value of the seized drugs), these dollars are not equivalent to or fungible with the monetary measure of program costs. By calculating the ratio of average cost to average impact for each drug law enforcement intervention, comparisons can be made regarding the average losses incurred by illicit drug enterprises for that average cost.

Using the same measure of impact across each of the policing interventions means that we can compare the interventions with each other. The ratio of cost to impact was calculated for each intervention and then rank ordered. The lower the ratio, the better the intervention is relative to the other interventions being assessed on this metric. This last point is important; the ratio of cost to impact is only useful relative to its comparators. It is not a reflection of efficiency or potential cost savings.

There are a possible seven law enforcement interventions in relation to methamphetamine. They include source country interventions, domestic enforcement of precursor regulations, end product seizures (border), precursor seizures (border), clandestine laboratory detections, end product trafficking seizures (domestic) and retail drug distribution.

After carefully examining data availability, only four levels of the methamphetamine supply chain were able to be included in the economic model. These were:

- end product seizures (border)
- precursor seizures (border)
- clandestine laboratory detections (domestic)
- end product trafficking seizures (domestic)

Seizure data for source country interventions were only partially available and we were unable to obtain budget allocations for the AFP Specialist ATS group responsible for offshore interventions in source countries. The AFP informed us that there was no way to determine what proportion of these seized drugs was destined for Australia. Thus, with insufficient data for analysis, we were forced to exclude this level of the supply chain from the study. In any case, as will be seen in our qualitative analysis (Chapter 4), the actual value of precursors seized in source countries is very low (approximately \$40.00 per kilogram, pseudoephedrine, South-East Asia and China; KI 4, KI 3), so our calculation of the replacement costs would have been exceptionally low for precursors seized in source countries. We do not know if this would hold for end-product seizures in source countries. Hence, the metric of cost-to-impact that we used was likely to undervalue these activities. The main value of doing operations in source countries is to gather intelligence that can be used to destroy smuggling throughput capacity, not from seizing easily replaced precursors.

In the current study, expenditure on law enforcement activities directed towards methamphetamine refers to policing costs, such as operational costs, overhead costs and so on. Other drug law enforcement costs, such as the costs of courts, administration of justice and incarceration costs are not included because the economic model focuses on policing, rather than the broader criminal justice system.

The costs imposed on illicit drug enterprises (dealers and traffickers) due to drug law enforcement are expressed as 'loss to illicit drug enterprises' and operationalised as the replacement value of seized drugs, including one production cycle from clandestine laboratory (discussed further later in the report).

A number of assumptions are implied in our approach. These are:

1. that drug law enforcement activity is most readily described by seizure activity and we neglect the other potential positive impacts of drug law enforcement (such as deterrence, dismantling criminal networks, public safety and so on);
2. that methamphetamine seizures represent substantial costs imposed on the drug suppliers (ie they are non-trivial costs) and operate as a proxy for total costs, which would include replacement costs plus opportunity costs plus avoidance costs;
3. that the monetary value of the weight of methamphetamine seizures is the most appropriate valuation of seizures;
4. that, in the absence of data for purity-adjusted price, price alone reflects a reasonable measure. The underlying assumption implied by this is that there are equivalent levels of methamphetamine purity-adjusted price across all seizures;
5. that there is no price transmission between levels of the market in our economic modelling. That is, each level is treated as if independent from other levels and the associated loss does not accrue to other market levels; and

6. that in the absence of drug law enforcement expenditure, the loss of seized product to illicit drug enterprises is minimal. This assumption implies that law enforcement is the primary cause of replacement losses.

There are some other important features of the economic approach:

- The four law enforcement interventions are not sequential supply chain elements. That is, unlike the heroin supply chain that moves inevitably from source country to border and from border to distribution, the methamphetamine supply chain is discontinuous. End product importations (#1 above) are passed to end product distribution (#4 above). Precursor importation (#2 above) and clandestine laboratory manufacture (#3 above) are irrelevant for end-product methamphetamine that has been imported. However, precursor importation is connected to clandestine laboratory manufacture and then on to distribution (#4 above; see also Figure 1, Executive Summary).
- The study year for the economic model was determined to be 2006–07, because this was the most recent annual year for which data were complete and available. Wherever possible we have drawn data from the years 2006–07.
- Data for clandestine laboratories and domestic trafficking were drawn from three states (Victoria, New South Wales and Queensland). We had originally hoped to have data from every jurisdiction but that proved impossible. Indeed, despite significant attempts, we still had gaps in data from the three states (as detailed later in the report). The economic model derives a ratio of government spending to ‘loss to illicit drug enterprises’. As long as what is included in the government spending (3 states only) matches what is included in the estimated loss to illicit drug enterprises (3 states only), the exclusion of other jurisdictions is not a major limitation of the study.
- The spending estimates and the estimates of loss to illicit drug enterprises were developed based on considerable assumptions, given the data gaps. We detail all the assumptions below, but caution the reader not to take the values in the tables below as absolute. Importantly, we have endeavoured to hold the assumptions constant across the various data elements².
- The price used for calculation of replacement cost of end product is derived from the price and weight functions, which are based on domestic transactions. This is due to the difficulties in collecting the overseas prices of end product. Thus, it is problematic to apply these price data for end-product seizures to the border seizures because the replacement price should be price paid overseas, which would be lower than domestic prices. This leads to overestimating the value of replacement cost. The same problem applies to the estimation of replacement cost of precursor seizures at border. The influences on final results are discussed in Chapter 6.

2.3.3 Calculation of government spending on drug law enforcement directed at methamphetamine

We used a top-down approach for the derivation of drug law enforcement expenditure. In a top-down approach, we estimated the relevant sub-budget by estimating its proportion of the total. The agencies for which expenditure was sought were—Customs, AFP and three state police agencies (New South Wales, Victoria, Queensland). For each agency, the annual report and budget documents were scrutinised for detailed budgetary information. No agency provided an expenditure specific to methamphetamine (or other drug types specifically). We therefore had to estimate the proportion of total expenditure attributable to interventions against methamphetamine. We did this by selecting a measure of law enforcement ‘activity’, the number of seizures and then calculated the pro rata amount of spending attributable to methamphetamine (relative to the number of seizures for all other illicit drugs). The assumption underpinning this is that the costs incurred by drug law enforcement are relatively similar irrespective of whether the drugs seized are cocaine, heroin, cannabis or methamphetamine.

² The exception is the calculation of the clandestine laboratory detections police spending, where we were unable to apply the same spending estimate method as we did for the other three interventions.

Estimates of drug law enforcement spending were required for each of the four interventions:

- end product seizures (border)—AFP and Customs
- precursor seizures (border)—AFP and Customs
- clandestine laboratory detections (domestic)—state police
- end product trafficking seizures (domestic)—state police

There were some methodological differences in the ways in which we approached each of the agencies, dependent upon data availability. The details below provide the calculations for Customs, the AFP and state police³.

Australian Customs Service

The law enforcement expenditure estimates from the Australian Customs and Border Protection Service (henceforth termed 'Customs') contributed to both end-product seizures and precursor seizures. Customs has a wide range of responsibilities. These include to protect Australia's borders against illegal movement of people and goods, to contribute to offshore protection, to minimise disruption to trade and travel (passenger and cargo facilitation) and to raise revenue (Customs 2007, p. 5). Among those responsibilities, one of the key parts of Customs' protection role is the detection of illicit drugs and precursors at the border to support the objectives of the Australian Government's National Drug Strategy (Customs 2007, p. 39). Customs usually carries out its border compliance and enforcement for passengers, vessels, illicit drugs and other prohibited goods concurrently. Items crossing the border into Australia are subject to routine inspections for possible breaches of Australian laws. Illicit importations can include many types of goods, not just illicit drugs (eg weapons, animals, plants). Thus, the resources spent on illicit drug detections are hard to separate out from the total resource allocated to border protection.

The first attempt in Australia to estimate the Customs illicit drug budget was work by Tim Moore (2005b, 2008). Moore's best estimation was 15.4% of the total Customs budget. This figure was based on US data, taking the weighted average of estimations of illicit drug spending in the budgets for the US Customs Service (28%) and the US Coast Guard (10%), respectively (ONDCP 2004). The replication of this calculation method, following Moore, but using 2007 budget data, resulted in the weighted average of 14%. We could not derive a better method to estimate the Customs expenditure and so we followed Moore's method. We appreciate that this is a significant assumption—that the US percentage estimate in any way approximates the Australian situation. The sensitivity analyses we conducted go some way to reassure us that differences in our estimated policing costs do not impact on the results.

The actual total expenditure by Customs was \$1.2b in 2006–07, which includes both outputs and administration expenses (Customs 2007, p. 16). Using Moore's (2005, 2008) methodology, we take 15.4% of the total to be directed towards illicit drugs. The resultant annual expenditure is \$186.87m spent on illicit drug-related activities by Customs in 2006–07⁴.

Having estimated the expenditure on illicit drug interventions by Customs for 2006–07 (\$186.87m), we then calculated the proportion of the total drug budget allocated to methamphetamine end-product seizures and methamphetamine precursor seizures. To do this, we used the number of seizures/detections as an activity measure⁵. The details are provided in Table 2.1.

Customs made considerable illicit drug detections in 2006–07. There were 744 'Amphetamine Type Stimulant' detections among air passenger and crew, cargo and postal, and shipping and aircraft (Customs 2007, p. 41).

3 The Expert Reference Group to this project reviewed the draft report and provided what feedback they could on the budget estimates.

4 Using this method, the expenditure on illicit drugs by Customs increased by 121% between 2002–03 (\$84.4m) and 2006–07 (\$186.87m).

5 We used seizure number to derive the budget estimates (policing cost) and weight of seizures to value the impact (loss to illicit drug enterprises). This circularity may be of concern but we were unable to determine an alternate measure to pro rata agency activity other than the numbers of seizures.

According to Customs' definitions, the figure for 'Amphetamine Type Stimulant' seizures includes methamphetamine and amphetamine but excludes MDMA. Therefore, the application of the full 'Amphetamine Type Stimulant' seizure proportion was appropriate. According to our calculations, end-product seizures represented 9.31% (744/7993) of the total number of Customs drug detections. The budget for end product seizures was therefore estimated at \$17.39m (9.31% \times \$186.87m).

Using the same method, the Customs expenditure estimate for precursor seizures was derived. The number of 'Amphetamine Type Stimulant' precursor detections was 630 and accounted for 7.88% of the Customs total detections. Therefore the budget for methamphetamine precursors was estimated at \$14.73m (7.88% \times \$186.87m).

Table 2.1: End product and precursor seizures (border): Customs estimate

	Number of detections	% of total illicit drug detection	Budget estimation \$m
ATS detection	744	9.31	17.39
ATS precursor detection	630	7.88	14.73
Total drug detections	7,993	100	

Note: Data for the number of detections are from Australian Customs Service (2007, pp. 43–44)

Australian Federal Police

As with Customs, the AFP spending estimates were used to derive an annual (2006–07 year) expenditure estimate on end product seizures (border) and a separate figure for precursor seizures (border).

The AFP's major responsibility is to enforce Commonwealth criminal law and protect Commonwealth and national interests from crime in Australia and overseas. At the border, investigations are undertaken against drug-related incidents, including illicit drug importation, illicit drug export, manufacture and trafficking (Australian Federal Police, 2007, p. 22). The AFP also works overseas against illicit drug and precursor trafficking in order to disrupt criminal syndicates involved in the international trade in illicit drugs. They do this through an international network of AFP liaison officers at overseas offices and through the work of the Specialist Response-ATS.

In 2006–07, the AFP expenditure on criminal investigations at the border and international level was \$156.21m (AFP Annual report 2006–07, p. 20). A rough estimate by a prior AFP researcher (McFadden 2010, personal communication) would suggest 90% of that figure is related to drug law enforcement, including all the corporate support overheads and supplies. Thus, the estimate for the total amount spent by the AFP on drug related investigations at the border in 2006–07 was \$140.59m.⁶

In order to cross-check this figure, we also calculated the total illicit drug spending using an alternate method. In previous studies, it was estimated that 42% of the total investigatory resources of the AFP were used on drug-related investigations (McFadden & Mwesigye, 2001; Moore, 2005b).⁷ For validation, we summed the total estimated investigation budget (\$335.28m) from three categories—border and international network, economic and special operations, and terrorism (as reported in the AFP annual report, p 20). After applying 42% to this figure, the drug-related investigation expenditure was calculated to be \$140.82m. Given that this figure is very close to the calculation based on AFP expert judgement, we chose to use the former drug investigation budget figure of \$140.59m.

We then needed to determine what proportion of the AFP spending of \$140.59m could be reasonably ascribed to methamphetamine end product seizures and precursor seizures. Similar to the Customs' definition, the figure for AFP amphetamine seizure includes methamphetamine and amphetamine but excludes

⁶ There was a 44.8% increase in the budget allocation for the investigation of illicit drug crime from 2002–03 to 2006–07.

⁷ We could not use this second method as our preferred or main method because the way in which AFP report expenditure has changed considerably (McFadden, personal communication).

MDMA. Table 2.2 provides the details of the number of AFP seizures. There were 263 methamphetamine seizures in 2006–07 and this accounted for 10.94% of total number of drug seizures. Based on this, it was estimated that the AFP budget for end product seizure for 2006–07 was \$15.38m.

Table 2.2: End product and precursor seizures (border): AFP estimate			
	Number of seizures	% of total drug seizures	Budget estimation \$m
Amphetamine	263	10.94	15.38
Precursor	39	1.62	
PSE precursor ^a	27	1.12	1.58
Total drug seizures	2,404		

a: From AFP raw data, the categories related to meth precursor are pseudoephedrine and phenylacetic acid.

Source: Australian Federal Police, (2008, p. 26) and AFP raw data

The same methodology was then used for the estimation of the AFP budget for methamphetamine precursor seizures at the border. However, the AFP annual report (Australian Federal Police, 2008) only presented the precursor seizure count for all precursors of illicit drugs and did not report the methamphetamine precursor seizure count. We therefore used AFP raw data, which were provided on special request to the AFP. As shown in Table 2.2, there were 27 individual pseudoephedrine seizures (with 1.12% of total drug counts) in 2006–07. Based on the number of seizures, it was calculated that \$1.58m (1.12% \times \$140.59m) was invested in methamphetamine precursor related investigations (at the border) by the AFP in 2006–07.

State police

State police spending estimates were derived for the budget for both clandestine laboratory detections (domestic) and for end-product trafficking seizures (domestic). We deal with the overall domestic methamphetamine budget first and then clandestine laboratory detections (domestic) as a subset of the domestic policing budget.

Budget: Total domestic policing methamphetamine (above retail level)

Publicly available budget information for the state police agencies did not include a specific allocation for illicit drug interventions. First, we needed to calculate a crime budget from the total state police budget, usually labelled ‘criminal investigations’. We were able to calculate the proportion of total criminal investigations for Victoria only (30%⁸). We applied this figure to the other two state police agencies, under the assumption that the proportion of total activity taken up by criminal investigations would be similar across these three states.

Once we had calculated a total criminal investigations budget for each of the three states, we then derived an estimate for total illicit drug investigations, based on the proportion of total offence numbers attributable to illicit drug offences (eg use and possess, trafficking, importation). The ratios were calculated individually for each state. The offence data were obtained from each jurisdiction (NSW Recorded Crime Statistics, Quarterly report, 2007: NSW Bureau of Crime Statistics and Research; Victoria Police Crime statistics 2007–08: Victoria Police; Qld Annual statistical review 2006–07: QLD Police) and applied accordingly. This gave us an estimated budget for each state for illicit drug law enforcement. The assumption underlying this calculation method is that the policing costs (excluding criminal justice costs) are largely equivalent in detecting an offence, whether that offence by drug use, possession or trafficking⁹.

⁸ Based on Victoria Police Annual Report 2006/07 (p. 42), there were 30% of total budget spent on crime investigation. We use the same figure for NSW and QLD.

⁹ We appreciate that this is a significant assumption. The sensitivity analyses we conduct go some way to reassure us that substantial differences in our estimated policing costs do not impact on the results.

Next, we calculated the proportion of the total illicit drug budget attributable to the manufacture and distribution of methamphetamine. We make the same assumptions as we did for federal law enforcement agencies; that is, the cost of the intervention is the same for each drug type, thus the proportion of the total drug budget allocated to methamphetamine is simply a function of the proportion of total drug interventions that are methamphetamine related above the retail (user) level. We used total provider arrest data from the IDDR 2006–07 and methamphetamine provider arrest data from ACC raw data to calculate the proportion of total drug provider related ‘activities’ attributable to the methamphetamine market.

We provide a worked example in Table 2.3. As can be seen, annual reports were used to establish total police expenditure, 30% was then applied to that to estimate the total expenditure on criminal investigations (\$684.6m=0.30%×\$2.28b). The number of drug offences as a proportion of total offences¹⁰ (taken from BoCSAR, NSW Recorded Crime Statistics, 2007, Q2) was 3.5% and applied to the total budget, resulted in a drug budget of \$23,991,000 (3.50%×684.6m, with rounding). To derive the methamphetamine budget estimate for policing at levels higher than retail, we applied the ACC arrest data for consumers versus providers. The methamphetamine provider arrests from ACC raw data are used to derive the proportion of methamphetamine provider arrests to total drug arrests (23.02%=657/2,854). Applying 23.02% to the drug budget results in an estimate of \$5.52m.

Table 2.3: NSW Police drug budget data

Expenditure (\$)		
Total expenditure	2,282,000,000	NSW Police Force Annual Report 2006–07, p.82
Expenditure on investigating crime	684,600,000	30% of total expenditure spent on criminal investigations; Victoria Police Annual Report 2006–07
Number of offences/drug offences		
Total offences investigated	686,263	BoCSAR: NSW Recorded Crime Statistics 2007 Q2, pp.42–45
Total drug offences (state data)	24,049	BoCSAR: NSW Recorded Crime Statistics 2007 Q2, pp.42–45
Total provider arrests	2,854	ACC:IDDR 2006/07, p.108
Total methamphetamine provider arrests	657	ACC raw data
Total drug budget	23,991,000	=684m * 24,049/686,263
Methamphetamine policing budget (above retail level)	5,521,000	=23.9m * 657/2,854

Budget: Clandestine laboratory detections (domestic)

For clandestine laboratory detections (domestic), we received data based on special request from three states—Victoria, New South Wales and Queensland. Table 2.4 illustrates a breakdown of the specific budget items provided by the state police agencies. Detailed allocations of operating costs were available for New South Wales; salary costs and on-costs were collected for Victoria; and for Queensland we could only source equipment costs.

¹⁰ We did look at the ABS data but we could not use them for the offence calculations for three reasons: (1) there is only one report available that is for 2007–08; (2) the figure reported is the number of offenders on principal offence, which will be a lot less than the incident numbers; and (3) given the purpose of our report (proportionate drug-related police activities to estimate expenditure) it is better to use incident numbers rather than offender number.

Table 2.4: Budget details provided to the research team for clandestine laboratory detections

	NSW	VIC	QLD
Equipment cost	√		√
Salary cost		√	
On-cost		√	

Importantly, the budget calculations for clandestine laboratories do not conform to our top-down method. Instead, we have had to use bottom-up estimates from KIs. There was no information that we could use to derive a top-down clandestine laboratory spending estimate by state police. In the end, we calculated state budgets for clandestine laboratory detections (domestic) based on KIs advice and apply the figure to the two other states. The total figure is \$5.4m.¹¹

Budget: End product trafficking seizures (domestic)

By subtracting the budget for clandestine laboratory (domestic) from the total domestic policing methamphetamine budget (above retail level), we derive the budget for end product trafficking seizures (domestic).

Policing expenditure: Summary

Table 2.5 combines all the above estimates. The highest budget (\$32.78m) was spent for end-product seizures at border level, followed by precursor seizures at border level (\$16.31m). At the domestic level, more spending occurred for end-product trafficking seizures versus clandestine laboratory detections (\$13.89m vs \$5.4m).

Table 2.5: Summary of estimated methamphetamine expenditure by different law enforcement agencies in 2006–07 ('000)

	AFP	Customs	State police	Total
End product seizures (border)	15,381	17,394		32,775
Precursor seizures (border)	1,579	14,729		16,308
Clandestine laboratory detections (domestic)			5,400	5,400
End product trafficking seizures (domestic)			13,893	13,893

Note: The figures in the Table have not been rounded. These should be understood as rough estimates to, at most, two digits of precision.

For the economic model (see Chapter 6), a low estimate and a high estimate were derived from 20% lower and upper bounds. There is no apparent logic as to a best approach to vary these estimates—the proportion of methamphetamine offences may be either over or underestimated as a proportion of policing costs. As a result, we apply an arbitrary percentage (in this case 20%) to derive ranges for the sensitivity analysis. This replicates Moore's approach.

2.3.4 Calculation of the value of seized drugs ('Loss to illicit drug industry')

We calculated estimates of the value of seized drugs (end products and precursors) at the four methamphetamine interventions:

- end-product seizures (border)
- precursor seizures (border)

¹¹ As noted previously, while we are less confident in the exactness of the figure estimated here, the sensitivity analyses address the extent to which varying the policing costs for clan lab seizures changes the main findings.

- clandestine laboratory detections (domestic)
- end product trafficking seizures (domestic)

Using the weight of seized drugs for each intervention, we apply the relevant value for the methamphetamine, as detailed below.

According to the ACC (Australian Crime Commission, 2008a), a seizure is defined as ‘the confiscation by a law enforcement agency of a quantity of an illicit drug or a regulated drug being used or possessed unlawfully, whether or not an arrest is made in conjunction with that confiscation’. Publicly available data on Australian drug seizures are published by the ACC annually in the IDDR. Their report (Australian Crime Commission, 2008a), documents the number and weight of seizures for each state and territory police agency and the AFP (by state) across ATS, cannabis, heroin, steroids, hallucinogens and other/unknown drugs. Unfortunately for our research purposes, the amphetamine-type stimulant category does not distinguish between ecstasy and methamphetamine seizures. As a result, we needed to turn to police data sources for details of methamphetamine seizures.

Seizure data

End product seizures (border)

Data on end product seizures by the AFP during 2006–07 were obtained from the AFP. The data from AFP include ‘those seizures made by the AFP, the Customs and the Joint Asian Crime Group where the drugs have been held in AFP custody’ (Australian Federal Police, 2008 p.26). The data obtained indicated 274 cases¹², with a total seizure weight of 81.75 kg¹³. This is very close to the published data from the AFP (77.9 kg seized and 263 seizure count in 2006–07) (Australian Federal Police, 2008, p. 26).

Precursor seizures (border)

AFP provided data on precursor seizures, which identified 27 cases of detections where a specific methamphetamine precursor¹⁴ is mentioned. The total weight was 48.08 kg. However, a broader category of ‘precursor’ (Code 9) results in a total precursor seizure weight of 332.0 kg. Given that the AFP annual report notes a total precursor seizure weight of 541.8 kg (Australian Federal Police, 2008, p. 26), we believe that the 332.00kg is a better estimate than the 48.08kg. Therefore, we used 332.0 kg as the upper estimate of the precursor seizure weight.

Clandestine laboratory detections (domestic)

NSW Police provided raw data on methamphetamine clandestine laboratory detections from New South Wales. We were not able to obtain Victoria or Queensland data. There were 25 detections from the raw data, which is identical to that reported in the IDDR 2006–07 (p. 30). We therefore used the IDDR report to source the number of clandestine laboratory detections for Victoria and Queensland (IDDR 2006–07, p. 30). To estimate the seizure weight from clandestine laboratory detections, we make the assumptions that:

- The size of clandestine laboratory are classified into four groups—small (1g–250g), medium (250g–1kg), large (1kg–4.5kg) and ‘superlabs’(>4.5kg) (based on KI interviews, legislation and UNODC ‘Amphetamines and Ecstasy: 2008 Global Threat Assessment’ (2008 p. 25)).
- There is minimum one complete production cycle before being detected/seizure (see below).
- The characteristics of clandestine laboratories are the same among the different states, that is Queensland and Victoria have the same proportion of laboratory sizes as in New South Wales.

¹² There are 44 cases of duplicated coded ID.

¹³ This includes the sub groups of amphetamine, amphetamine/methamphetamine, methedrine, ice and dexamphetamine in raw data.

¹⁴ This includes the sub groups of pseudoephedrine and phenylacetic acid in raw data.

As seen from Table 2.6, we have NSW clandestine laboratory data of sizes from the provided raw data. There are 60% reported as small, 24% medium and 16% as large. We have no way of validating these figures, except we note that McKetin et al. (2005) reported NSW 2003 data indicating Large labs: 20.83%; Medium: 37.50%; Small: 41.66% but this pre-dates PSE regulations (2005) and Project Stop (2006).

The IDDR report (2006–07) provides the number of clandestine laboratory detections from Victoria and Queensland. We derive the proportion that would be small, medium and large by applying the NSW percentages (see Table 2.6). We cross-checked with the IDDR report 2006–07 for validation (there were 11 laboratories detected using Nazi methods in Victoria, which we know should be small laboratories and the total estimation for small laboratories should be at least equal or greater than 11. In our estimation, there were 43 small laboratories detected which proved our estimation is within a valid range). We also noted that KIs advised in the interviews that Queensland had predominantly small labs:

- The majority of Queensland clan labs are usually small in size and are therefore not of the large size typical of commercial production (KI 2).
- Although there is the occasional large commercial lab seized in Queensland, there are far fewer compared with the southern states, which have fewer seizures of labs compared with Queensland, but where the yields of labs are higher (KI 1).

We deal with this potential change to our clandestine laboratories calculation in sensitivity analysis in Chapter 6.

Table 2.6: Size of seized clandestine laboratories

	Small	Medium	Large	Total
Percentage	60%	24%	16%	
NSW	15	6	4	25
Vic	43	17	12	72
Qld	36	14	10	60

We need to convert the estimates of the numbers of laboratory detections by size, into the methamphetamine weight seized. Most typically, law enforcement seize a laboratory part way through the manufacture process and end up seizing the lab equipment plus some admixture of chemicals, which is neither precursor nor end product but an intermediate between the two. Each clandestine laboratory has the capacity to have been used for several manufacture cycles prior to the seizure and could have been used for several more if it had not been seized. We included only the potential output of a single manufacture cycle. This may lead to an underestimate of the impact of clandestine laboratory detections, however this methodology helps maintain consistency across other methods (eg we do not build into the model for end-product border seizures the fact that an air passenger who had 2 kg seized had the potential (if they were not caught) to make several more trips with drug concealments). So, we use the size or capacity of the lab to calculate the potential amount from a single production cycle of end product that the clandestine laboratory could potentially have produced had it not been detected.

Applying the average weights from one production cycle to the estimates of small, medium and large clandestine laboratory detections results in a lower estimate of 35,344 grams and an upper estimate of 177,500 grams seized (see Table 2.7).

Table 2.7: Clandestine laboratory detections (domestic) seizure weights (g)

	Min	Max
Total	35,344	177,500

Seized laboratories are often in mid-production cycle, and so we were unable to determine whether a particular seizure was end product (ready to be on-sold as methamphetamine) or was an admixture of chemicals from a clandestine laboratory that were not intended for sale. This may have resulted in an overestimate of the value of seized end product from clandestine laboratories.

End product trafficking seizures (domestic)

The ACC (via approvals from NSW Police and Victoria Police) provided raw data on methamphetamine seizures in New South Wales and Victoria during 2006–07.

Commonwealth legislation specifies that the trafficable quantity of methamphetamine is two grams. State legislation has higher requirement for trafficable quantities, with three grams¹⁵. We use the three gram minimum amount for inclusion in this study, recalling that the economic model only concerns the higher levels of the market and excludes the retail level.

We extracted the weight of each seizure for New South Wales and Victoria. We derived Queensland seizure weight of methamphetamine over three grams based on the assumption that Queensland has the same proportion of above three gram seizures of total ATS as Victoria. By knowing the total ATS seizure weight for Queensland, which was 32.09 kg (IDDR 2006–07, p. 113), we calculated the estimated methamphetamine seizure weights (above 3 grams) for Queensland.

Summary

Based on all the above, we have estimated the seizure weight (in grams) for the four interventions under study, as summarised in Table 2.8.

Table 2.8: Seizure weight for each level of intervention (g) in 2006–07			
	Seizure weight (grams)		
	Min	Main	Max
End-product seizures (border)		81,755	
Precursor seizures (border)	48,080		332,004
Clandestine laboratory detections (domestic)	35,344		177,500
End product trafficking seizures (domestic)		104,089	

We examined the distribution of seizure weights by the number of seizures. Plotting the Lorenz curves demonstrated that approximately the top 20% of the seizures (in number) accounted for approximately 80% of the total weight for interventions at end-product seizure at borders. The same situation applied to the other interventions. Thus, the distribution is largely unequal, with a small number of seizures accounting for the largest proportions of weight. We could not determine the extent to which this means that the value of the seizures calculated for the cost-to-impact ratio is largely confined to a small number of operators. Further research could look at whether the distribution differs between the four different law enforcement interventions.

Valuing the seizures at the relevant market level (price data)

In order to estimate replacement costs, it was necessary to ‘value’ the seized drugs/precursors at the price they represent in the drug market. There was no available study that has provided detailed price estimations. We relied on the qualitative data that we collected (from KIs) and the existing (limited) literature on methamphetamine prices. These prices data are discussed in detail in Chapter 4.¹⁶

¹⁵ See detailed in Appendix E.

¹⁶ There are some studies that have tried to aggregate a national average price for heroin (Prunckun, 2007; Weatherburn & Lind, 1995), by weighting the population and averaging the quarterly data (before 2002/03) and other studies in US report the national price by simply weighting the averages of prices obtained for particular cities and regions (ONDCP (US Office of National Drug Control Policy), 2004). However, given the paucity of data and our need to estimate price at each level of the market, we did not pursue the option of deriving an average national price.

End product

Our approach was to use the price data collated provided from KIs and the published literature (see Chapter 4), with two variations. First, we only used price data from the three states selected for the economic model (New South Wales, Queensland and Victoria), rather than national price data as reported in Chapter 4. Second, we applied a Consumer Price Index adjustment to all those prices that were reported from years other than 2007.

We used these adjusted raw prices data to derive a function of best fit for seizure weight and value/unit price. The analysis was conducted on two types of methamphetamine product—crystal and non-crystal, using SPSS (18th ver). We obtained log-linear relationships for both forms of methamphetamine (Table 2.9)

Table 2.9: Log-linear relationship between weight and price (value and cost)

	Transaction value y and transaction size x	Unit price value y and transaction size x
Crystal form	$y=364.62x^{0.8727}$	$y=364.62x^{-0.127}$
R2	0.9914	0.7092
Non-crystal form	$y=288.73x^{0.8453}$	$y=288.73x^{-0.155}$
R2	0.9285	0.3029

From these functions, we derived the replacement costs based on seizure weight. The value of non-crystal form was used as the minimum replacement cost estimation and the value of crystal form was used as the maximum. We used the average of minimum and maximum as the main estimate.

Seizure price data (precursor)

The prices of methamphetamine precursors were summarised from KIs (see qualitative results, Chapter 4). They included prices of precursor materials purchased outside Australia and within Australia. As seen in Table 2.10, the purchase prices were very low overseas and were much higher when items were obtained in Australia. We used the median price (\$35,000/kg) in our study.

Table 2.10: Methamphetamine precursors, pre-precursors and reagents—\$ per kilogram

	Min	Max	Median
Purchase overseas			
KI 3	40		
KI 4	40	120	
KI 12	2,500		
KI 12	2,500		
Purchase in Australia			
KI 2	10,000		
KI 3	15,000		
KI 4	40,000		
KI 7	30,000		
KI 12	35,000	40,000	
KI 12	35,000		
KI 12	250,000	400,000	
			35,000

Clandestine laboratory detections (domestic)

When law enforcement agencies seize a clandestine laboratory site, they may seize laboratory equipment, precursor chemicals, reagents and end product, or any combination of these. The capital costs of clandestine laboratories (eg glassware) are neglected because these costs are likely to be relatively small compared

with the costs of precursor chemicals and end product. This is consistent with our approach to other law enforcement interventions. For example, with respect to importation of end product, when drugs are detected, the cost included in our calculation is only the replacement costs of the seized product, but not the other costs associated with the importation to Australia (such as postal fees, air ticket cost, packaging cost etc).

For each clandestine laboratory detected, we estimated the end product seizure weight based on its size (see Section 2.3.1 above). Then we calculated a minimum and maximum value for clandestine laboratory seizures by applying the price and weight functions for both crystal and non-crystal.

Loss to illicit drug enterprises: Summary

The results of calculations of the total loss to illicit drug enterprises are presented in Table 2.11.

Table 2.11: Monetary value of the loss to illicit drug enterprises due to drug law enforcement interventions (\$) in 2006–07

	Low estimate	Main	High estimate
End-product seizures (border)	7,112,000	9,078,500	11,045,000
Precursor seizures (border)	1,683,000	6,652,000	11,620,000
Clandestine laboratory detections (domestic)	3,742,000	14,620,000	25,497,000
End-product trafficking seizures (domestic)	10,345,000	13,516,000	16,685,000

The low estimate and high estimate are derived from the price calculations for crystal and non-crystal forms. There is an exception for the value of precursor seizures at border level—we did not have a minimum and maximum (crystal and non-crystal forms were not applicable) so we applied 20% lower and upper bounds to derive the low and high estimates.

The use of the non-crystal forms to derive the minimum price and crystal forms to derive the maximum price is a logical approach, given data limitations but it may result in estimation error because we know that the majority of locally produced methamphetamine is base/powder, whereas the majority of imported methamphetamine is crystal. Hence, our approach may underestimate the replacement cost of border seizures and overestimate the replacement costs of domestic seizures.

There are a number of ways to estimate the impact on illicit drug enterprises due to law enforcement. The methodology used in this study was based on estimates of replacement costs incurred by criminal enterprises as a result of actual seizures of drugs or precursors. As we were comparing effects *across* law enforcement interventions, a common metric was required. This does not mean that there were no other (possibly better) ways to value the impact of particular law enforcement interventions. For example, for precursor chemical seizures, an estimate of the amount of methamphetamine that was *not* produced due to precursor chemical seizures is arguably a better metric of the impact on illicit drug enterprises. The amount of methamphetamine that did not get manufactured could then be converted into the profits lost by illicit drug enterprises.

The results of the economic model are reported in Chapter 6.

Chapter 3: Results: Methamphetamine supply chains in Australia: Networks and people

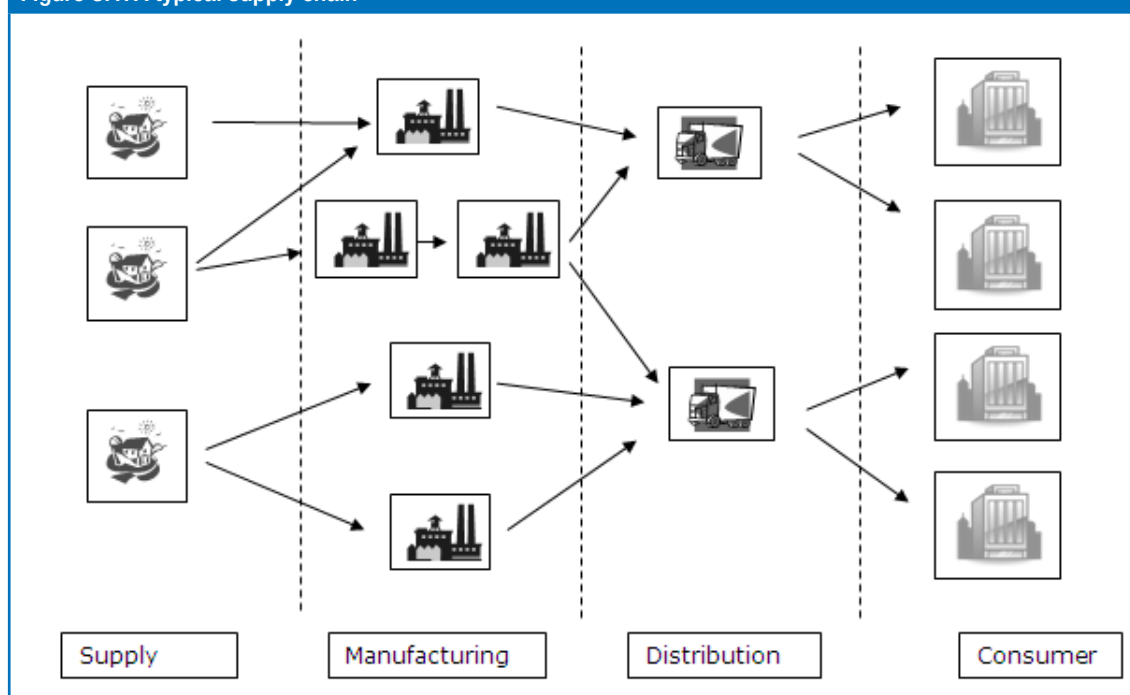
Information on the supply chains for methamphetamine is limited. In fact, there are no sources of detailed descriptions of the supply chains for methamphetamine that cover all aspects of the production and distribution of this illicit drug above retail level. Some information on discrete components of the supply chain can be found in published and grey literature, but on the whole, there is no single comprehensive source. Furthermore, the manufacture and distribution of methamphetamine is likely to be dynamic and will change as new importation methods are discovered and as novel manufacture processes are invented. The current project focuses only on supply chain levels above retail level (ie wholesale and above). There is very little information on these higher levels of the methamphetamine supply chain. The economic analysis focuses on drug law enforcement interventions that target supply levels at the wholesale level and above.

The term supply chain refers to:

an integrated process wherein a number of various business entities (ie suppliers, manufactures, distributors, and retailers) work together in an effort to: (1) acquire raw materials, (2) convert these raw materials into specified final products, and (3) deliver these final products to retailers (Beamon, 1998).

A supply chain refers not only to the processes involved, but also to the interrelationships among suppliers, manufacturers, distributors and retailers that facilitate the movement of raw materials through the manufacture and distribution process, into end products to be sold at retail (Beamon, 1998). A typical supply chain is depicted in Figure 3.1 (modified from Beamon, 1998). This supply chain has four levels—supply, manufacture, distribution and consumers. Each level of the chain can include several facilities (eg more than one manufacturing plant). The complexity of a supply chain increases as the number of levels in the chain and the number of facilities in each level increase.

Figure 3.1: A typical supply chain



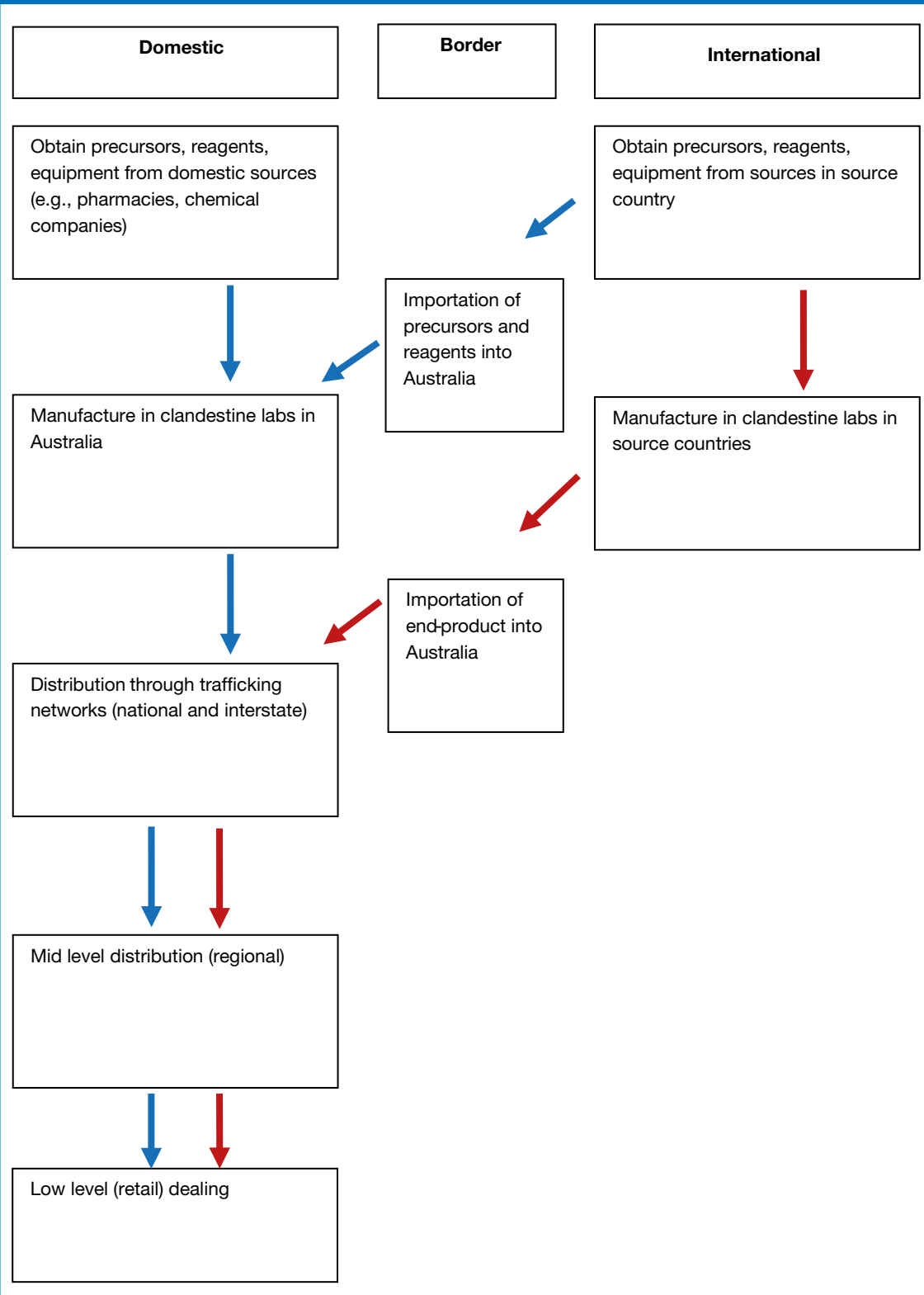
This chapter and the following chapter aim to provide a rich description of all aspects of these supply chains and the methamphetamine market above the retail level. In this chapter, we start with a summary of the methamphetamine supply chains and then describe the people and groups involved in the methamphetamine supply chain at both the international importation level and at the domestic level, where product is both manufactured and distributed. Chapter 4 covers prices and profits. In Chapter 5, we explore the structures and processes, such as the manufacturing and distribution of methamphetamine.

The chapters are based on data collected from a review of the literature, judges' comments in criminal cases and interviews with KIs, as detailed in Chapter 2. The information contained in these chapters provides a detailed snapshot of the structure and function of the methamphetamine market(s) operating in Australia throughout 2008 and 2009. It should be noted that the methamphetamine markets and supply chains are subject to constant change, largely due to endeavours by the criminal networks and individuals to avoid detection by law enforcement.

Methamphetamine supply chains: Summary

Our research has clarified the methamphetamine supply chains and identified a solely domestic supply chain (from manufacture to distribution to retail sale), as well as another supply chain that commences offshore, followed by importation of either end product or precursors, followed by manufacture and distribution. The details are provided in Figure 3.2. The activities associated with procuring methamphetamine are listed in the boxes. The arrows indicate the relationships between the two supply chains (domestic and international). As can be seen, the supply chains converge at the wholesale level.

Figure 3.2: Supply chains and drug law enforcement interventions



3.1 Networks, organisations and people involved

Harland (1996) describes supply chain management as the management of inter-business networks. In this conceptualisation, the term *network* is used to refer to a specific type of relationship in which a defined set of individuals, objects and events are linked (Harland, 1996). Individuals, resources and activities that comprise networks are interdependent. Individuals in the network are defined by both their activities and the resources they control. Interconnections between individuals occur through these resources and activities. Relationships between individuals in the network allow for one individual to access the resources of another.

A key challenge is understanding the extent to which the importation, production and distribution of methamphetamine for Australia is best characterised by organised crime groups, or whether it is better characterised by interdependent networks, with opportunistic networks of people operating independently and sometimes cooperatively. These are not mutually exclusive. There has been some recent literature from the heroin markets (Paoli, 2002, 2004) that suggests that largely speaking, there are not systematic organised crime groups and that there is little vertical integration in the global heroin market. In the report 'Global drug markets 1998 to 2007' (Reuter & Trautmann, 2009), the authors also suggest that there is little vertical integration in methamphetamine markets. As will be seen below, however, we received information from police sources that seem to suggest both the central involvement of organised crime groups in Australia and some vertical integration of the market. Vertical integration is measured by the extent to which any one firm is involved all the steps of a supply chain from extraction of raw materials to retail sales to consumers (Moore, 1986). It is clear that both vertical integration and loose networks, which focus on one or two, but not all, supply chain levels, occur. Using the typologies of drug dealing enterprises developed by Curtis and Wendell (2000), the information we collected suggests that 'freelance' structures, characterised by the absence of formal hierarchies and no rigid division of labour, do exist as well as evidence of 'corporate'-type structures that typically include formal hierarchies and a clear division of labour.

The typology developed by Curtis and Wendel (2000) is comprised of three main types, based on social organisation. First are corporate-style groups, which are hierarchical and have the highest division of labour. In corporate-style groups, employees must be trusted by the organisation or be ignorant of the details of business dealings. There are sharp divisions between ownership, management and labour. The second type of group is socially bonded groups in which trust is facilitated by shared characteristics such as kinship, race, ethnicity, nationality, or neighbourhood. There is wide variation in these groups—some are egalitarian and resemble collectives, while other are more hierarchical. And third are freelance groups, which are characterised by a lack of formal hierarchy and the absence of division of labour. Cooperation and alliance are fluid, ad hoc and may be short lived. The type of social organisation has important implications for law enforcement interventions. For example, socially bonded organisations rely on relational capital (trust between members) and are therefore hard to infiltrate (eg with undercover operatives) and break. Vertically organised hierarchical structures imply that policy attention towards the top of the hierarchy is likely to bring greatest results. Freelance structures means that police cannot direct their resources to a particular organisation or chain of supply.

Within Australia, organised crime groups are reportedly heavily involved in the manufacture and distribution of synthetic drugs in New South Wales and Victoria (Parliamentary Joint Committee on the Australian Crime Commission, 2007). The market for synthetic drugs in Queensland, Western Australia and South Australia is marked by the involvement of OMCGs in the manufacture and distribution of synthetic drugs, including amphetamines and crystal methamphetamine (Joint Parliamentary Committee on the Australian Crime Commission, 2007). Although some groups may be involved in only one level of the supply chain, some criminal networks control the entire supply chain from the sourcing of precursors through to high and mid distribution of end product (United Nations Office on Drugs and Crime, 2008). One measure of the significance of the single organised crime group is the size of the endeavour and if production of substantial quantities of methamphetamine are then controlled by this same group through the levels of the supply chain, this has significant implications for policing. The disruption of such a criminal group is likely to have larger impact than if the production is small and characterised by loose networks that 'freelance'.

The nature of criminal networks within Australian drug markets was described by Mr Kevin Kitson, Director of National Criminal Intelligence for the Australian Crime Commission in the following terms:

The networks are...fluid, entrepreneurial and flexible. Some longstanding notions of hierarchical structures in organised crime, I think, simply do not apply here. So we have a series of shifting alliances of convenience that allow people to move their commodities at whatever stage of the production cycle they might be at. What we see is a strong representation of people with Outlaw Motorcycle Gang associations or connections in that process. I would not wish to characterise Outlaw Motorcycle Gangs as being the predominant force in amphetamines and other synthetic drugs, but there are significant representations (Parliamentary Joint Committee on the Australian Crime Commission, 2007, p. 95).

There appears to be some evidence, therefore, of loosely connected networks that show some hierarchical structure. This suggests that a dichotomy between vertically integration and loosely connected networks is, at least for groups involved in methamphetamine trafficking, an artificial dichotomy and that in fact, groups can be a blend of the two. Indeed, it is a little more complicated still. The overall network can be disaggregated, but still have real organisations at particular steps/levels.

Importantly, too little attention has been paid to the issue of whether organised crime groups engage in activities other than drug production and distribution, such as trade in illegal firearms, human trafficking, money laundering and so on. It is suggested that the organised crime groups do have diversified interests. As noted by the Queensland Crime and Misconduct Commission, organised criminal networks have the capacity to 'deal simultaneously in a variety of illicit commodities and the members of any one network may simultaneously be members of a number of other networks' (Queensland Crime and Misconduct Commission, submission to Parliamentary Joint Committee on the Australian Crime Commission 2007, p.3). This has important implications for drug law enforcement—simply discouraging these groups from dealing in the drug trade (ie making it less profitable than other illegal activities, rather than not profitable at all) may be sufficient to have them turn to other illegal activities.

There is also evidence that different groups will cooperate to achieve common goals (ie generating profits). For example, the market for synthetic drugs, including methamphetamine, is increasingly characterised by cooperation between transnational organised crime groups and domestic crime groups, including coordination among individuals and groups from diverse nationalities and ethnicities (United Nations Office on Drugs and Crime, 2008). The diverse ethnic backgrounds of domestic crime groups facilitate cooperation and coordination with established international organised crime groups.

3.2 International networks of relevance for Australian supply

It is difficult to firmly ascertain the extent to which international crime groups are involved in the importation of methamphetamine or precursors into Australia. According to police interviews, Asian crime gangs are involved in the importation of crystal methamphetamine (KI 9), often in conjunction with other domestic criminal syndicates. For example, Vietnamese gangs have moved from the traditional role of heroin importers to the importation of methamphetamine as well as heroin (KI 2). It appears that these groups utilise the trafficking routes, techniques and personnel established for the importation of heroin and apply these 'tried and true' resources to the importation of methamphetamine. One KI noted the involvement of Italian crime groups:

...there is a bunch of sort of fairly high end organised criminals who are moving towards the importation of precursor chemicals...back in June we seized in the vicinity of two or three tonnes of pseudoephedrine or ephedrine coming into Australia to be used for methamphetamine manufacture. Now they [are] predominantly Italian groups (KI 12).

This suggests that a variety of nationalities are involved in methamphetamine trafficking including European groups, Middle-eastern groups, Asian groups and groups from North America. The diversity speaks to the globalisation of the methamphetamine trade—there is no typical profile of methamphetamine traffickers based solely on nationality or ethnic background.

The extent to which Australian crime groups have developed and maintained links with international/offshore crime groups was not identified in our data. However, connections between domestic crime groups and international groups are facilitated by common ethnic origins (eg Asian groups that operate in Australia and that have connections with organised criminal groups in southeast Asia; KI 7). Trust within these crime groups and between groups in Australia and those overseas is facilitated by common ethnic background (Curtis & Wendel, 2000). The common factor within any one criminal group was a bonding based on a common thread such as ethnicity (eg Middle Eastern groups, Asian groups) or membership of a group (eg OMCGs) (KI 4). As mentioned previously, organised crime groups will cooperate to complement each other's abilities and achieve a common goal. Despite the observation that common ethnic background or formal group membership can establish trust and facilitate cooperation between groups, it is known that divergent backgrounds, including ethnicities of key groups/individuals are not barriers to cooperative international relationships (Customs KI). KIs stated that although some local Australian criminal groups do not yet have international connections, such groups appear to recognise the potential utility of such cooperative arrangements. For example, OMCGs do not yet appear to have the necessary contacts in southeast Asia to facilitate the importation of crystal methamphetamine (KI 3). However, KI 3 stated that OMCGs are moving toward the importation of precursors and have therefore established contacts and connections within Asia for that purpose. Similarly, KI 12 stated that OMCGs have the money and the international connections to tap into offshore connections (eg to obtain pseudoephedrine). However, he stated that 'I wouldn't put them at the top end of the market'. This comment appears to indicate that OMCGs are not involved in the importation of end product. This observation is consistent with other data sources (see above) that indicate that OMCGs have not established international trade routes for methamphetamine importation, although there is evidence that they will cooperate with international OMCGs chapters (Schloenhardt, 2007). The potential for the formation of ties between OMCGs and crime groups in southeast Asia for methamphetamine importation should be closely monitored by law enforcement agencies.

3.3 Domestic networks and organisation of the market

Within Australia, methamphetamine production involves a range of criminal groupings, from highly organised and sophisticated criminal organisations to small-scale entrepreneurs (Australian Crime Commission, 2008b). This suggests both the operation of organised crime groups as well as 'disorganised' opportunistic activity is consistent with observations about methamphetamine production in other countries such as the United States (eg Cunningham and Liu, 2003). In addition, the Australian Crime Commission (2003) notes evidence of cooperation between high-level organised criminal networks that pool resources (including precursors, expertise and production facilities) for short-term high output manufacture operations (as per international cooperation noted above). Consistent with this notion of organised groups with well-established networks within Australia, criminal groups (involved in a range of criminal activities including armed robberies) have become established and have evolved to form some of the larger syndicates involved in methamphetamine manufacture and distribution in Australia (KI 7). According to KI 9, large criminal syndicates are often national and multi-jurisdictional and will use their contacts throughout Australia to source necessary chemicals and equipment. A number of criminal networks are purportedly involved in domestic methamphetamine distribution including OMCGs and ethnically based criminal networks (McKetin, et al., 2005).

OMCGs are consistently highlighted in the literature, in judges sentencing comments and in KI reports as being involved in the manufacture and distribution of methamphetamine in Australia. OMCGs are involved in methamphetamine distribution around Australia, facilitated by good interstate networks (KI 13). OMCGs are an example of highly structured, hierarchical organisations and police reported that they have structures in place for the sale and distribution of end product from the high levels to the low levels of the market (KI 1). OMCGs have been linked with larger clandestine laboratories and it has been noted that OMCGs have the organisational capacity to develop contacts through which precursors, reagents and glassware can be obtained for these illegal laboratories (McKetin, et al., 2005). This suggests that OMCGs may be a sole example of vertical integration in the Australian methamphetamine market. Each jurisdictional KI reported the

presence of OMCGs as involved in methamphetamine distribution. For example, one KI noted that OMCGs 'have a lot of experience and have access to a lot of experienced cooks, and also have access to a lot of precursors. They also have a good distribution network interstate' (KI 8).

According to the then Deputy Commissioner Overland of Victoria Police, 'Outlaw Motorcycle Gangs have been directly involved in the manufacture of amphetamines...there is money to be made and they see it as quite a low risk activity' (Parliamentary Joint Committee on the Australian Crime Commission, 2007, p. 3). OMCGs often hire specialists such as accountants, chemists and lawyers to perform discrete tasks (Schloenhardt, 2007). They will also use individuals from other criminal organisations to perform particular tasks in order to avoid detection and in an attempt to divert law enforcement attention from themselves (Australian Bureau of Criminal Intelligence, 2002). We were unable to determine whether other criminal groups used similar methods.

Although OMCGs dominated the manufacture and distribution of methamphetamine in the 1990s in Australia, other established criminal groups became involved after the introduction of pseudoephedrine-based manufacture methods, which were significantly easier than the earlier P2P methods¹⁷ (KI 7). Many different nationalities are now involved including Lebanese, Vietnamese and Caucasians (KI 10) (see also Case Example 4). The type of ethnic origin is not important (apart from geographical trends in production/export and proximity to Australia eg southeast Asia); the key point is that trust is facilitated by shared ethnic identity (ie these are communal groups connected by extra-economic ties). Evidence of nationality-based criminal groups were also reported in different jurisdictions. For example, in New South Wales, criminal groups or networks involved in the methamphetamine market included Middle Eastern organised crime groups and Asian crime groups (involved in the importation of precursors and end product), although no one group exerted a monopoly on the market. Middle Eastern groups dominate in the south western suburbs of Sydney simply because they live there—'the organised crooks are not bound by certain areas and they will operate anywhere in Sydney or outside Sydney if they have to' (KI 4). The Middle Eastern crime gangs are also known to be involved in West Australian production and distribution of methamphetamine. In Queensland, criminal networks involved in the methamphetamine trade include ethnic-based gangs (KI 2). An emerging trend in Queensland is the involvement of Romanian gangs (KI 2). Lebanese gangs, though mainly based in Sydney, also travel up to Queensland to deal in methamphetamine (KI 2). A small number of Lebanese criminals have moved into the Gold Coast region (KI 1). The Gold Coast area also contains Russian and Australian criminal networks involved in the methamphetamine trade (KI 1). In Victoria, the main groups involved include Middle Eastern criminal gangs and Asian gangs. KI 8 stated:

We are finding that Middle Easterners are definitely becoming more involved and we are also finding that Vietnamese are also moving into that market. Up until recently, the Vietnamese [were] pretty happy in heroin and moved up to heroin and cannabis, and now they are diverting into a lot more ice rather than just methamphetamine.

Again, we see evidence of established criminal groups using established techniques and trafficking routes once used for other drugs such as heroin, to transport methamphetamine. This suggests that these criminal groups are flexible and will respond to changing market conditions (eg shortage of heroin following the Australian heroin 'drought'; increasing demand for methamphetamine).

The common thread between the corporate style OMCGs and the ethnically based, socially bonded networks is that ethnicity or formal membership of a group (eg OMCG) enhances trust relationships between individuals. In illicit, unregulated markets, criminal groups cannot rely on legal recourse to resolve disputes and therefore must utilise other methods to build/ensure trust and loyalty. Where systems are not in place to ensure trust (eg in OMCGs punishment is meted out for proscribed behaviour), trust can be facilitated by shared characteristics (eg relatedness, ethnic background)

There is also evidence that some legitimate business can interact with criminal groups to facilitate the trafficking of methamphetamine. For example, KI 10 stated that some financiers of the illicit manufacture and distribution of methamphetamine are often 'fairly well respected in the community' such as property developers:

¹⁷ The detailed description of the production methods is provided in Chapter 5.

...all of a sudden you've got a drug manufacturer/trafficker teamed up with a so-called property developer who may have a legitimate background, but together they go hand in hand because one has a lot of money and the other knows how to put that money into developments (KI 9).

Although this is only an illustrative example, it does suggest the intersection of licit and illicit business within the black market trade of methamphetamine.

Some groups specialise in sourcing precursors and do not engage in manufacture or distribution (KIs 4, 13). According to KI 8, the OMCGs and Middle Eastern groups are involved in manufacture and the Vietnamese groups are mainly involved in distribution and possibly importation. Typically, Asian crime groups are not involved in domestic manufacture (KI 9).

KI 3 stated that 'the market is more entrepreneurial and recognises that conflict is counter to business; it attracts police attention'. This is likely to be true of the market for all illicit commodities. Criminal groups are more likely to cooperate 'irrespective of culture or ethnicity...if there is a buck to be made, irrespective of who you are, and there's an opportunity to come together, that will happen—they will do the business and then go back to their own stuff' (KI 1). For example, links have been identified between ethnic-based gangs and OMCGs (ABCI, 2002), and groups may share the same methamphetamine 'cook'. Lebanese groups may have become aligned with OMCGs, including achieving membership (KI 8). Inter-group contacts are often made through periods in jail and by operating in similar geographical areas.

According to KI 13, many different criminal groups will cooperate in the distribution of methamphetamine in order to make a profit:

You will frequently get one group of Outlaw Motorcycle Gangs who will cook and they will offload their gear to members of another Outlaw Motorcycle Gang to actually supply it. We were doing a job where Vietnamese and Asian groups were bringing in pseudoephedrine tablets in the post by...the old shotgun effect. They'd just bring them into different post office boxes under bodgey names and they'd just go and collect them and accumulate them and they on-sold to a group of Italians who really did nothing to add any value. They just acted as brokers for a bunch of Middle Easterns/Serbs who were bikies...So you've got three different ethnic groups there. Just in the trail of sourcing pseudoephedrine. It's all about money. There seems to be a lot more free trade than what you would expect, across different ethnic groups and across traditional organised crime groups such as bikie gangs.

According to KI 3, the different networks involved in the mid to high levels (ie wholesale and above) of the methamphetamine market do not compete for market position or market share. KI 3 stated that there may be competition at the lower (ie retail) levels of the market and in particular competition for territory (eg Middle Eastern criminal networks in Western Sydney).

The extent of violence in the methamphetamine market is an important feature that may determine the way law enforcement operates and the extent of competition versus cooperation between players. In international drug markets, such as those in major cities in the United States, violence has played a central role, particularly in retail level 'street markets'. In one particular street market in New York, Curtis and Wendel (2007) note shifting trends in violence associated with drug markets as the markets themselves evolved from open street markets to 'freelance' and 'delivery' markets. They note that in freelance markets, violence and threats of violence occur to 'earn respect' and to protect territory, while in delivery (eg home delivery) markets, violence is shunned as being bad for business. Similarly, in research conducted in the United Kingdom, violence and intimidation were reported by drug dealers, mostly at lower market levels (Matrix Knowledge Group, 2007). Again, there was recognition among dealers that violence was not conducive to successful business operations.

It was difficult to determine the extent of routine violence in the mid to upper levels of the Australian methamphetamine market. KI 1 stated that if a dealer is in credit and loses the drugs for one reason or another (eg lost, stolen, or seized by police), the money is still owed and this can lead to violence or threats. There have been anecdotal reports of physical violence, abductions, threats and even the transfer of outstanding debt to family members of dealers. KI 1 provided an anecdotal example of family members

being coerced to work for the syndicate as a replacement for an incarcerated dealer. However, these anecdotal accounts appear to concentrate on the retail level of the methamphetamine market and we have no systematic information about the role that violence plays in the higher levels of the Australian market. Perhaps, as Curtis and Wendel (2007) suggest, Australian criminal groups have recognised that violence is counterproductive to successful business, as it creates disorder and attracts the attention of law enforcement agencies.

A final brief comment on the organisation and networks of methamphetamine manufacture and distribution is warranted. As with any illegal activities, drug syndicates thrive in situations of lax or weak law enforcement. This can be compounded by police corruption. In the case of *R v Kalache* (2000), we observe an incident of police corruption from the 1990s. Kalache (the principal for an organised drug syndicate) paid an \$8,000 bribe to a Detective Sergeant of Police. The Detective (in cooperation with another police officer) arranged for a third police officer to wipe Kalache's fingerprints from seized items. The third officer was promised \$5,000 (he received \$3,300). We have no further information about whether police corruption is a significant feature of methamphetamine supply chains or whether this is a single, isolated case.

3.4 Roles of players within the market

As described above, clearly there are significant roles in coordinating syndicates and managing the networks of people involved. All drug markets operate on 'relational capital' and the methamphetamine market in Australia is no exception. The importance of relationships between people involved in the market is also highlighted in the case of methamphetamine due to the requirement to have a 'specialist' cook. As noted above, there is much crossover and cooperation between the different groups involved in the supply of methamphetamine to and around Australia, including sharing the same cook who may sub-contract to several criminal groups. Here we briefly describe three roles (pseudo-runners, cooks and dealers).

Pseudo-runners

According to the Pharmacy Guild of Australia (Parliamentary Joint Committee on the Australian Crime Commission, 2007), pseudo-runners are individuals or groups who attend several retail pharmacy outlets to obtain products that contain pseudoephedrine. The Pharmacy Guild notes instances where organised groups will approach individuals 'on the street' and offer them payment in return for acquiring pseudoephedrine-based products from retail pharmacies (Parliamentary Joint Committee on the Australian Crime Commission, 2007). It has also been reported that methamphetamine dealers at the retail level may offer to pay their customers (ie users) for pharmaceutical preparations that contain pseudoephedrine (McKetin, et al., 2005). According to KI 8, more males than females are involved in pseudo running, on about a 15:1 scale. Some are specialist pseudo-runners who are not involved in another part of the manufacture/distribution process.

McKetin et al. (2005) noted that as domestic precursor regulations are tightened, and access to pharmacy-based pseudoephedrine becomes more limited, there is expected to be an increased trend towards the importation of pseudoephedrine. If this is the case, the role for the pseudo-runner in methamphetamine manufacture may be on the decline. This was borne out in KI interviews. KIs who commented on trends in pseudo-running (KI 2, 3, 4) consistently reported that the practice has become less common over the last few years.

Cooks

Due to the unique nature of methamphetamine, cooks are required in order to manufacture the end product. Cooks or manufacturers tend to be contracted or employed as consultants by larger syndicates (KI 9) and

may sub-contract to a number of different groups (KI 8). Some criminal networks (eg OMCGs) will have a cook as part of the network (perhaps with formal group membership). In other cases, they may have access to precursor chemicals but no cook and will need to access one through their contacts (KI 3). Maintaining multiple shifting allegiances can be a risky undertaking for cooks. According to KI 8:

It becomes a very tangled web after a while. You do see a lot of them (cooks) crossing over between Lebanese groups and then becoming involved in Outlaw Motorcycle Gangs and then other criminal elements, and it seems to be those people with a well known ability to manufacture who move and sell their skills to diverse groups.

Due to the necessity for cooks in domestic production, and the short supply of requisite skills, methamphetamine manufacture is a lucrative business and cooks can make extravagant incomes from their illicit activities (see next section *The Money Trail* for full discussion of the profits). Some cooks have been known to act as a consultant in case of a problem in the manufacture process (often a 'fee for service' arrangement; KI 3).

KIs 3 and 10 stated that methamphetamine cooks may be people with a chemical or pharmaceutical background. However, most methamphetamine cooks are not trained chemists but have learned how to manufacture methamphetamine from someone else or from accessing instructions over the Internet. Some individuals will pay other people to teach them to become methamphetamine cooks (KI 3). KI 3 stated that

One cook in particular...was paid large amounts of money. One person paid him six thousand dollars to be taught how to cook the P2P method. So you might have your 'master chef' who actually hires himself out to teach people on how to cook.

There is some evidence that criminal groups will seek out individuals with expertise in chemistry in order to use their knowledge and skill for the manufacture of methamphetamine:

...interestingly over the last couple of years here too, a few people who have been caught up in manufacturing have been linked to universities: people with backgrounds in chemistry, and one particular cook had a chemistry background, so he and his brother got into it. It went on from there and it is quite interesting that these people who are well educated and not young people either, we are talking people in their forties and fifties, who work at universities and somehow got caught up in these syndicates... (KI 9).

In some cases, individuals with chemistry backgrounds have been threatened or intimidated into manufacturing methamphetamine for large criminal syndicates (KI 10). The following cases provide illustrative examples of the operation of criminal networks involved in methamphetamine trafficking. The first and second cases demonstrate how the retail end of the market operates when structured by a syndicate, with the use of paid employees to sell the drugs:

R v Cheikh; R v Hoete (2004). Cheikh and a second man, Osman managed a drug syndicate in western Sydney. Street dealers worked for the pair, and were rostered to work day and night shifts. The day shift commenced at 10.30am and the evening shift started at 4.30 until 11pm. They were required to supply drugs to consumers and to receive payments for the drugs, and were engaged in the supply of cannabis and methamphetamine in the Bankstown and Hurstville areas. The dealers were supplied with drugs, mobile phones, and some were provided with motor vehicles. They received a set monetary wage or a set amount of drugs for each shift they worked. The two managers arranged the shifts, supplies, and payment. They made regular checks of the locations of the dealers, their stocks of drugs, and reports of drugs sold and money received.

R v Rao (2006). Rao was a runner or dealer in a large drug syndicate. He was an employee, paid \$150 per day and earned \$300 in a typical week. He stated that he conducted approximately 10–20 deals per day.

The third case demonstrates the diversity of international networks—in this case, not Asian syndicates or Middle Eastern groups, but a UK national. We provide this to reinforce the point about the diversity of operations of Australian drug distribution networks.

R v Emanuel (2004). In 2002, Emanuel (a UK national) was a 'middle manager' of a drug distribution operation. His role within the enterprise was as a 'branch manager'—he was responsible for collecting money from a number of distributors and remitting it to his superiors. He was also responsible for the supervision of the distribution and sale of drugs in Sydney and elsewhere in Australia. He was in liaison with principals in the UK about the status of the supply and sale of methamphetamine. He was connected with a group in the UK that conducted a large scale drug trafficking operation, which included the importation of methamphetamine to Australia from the UK. For example, Emanuel supervised and coordinated the distribution of 18.25 kilograms of methamphetamine by an individual in Perth. He also collected money from the sale of 8 kilograms of methamphetamine in Sydney. In telephone conversations with the higher levels of the operation in the UK, he discussed problems relating to police operations.

The fourth case example describes a well-organised syndicate operating in Sydney:

R v Kalache (2000). Kalache was the principal in an organised network involved in the manufacture and distribution of drugs (primarily methamphetamine). From December 1995, he was involved with a number of others in an operation to finance the manufacture of methamphetamine. Kalache discussed with his associates the potential of selling the drug for \$70,000 per kilogram and splitting the profits. Kalache expected the manufacture at Wollombi to reap profits of around \$350,000. From his premises in Clovelly, Kalache regularly supplied 454g (1 pound) of methamphetamine and occasionally as much as 1,362 grams (3 pounds). Approximately 50 other individuals were arrested in connection with the Kalache syndicate.

This syndicate had some freelance structures in place (eg the cooks), but there was also evidence of hierarchical relationships (eg the 'principal' gave orders that were carried out by others and there was some evidence of specialisation and division of labour). The syndicate appeared well organised as it included more than one clandestine laboratory site, with each site being 'managed' by an individual. The methamphetamine manufactured by each site was transported back to the principal, who then passed the proceeds to wholesale dealers.

The fifth case example demonstrates the specialist role of a cook:

R v Dolman (2001). Dolman was an industrial chemist who supplied materials for the illicit manufacture of methamphetamine (eg phenylacetic acid and other chemical compounds). He became associated with Kidd and Launt who were part of the Kalache syndicate. Launt paid Dolman as a consultant. Dolman visited Launt's Queensland property in March 1996, where approximately 100kg of phenylacetic acid was produced, in addition to other precursor chemicals. Dolman was paid \$50 per hour for his consultancy work, on a scale comparable with legitimate consultancy. Payments to Dolman totalled \$3,000. Dolman admitted to providing training to two persons on the chemical procedures needed to convert phenylacetic acid into methamphetamine.

3.5 Summary: Networks and organisations

The following points characterise the networks and people involved in methamphetamine supply:

- We found evidence of diverse organised crime groups involved in methamphetamine manufacture and trafficking (OMCGs, multinational syndicates, Asian crime syndicates and so on). These organised crime groups are not confined to any one ethnicity or association. The range of ethnic criminal groups includes those of European, Middle-Eastern and Asian backgrounds.
- There are a number of implications for policing that flow from our findings with respect to social organisation:
 - Corporate style groups imply that policy attention at the top of the hierarchy is likely to bring the greatest results, especially when leaders are difficult to replace from within the organisation (no succession planning in the organisation)

- Socially bonded organisations rely on social capital (trust between members) and are therefore harder to infiltrate (eg with undercover operatives) and to dismantle.
- Freelance structures mean that police cannot direct their resources to a particular organisation or chain of supply; but arrests of freelancing specialists (who are in short supply and are difficult to replace) can be particularly effective.
- Blended types will require careful collection of intelligence to determine who is really important for the network (social network analysis may be useful here)
- The extent to which these organised crime groups control the entire supply chain, or parts thereof is unclear. There is evidence of vertical integration within the methamphetamine supply chain (OMCGs are involved at all levels of the domestic supply chain from accessing raw materials to retail sales). Alternately some groups/individuals are involved at only one level of the supply chain (eg groups who import precursor chemicals but are not involved at any other level). The existence of vertical integration within the methamphetamine market has important policing implications; law enforcement may be more cost effective when it is targeted at those groups that control several supply chain levels, as the removal of these groups is likely to exert a greater impact on the methamphetamine market compared with groups who are involved at only one level.
- We found evidence of cooperation between criminal groups. The effectiveness of law enforcement operations are likely to be enhanced if detailed intelligence is collected on relationships and connections between groups prior to arrests being secured. The additional resources and time spent mapping out these networks may lead to more effective arrests, which have a greater likelihood of breaking up several interconnected criminal groups.
- Established criminal groups appear to use established techniques and trafficking routes that were once used for other drugs such as heroin. Thus, law enforcement strategies used successfully against heroin are likely to also be effective against methamphetamine.
- Multiple and diverse role specialisation is apparent within and across groups. For example, cooks possess specialised knowledge and skill and serve an important function. Cooks are therefore difficult to replace in criminal networks. Law enforcement interventions that lead to the arrest and incarceration of cooks are therefore likely to be particularly effective at disrupting the manufacture of methamphetamine.
- The extent to which violence and intimidation are utilised at the higher levels of methamphetamine markets in Australia remains unclear.
- Criminal groups are involved in diverse criminal activities. Dismantling drug dealing enterprises can have flow-on effects to other illicit activity. This has important implications for drug law enforcement—simply discouraging these groups from dealing in the drug trade (ie making it less profitable than other illegal activities, rather than not profitable at all) may be sufficient to have them turn to other illegal activities.

Having described the networks, organisations, structures and people involved, we now turn to examining the money—profits, prices and mark-ups.

Chapter 4: Prices and profits

The manufacture of synthetic drugs including methamphetamine has been described as a business venture motivated by significant financial reward (Parliamentary Joint Committee on the Australian Crime Commission, 2007). According to Schloenhardt (2007, p.2)

the size of the Amphetamine Type Stimulants market in Oceania creates significant economic incentives for organised crime and other criminal elements, especially if the risks of detection, arrest, and seizure are outweighed by the possibilities of large profits.

Describing the money trail accurately for an illicit business is very challenging. There are no official records of prices paid for various quantities, nor of the quality (purity) of the product. For methamphetamine, there is the additional complication of three different forms (powder, base and crystal), which are associated with different prices. Purity is an essential component in understanding prices and profits. This is because price can remain constant, while quality (or purity) of the substance changes. For example, doubling the price of two kilograms of methamphetamine is equivalent, in terms of purity adjusted price, to halving the purity of the same two kilograms of methamphetamine. Unfortunately, data on purity adjusted prices are very limited.

This section describes the information we could ascertain on the prices, purity and mark-ups associated with the methamphetamine market in Australia¹⁸. The key features for any illicit drug market that should be explicated are the prices paid at each level of the supply chain and the mark-ups. Mark-ups are a proxy for the 'profit' for any one individual or enterprise. In drug markets, it is assumed that mark-ups are high across the supply chain. Mark-ups represent the extent to which the activity is lucrative and the extent to which it is perceived as risky; sellers expect a higher profit for activities that are perceived as more risky. In general, the greater the intensity of drug law enforcement, the higher the mark-ups; that is, because as law enforcement intensity increases, individuals engaged in the drug market business expect greater returns for engaging in higher risk activities (as per the risk and prices theory).

Aside from describing the prices at various weights, we also conducted analysis to examine the relationships between the price and weight. Quantity discounts can be calculated from price-weight data, which provides a proxy for the extent of price mark-ups across the market. The method is based on the assumptions of a power law between transaction size (weight) and transaction price (total cost) (Caulkins, 1994; Caulkins & Padman, 1993; Crane, et al., 1997). When the dealers buy in quantity Q and resell in lots of quantity Q/Φ , with a mark-up of $100(\delta-1)\%$, then . The parameter Φ is called the multiplicity or branching ratio. Caulkins and Padman (1993) proposed that there is a power law relationship at different market levels. This means that the total transaction price P and the transaction size Q are related by a power law:

$$P(Q)=\alpha Q^{\beta}$$

(Equation 1)

where α is a proportionality constant, and β is the size elasticity/quantity discount coefficient.

Taking the log of either side of Equation 1 derives a linear relationship between price and transaction quantity. If there is no mark-up, $\delta = 1$ and $\beta = 1$, there would be no quantity discount for buying in bulk. When $\delta > 1$, the unit price falls with the quantity purchased and discounts would apply. As the mark-up rises, so does the quantity discount and the proportionate increase in the total price resulting from a unit increase in size is lower. In other words, the size elasticity β falls with the mark-up. In addition, the branching factor influences the mark-up. If the branching factor Φ is greater (which means the drugs are cut many times), then the mark-ups will be higher.

¹⁸ Even though this research has concentrated on the methamphetamine market above retail levels throughout, here for the prices and purity we include all available data across market levels inclusive of retail in order to construct a price series.

We undertook a comprehensive summary of all methamphetamine price data and where possible matched purity data. Our goal was to locate as much information and data as possible in order to specify the prices at the various levels of the supply chain and calculate the quantity discount, as per the above power law. There are reasonably good Australian data on the retail prices paid on the street for methamphetamine (including its various forms—powder, base crystal) (IDRS data) but for the higher levels of the supply chain, the information is patchy. We used five sources of methamphetamine price/purity data—the IDDR, the IDRS, interviews with KIs and the sentencing remarks of judges (New South Wales and Queensland) and Victoria Forensic data as detailed in the *Methods* section, Chapter 2. We report on precursors first, followed by end product.

4.1 Prices and mark-ups for precursors

Data on the prices paid for precursor purchases outside Australia are limited. As no published or grey literature was located that included precursor prices, we relied on prices provided by the KIs. A summary of all the data we obtained from KIs in relation to prices for precursors is provided in Table 4.1, 4.2 and 4.3.

At an international level, KI 4 reported that prices in southeast Asia for pseudoephedrine-based products are as low as \$40 a kilogram through to \$120 a kilogram. Similarly, according to KI 3, pseudoephedrine can be purchased in China and other Asian countries for approximately \$40 a kilogram and can be sold in Australia for \$15,000 a kilogram—‘you could purchase a tonne of pseudoephedrine in Asia for \$40,000 and get it here for under a total of \$50,000 in total cost, and potentially make a lot of money’. According to KI 12:

[The price] ranges depending on where you are tapped in. I think you can buy a kilo of pseudoephedrine or ephedrine in places like China for about \$2,500 and that would retail here on the black market for about \$25,000 to \$40,000. Maybe a little higher now that the precursor controls have hit here. Now, obviously the more you buy, the cheaper it becomes, so discounts for bulk...I remember doing a job back in about 2000 up in Queensland when these guys were accessing...pseudoephedrine from Canada and they were paying about \$2,500 a kilo there...they weren't involved in the manufacture but they were bringing it in... for those that do. And they were selling it for about \$35,000 a kilo which is a handy little profit.

KI 2 stated that an illicit importation of five million pseudoephedrine tablets could result in a profit of five to 10 times what is paid for the product. The magnitude of profits from importation of precursor chemicals is such that if a shipment was abandoned due to concern regarding possible detection by law enforcement, the importers would simply ‘write it off as a bad month’ (KI 2).

At a domestic level, we located a number of estimates of the prices for precursors (and pre-precursors and reagents), as listed in Table 4.1. But no published or grey literature on precursor prices was located.

Pseudoephedrine

KI 2 estimated that Australian pseudoephedrine-based product with a wholesale value on the legitimate market of \$2,000 could be worth \$10,000 to \$20,000 on the black market (ie 8 to 10 times the wholesale value). KI 7 estimated the price of pseudoephedrine on the black market at approximately \$30,000 a kilogram. KI 1 estimated that a box of medication containing pseudoephedrine that retails for approximately \$15 at a pharmacy could be worth anywhere between \$60 and \$90 on the black market. For example, a box of 24 cold and flu tablets was estimated to be worth around \$60 or \$70 (KI 1). KI 8 stated that a box of pseudoephedrine medication, diverted from Victoria, would sell for around \$100 on the black market in Queensland (mainly due to Project STOP in Queensland, which had reduced the accessibility of pseudoephedrine-based products there), but would not be worth as much in Victoria. KI 2 stated

It's white gold, that's what it is and that's the way it's treated in the market place...where people rather than producing and trafficking in dangerous drugs, have just got themselves in the niche market to actually produce and traffic in precursors...You can make as much money out of selling precursors as you can out of selling dangerous drugs, the actual end product.

According to KI 2 ‘pseudoephedrine is probably the only product in the market place that actually increases value when it is stolen’.

Pre-precursors

One tactic used to circumvent law enforcement is to use a chemical that is one production stage back from a precursor (eg propiophenone or phenyl-1-propanone), mainly because these pre-precursors are unregulated chemicals and are therefore less likely to spark the interest of drug law enforcement agents. In a common production method, three ingredients are required to produce P2P—acetic anhydride, sodium acetate and phenylacetic acid (for more detail about manufacture processes, see Chapter 5). These chemicals are often purchased and transported in kilogram amounts for the purposes of the manufacture of P2P (KIs 9, 11). P2P can also be produced in Australia using benzaldehyde, nitro-ethane and either butylamine or ammonium acetate (KI 11). Sodium acetate, which is needed to produce P2P, might sell on the legitimate market for \$400–500, but will fetch \$4,000 on the black market (KI 9).

Case example

R v Ha (2004). On May 1 2003, Ha attended a number of pharmacies and purchased boxes of tablets which contained pseudoephedrine (total of 840 pseudoephedrine-based tablets). The tablets weighed 305.4g, which could yield 78.1g pseudoephedrine with the potential to produce between 31g and 87g of methamphetamine. Ha invested \$800 of his own money to purchase the tablets and was planning to sell the tablets for between \$2,400 and \$3,200, representing a profit of between \$1,600 and \$2,400 (less expenses).

The retail value in Australia of 25kg drums of pseudoephedrine is approximately \$6,000 (KI 2). This is the price legitimate industry such as pharmaceutical companies pay for 25kg drums of raw pseudoephedrine. Estimates of the black market value of the drums after importation into Australia ranged between \$250,000 (KI 2) and \$1million dollars (KI 4).

Table 4.1 provides data we were able to locate from our sources on precursor prices (Appendix G provides a more detailed version of this Table, which also includes raw data that we were not able to convert). The offshore prices (international price for precursors) are listed first, followed by domestic prices for precursors. No further analysis of the relationship between price and weight are possible on these limited data.

Table 4.1: Methamphetamine precursors, pre-precursors and reagents—\$ per kilogram

	Min	Max	Median
Purchase overseas			
KI 3	40		
KI 4	40	120	
KI 12	2,500		
KI 12	2,500		
Purchase in Australia			
KI 2	10,000		
KI 3	15,000		
KI 4	40,000		
KI 7	30,000		
KI 12	35,000	40,000	
KI 12	35,000		
KI 12	250,000	400,000	
			35,000

It appears from these data that the prices for purchase of precursors overseas (in source countries) is significantly lower than prices in Australia. In economic terms, this means that the purchase price in source countries is largely trivial, relative to the significant mark-ups that are made when selling precursors in Australia. The premium on price for precursors within Australia may reflect the success of border enforcement.

4.2 Prices and mark-ups for end product

We distinguish between crystal and non-crystal prices for methamphetamine end-product because there is evidence that these two versions of the product are priced differently (Black et al., 2008; IDRS). There are not sufficient data on price differentials between the base and powder forms of the drug, hence all non-crystal forms are combined.

Crystal methamphetamine

The prices for crystal methamphetamine are listed in Table 4.2 and are largely derived from the published literature.

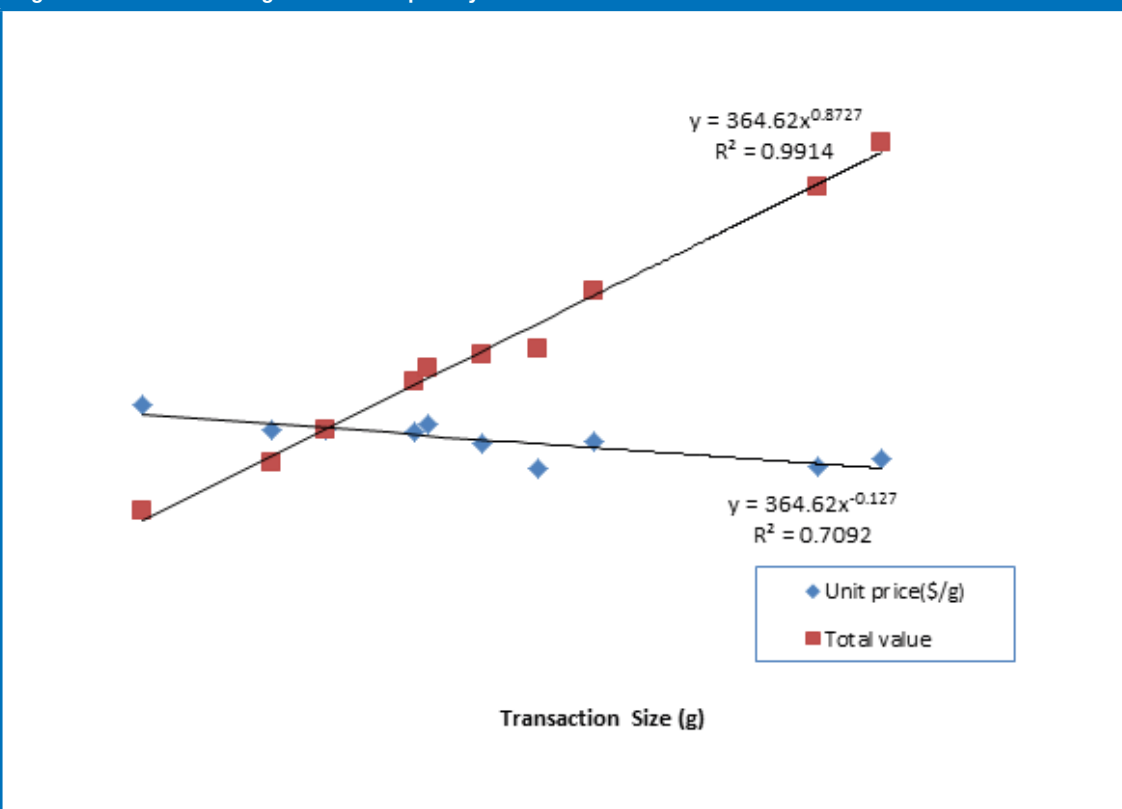
Table 4.2: Summary of raw data on prices of methamphetamine (crystal)			
Deal	Weight (g)	Price ^a	Source
Point	0.10	50–100	(IDDR 2006/07)
Point	0.10	50–100	(IDRS 2007)
Half weight	0.50	150–250	(IDRS 2007)
0.7 gram	0.70	170–400	(IDDR 2006/07)
1 gram	1.00	200–500	(IDDR 2006/07)
1 gram	1.00	220–400	(IDRS 2007)
1 gram	1.00	250–550	(KI 3)
3 grams	3.00	1,000	(IDDR 2006/07)
8 ball, 1/8th ounce	3.50	500–1,540	(IDDR 2006/07)
1/4 ounce	7.00	1,200–2,500	(IDDR 2006/07)
1/2 ounce	14.00	2,100–5,000	(IDDR 2006/07)
1 ounce	28.00	2,700–11,000	(IDDR 2006/07)
1 pound	455.00	75,000–110,000	(IDDR 2006/07)
1 pound	455.00	50,000–60,000	(KI 3)
1 pound	455.00	75,000–100,000	(KI 3)
1 kilogram	1000	150,000–200,000	(IDDR 2006/07)
1 kilogram	1000	200,000–250,000	(KI 3)

a: For prices extracted from IDDR and IDRS, the minimum and maximum prices are the lowest and highest prices across all eight Australian jurisdictions.

As noted earlier, mark-ups across the methamphetamine supply chain are important to calculate because it speaks to the extent to which the business is lucrative and the extent to which current drug law enforcement is regarded as effective. That is, according to risks and prices theory, higher mark-ups reflect a judgement by criminals that greater profits are required to offset the greater risks associated with effective law enforcement.

We calculated the quantity discount, using the power law described earlier, as a proxy for mark-ups. We plotted the \log^{20} (total value) and \log^{20} (unit price) vs \log^{20} (transaction size). The upward sloping line shows the inverse relationship between the total value and transaction weight; the flatter line shows the inverse relationship between average unit price and transaction size (see Figure 4.1).

Figure 4.1 Price and weight relationship—crystal form



In both cases, the R^2 are higher in the total amount paid by weight (0.9914) versus that for unit price (0.7092). These analyses tell us that as weight increases, the price increases, but more importantly that the quantity discount (β) estimate is 0.8727. We discuss these results fully at the end of this chapter (see Discussion).

Non-crystal methamphetamine

Table 4.3 provides the prices for non-crystal methamphetamine, many of which came from our KIs in their capacity as police officers¹⁹. As can be seen in Table 4.3, below, there are significantly more data points in relation to prices for the non-crystal form of methamphetamine (powder and base). All four data sources (IDDR, IDRS, judges' sentencing remarks and KI comments) were able to be used to construct the non-crystal methamphetamine price table.

Table 4.3: Summary of raw data on prices of methamphetamine (non-crystal)			
Deal	Weight (g)	Price ^a	Source
Point	0.10	30-80	IDDR 2006/07
Point	0.10	50 (Powder)	IDRS 2007
Point	0.10	50 (Base)	IDRS 2007
	0.45	150	R v Wilkins, 2007
Half weight	0.50	100–200 (Powder)	IDRS 2007
Half weight	0.50	100–200 (Base)	IDRS 2007
	0.70	200–250	IDDR 2006/07
	0.70	100	Stack v R, 2008

¹⁹ These prices data were subsequently transformed from Tables 4.2 and 4.3 for the purposes of the economic analysis (see Chapters 2 and 5), for example, adjustment for year of collection is made.

Table 4.3: (continued)

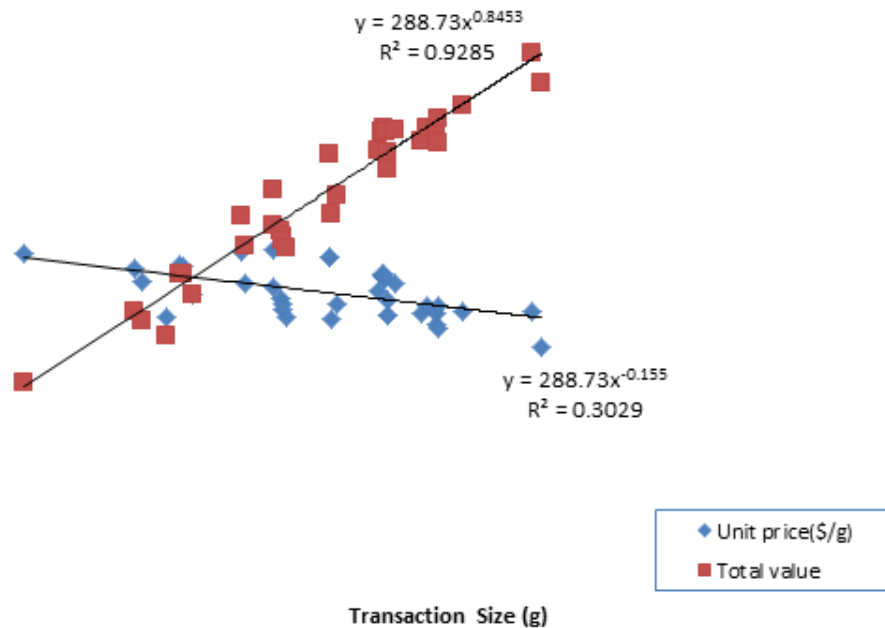
Deal	Weight (g)	Price ^a	Source
	0.83	300	Stanton v R, 2008
	0.88	300	R v Wilkins, 2007
1 gram	1.00	50–380	IDDR 2006/07
1 gram	1.00	65–400 (Powder)	IDRS 2007
1 gram	1.00	150–300 (Base)	IDRS 2007
1 gram	1.00	250	R v Fisher, 2007
1 gram	1.00	90–150	KI 3
1 gram	1.00	350–400	KI 8
	1.92	850	R v Roberts, 2007
2 grams	2.00	900	R v Roberts, 2007
2 grams	2.00	200–400	IDDR 2006/07
	2.92	1,350	R v Roberts, 2007
	2.96	700	R v Wilkins, 2007
	3.27	650	Stanton v R, 2008
	3.38	600	Stanton v R, 2008
	3.40	550	Stanton v R, 2008
8 ball, 1/8th ounce	3.50	180–1,200	IDDR 2006–07
8 ball, 1/8th ounce	3.50	500	R v Walsh and Little 2005
	6.28	2 100	R v Twaddle, 2002
	6.35	2 100	R v Twaddle, 2002
	6.55	900	Stack v R, 2008
¼ ounce	7.00	400–1,650	IDDR 2006–07
¼ ounce	7.00	850	R v Walsh and Little 2005
	7.00	2000	KI 8
	12.30	2,600	R v Burgess, 2006
	12.88	3,000	R v Grima, 2000
	13	3,000	R v Grima, 2000
	13.372	3,000	R v Grima, 2000
	13.34	3,200	R v Grima, 2000
	13.62	3,000	R v Grima, 2000
	13.80	2,000	R v Stanton, 2008
	13.90	2,000	Stanton v R, 2008
½ ounce	14.00	2,500–3,500	IDDR 2006/07
	15.50	4 000	Stanton v R, 2008
	21.99	3 010	R v Slivo, 2007
	23.80	4 000	R v Wilkins, 2007
	26.90	4 000	Stanton v R, 2008
	27.00	3 300	Stack v R, 2008
	27.40	3 200	Stack v R, 2008
1 ounce	28.00	900–7,000	IDDR 2006–07
1 ounce	28.00	4,000	R v Elizalde 2006

Table 4.3: (continued)			
Deal	Weight (g)	Price ^a	Source
1 ounce	28.00	3,600–4,000	Diesing v R, 2007
	28.00	6,500–7,000	KI 8
	38.58	6,100	Stanton v R, 2008
	100	13,600	R v O Connor, 2002
	111.12	9,000	R v Rollason, 2007
	112.00	10,000	(R v Rollason, 2007
	118.00	14,700	R v Barton, 2006
	130.60	11,550	R v Postic, 2004
	190	50,000	R v Ikin, 2007
	196.00	25,200	Diesing v R, 2007
	300	111,000	(R v Hirst, 2003
	331.70	31,000	Adams v R, 2006
1 pound	455.00	35,000–40,000	KI 3
1 pound	455.00	50,000–60,000	R v Walsh & Little, 2005
1 pound	455.00	50,000–60,000	KI 8
1 pound	455.00	45,000	KI 9
1 pound	455.00	20,000	R v Burgess, 2006
1 pound	455.00	45,000	R v Kalache, 2000
1 pound	455.00	60,000	R v Grima, 2000
1 pound	455.00	35,000–80,000	IDDR 2006–07
	468.00	48,600	Diesing v R, 2007
	500.00	113,000	Do v R, 2008
1 kilogram	1,000.00	90,000–150,000	IDDR 2006/07
1 kilogram	1,000.00	100,000	KI 13
1 kilogram	1,000.00	50,000	Hamieh v R, 2007
1 kilogram	1,000.00	70,000	R v Kalache, 2000
1 kilogram	1,000.00	70,000	R v Elizalde, 2007
	1,500.00	130,000	R v Slivo, 2007
	2,000.00	100,000	Hamieh v R, 2007
	7,310.00	1.5–1.6m	R v Labanon, 2006

a: For prices extracted from IDDR and IDRS, the minimum and maximum prices are the lowest and highest prices across all eight Australian jurisdictions.

As with the crystal form of methamphetamine, we calculated the power law relationship between price and weight for both total value and for unit price to derive an estimate of the quantity discount variable. The results are provided in Figure 4.2.

Figure 4.2: Price and weight relationship—non-crystal form

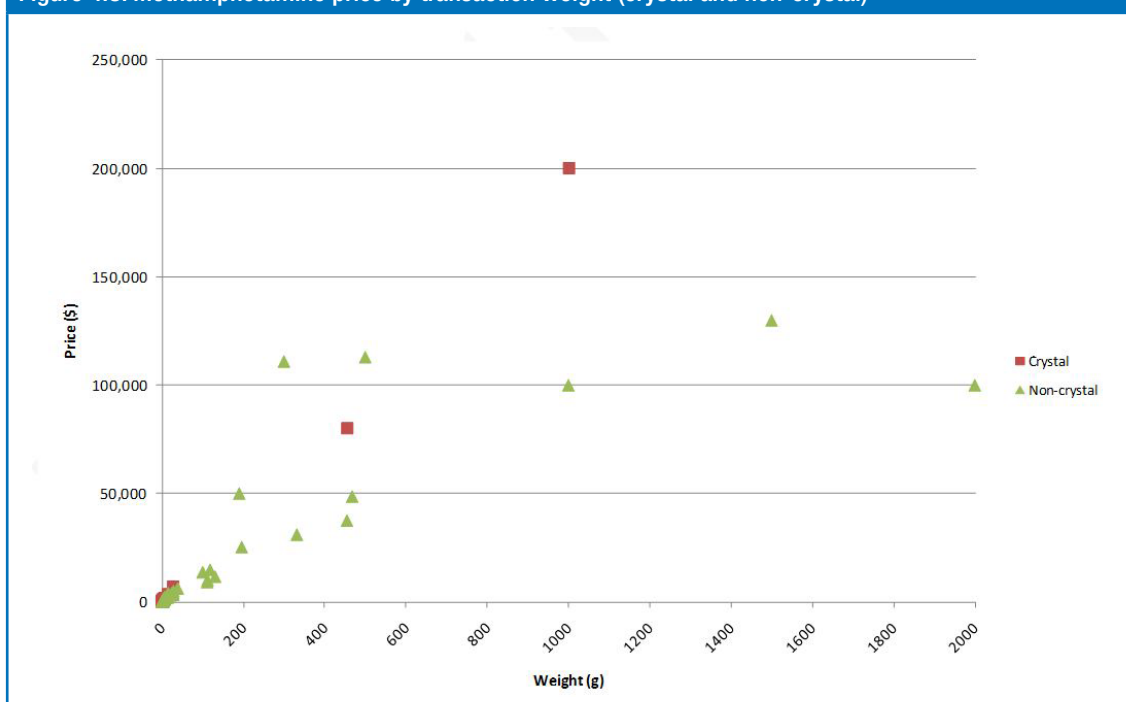


As with crystal, the non-crystal total value by weight has a higher R^2 than unit price (0.8453 vs 0.155). The estimated quantity discount (β) is 0.8453 for non-crystal total value.

Comparisons of crystal with non-crystal forms of methamphetamine

Data from retail levels of the methamphetamine market (such as IDRS) suggest that the price for non-crystal forms of methamphetamine is lower than the price for crystal forms. Figure 4.3 shows price by weight for both crystal and non-crystal methamphetamine. The data are not purity adjusted and may therefore reflect the differences in purity between larger weights (transacted by dealers at wholesale level and above) and smaller weights (eg points that are purchased by users). For each weight shown in Tables 4.2 and 4.3, where a range of prices was recorded for a particular weight, the average price for that weight was used to construct the graph.

Figure 4.3: Methamphetamine price by transaction weight (crystal and non-crystal)



For weights below an ounce (28 grams), the price for crystal and non-crystal methamphetamine is comparable. However, for weights above 28 grams, crystal methamphetamine is, on the whole, more expensive than non-crystal methamphetamine. The price differential is most pronounced for the largest weights (eg the average price for 1 kilogram of non-crystal methamphetamine was \$100,000 while the average price recorded for 1 kilogram of crystal methamphetamine was double this price).

Further to differences in price between crystal and non-crystal forms, the power law analysis reveals a difference between crystal and non-crystal forms in terms of the β estimate (quantity discount). The quantity discount for crystal methamphetamine is 0.87 whereas it is lower for non-crystal (0.85). While this suggests lower mark-ups for the crystal form over the non-crystal form²⁰, the result should be interpreted with caution given that the sample size for the crystal methamphetamine price/weight was very small (10 observations).

4.3 Purity

As with all illicit drugs, as methamphetamine moves down the supply chain it both decreases in quality (purity) and increases in price per unit. As stated by KI 9:

At the upper end of the market you are talking about people who are producing multiple pounds, five or ten at a time, and then what they might do is have a customer who might buy two or three pounds. Purity might be as high as 70 or 80%. From the lab, it goes at 80% and gets sold, say \$45,000 a pound give or take a few thousand, and then the next person will jump on it say 50%. So you go from 80% to 40%. And then that person sells it and they jump on it again and it goes down to 20%. And then it probably gets jumped on one more time to go to street dealers at 5–10%.

The price per pure gram (as opposed to price per gram) is the most important measure of the market; however, data are poor on purity matched to price. For example, the IDRS reports the perceptions of consumers in relation to purity of methamphetamine powder, base and crystal forms. These data confirm that crystal is of a higher purity than other forms. But the IDRS data cannot be used to match perceived purity with

²⁰ A quantity discount of 1.0 means that there are no mark-ups. The lower the β (quantity discount estimate) the greater the putative mark-ups.

prices paid for the drugs. IDDR data provide minimum and maximum purity estimates for weights less than or equal to two grams, or greater than two grams. But again, these are not matched to individual weights.

KIs noted a trend of increasing purity of methamphetamine. KI 12 stated that the purity of methamphetamine on the street has been increasing from around five to 10% a few years back to 15 to 20% now, mainly due to the increasing use of crystal methamphetamine. According to KI 5:

Obviously, most of the ice samples are still relatively high (in purity). If anything, I'd say they are quite low if it's not an ice sample. The first lot of ice, before they started mixing it, was very high, almost pure—but then to save money, they are cutting it with dimethylsulfone and so typically, you might see 60–70% for crystal methamphetamine.

KI 7 stated that in Victoria, the purity of methamphetamine has been increasing possibly due to changes to the structure of the methamphetamine market in Victoria:

I think it (the increase in purity) is because the gap between the actual cook and the user is narrowed. You haven't got those middle men that once upon a time you did. See, the big laboratories....[are] producing 10 kilos a cook or something like that. To offload that, you'd be selling kilo lots and then it would go down and they would be...jumping on it once and selling it in four pound lots, and then it would be broken down and then by the time it was being sold in gram form or 8-ball form or something like that—it would have passed through six or seven hands and been cut every time. Nowadays, you've got the bloke around the corner with his little lab churning out an ounce or two. He's going to be... jumping on it once and selling it to someone, probably selling it in ounce lots. They'll jump on it and sell it in quarter lots, and then it'd be sold on to probably someone who'd buy it in...grams. So instead of going through 10 lots of hands and everyone jumping on it, it's only going through two or three.

We therefore have two possible reasons for the observed trend of increases in purity—first, an increase in availability of the generally more pure crystal form of the drugs and shifts in the supply chain such that domestic clandestine laboratories produce methamphetamine of high purity, which passes through a flattened market with fewer levels such that it is not adulterated to the extent it would be in markets with more levels between production and use.

Table 4.4 summarises the available published data on purity for each weight of methamphetamine, irrespective of whether the methamphetamine was crystal or non-crystal. The IDDR only reports for seizures above two grams and below (or equal to) two grams.

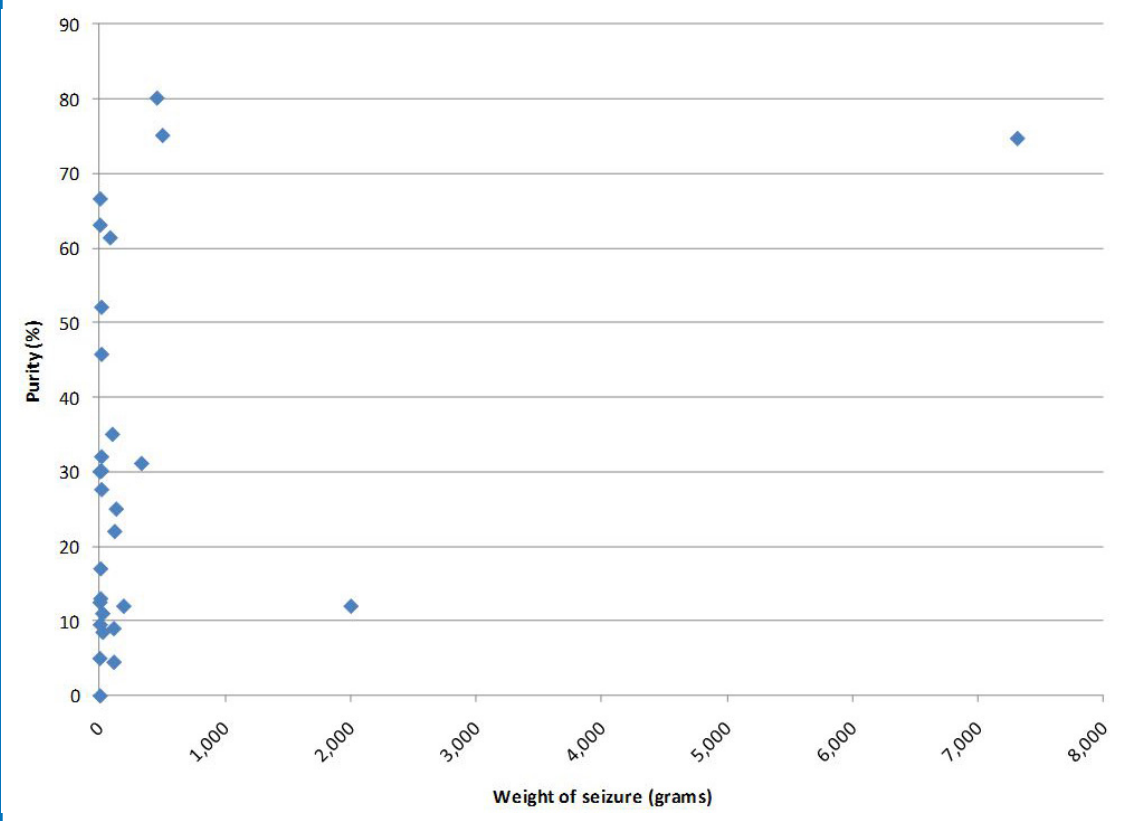
Weight (g)	Purity %			Source
	Minimum (n)	Single point	Maximum (n)	
<= 2grams	12.3 (22)		23 (49)	IDDR 2006/07 (NSW, State police)
<= 2grams	63.4 (27)		76.9 (6)	IDDR 2006/07 (NSW, AFP)
<= 2grams	11.7 (112)		19.3 (32)	IDDR 2006/07 (Vic, State police)
<= 2grams	26.2 (1)		77.1 (2)	IDDR 2006/07 (Vic, AFP)
<= 2grams	10.0 (366)		15.5 (72)	IDDR 2006/07 (QLD, State police)
<= 2grams		38.1 (1)		IDDR 2006/07 (QLD, AFP)
<= 2grams	15.1 (174)		25.8 (179)	IDDR 2006/07 (SA, State police)
<= 2grams	12 (23)		21 (51)	IDDR 2006/07 (WA, State police)
<= 2grams	11.7 (2)		79.5 (5)	IDDR 2006/07 (WA, AFP)
<= 2grams	7.3 (1)		24.6 (15)	IDDR 2006/07 (Tas, State police)
0.01		5		KI4

Table 4.4: (continued)

Weight (g)	Purity %		Source
	Minimum (n)	Single point Maximum (n)	
0.88		12.50	R v Wilkins, 2007
1.00		30	KI 8
1.92		63.00	R v Roberts, 2007
2.00		64.5-76	R v Roberts, 2007
> 2grams	11.3 (112)	26.8 (86)	IDDR 2006/07 (NSW, State police)
> 2grams	1.6 (6)	41.1 (13)	IDDR 2006/07 (NSW, AFP)
> 2grams	14.8 (24)	19.1 (19)	IDDR 2006/07 (Vic, State police)
> 2grams	-	-	IDDR 2006/07 (Vic, AFP)
> 2grams	11.0 (135)	17.7 (39)	IDDR 2006/07 (QLD, State police)
> 2grams		8.3 (1)	IDDR 2006/07 (QLD, AFP)
> 2grams	19.8 (33)	32.6 (116)	IDDR 2006/07 (SA, State police)
> 2grams	18.5 (62)	25 (222)	IDDR 2006/07 (WA, State police)
> 2grams		5.2 (1)	IDDR 2006/07 (WA, AFP)
> 2grams	2.4 (7)	9.9 (3)	IDDR 2006/07 (Tas, State police)
2.92		66.50	R v Roberts, 2007
2.96		9.50	R v Wilkins, 2007
6.28		17.00	R v Twaddle, 2002
6.35		13.00	R v Twaddle, 2002
12.88		30.10	R v Grima, 2000
13		52.00	R v Grima, 2000
13.372		32.00	R v Grima, 2000
13.34		45.70	R v Grima, 2000
13.62		27.60	R v Grima, 2000
21.99		11.00	R v Slivo, 2007
23.80		8.50	R v Wilkins, 2007
82.25		61.30	(R v Hesketh, 2004
100		35.00	R v O Connor, 2002
111.12		9.00	R v Rollason, 2007
112.00		4.50	(R v Rollason, 2007
118.00		22.00	R v Barton, 2006
130.60		25.00	R v Postic, 2004
190		12.00	R v Ikin, 2007
331.70		31.10	Adams v R, 2006
455.00		80	KI 9
500.00		75.00	Do v R, 2008
2,000.00		12.00	Hamieh v R, 2007
7,310.00		74.60	R v Lebanon, 2006

Table 4.4 suggests that purity varies considerably at the same weights. The same data are displayed in Figure 4.4. The Figure includes only purity taken from KI reports and purity estimates extracted from judges' sentencing comments. Purity reported in the IDDR was not included, as these data only include median purity for seizures above and below two grams.

Figure 4.4: Methamphetamine purity by weight



Aside from noting the preponderance of smaller seizures (lower weight), Figure 4.4 amply demonstrates that there appears to be no systematic relationship between seizure weight and purity—there is a big variation in purity across different weights.

Figure 4.4 clearly shows that at each weight, some methamphetamine samples were of low purity (in the range 10–20%) and others were of relatively higher purity (50–60%). This fluctuation in purity levels is supported by IDDR data. For example, for seizures above two grams, the IDDR reports purity ranges between 1.6% and 32.6%, while the other data sources report purity ranges between 4.5% and 75%.

Second, purity does not appear to follow a logical trend from lower weights with lower purity to higher weights with higher purity (eg 12% purity for 2kg vs 75% for 500 grams). This may reflect different strategies/operations in manufacture and distribution of methamphetamine. For example, one kilogram of imported methamphetamine may be diluted through several market levels such that at one gram it has low purity (say 5%). By contrast, one gram of domestically manufactured methamphetamine may be very high purity (approximately 80% based on KI reports) if it is seized straight out of a clandestine laboratory. This would lead to a large variation in methamphetamine purity at similar weights. When methamphetamine purity is examined by weight, this heterogeneity in purity levels would lead to the kind of purity X weight pattern seen in Figure 4.4. The results suggest that the relationship between the weight and purity for synthetic drugs like methamphetamine is different to the purity–weight relationship, which is more typical for plant-based drugs that are imported into Australia and are not locally manufactured. An alternative explanation for the purity X weight results is that poor data quality produces artificial and random relationships between weight and purity. To that end, we next briefly consider the Victorian Police Forensic data.

We requested seizure data for Victoria (number, weight, purity) for methamphetamine for the 2006–07 financial year. We selected Victoria Police data as the Forensic Services Department analyse purity for every seizure by Victoria Police. Other jurisdictions (eg New South Wales) analyse seizure purity only in instances where such data are required for legal processes (eg contested hearings).

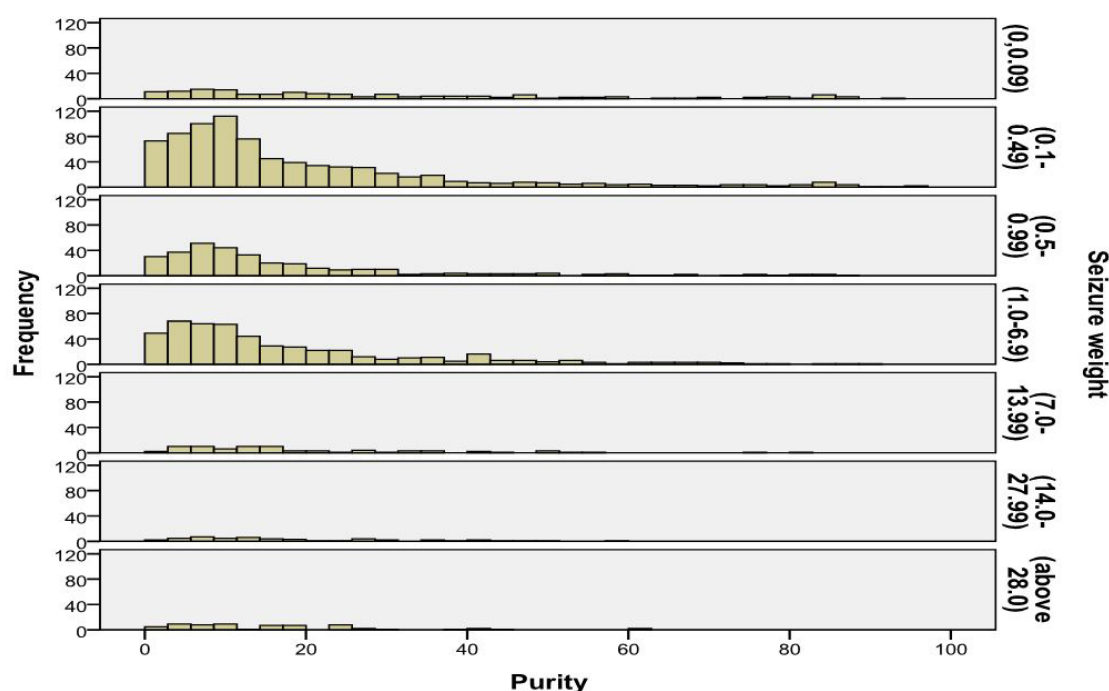
There were 1,941 valid datasets from the raw data source. There was no recorded category for the form of methamphetamine, thus we cannot determine whether they are crystal or non-crystal form. Across these 1,941 cases, purity varied between 0.1% and 96.5%, with a mean of 18.9% (and median of 12.3%). The averages (both mean and median) are not particularly helpful, given the enormous variation in the purity levels.

When we examined the distribution of weights for this sample of seizures, the vast majority of them were small seizures. Seizure weight ranged from 0.02g to 462.88g, with great variation (standard deviation=24.26). There was a large difference between mean and median (5.04 vs 0.53), which shows the data are not normally distributed. Most of data of seizure weight fall under 100g.

To explore the relationship between weight and purity, we classified the weight data according to its deal size into seven categories—0–0.09g, 0.1g–0.49g, 0.50g–0.99g, 1.0g–6.99g, 7.0g–13.99g, 14.0g–27.99g and >28.0g. The cut-off points are one point (0.1g), a half weight (0.5g), a ¼ ounce (7g), a ½ ounce (14g), one ounce (28g) and one pound (455g)²¹. The frequency of purity was calculated for each of the seizure weight band. Most of seizure weights were located in the bands two, three and four (from 1g to 6.9g) with the purity skewed to the left of 20%. However, with bands 1 (less than 0.09), the purity spread over to the right side to about 80% and the same applies for band two (0.1g–0.49g) and band three (0.5g–0.99g). This shows that the high purity happens with low seizure weight but not high seizure weight. Interestingly, for higher seizure weight, the purity centred at lower purity of about 20% for the last three bands. This can be seen from the bar error figure of mean purity with seizure weight bands. Band one (less than 0.01g) has the highest mean purity of 28.02% and the band seven (more than 28g) has the lowest average purity (16.10%). Bands two, three and four have lower purity than bands five and six, largely because most of the cases in the former fall to the lower purity side, even with a few on the high purity side, and this lowered the average value.

This shows that the purity varies considerably at each seizure weight group except for band seven (above 28g). Purity (mean) tends to be higher at the lowest weight band (less than 0.1g.), however, the trend is the opposite for higher seizure weight (above 28g).

Figure 4.5: Summaries of purity (%) by frequency of seizure weight groups from Victoria Forensic Laboratory 2006–07



²¹ There is only one case of seizure weight above one ounce, therefore is combined with the category of over 28g.

Figure 4.6: Scatterplot of seizure purity by seizure weight

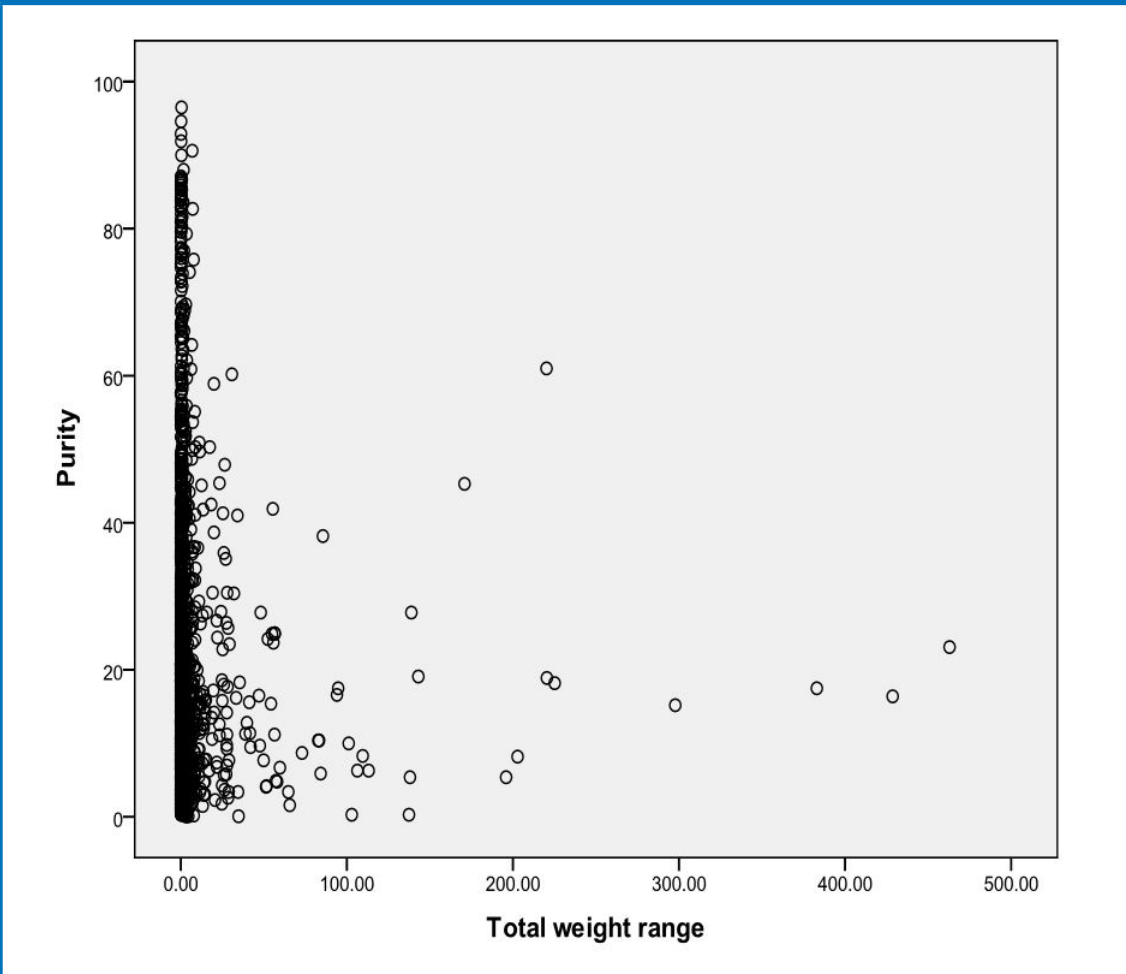
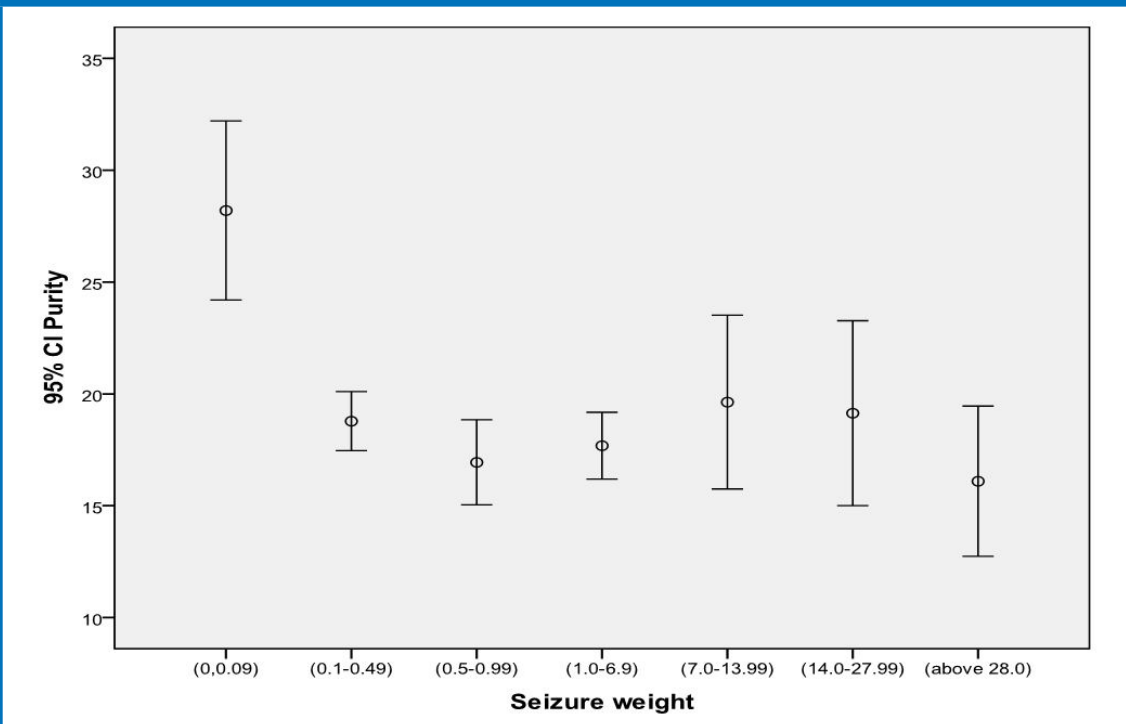


Figure 4.7: Summaries of purity (%) for seizure weight groups from Victoria Forensic Laboratory 2006–07



Purity showed marked variation at retail level, with fluctuations from 10% to 90%. Purity also varied (at similar weights) at higher market levels (eg 28 grams and above). For example, Table 4.4 shows that at 21.99 grams the purity was 11%, while for 13.62 grams the purity was 27.60%. Similarly, Table 4.4 also shows that for two seizures of around 112 grams, one was 9% pure and the other was 4.5% pure. This suggests that criminals are varying purity at all market levels.

As will be seen later (see Chapter 6), we were unable to use purity-adjusted prices in our economic model and had to resort to using unadjusted prices alone. The price and weight relationships derived from Section 4.2 tried to best describe the situation based on available information, but we do not have matched price to purity data. It is difficult to assess the implications of lack of purity data without knowing the relationship between price and purity, but the use of price alone (rather than purity-adjusted price) might underestimate the differences between the law enforcement strategies. This is because prices can remain stable (flat) while purity is adjusted; therefore, we are likely to see less differences between the policing strategies by using price alone, rather than purity adjusted price.

4.4 Price and purity: Discussion and conclusions

As the KI below notes, often the logic of the prices across market levels is missing:

The price of a kilo of methamphetamine from a cook, let's just say it hasn't had any purification, it hasn't been converted to crystal methamphetamine, you'd just assume it was a base or a paste...it would be around the \$100,000 for a kilo which is wholesale. Or \$50-60,000 a pound, which is just under half a kilo...However, you hear of \$200,000 to \$250,000 for a kilo of crystal methamphetamine. The numbers don't quite add up because crystal methamphetamine isn't two and half times as pure (KI 13).

Three prices exist in the methamphetamine market—prices for precursors, prices for the crystal methamphetamine form and prices for the non-crystal methamphetamine form.

Our research on precursor prices reveals that precursors purchased off-shore are very inexpensive, whereas within Australia high prices are paid. This may reflect successful law enforcement efforts at reducing importation of precursor chemicals. For end product, crystal and non-crystal prices vary according to weight, as expected. Higher prices are paid for higher weights across the supply chain.

The quantity discount exponent β is a useful indicator of the size of price mark-ups. Generally speaking, the smaller β is, the more extensive are price mark-ups. It should be noted however, that technically to convert the quantity discount β exponent to a mark-up amount, one requires the branching factor (ie the number of times the product is on-sold through the market chains). We do not have that information, so were not able to calculate the mark-up with any precision. We therefore use the exponent β as a proxy. We have calculated an estimate for the quantity discount function for both forms of methamphetamine. This is the first attempt to conduct such analyses.

We estimated that the exponent β_1 (quantity discount estimate) for crystal methamphetamine is 0.8727 and for the non-crystal form of methamphetamine it is 0.8453. The goodness of fit is reasonably high ($R^2 = 0.9914$) for the line of total value in crystal form, while it is relatively low ($R^2 = 0.7092$) for the unit price line. The same situation is true for non-crystal form of methamphetamine (0.9285 vs 0.3029).

From these results, methamphetamine seems to be subject to the following pricing rule: for every 10% increase in transaction size the unit price will fall by 1.21% for crystal form and by 1.47% for non-crystal form. The figures clearly show that the unit price decreases as the transaction sizes increase. This is common for other commodities that have a quantity discount when buying in bulk. Interestingly, it is a rather small change compared with other illicit drugs. The size of the quantity discount exponent β reflects lower mark-ups than might be expected for an illicit drug market. For example, cannabis has a 2.5% drop in unit price for every 10% increase in transaction size (Clements, 2004). The other side of quantity discount is the mark-ups. If we had information on the branching factor, we would be able to estimate the mark-ups. For example, if crystal methamphetamine were cut four to 20 times before selling to the next level dealer/user, the mark-ups can

be about 119% to 146%. This is again very low compared with other drugs such as heroin, with mark-ups in the order of 26 times when moving from source countries to Australia but is in the same magnitude for heroin moving between mid-level distributions (2 times mark-up) (Moore, 2005a).

For comparison, we summarise the results for β estimates for other drugs overseas in Table 4.5. Overall, the β coefficient we derived for methamphetamine in Australia is higher than overseas coefficients for other drugs. The US estimates are generally smaller (from 0.531 to 0.833), which shows that the price mark-ups in the United States are higher and quantity discounts are smaller. Caulkins et al. (2009) suggests that the difference between the United States and United Kingdom estimates can be explained by the relatively high intensity of drug law enforcement in the United States compared with the United Kingdom (based on the price and risks theory). Our Australian methamphetamine figures are more similar to the UK figures for cannabis, cocaine, crack and heroin, than the US figures. The high quantity discount coefficient β estimate in Australia may mean that running a methamphetamine drug business in Australia may pose lower risks than in the United States, although this is completely suppositional.

Table 4.5: Price mark-up coefficients β estimations

	Australia	United Kingdom		United States		
		Caulkins et al. (2009)	Caulkins & Padman (1993)	Arkes et al. (2004)		Crane et al. (1997)
				Retail-level	Med- level	Top-level
Cannabis		0.817	0.72 (imported) 0.76 (domestic)	0.573	0.802	0.783
Cocaine		0.869	0.83 (powder)	0.716	0.787	0.813
Crack		0.827	0.79	0.731	0.661	0.833
Heroin		0.834	0.83 (brown) 0.84 (white)	0.531	0.718	0.764
Meth	0.845 (non-crystal) 0.873 (crystal)		0.79			

Price differences between crystal and non-crystal forms of methamphetamine have been documented at retail levels (in the IDRS surveys). Our research shows that price difference is generally not much at lower seizure weights, for example at less than 0.1g level (only 20% difference), while at higher seizure weights, crystal methamphetamine has a higher price than the non-crystal form. For instance, at a deal size of one pound (455g), crystal methamphetamine has 1.5 times the price compared with non-crystal methamphetamine. At higher market levels (higher transaction size), this price differential is even greater, with crystal methamphetamine being worth almost double that of non-crystal methamphetamine.

Finally, in relation to purity, the data demonstrated that purity varied greatly across weight. In addition, our analysis did not support the assumption of higher weight associated with higher purity. Furthermore, the data analysed here reinforces that caution needs to be taken when using average purity (which may be highly misleading). Future research should incorporate purity with price, if data that matches purity with price can be obtained.

Chapter 5: Results: Methamphetamine supply chains: structure and dynamics

While the previous chapters described the criminal networks that operate the supply chains and the prices, the current chapter elucidates the activities conducted at each supply chain level. First, we describe acquiring raw materials, then the manufacturing process and finally distribution of end product. Throughout the chapter, we draw a distinction between domestic and international supply chains that supply the Australian market.

5.1 Acquiring raw materials

Raw materials required for the manufacture of methamphetamine include precursor chemicals, chemical reagents and laboratory equipment. These raw materials are either sourced outside Australia and brought in through the border, or sourced within Australia. We describe the international sources of precursor chemicals first. The most commonly used chemical precursors for methamphetamine manufacture within Australia are ephedrine, pseudoephedrine (pseudoephedrine) and phenyl-2-propanone (P2P).

5.1.1 Raw materials: Sourcing precursors internationally

Although there were importations of pseudoephedrine in the late 1990s, importation was not the main method by which precursors were obtained in Australia in the 1990s. Throughout the 1990s, diversion from retail pharmacies was the main source of pseudoephedrine across Australia (KI 7). The rescheduling of pseudoephedrine in Australia has restricted the availability of precursors domestically and in response to this, there has reportedly been an increase in the bulk importation of raw pseudoephedrine (KI 4). The two main producers of ephedrine and pseudoephedrine are China and India (KI 12). The capacity of domestic crime groups to import precursors has been facilitated by enhanced partnerships between criminal networks located within Australia, as well as transnational criminal networks (United Nations Office on Drugs and Crime, 2008). As noted in Chapter 3, criminal groups such as OMCGs, not formerly involved in importation of end product or precursor chemicals, are now developing international linkages for the purposes of precursor importation.

In 2006–07, the AFP seized approximately 467kg of precursor chemicals (including MDMA precursors), including 125kg of phenylacetic acid from India in April 2007 (phenylacetic acid is a precursor to P2P) and 44kg of ephedrine from Vietnam in March 2007 (Australian Crime Commission, 2008a). Two of the largest importations in 2007 involved the seizure of two separate (though linked) importations of 45kg and 68kg of ephedrine powder detected in air cargo in transit from Vietnam to Sydney in March 2007 (Australian Crime Commission, 2008a). Bulk importations of precursors are expected to continue as Australia's domestic restrictions on pseudoephedrine are tightened (Australian Crime Commission, 2008a).

From 2005, the *Ephedra* (or *ma huang*) plant has been trafficked as a source of ephedrine (United Nations Office on Drugs and Crime, 2008). In Australia, there have been importations of the *Ephedra* plant, from which ephedrine can be extracted (KI 7; KI 13). The *Ephedra* plant contains 10% ephedrine alkaloids (Customs KI). Criminals will buy the *Ephedra* plant from Chinese importers and attempt to extract ephedrine from it (KI 7). According to KI 13 'we don't see it as a big threat...it is very inefficient...there's usually only one or two percent active ingredient in some of these plant forms, so there's a lot of work in it'.

Recent trends in border detections include the detection of 'masked precursors' and pre-precursors. Masked precursors are chemical precursors that have been converted into a substance, which is usually an unregulated substance, and therefore difficult to detect (Customs KI). Pre-precursors are chemicals that are

not under international control but are usually closely related to regulated precursors. These chemicals can be transformed into precursor chemicals using chemical processes. Pre-precursors are produced specifically for international trafficking purposes in order to circumvent international controls (UNODC, 2008).

Importation streams for precursors include air cargo, sea cargo, international post, sea passengers and crew, vessels and aircraft (Australian Crime Commission, 2008a). One KI noted sea cargo importation of 44 gallon drums of P2P (KI 7).

Pseudoephedrine and ephedrine are legally imported into Australia from China and India to supply the pharmaceuticals industry. For example, KI 2 reported that pseudoephedrine is imported legitimately into Australia in 25kg cylindrical drums. In the illicit industry, these precursors are diverted from legitimate industry in the source countries (KI 12, KI 13). In addition, some pseudoephedrine tablets are manufactured in Asia specifically for the purpose of transshipment to criminal syndicates in Australia (KI 13). According to KI 13:

There seems to be a bit of a reporting loophole...you can send pseudoephedrine, if it is packaged, as cough and cold tablets without necessarily the precursor export notification that you would have to use if it was raw. So there seems to be more and more of that kind of movement.

The criminal groups appear to be using importation strategies that mirror those strategies used for other illicit drugs such as heroin and cocaine. For example, one KI reported that there have been border seizures of 'cheap pharmaceutical tablets' that have been produced in Asian countries and smuggled into Australia, often in shipping containers, and have used similar concealment methods as for illicit drugs (KI 13). This suggests that criminal groups are flexible in their approach and have transferred their skills with relative ease from the importation of other illicit drugs to the importation of methamphetamine precursors.

Strategies used to import precursor chemicals and avoid detection include the avoidance of countries with effective precursor regulation systems, the falsification of official authorisations such as shipping documents, labelling the import inaccurately as a legal substance (Customs KI), concealing the precursor inside a legal shipment of goods (Customs KI) and the use of third-party brokers who arrange transactions using false names (Jayasuriya, 1998, p. 273).

With respect to importation of precursors via the mail stream, criminals will purchase pseudoephedrine or ephedrine in bulk and send multiple smaller packages back to Australia to enhance the likelihood that at least some of the packages will remain undetected (KI 4). Large amounts of pseudoephedrine enter Victoria in this way (KI 7).

The importation of precursors via the postal stream had been facilitated by the internet. For example, orders can be placed via internet websites with the product delivered by mail (KI 4). In Western Australia in 2007–08, a 'crew' of about a dozen people were detected engaged in importing small amounts of pseudoephedrine (eg 30 grams at a time) through the postal system. The importations were detected when the group attempted to import larger amounts (eg half kilos and kilos). In this case, the pseudoephedrine was sourced from India and Pakistan via the internet and sent to multiple addresses in Australia. The group used fictitious names but had sent the items to addresses of acquaintances in Australia who were willing to receive the packages. This was not a commercial enterprise, but was motivated in order to supply the group and their friends with methamphetamine for personal use (KI 7).

Importations of pseudoephedrine have been attempted via passengers and cargo in Western Australia, with some amount of the drug apparently intended for interstate, as groups consider the west coast of Australia as a 'softer target' compared with major eastern Australian capital cities (KI 5). Regional Western Australia (eg the Pilbarra region) receives international flights from Indonesia and groups have attempted importation of pseudoephedrine via this route.

There have also been reports of Australian 'pseudo-runners' travelling to Thailand to source pharmaceutical preparations containing pseudoephedrine. These individuals will obtain pharmaceutical preparations containing pseudoephedrine from pharmacies throughout Thailand, grind up the tablets, conceal the powder in other products (eg tins of protein powder) and then send the disguised precursors to Australia (McDougall, 2009).

Risk of detection

There are differences in the risks posed to criminals from importing precursor chemicals compared with importing end product. For example, according to KI 2:

If you go importing the precursor, you've then got a number of areas where you are vulnerable. You're vulnerable in the importation, you're vulnerable on the transport, then you're vulnerable on the production. So you're setting yourself up as a target for law enforcement, whereas if you import the finished product and on sell you only have one vulnerability and that's when it actually hits the country (KI 2).

According to KI 13, the importation of precursors...

sort of surprises us a bit because if you are going to go to the trouble of illicitly importing a precursor, you might as well bring in the end drug...if you are going to take the risk and you've got that whole organised crime network in place, it surprises us sometimes that they will just bring in the precursor...

The willingness of criminal groups to assume these risks speaks to the critical importance of precursor chemicals for domestic manufacture of methamphetamine. Without the precursor chemicals, there can be no domestic production. As we saw in Chapter 3, the manufacture and distribution of methamphetamine is a lucrative business and large profits can be generated. Criminal groups involved in domestic manufacture require precursor chemicals in order to produce methamphetamine and appear willing to assume the necessary risks inherent in the importation of these necessary chemicals.

Case examples from judges' sentencing remarks were not available for importation of precursors.

5.1.2 Raw materials: Sourcing precursors within Australia

Due to legislative changes, the way criminals acquire domestic precursors has changed over time. In most Australian states prior to 1995, pseudoephedrine and P2P were unrestricted. Since the 1995 legislative changes, criminals have endeavoured to source precursors to P2P and have then used these 'pre-precursors' to manufacture P2P. The introduction of Project STOP has also led to changes in the way criminals acquire precursors. For example:

There seems to be less stock and less availability of pseudoephedrine for syndicates lately just due to rescheduling and just due to other initiatives like project STOP that sort of monitors the identification of those who purchase pseudoephedrine (KI 13).

Within Australia, the main methods of obtaining precursors (as detailed below) are:

- pseudo-running (retail purchase from pharmacies)
- break and enters/robberies of pharmacies
- theft or diversion from transportation and waste facilities
- purchase from legitimate industries
- diversion by medical professionals

'Pseudo-running'

Prior to more stringent regulation of pseudoephedrine in 2005, one of the most common methods for obtaining pseudoephedrine was diversion of cold and flu preparations (eg Sudafed, Codral) from pharmacies (McKetin, et al., 2005). *Pseudo-running* refers to the practice of obtaining products containing pseudoephedrine via multiple purchases or theft (McKetin, et al., 2005) (see earlier section re pseudo-runners). Since Project STOP, the incidence of this type of activity appears to have declined (KI 2). Although pseudo-running still occurs, it is not as prolific as it had been between 2002 and 2005 (KI 4). KI 4 stated that Project STOP has made it more difficult for pseudo-runners to access pseudoephedrine-based products. KI 3 noted a reduction in reports of pseudo-runners in New South Wales. KI 3 also reported that anecdotally,

police attending clandestine laboratory sites are not collecting as many pseudoephedrine blister packs as previously. However, this trend is not uniform across Australia as roll-out of Project STOP is only partial (KI 3 noted only 30% of pharmacists in New South Wales are participating in the program; KI 8 noted that Project STOP was voluntary in Victoria and only about half the pharmacies participated in the program). Pseudo-running is still apparent, for example, in Western Australia in 2007–08, a ‘crew’ of about a dozen people were detected engaged in pseudo-running and burglaries from pharmacies. KI 2 from Queensland reported that it is likely that pseudo-runners are purchasing pseudoephedrine in other states and transporting the product back to Queensland for use in manufacture (this was supported by information provided by KI 8).

Lower level (ie small scale) manufacture relies on sourcing pseudoephedrine from chemists. However, it is not just lower level manufacturers who source precursors through retail purchases (pseudo runners), as outlined by KI 8 who reported that pseudo-runners are also used by more organised operations. This often involves manufacturers subcontracting pseudo-runners to obtain the required precursors (KI 8). At more advanced levels of production, the more organised syndicates have been known to arrange for groups (5–6 people) to travel by bus, stopping in country towns, with each person in the group purchasing pseudoephedrine-based products from the local pharmacy in the town. In this way large amounts of precursor chemicals can be sourced (KI 8). In attempts to short-circuit the Project STOP initiative, organised crime groups will provide pseudo-runners with 20–30 fake identifications (eg drivers’ licences; (Iorfina, 2009). The groups are also known to maintain lists of pharmacies that are not participating in Project STOP and therefore do not enforce the requirement for identification to be produced prior to a sale of products containing pseudoephedrine (Iorfino, 2009). Pseudo-runners are usually paid in cash or with end product (KI 8). According to KI 4:

One of the pseudo-runners I debriefed, he was the best here in NSW and we finally got him, and he made it clear that...the way he operated, the major cooks would give him \$10,000, he would go and buy packets, and for every packet he brought back, he got an additional \$50.

An example of shifting trends in response to restrictions on access to products containing pseudoephedrine is the increased popularity of liquid preparations containing pseudoephedrine. KI 13 stated that there has been a recent trend of increasing interest in obtaining liquid preparations or elixirs from pharmacies as a source of pseudoephedrine:

There was...a vehicle stop last year in Queensland...about 50 litres of the elixir in the boot of a car, so thousands of little two hundred millilitre bottles have been decanted into a large drum and [were] being on-sold. We’ve had some laboratories that have been elixir based ones instead of pseudoephedrine tablet based...

A recent trend, and a variation on pseudo-running, is individuals who attend several medical practitioners in order to get prescriptions for pharmaceutical preparations that contain pseudoephedrine (Frost, 2009). This again appears to be a response to the rescheduling of products containing pseudoephedrine, such that large boxes are only available via a prescription from a medical practitioner.

Overall, we see the evolution of techniques used by criminal groups as a response to law enforcement and policy initiatives. For example, there has been a transition from small-scale disorganised purchases of pharmaceutical products to more structured, organised and coordinated strategies to access large amounts of precursor chemical via pseudo-runners—a trend toward liquid pharmaceutical preparations in an attempt to sidestep the restrictions and an increase in ‘doctor-shopping’ to access large amounts of pseudoephedrine. It is likely that as regulations on pseudoephedrine tighten and as the availability of this precursor chemical shrinks further, criminal groups will look to alternate chemicals or alternate means for accessing precursors.

The following case examples drawn from criminal cases in New South Wales are illustrative of the practice of pseudo-running.

R v Campbell (1999). The ‘Kalache’ network operated in the late 1990s and was involved in the procurement of pseudoephedrine, and the manufacture and distribution of methamphetamine. Kalache provided Campbell with funds specifically for the purpose of the large-scale purchase of Sudafed cold and flu tablets. Campbell purchased the following from chemist shops—96 boxes of Sudafed 90s, 70 boxes of Sudafed 60s and 30 boxes of Sudafed 30s. The total number of Sudafed tablets purchased

was 13,740 tablets. Campbell was also given the task of removing ('popping') the tablets from their plastic/foil packages.

R v Ha (2004). On May 1 2003, Ha attended a number of pharmacies and purchased boxes of tablets that contained pseudoephedrine (total of 840 pseudoephedrine-based tablets). The tablets weighed 305.4g, which could yield 78.1g pseudoephedrine with the potential to produce between 31g and 87g of methamphetamine. Ha invested \$800 of his own money to purchase the tablets, and was planning to sell the tablets for between \$2,400 and \$3,200, representing a profit of between \$1,600 and \$2,400 (less expenses).

Jackwitz v R; Franklin v R (2006). In June 2002, the pair (mother and daughter) drove a utility from their home in Queensland to New South Wales, stopping at numerous (at least 14) pharmacies to purchase small quantities of medicines that contained pseudoephedrine. They maintained records of purchases and anticipated profits in a notebook. Police found packets of three different kinds of medicines in a garbage bag in the tray of the utility and more packets in the glove box. In total, medicines containing the equivalent of 347.1g of pseudoephedrine were found.

Pharmacy break and enters/robberies

Pseudoephedrine is also sourced via break and enters of pharmacies (KI 2, KI 3, KI 8; Parliamentary Joint Committee on the Australian Crime Commission, 2007), which usually occur after business hours (KI 1). Such burglaries do not tend to result in large amounts of pseudoephedrine being obtained from any one pharmacy (KI 8). Pharmacies do not carry large amounts of pseudoephedrine-based products, so one group may commit several break and enters at several pharmacies on one evening in order to source sufficient amounts for manufacture (KI 2). Thefts of precursors have also been reported from doctors' surgeries (Australian Crime Commission, 2003). Wholesale pharmacy outlets have also been the focus of thefts and ram raids targeting pseudoephedrine-based pharmaceutical products (Parliamentary Joint Committee on the Australian Crime Commission, 2007). There is a perceived risk of armed robberies of pharmacies, although only one armed robbery in Queensland has been thought to relate to obtaining pseudoephedrine (KI 1).

The following case example demonstrates theft as one means of obtaining the precursor chemicals.

R v Coates & Murphy (2002). In March 2000, two men (Williams and Kerr) were arrested in a vehicle in which police found numerous boxes of Sudafed cold and flu tablets. A total of 226 boxes of unopened Sudafed tablets were found (each containing 90 tablets), two tins that contained white powder and a further 176 Sudafed tablets, 443 opened blister packs (mostly empty) and 74 opened Sudafed boxes. Some of the packets of Sudafed were sourced back to a pharmacy in Wentworthville which had been robbed (break and enter). Approximately 75 packets of Sudafed (30s) had been stolen from a display area in the front of the store and 75 packets of Sudafed (60s) were stolen from a rear storage area. Fingerprint evidence linked Kerr with the robbery.

Theft or diversion from transportation and waste facilities

Alternative points in the supply chain for pseudoephedrine are now targets for criminals; for example, during the transportation of pseudoephedrine by legitimate industry, while the product is being stored within storage facilities and at chemical waste destruction facilities.

Pseudoephedrine-based medication is legitimately transported between New South Wales and Queensland (for the pharmaceutical industry), and is sometimes stored overnight or over a weekend at a distribution (storage) centre (KI 1). In some instances, the drivers of transport vehicles and employees of transport companies have been involved in the diversion of precursor chemicals (KI 8). The diversion may also occur when criminals infiltrate a company, for example, criminals seeking employment within relevant industries (eg chemical companies, pharmaceutical companies, transport industry) in order to gain access to pseudoephedrine (KIs 3, 4, 13). OMCs have attempted to infiltrate the warehouse and transport industries by seeking employment either directly with the companies or indirectly via recruitment firms (Mayne, 2009).

Within the supply chain for legitimate products such as pharmaceutical preparations, warehouse workers and truck drivers are considered ‘easy targets’ for criminal groups, who offer large cash payments for diverted precursor chemicals (Mayne, 2009). If a quantity of a shipment goes missing and is not delivered to the warehouse, the company may not realise until some time has passed and the missing shipment may not be reported to police because there is uncertainty as to whether it has been lost or stolen. Reimbursement for the missing quantities is often simply claimed on company insurance. For example, if a chemical company in Sydney ships a thousand boxes of pseudoephedrine to Brisbane and the consignment is 200 boxes short (possibly because it was stolen en route), the company may simply replace the missing boxes without notifying the police (KIs 2 and 13).

At a warehouse or distribution centre, the boxes of pharmaceutical product are often stored on pallets and are ‘basically fair game for people who know what is in that pallet’ (KI 1). Both tablet- and liquid-based pseudoephedrine products have been stolen in ‘break and enters’ at storage facilities (KI 8). The theft of liquid preparations has increased as the availability of pseudoephedrine in tablet form has become more restricted due to tougher regulations and pharmaceutical preparations, such as cough and cold tablets, which do not contain pseudoephedrine (KI 13).

Pseudoephedrine-based products have also been diverted from waste facilities where they would otherwise be destroyed (KIs 2, 8). The medication is usually destined for destruction for two main reasons—first, because it has reached its expiry date and second, due to production faults (KI 1). Once a drug has reached its expiry date, there are no longer strict requirements regarding its transportation so it may be easier to divert (KI 3), although expired products still contain pseudoephedrine as the active ingredient (KI 4). Criminals have targeted waste destruction facilities in Queensland, New South Wales and Victoria in 2007–08 (KI 1). In one case, several million tablets were stolen from a waste facility in Victoria (KI 1).

Criminal groups who attempt to access precursor chemicals demonstrate flexibility in the face of increasing restrictions of access to these chemicals. They will continue to change their methods in response to regulations and law enforcement efforts.

Purchase from legitimate industry

To facilitate the purchase of precursor chemicals from legitimate industry, individuals have established false chemical companies, which have then been used to provide the appearance of legitimacy for the acquisition of pseudoephedrine or other required chemicals. The following case example demonstrates the use of a ‘legitimate’ company in order to purchase chemicals for methamphetamine manufacture (Australian Crime Commission, 2003).

R v Thompson (2000). In May and June 1995, Thompson registered a fictitious business, which was ostensibly to manufacture detergents, but that was used to purchase chemicals required for the manufacture of methamphetamine. Thompson established a lease for an office for the business and commenced rental payments. In June 1995, Thompson transferred chemicals and laboratory equipment to a premises in Horsley Park and set up a clandestine laboratory at that location. He prepared an order for the supply of chemicals required for the manufacture, using letterhead for the fictitious business and paid \$11,000 of his own money for the chemicals. Thompson arranged for the chemicals to be collected from the supplier and delivered to a property at Kurrajong.

Diversion by medical professionals

There have been isolated cases where medical practitioners and pharmacists have diverted large amounts of pharmaceutical preparations containing pseudoephedrine for the purposes of methamphetamine manufacture (Frost, 2009). In Queensland, for example, large-scale precursor diversions were being conducted by a medical practitioner who had established several medical centres in Brisbane (Frost, 2009).

5.1.3 Raw materials: Sourcing reagents within Australia and off-shore

Reagents are chemicals that facilitate chemical reactions. In the manufacture of methamphetamine, reagents are chemicals that are mixed with precursor chemicals to induce the necessary chemical reactions to produce methamphetamine. The specific reagents required for manufacture depend on the type of manufacture process used (see Section 3.2 in this chapter). Reagents such as hypophosphorous acid and iodine, which are required for the hypophosphorous method of manufacture, have legitimate uses and are not difficult to obtain (KI 2). In an effort to restrict diversion of these chemicals to illicit drug manufacture, the Plastics and Chemicals Industry Association Code of Conduct includes a requirement for completion of end-user declarations for purchases of chemicals such as hypophosphorous acid and iodine (KI 2). Industry compliance with the Plastics and Chemicals Industry Association Code is voluntary and is not legally enforceable.

There are five main methods by which reagents are obtained:

- 'Shell' companies
- Purchase through legitimate business
- Theft
- Manufacture
- Importation

'Shell' companies

Criminals will set up false chemical companies to facilitate the purchase of reagents (KIs 3, 7, 14). In essence, a shell company is one that is legally registered, but that does not actually operate in the manner for which it is registered. It is a company in name only. For example, the company address may be a domestic premises rather than commercial premises (KI 4). The company is established to appear to provide a legitimate need for reagents (eg chemical supply company, pharmaceutical company, or health products company; KI 3).

For example, an individual may set up a company simply for the purposes of registering a company name (eg a cleaning company), then purchase chemicals (eg hypophosphorous acid) and produce an apparently legitimate end-user declaration (KI 3). Another tactic is to pay third parties to set up shell companies, which then order chemicals through legitimate companies (KI 8). Brokers are sometimes used by criminal networks to facilitate the transfer of reagents from legitimate business to illicit manufacture (Australian Crime Commission, 2003).

Some individuals will set up legitimate companies (ie companies that actually operate in the legal market) through which to source reagents (KI 3). According to KI 7, 'we are aware of some companies that are... owned by organised crime and that are set up there as legitimate companies purely for the purpose of transacting chemicals and diverting those'. The individuals involved will supply the necessary end-user declarations for the purchase in order to reduce suspicion. For example, a cleaning company may be established and the company may operate as any other cleaning company would, but is set up with the intent to facilitate the purchase of required chemicals.

Purchase through legitimate business

At higher levels of production, reagents are sourced in larger quantities via chemical companies and distributors (KI 8). For example, in Victoria, iodine can be purchased from pharmacies as iodine tincture or as iodine pellets. However, this method offers only small amounts of the chemical. Some chemicals can be purchased in bulk amounts from chemical companies and an ostensibly legitimate reason provided for the purchases as there are many legitimate uses for the chemicals (KI 7). In attempts to avoid detection by law enforcement agencies when purchasing reagents from legitimate companies for illicit purposes, criminals will use false accounts and false identities (eg fake drivers' licences).

Theft

Thefts of chemical reagents have been reported from warehouses, chemical companies and factory yards (Australian Crime Commission, 2003). In Western Australia, where the Nazi manufacture method is common, ammonia is siphoned off (ie stolen) from farming and agricultural areas (eg abattoirs; KI 13).

Manufacture of reagents

Some individuals will consult the 'Merck Index' to determine which chemicals are required to manufacture particular reagents. The Merck Index is a manual that contains information about chemicals such as their properties, uses etc. The chemicals required to produce reagents may not be regulated in the same way as the reagents themselves. Once the required chemicals are obtained, the reagent will be produced. For example, in Victoria, criminals have obtained sodium hydrophosphate to produce hypophosphorous acid (KI 7).

Importation from overseas

The importation of chemical reagents does not require a licence as does the importation of precursor chemicals such as pseudoephedrine. Nonetheless, there are a handful of such chemicals such as phenylacetic acid and phenylpropanolamine that are listed as scheduled drugs in most states (KI 13).

According to KI 13, importation may entail the establishment of a shell company:

A company will set itself up just to basically bring in large quantities of certain chemicals and they will on-sell them...we call them a facilitator. They are like a broker, they sort of operate in that grey area where they are not actually illegally bringing in those key reagents, but they are only bringing them in so they can on-sell them at a hugely inflated price and sell them to crooks.

KI 9 described the following scenario:

We were successful with information in identifying chemical companies which were selling to a crime syndicate...Working with Customs, we were able to identify that that chemical company was importing large amounts of chemicals...they supplied them to a middle man and he was then supplying them on to the criminal syndicates...

KI 13 stated:

There was a recent one, only a couple of months ago...We warned him; we said 'look you've got this cleaning business. You're using all these substances that really you don't need for your cleaning business'. And he just said, 'Oh look, I'm selling them to such and such'. And he was just on-selling. He was doing the importing...all of the paperwork. He was just doing cash sales to a bunch of crooks. He was just purely motivated...by the money.

The importation of reagents is facilitated by the intersection of legitimate industry and criminal groups. Criminal groups will attempt to make connections with legitimate industry in order to circumvent the regulations on reagents.

The following case examples demonstrate some of the various strategies used to gain access to reagents required for the manufacture of methamphetamine. The first case example demonstrates the ease of legitimate purchase of reagents, in this case caustic soda and bicarbonate soda.

R v Jaouhar (2003). Jaouhar was involved in the manufacture of methamphetamine with a number of others including Sefian and Khouri. On 18 October 2001, Jaouhar purchased 11 x 500g containers of caustic soda and 6 x 500g packets of bicarbonate soda at a supermarket in Eagle Vale. On 28 November 2001, Khouri and Jaouhar set up a clandestine laboratory in the bathroom of premises at Minto. A third man, Fonofehi assisted in the transporting of the materials and also served as a 'look out'.

The second case, an example on a much larger scale, is derived from the Kalache syndicate described in an earlier case example.

R v Parker (2002). In mid-1995, Launt and Kalache arranged a large supply of precursor chemicals and reagents for \$35,000, including 40kg of phenylacetic acid, 20kg of Mannitol, 30 litres of hydriodic acid, 40kg of sodium acetate and 40kg of caustic soda. In January 1996, Launt, Kalache, and Parker met in Sydney to discuss ongoing supplies and to pay an outstanding debt for the initial supply in December 1995. In February, 1996 a further 30 litres of hydriodic acid was transported to Sydney by commercial carriers. In March 1996, Parker and Kalache purchased 75kg of phenylacetic acid, 40kg sodium acetate, 80 litres of acetic anhydride and 100 litres of hydrochloric acid. At the same time, Parker ordered a further consignment of chemicals from Launt which was delivered to persons working for Kalache at Peats Ridge. The consignment included 50kg phenylacetic acid, 40kg sodium acetate, 80 litres of acetic anhydride and 100 litres of hydrochloric acid. A clandestine laboratory was established at Wollombi using these chemicals.

The third case example describes the purchase of reagents from a chemical supplies company.

R v Coates & Murphy (2002). Coates had obtained 2 x 5kg packages of iodine from a laboratory supplies company on 31 January and 25 February 2000 (his driver's licence was attached to an 'end user declaration').

5.1.4 Raw materials: Sourcing equipment within Australia and offshore

The manufacture of synthetic drugs requires typical laboratory equipment such as condensers, round bottom flasks (100 ml through to 20L), separation funnels that are used to separate oil from water and Buchner funnels for filtering purposes (KI 11). Larger scale production using the P2P method (see Section 3.2) requires the following equipment—a hotplate, Teflon coated stirring bar, Pyrex graduated beakers, an oven, a round-bottomed flask, a Corningware casserole dish, a Buchner funnel, a filter flask, filter papers and a mortar-and pestle set (Freeh, 2008).

Criminal groups can access laboratory equipment from legitimate suppliers such as scientific supplies stores. However, regulations on the purchase of such equipment and the need to verify identity at point of purchase means that criminal groups have attempted to find alternate means for accessing this equipment. For example, online auction sites offer the opportunity for individuals to source laboratory equipment with enhanced anonymity and to bypass regulations (Parliamentary Joint Committee on the Australian Crime Commission, 2007). Glassware for manufacture can also be sourced from 'backyard' glass blowers (KI 13). There have also been reports of laboratory equipment having been stolen from schools for the express purpose of being used to manufacture methamphetamine (Australian Crime Commission, 2003).

Laboratory equipment is also sourced by importation. Organised Asian gangs in particular are known to be involved in the importation of scientific glassware for methamphetamine manufacture (KI 7). For example, imported glassware was found at a methamphetamine lab established by individuals of Vietnamese and Chinese origin (KI 7). In Western Australia, there was an attempt to source scientific glassware from China (KI 5). KI 8 stated that glassware is being sourced via direct importations and also internationally via internet shopping sites such as eBay. Once purchased online, the products are typically shipped to Australia via air freight.

Although conventional laboratory equipment is preferred by most manufacturers ('cooks'), for small scale production, it is possible to construct reaction vessels or to use domestic kitchen equipment (KI 13). In Western Australia, for example, the use of standard kitchen equipment rather than scientific glassware is common (KI 5), mainly because the most common manufacture method (the Nazi method), can be completed on a small scale using standard drink bottle-type containers (KI 13). Similarly, in Queensland, clandestine laboratory equipment does not tend to be the type of industrial-sized equipment that is typically used for large-scale manufacture and often standard kitchen utensils and equipment are utilised (KI 1).

The following case example of the detection of a clandestine laboratory includes reference to the equipment typically located at clandestine laboratory sites:

R v Cook (2002). In 2000, a clandestine laboratory was detected by police in a residential home in the Prospect area. Within the kitchen of the house was found the following—10,637 Sudafed tablets weighting 2.5kg, a 20L drum of methylated spirits, 5 Pyrex beakers containing white sludge and a clear liquid, traces of pseudoephedrine, 2 baking dishes, a hot plate, exhaust fan and two paper bags containing a total of 263.1g of pseudoephedrine.

5.2 Manufacture of end product

This section details information about the manufacture of methamphetamine both domestically and internationally, including a review of the common manufacturing methods used and typical locations of methamphetamine clandestine laboratories. The domestic section (below) also describes the storing of chemicals at lab sites, size of labs, timeframe for manufacture, set-up costs of labs and typical risk management strategies used by criminals during the manufacture process. The section concludes with a discussion of trends in manufacture at the state level. A section on international manufacture methods follows the section on domestic manufacture.

5.2.1 Manufacture: Methods

Overall, the manufacturing processes for methamphetamine are simple but can be dangerous, with numerous reports of injuries and deaths of manufacturers and bystanders in the United States (Caldicott, Pigou, Beattie, & Edwards, 2005). The flexibility and simplicity of manufacture means that clandestine laboratories can be set up close to consumer markets and can be relocated in efforts to avoid detection by law enforcement (Schloenhardt, 2007).

As discussed in Chapter 3, individuals who possess the knowledge and skill to manufacture methamphetamine (referred to as ‘cooks’) are typically employed, contracted and traded among different criminal groups and networks (Australian Crime Commission, 2003). In fact, specialists may be employed or contracted to perform specific discrete tasks throughout the manufacture process (eg extraction of pseudoephedrine, manufacture of precursors; Australian Crime Commission, 2003). The Internet has become a major facilitator of knowledge sharing about the processes required for methamphetamine production (Parliamentary Joint Committee on the Australian Crime Commission, 2007). Cooks are able to access techniques via websites, chat rooms and other online social networking structures.

Types of processes

Methamphetamine can exist as two different enantiomers (chemical compounds in which the chemical compositions are mirror images), *d*-methamphetamine and *l*-methamphetamine, and each exert different physiological effects (Australian Federal Police, 2009). The *d*-methamphetamine variant is the more potent of the two (Australian Federal Police, 2009). Manufacture techniques involve either the reduction of ephedrine or pseudoephedrine to give *d*-methamphetamine, or reductive amination of P2P to produce racemic (mixed) or *d/l*-methamphetamine. On the whole, pseudoephedrine-based methods involve simpler procedures compared with P2P-based methods (KI 7). P2P-based manufacture requires a higher level of chemistry knowledge and skill.

We group the 10 typical processes used in manufacture into three categories—(1) five methods that use pseudoephedrine as a precursor; (2) two methods that use P2P as precursor; and (3) three methods through which methamphetamine is manufactured from chemicals known as ‘pre-precursors’.

- Pseudoephedrine as precursor
 - Hypophosphorous method
 - Red phosphorous method
 - Nazi method
 - Low pressure hydrogenation ('Emde' method)
 - Push-pull method
- P2P as precursor
- Manufacture from pre-precursors
 - Kindler-Willgerodt method
 - Methcathinone method
 - L-PAC method

Manufacture using pseudoephedrine as precursor

Manufacture using pseudoephedrine can commence immediately if raw pseudoephedrine is sourced (typically from importation). When the criminal groups source pharmaceutical preparations containing pseudoephedrine (via importation or from domestic sources), the first task is to extract the active ingredient—pseudoephedrine—from the tablets. Thirty tablets (each tablet containing 60mg of pseudoephedrine) can produce 300 doses of methamphetamine (Cherney, et al., 2005). There are five typical methods that use pseudoephedrine as a precursor:

- Hypophosphorous method: The hypophosphorous method takes approximately one to two hours to complete (KI 11).
- Red phosphorous method: The red phosphorous method is somewhat 'more messy' (KI 11), takes longer to complete and is therefore less popular compared with the hypophosphorous method (KI 11). The red phosphorous method has attendant risks—'In the United States...people were cooking it in hotels and as a result of not watching and allowing it to boil down, they produced a lot of phosphine and the phosphine has unfortunately killed these people' (KI 11).
- Nazi method: The Nazi method is very quick and does not require specialised laboratory equipment. It can be completed in around one hour (KI 11), is only useful on a small scale and is not suitable for larger sized labs (KI 11). Nazi labs are notoriously volatile and can cause serious injuries if they explode (KI 4). KI 6 referred to an instance of Nazi method manufacture in which a house was incinerated and another in which a roof was blown off a house and two cooks suffered serious burns requiring hospitalisation.
- Low pressure hydrogenation: Also known as the 'Emde' method, this one of the typical manufacture methods used in regional super labs in Asia (KI 12). Low pressure hydrogenation allows for 'up-scaling' of production (ie increasing output), but requires specialised equipment (eg pressurised reaction vessels, fume hoods, scrubber units) (KI 12). The Emde method is preferred in operations that produce methamphetamine tablets. More recently, the Emde method has also been associated with crystal manufacture (eg in Philippines) (Australian Crime Commission, 2008a).
- Push-pull method: This is a pseudoephedrine-based method, which is a 'cold' manufacture method (no heating is required) and uses two plastic bottles with a hose attached to each (KI 11).

Manufacture using P2P as a precursor (or ketone type)

Two manufacture methods use P2P as a precursor (KI 11). KI 11 stated 'P2P itself has got a distinctive odour, methylamine is like ammonia so it has got a strong odour. And if you are using phenylacetic acid to make the P2P, that's got an odour that sticks with you. It gets into your clothing and into your hair and is...very persistent...and very distinctive odour'. Manufacture using the P2P method takes approximately 10 hours (KI 11). As of 2004–05, a resurgence in the P2P method has been reported (Australian Crime Commission, 2008a; McKetin, et al., 2005), possibly in response to legislative controls on pseudoephedrine and/or because P2P can itself be synthesised from unrestricted chemicals.

Manufacture from pre-precursors

The increasing restrictions on precursor chemicals has stimulated interest in alternate manufacture processes that rely on unregulated chemicals that are used to manufacture the necessary precursors as a prelude to methamphetamine manufacture.

Kindler Willgerodt method: KI 13 described this more obscure method in which manufacturers produce precursors out of styrene. Methcathinone method: KI 4 stated that the methcathinone method is a highly toxic way of manufacturing methamphetamine and has been seen infrequently in New South Wales. L-PAC (L-pheylacetylcarbinol) method: This method is used to produce ephedrine.

The history of methamphetamine manufacture demonstrates the flexibility of both the production process and the manufacturers themselves, highlighting the need for law enforcement agencies to remain abreast of current trends in manufacture and precursor chemicals. The shift from P2P to pseudoephedrine-based methods in the 1990s and the recent developments in the use of pre-precursors, suggests that new manufacture methods will continue to arise.

Manufacture of crystal methamphetamine

All forms of methamphetamine are manufactured the same way (KI 4). The form in which the end product is sold depends on how far the manufacturers extend the crystallisation process—‘(If) you manufacture methamphetamine to get ice, all you are doing is recrystallising. It’s just a further step’. (KI 4).

According to KI 12, all manufacture processes can produce either powder or crystal methamphetamine:

The key step is getting it to the oil and the salting out process will take it through to whatever you want... Then it comes down to a trick on how long... you want to spend crystallising out. Generally in Australia, they tend to do this process very quickly on a heat source which is why you end up with powder or the orangey goop (colloquially referred to as ‘base’ methamphetamine).

There has been a trend towards the domestic production of crystal methamphetamine (Parliamentary Joint Committee on the Australian Crime Commission, 2007). While initially almost exclusively imported, domestic manufacturers are more likely to extend manufacture to the additional purification phase required to convert powder methamphetamine into crystal methamphetamine (Parliamentary Joint Committee on the Australian Crime Commission, 2007). KI 10 stated it was ‘rare’ to detect domestic manufacture of crystal methamphetamine:

I don’t know what the reasons are as to why that is. I think it is a lot more difficult to produce the high purities of crystal methamphetamine as opposed to the amphetamines which are 60% and up to 70% which is pretty good. I don’t think at the moment we have the expertise to produce it at that high purity.

Although domestic manufacture of crystal methamphetamine is not common, there have been detections of clandestine laboratories producing crystal methamphetamine. In New South Wales, crystal methamphetamine is being manufactured in domestic labs (KIs 4, 7). KI 4 gave an example of a clandestine laboratory detection in March 2005 where precursors and end products were seized, including ‘many kilos of crystal methamphetamine’.

Some clandestine laboratories are used to ‘cut’ or adulterate crystal methamphetamine with methyl sulfonylmethane (also known as MSM; KI 7). Methyl sulfonylmethane is marketed as a dietary supplement and has a crystalline appearance.

Manufacture of methamphetamine and MDMA

Often methamphetamine and MDMA are found mixed together in tablet form (KI 5). One explanation for this is that the precursors for methamphetamine and MDMA are mixed together and manufactured in one chemical process

...the only difference is the benzene ring is the major building block for methylamphetamine. MDMA has an additional methylenedioxy component on the benzene ring. The MD stands for methylenedioxy, so basically it has got two oxygens joined by a CH₂ bridge, and that's the only difference, so all the rest of the molecules are identical so if you throw it in as like your starting mix, and you go through the process, you end up with the same product except one will just have a benzene ring and the other has got two oxygens on the benzene ring, one is methamphetamine and one is MDMA (KI 5).

5.2.2 Other aspects to manufacture: Stockpiling, costs and lab size/production outputs

Stockpiling precursors and reagents

The various chemicals required for manufacture are typically sourced over an extended period of time and then brought together for the manufacture process (KIs 3, 9). Pseudoephedrine, due to the difficulties obtaining it, is the key ingredient for the manufacture process.

Most drug labs can easily stockpile your solvents and reagents, your iodine, hypophosphorous and things like that. Pseudoephedrine seems to be what sort of dictates when the actual cook occurs...

There is no doubt that there are some syndicates that are sitting on drums of pseudoephedrine that they have smuggled in and they are just gradually going through it (KI 4).

A delay in manufacture waiting for sufficient pseudoephedrine is more likely when pseudoephedrine is sourced from pharmacies through 'pseudo-running' rather than when the pseudoephedrine is sourced from importations (KI 13). For example, KI 13 stated 'I did a job in 1999...and we found eight 30 litre drums (of pseudoephedrine) that had been stolen two years before. So that syndicate were gradually on-selling it or gradually...using it for themselves'.

Size of labs/output

The size of clandestine laboratories is usually measured by the size of the reaction vessel (KI 13). If a laboratory has the capacity to produce a large commercial quantity (greater than 1 kilogram) in one manufacture cycle, it is labelled as a large laboratory. A medium sized laboratory can produce between a small commercial quantity and large commercial quantity (above 250g and below 1kg). Small laboratories have the capacity to produce up to a small quantity (ie up to 250g). A 10 litre reaction flask would be termed a large lab, between one litre and five litre would be classed as medium and anything under a litre (eg 250 ml or 500mL reaction vessel) would be considered small (KI 13).

Some manufacturers conduct multiple production runs to increase output so some clandestine laboratories may have more than one reaction vessel (eg two 20 litre reactions vessels; KI 3). If cooks have access to large amounts of precursor (eg hundreds of litres), there appear to be two models of typical operation—(1) the manufacture of small amounts on an 'order by order' basis, for example a regular customer who buys five kilos every month; or (2) large sized manufacture processes with sometimes multiple reaction vessels, constantly producing methamphetamine in large quantities (KI 3).

KI 12 offered a prediction about the future of methamphetamine manufacture in Australia:

Now with the precursor restrictions that have been put in place, basically you have cut out their ability... to actually get a sufficient amount of precursors to make it worthwhile to do the business. Now that doesn't obviously mean that the problem goes away but what it does mean is that the bottom end of the market no longer has access to this and so the bottom end of the market...doesn't have the international contacts...to be able to source the precursor chemicals needed...What it does mean though is that the smarter, the more organised, the more internationally connected people will just tap into offshore markets and they will start importing the precursor. So again, while there will be less labs available...because all the low end of the market drops out, the production that's going to be left in Australia will be the higher end more organised crime type end of the market (KI 12).

That is, fewer people will be involved in manufacturing but manufacture processes will be conducted on a larger scale.

Set up costs

According to KI 13, approximate costs to establish a clandestine laboratory are \$100 to set up a small lab and \$1,000 to set up a large lab. These are small costs relative to the profits being made.

Risk management strategies

Criminal groups and individuals will use a range of strategies to minimise the chances that a clandestine laboratory will be detected and strategies to limit the potential impact of detection if it occurs. According to KI 4:

The well organised crooks...do monitor the legislation. They know what the legislation is about, they know how to operate, and that's come from you know court matters and stuff like that. They've been through it. They understand what our methodology is like and putting restrictions on chemicals so they start looking at different ways to manufacture...or even different drugs to manufacture.

Similarly, KI 7 stated:

...they will do their cooking in batches so that when we do arrest them we will have just under a commercial quantity or a large commercial quantity—so they are fully aware of the legislation.

Manufacturers will also often break the manufacture process up into a number of sites to reduce the risk of losing large amounts of product (eg 1 site for the extraction process, 1 site for the reaction process and another site for the salting out process) (KI 7; KI 13). To reduce their risk of arrest, cooks will usually try to minimise the time they remain at a lab site (KI 3)—‘contract cooks...they just go in and do what they have to do and go on their way’ (KI 7).

To reduce the potential impact of detection by law enforcement detection, end-product is not stored very long at the manufacture site but is quickly distributed. KIs reported that it was therefore unusual to seize end product at clandestine laboratory sites. Usually, when law enforcement agencies detect a clandestine laboratory, the manufacture process is either part way through, or not yet commenced. Therefore, when law enforcement seize an operable laboratory, they will typically seize an admixture of chemicals and laboratory equipment.

The following seven case studies provide examples of methamphetamine manufacture in Australia.

Alameddine v R (2006). In 2002, a clandestine laboratory was located in a shed in the backyard of a property in Sydney. The shed contained liquid condensers for chemical processes and plastic containers that contained off-white and pale-brown substances.

R v El Azzi (2004). El Azzi was involved in two separate clandestine laboratories, assisted in both endeavours by a man named Simpson and with two different groups of men. The first lab was located at a property at Dooralong (with Drew, Knight and Phillips) and the second was at Sylvania Waters (with Proctor, Hearne and Brown.) El Azzi sourced and secured the premises at Dee Why, provided assistance during the manufacture, transported Simpson to and from the premises and instructed Simpson in anti-surveillance techniques. The clandestine laboratories were set up in the bathroom of residential premises leased or occupied by friends or associates of El Azzi or Simpson.

The first manufacture process was commenced at Dee Why and was completed at Wentworthville. El Azzi's role was as caretaker of the premises at Dee Why, finance for the purchase of precursors and assistance with the actual process of manufacture at the Wentworthville laboratory. El Azzi was the co-principal organiser of the manufacture sites at Dooralong and Sylvania.

Simpson was the cook and had many years of experience in the manufacture of methamphetamine. For the clandestine laboratory at Dooralong, El Azzi organised and supervised the manufacture, recruited Simpson to carry out the manufacture process, secured the premises and obtained the precursors.

Following police detection of the lab at Dooralong, a new clandestine laboratory was established at Glenfield, but due to the suspicion of police activity in the area, the lab was moved to Sylvania Waters.

R v Hansel (2004). In 2002, Panebianco was operating a syndicate that manufactured methamphetamine. He coordinated the acquisition of equipment and chemicals, and arranged the manufacture, storage and distribution of the final product. Panebianco was in regular contact with Hansel who was to conduct the manufacture process. A premises in Riverstone was identified as the location for the clandestine laboratory. The property was rented by Hansel for this purpose, although he did not reside there. The clandestine laboratory was set up in the garage of the house. Police found sources of pseudoephedrine and precursors in the process of extraction.

Langham v R (2006). In 2003, Langham and Spalding were involved in the manufacture of methamphetamine. They recruited a third individual to acquire Telfast tablets (that contain pseudoephedrine). Langham leased a rural property at Bilambil. It was at this property that police discovered a partly dismantled clandestine laboratory in the kitchen and laundry. They found a liquid containing pseudoephedrine and methamphetamine, documents that described the chemical conversion processes of pseudoephedrine to methamphetamine and receipts for the purchase of implements used in the manufacture process.

R v Novakovic (2004). Novakovic was involved with three others in methamphetamine manufacture at a premises in Riverstone. The laboratory was detected by police midway through the cooking process. In a garage at the property police found a 3-neck reaction flask with a capacity of 5L containing a brownish liquid. A separate premises at Prestons was also searched and the following items found—a large quantity of empty boxes of Sudafed tablets and blister packs, large quantities of tablets which contain pseudoephedrine (including Sudafed), documents outlining the manufacture of methamphetamine, electronic scales and a quantity of pure pseudoephedrine powder.

R v Parker (2002). In 1996, police discovered a clandestine laboratory in the bathroom of a house at Dooralong. The clandestine laboratory comprised a 20 litre reaction flask, a stainless steel pot, garden hoses and an electric hot plate and condenser. Forensic analysis indicated that phenylacetic acid had been converted to P2P and subsequently methamphetamine.

R v Arikan (1999). Arikan had established a clandestine laboratory at a remote farm in Booral (north of Newcastle), with the assistance of a second man, Marskell. A generator was operating at the property to supply electricity for the manufacture process. The clandestine laboratory consisted of the following—a large reaction vessel containing a quantity of red phosphorous inside a large steel pot which was sitting on an electric hot plate and liquid condensers at the top of the reaction vessel.

5.2.3 International manufacture

Regional super-labs

The recent trend in international clandestine laboratories is that while the number of labs has gone down, the size and scale of those labs has increased ‘considerably’ (KI 12). ‘Super-labs’ refer to large clandestine manufacture sites. A superlab has the capacity to produce 4.5kg or more per production cycle, while a ‘megablab’ has the capacity to produce 1,000kg or more per production cycle (Australian Crime Commission, 2008a).

Regional superlabs have been in operation since around the year 2000 (KI 12). The first major regional superlab was detected in Fiji and was subsequently moved between Malaysia, Indonesia and the Philippines in attempts to avoid detection by regional law enforcement (KI 12). Chemical profiling by the AFP allows law enforcement agencies to determine the manufacture process used to produce methamphetamine that is seized at the border in Australia. Seventy percent of Australian seizures that were subjected to chemical profiling by the AFP were found to contain samples that used the red phosphorous method and 11.7% used the thionyl chloride method (Emde method), both of which are ephedrine/pseudoephedrine based (Australian

Federal Police, 2009). A further five percent of seizures used both low pressure hydrogenation and red phosphorous methods with similar or smaller proportions of seizures containing other mixes or unclassified samples (Australian Federal Police, 2009). Five percent employed the P2P method (AFP, 2009).

The chemical profiling by the AFP therefore suggests that the majority of methamphetamine imported into Australia is produced via the red phosphorous method (commonly used for the manufacture of crystal methamphetamine) and the Emde method. Both of these processes use pseudoephedrine as a precursor and produce the more potent *d*-methamphetamine.

5.2.4 State based manufacturing trends

Queensland

In Queensland, the majority of labs are seized in the southeast corner of the state (KI 1, 2). The majority of Queensland clandestine laboratories are typically small in size and are therefore not of the size typical of commercial production (KI 2). In Queensland, small-scale manufacture usually involves a single production cycle after which the equipment is either used for a further production process or put into storage (KI 1). The 'vast majority of labs...95%....are pseudoephedrine based' (KI 2) and use the hypophosphorous method (KI 2). Small-scale manufacturers produce enough end product for their own use and for a small group of friends, and the manufacture is not aimed at generating profit (KI 1). Larger scale manufacture is conducted by organised crime group such as OMCGs. Although there is the occasional large commercial lab seized in Queensland, there are far fewer compared with the southern states which have fewer seizures of labs compared with Queensland, but where the yields of labs are higher (KI 1). As noted above, under risk management strategies, a recent trend that has been noted in Queensland (Frost, 2009) is the separation of the manufacture into several discrete stages at different locations (eg pseudoephedrine extraction at one site, distillation processes at another site). This breaks the manufacture process into shorter cycles and reduces the impact of any one clandestine laboratory detection.

New South Wales

In New South Wales, clandestine laboratories are concentrated on the eastern seaboard, north and south of Sydney and in the outer western edges of metropolitan Sydney (McKetin, et al., 2005). Clandestine laboratories have also been detected in rural and semi-rural areas in the outer reaches of Sydney, which renders the labs difficult to detect by law enforcement, but close to supplies of precursors, reagents and laboratory equipment (McKetin, et al., 2005). The majority of clandestine laboratories in New South Wales are 'addiction based' rather than 'economic based' meaning that they are set up by methamphetamine users to manufacture methamphetamine for their own use, rather than to manufacture methamphetamine to sell for profit (Hugel, 2009). However in New South Wales, there has been a decrease in the number of small ('addiction-based') labs detected (KI 4). The largest labs have multiple reactions occurring simultaneously and include 10 to 20 litre reaction flasks (KI 4). The hypophosphorous method is reported to be the most common manufacture method (60–65% of all manufacture; KI 3) used in New South Wales, mainly because it is faster and more efficient (ie greater yield) and the required chemicals have been relatively easy to obtain compared with the red phosphorous method (McKetin, et al., 2005).

In the late 1980s and early 1990s, the main production process in New South Wales was the P2P method (KI 4). There has recently been a resurgence of the P2P method in New South Wales (KI 4). Cooks who had specialised in the P2P method and who had been incarcerated have recently been released and have returned to using the P2P manufacture process (KI 4). There are only a small number of Nazi manufacture labs in New South Wales (KI 4). In New South Wales, there appears to be relatively little manufacture of crystal methamphetamine, with most domestic production being speed or base rather than crystal (KI 3). This may reflect the focus on quick production methods rather than quality of the product.

A recent trend in New South Wales is the emergence of clandestine laboratories that manufacture methamphetamine using pre-precursors such as those using the L-PAC manufacture method (see above section on manufacture processes Hugel, 2009).

Western Australia

In Western Australia, the 'large majority' of labs are small Nazi method labs (KI 6). P2P-based labs are uncommon in Western Australia (KI 6). In discussing the predominance of Nazi type cooks in Western Australia, KI 13 stated '...ammonia is one of the things that is produced in Western Australia...It is too coincidental that the main ammonia manufacturing plant is in Western Australia and that is where you see your Nazi cooks'. Manufacture is usually conducted by users for personal use, utilising pseudoephedrine-based product sourced from pseudo-running or break and enters at pharmacies. Recent trends include the introduction of the L-PAC method and the extraction of precursors from Vicks inhalers (Hugel, 2009).

Victoria

There are three main 'levels' of methamphetamine manufacture in Victoria (KI 7). At the lowest level are small 'backyard' or 'addiction-based' labs that produce a few ounces per manufacture cycle. At the next level are larger manufacture operations that source pseudoephedrine from diversion or importation. At the top end are large P2P-based labs that have the capacity to produce five kilograms or more per manufacture cycle. These large labs are usually run by established criminal networks.

There has been an increase in the number of small 'addiction-based' laboratories (KI 7):

...we have taken away some of the bigger organised chains that were in place...they are out of the picture and so the void is being filled by a number of backyarders...It is very hard to say exactly what is going on, but all you can really look at is the purity and the price and that's not changing. We are talking about a lot of small labs but the purity and price are not changing...I would suspect that probably the gap between the manufacture and the end-user is getting narrower. There are not as many steps in the chain because you've got these people churning out small amounts; they are probably selling it as quickly as they manufacture it.

This trend in clandestine laboratories towards smaller sized labs appears to be the result of drug law enforcement interventions directed at the larger manufacturers. As these larger syndicates have been dismantled, the supply of methamphetamine has fallen to smaller scale producers.

The most common manufacture method in Victoria is the hypophosphorous method (KI 7, 8), but there have been increases in the Nazi method and the P2P method (although both still comprise the minority of labs). The P2P manufacture process is making a resurgence in Victoria:

With the mid-range organisations, they are starting to move across into P2P-based cooks because they are starting to get a level of sophistication in their process so they want to expand their production. They can't do that because they are limited by the amount of pseudoephedrine they can source (KI 7).

This suggests that one impact of the regulations on pseudoephedrine, which reduced the availability of pseudoephedrine (particularly for mid-level operators), is leading to a move back to the P2P manufacture processes.

In Victoria, there has also been a move to the manufacture of precursor chemicals from pre-precursors. Approximately four labs have been identified in Victoria where there have been attempts to convert other chemicals to P2P (eg hydratropic aldehyde to P2P; benzaldehyde and nitroethane converted to nitrostyrene and iron, and then converted to P2P; Hugel, 2009).

South Australia

Most South Australian labs are 'addiction-based' and use the hypophosphorous method (Hugel, 2009; Rathjen, 2009). Recent trends include the use of the pre-precursor L-PAC method and Willgerodt

methods (Hugel, 2009). Three years ago, most methamphetamine manufacture in South Australia used pseudoephedrine as a precursor; however, now one-third of manufacture sites use precursors other than pseudoephedrine. This is probably the result of the decreased availability of pseudoephedrine-based pharmaceutical preparations (Rathjen, 2009).

5.2.5 Manufacture: Locations

Methamphetamine labs are typically located in domestic residences and in industrial units (KI 4, 6, 7, 8). The labs are usually found in rental premises (KI 8); in fact, 95% of clandestine laboratory detections in Victoria are rental houses and in nearly all cases they are occupied by a member of the criminal syndicate involved in manufacture. The labs are usually set up in one of the rooms of the house (KI 6; KI 8). Some labs are set up in backyard sheds (KI 6; KI 9). In Victoria, mega-labs have been detected in residential premises, although most of the larger labs tend to be in farmyards or factories (KI 7). Criminals may conduct the manufacture process at their own home or in properties linked with them, but will also seek the compliance of property owners (friends, acquaintances) to permit the manufacture on their premises. Smaller labs have been found underneath houses, behind fake walls and in roof cavities (KI 13). Medium sized labs are typically constructed at people's houses (owned or rented) in the laundry, kitchen or garage (KI 13). KI 13 stated that although it is not possible to generalise regarding locations of labs, larger labs were usually located in industrial units in metropolitan areas, close to sources of chemicals in addition to water and power. Larger manufacture processes are typically located in commercial premises like factories (KI 9). The individuals involved will choose isolated or remote sites where there is unlikely to be people around and that offer minimal visibility (eg at the end of a cul-de-sac). For example, a clandestine laboratory in Hornsby (north of Sydney) was located in a warehouse that had been occupied for only a brief period—enough time to conduct the manufacture process. Following completion of the manufacture process, the warehouse was abandoned (KI 3).

In Australia, clandestine laboratories are typically located in urban/suburban areas and on the rural fringe of the metropolitan area:

It just seems to be a matter of what the crooks are used to, whether they have had success in certain environments before. Some crooks love industrial units...Other crooks love rural areas...some will go so far as getting out onto a 50,000 hectare property on dirt roads and take everything with them—generators...tents and water baths, and gas for heat sources (KI 3).

Methamphetamine laboratories have been discovered in rural areas on the outskirts of major cities (eg Sydney, Melbourne, Perth; KIs 4, 6, 7, 8). Although rural sites are likely to be used more than once for manufacture, sites closer to the metropolitan areas of Sydney and Melbourne are typically used for a single manufacture run and subsequently abandoned (KIs 3, 9). Irrespective of the location, manufacture sites are usually selected to offer secrecy and sufficient physical space for the necessary equipment. For example, in Sydney, many labs have been detected in Padstow, not due to geographic boundaries but simply because there are a lot of industrial areas in Padstow that are amenable to methamphetamine production (KI 4).

Houses or factories that are to be used as locations for the clandestine manufacture of methamphetamine are typically leased under false names (KI 7) and criminals may spend time attempting to establish a false reason for leasing particular premises (KI 7).

Clandestine laboratories have also been found in caravans and motel rooms (KI 7). A few years ago, smaller clandestine laboratories were common in caravans, motels, hotels, cars, etc in New South Wales and Queensland (KI 13). The use of hotel rooms is now infrequent (KI 13).

Clandestine laboratories will often remain set up at a site for six to 24 months and then move on, 'depending on if they get spooked or...what the arrangements are with that lease' (KI 9, 13). Movement of such sites is high risk as it involves the transportation of chemicals and glassware (KI 9), which are then at greater risk of detection by police. Smaller labs are more likely to be moved around, usually as a method to avoid detection by law enforcement, possibly once a month (KI 9).

5.3 Distribution of end product

This section details the distribution of end product domestically, including the importation of methamphetamine into Australia. The international section describes the importation of end product and the movement of that end product to wholesale dealers and also includes information on source countries, typical methods of importation and current trends. The domestic section focuses on the movement of methamphetamine from domestic manufacture sites to wholesale dealers and includes information on the structure of the market, interstate distribution, price and risk-management strategies used by dealers.

5.3.1 International (importation)

The Australian Crime Commission report that methamphetamine is imported in two main forms—powder and high-purity crystals (Australian Crime Commission, 2003). The majority of shipments of methamphetamine arrive in cities and ports on Australia's east coast via intermediary countries from China.

Source countries

Historically, the main source country for methamphetamine has been China (KIs 3 and 12). In 2001–02, 30% of methamphetamine imported into Australia was sourced from the United States, 20% from Thailand and 15% from the Philippines (United Nations Office on Drugs and Crime, 2008). By 2006–07, there had been a marked increase in the number of methamphetamine seizures at the border that originated in Canada (Australian Crime Commission, 2007).

In 2006–07, methamphetamine imports that were detected by law enforcement agencies originated from the following countries (ranked by weight of detections)—Canada, the United States, Malaysia, South Africa, Vietnam, the United Kingdom, the Philippines, Indonesia, China, Thailand, Spain, Hong Kong SAR area of China, Romania and New Zealand (Australian Crime Commission, 2008a). In 2007–08, the majority of methamphetamine importations detected at the border originated from Canada and southeast Asia (Australian Crime Commission, 2008a). The importation of methamphetamine from southeast and East Asia is facilitated by geographic proximity to commercial infrastructure and transport routes (McKetin, et al., 2005).

Approximately 90% of methamphetamine seized at the Australian border is crystal methamphetamine (KI 3), suggesting that the domestic supply of crystal methamphetamine is mainly from importation. KI 7 stated that good quality crystal methamphetamine is being imported from source countries in southeast Asia. The AFP report that the median purity of border seizures between 2005 and 2008 was 70–75% (range of approximately 2–86%); about half of seizures had no adulterants and approximately half were adulterated with dimethylsulfone. The consistently high level of purity of these seizures may indicate that these seizures were crystal methamphetamine (Australian Federal Police, 2009).

These source countries are different from those identified for precursor importation (ie China and India; see Section 5.1 for precursor source countries).

Methods of importation

Methods of importation of end product include being carried across the border by passengers (eg internal concealment strapped to bodies, hidden in suitcases, concealed in shoes or clothing (KI 12), through the postal stream by parcel post or by courier and in large sea cargo containers (see pages 77–79 for methods of importation of precursors).

According to KI 12, some importers are reverting to liquid methamphetamine in order to evade detection at the border

Going back once upon a time...back in 2003–04...what tended to be imported was the crystal meth and the powder and the base and whatever would satisfy the local market. So in 2003–04, 85% of

all seizures at the border were crystal meth; 2004–05 was 87 and 2005–06 it went down to 60. Now interestingly, the other 35 was actually liquid meth and this is where it starts getting a little messy and a little confusing. So the liquid meth is basically meth that...needs to go through that last stage of processing. So...just that last stage processing would happen here onshore.

The liquid is then converted into either powder methamphetamine or crystal methamphetamine, depending on the skill of those involved (KI 12). Conversion from powder to crystal methamphetamine involves an additional process (a re-crystallisation process) that requires additional skill and more time.

The following case examples are illustrative of the types of strategies used to import methamphetamine into Australia.

R v Bigic (2000); R v Marchando (2003). This was a failed attempt in February 1998 to import a number of packages of MDMA and methamphetamine strapped to the legs of two women travelling from Los Angeles to Sydney. The two women were accompanied on the flight by the 'principal' of the operation, who trained the women in the United States regarding techniques for secreting drugs on their bodies and what to say to Customs officers. The principal accompanied the women for 'security' reasons to ensure that they remained calm and discreet, and did not abscond with the drugs. Each woman was to be paid \$US3,000 to carry the drugs into Australia and a further \$1,000 upon return to the United States. They were also to be provided with accommodation and living expenses for a two week holiday.

R v Bimahendali (1999). On 19 August 1999, a package was lodged with DHL Worldwide Express in Djakarta for air transport to Sydney. The package contained items of men's clothing. Concealed within the waistband of jeans and within the lining of a jacket were small clip seal plastic bags wrapped in carbon paper. Each bag contained crystal methamphetamine of 82% purity.

R v Pham; R v To (2005). Five letters that were posted to addresses in South Western Sydney from Hong Kong were intercepted between July and September 2001. The letters contained heroin and methamphetamine. The organiser of the operation, who resided in Australia, had despatched money for the purchases and had supplied addresses where the letters should be sent.

R v Thanh To (2007). On 12 October 2005, a shipping container arrived in Sydney. A speedboat was shipped in the container and concealed in the speedboat were packages of methamphetamine. The drug was contained in plastic bags with a gross weight of 45.83kg (38.8kg meth). In coordinating the importation, Thanh To arranged for clearance of the container through Customs, used a false name to conceal his identity, used telephones connected in different names and addresses, requested and received money from principals in the operation located overseas which he used to pay the outstanding monies for shipment and storage costs, recruited two other men and provided money for the purchase of power tools that were used to facilitate the extraction of the drugs.

R v 'W' (2002). Two shipping containers arrived in Australia from Singapore on 19 November 2000. Methamphetamine was concealed within modified metal struts of the containers. After removing the drugs, 'W' repacked them into 72 brown paper packages and separated these into three discrete larger packages and then placed all three packages into a sports bag. He drove a rented motor vehicle, and following a telephone call from another man, he delivered two of the three packages to an address in Mascot. He then drove to the Sydney Casino car park where he delivered the third packaged to a third man, Lee. It appears that W played a subordinate role in the enterprise and was following directions provided by those higher up in the hierarchy of the criminal network.

5.3.2 Domestic distribution of end product

Ethnically based criminal networks in south-western Sydney are dominant in the distribution of crystal and other forms of methamphetamine, whereas OMCGs have been linked to the manufacture and distribution of the form of methamphetamine with the street name, *base* (McKetin, et al., 2005). There appears to be two separate supply chains in the domestic sphere—one for crystal (mainly imported) and the other for locally produced powder and base forms of methamphetamine.

According to McKetin et al. (2005), methamphetamine distributors at the higher market levels create distance between themselves and the illicit activities of their network by outsourcing tasks involved in distribution (eg

labelling and packaging of drugs) that are associated with increased risk of detection by police. There are also reports of the payment of protection money; for example, high-level dealers will pay someone to 'take the fall' (ie arrest, conviction, penalty) if the operation is detected by law enforcement (McKetin, et al., 2005).

The following two case examples describe the operation of an OMCG chapter in the distribution of methamphetamine.

R v Roberts (2004). Roberts and Schumacher were involved in the supply of methamphetamine. Roberts was a member of the Nomads Outlaw Motorcycle Gang in Newcastle. The principal of the drug enterprise was Walsh who was Sergeant-at-Arms with the Nomads. The other principal of the operation was Walsh's wife (Love). Love estimated that Roberts and Schumacher supplied approximately 45 kilograms of methamphetamine in the period between 1997 and 2001.

R v Walsh & Little (2005). Walsh assisted another member of the Nomads, Johnny Skyrus, to distribute methamphetamine that was supplied by another Nomad, Vizi. When Skyrus was killed in an accident in 1997, Walsh took over the distribution of the drug. Paul and Anne Chapman were recruited. Anne Chapman tested the drug after it was cut by Love. Paul Chapman was a courier of the drug from the new supplier, Little. Little was engaged in the manufacture of methamphetamine in northern New South Wales and Paul Chapman transported the drug from the manufacture site to Newcastle. After a falling out between Walsh and Paul Chapman, Quinnel assumed the role of drug courier. Following Quinnel's death, Walsh did the courier job himself. He would hire a car and make the return journey from Newcastle to Little's manufacturing plant (approximately 8 hours each way). He would usually be accompanied on the trip by a junior member of the Outlaw Motorcycle Gang. On 22 September 2001, Walsh was arrested. Police found 510g of methamphetamine (77.6% pure) in the door of his vehicle. The following items were found at his home—equipment for the cutting, packaging and distribution of the drug, and records relating to customers. It was estimated that over a two year period, Little manufactured and supplied to Walsh and Love approximately 19kg of methamphetamine with an average purity of 75%. Little was paid \$50–60,000 per pound for the drug and received in total between \$2–2.5 million. Between 1997 and 2001, Walsh purchased about 50kg of pure methamphetamine and supplied approximately 450kg to members of the Nomads and other associates.

The method used for domestic distribution is variable and usually depends on the particular syndicate involved (KI 8). Some groups are involved in only one level of the supply chain (eg importation by Asian crime groups), whereas other groups are involved in all levels of the supply chain within Australia (the most notable example of which are OMCGs). However, generally 'most of the upper level would start selling off at pounds and they would be distributing it in pound amounts and they would be done as separate deals, usually pre-arranged for a set price and then that would be on-sold to people in ounce lots and then go from ounce lots down to low-level dealers'. At each change of hands, the drug is 'cut' (mixed with glucose powder or similar) in order to increase the profit margin (KI 8). The distribution of methamphetamine was described by KI 4:

...you get it out of the lab, you're cutting it and then everyone as it goes down the line, jumping on it (ie cutting or adulterating the drug) to make their profit as we go. Getting on the streets, the percentages (purity) are relatively lower—a lot lower—than when they leave the lab, so people are making their dollars along the way...if you are getting methamphetamine powder down to 5% when it hits the streets, you are looking at gear that has been jumped on quite a few times along the way, generally from your lab sites...they will generally jump on it between 5 and 7 times once they've produced their pure, so then it moves down the chain from there.

The following cases provide examples of the operation of wholesale dealers.

Hamieh v R (2007). In March 2003, Hamieh and Hood discussed the purchase of two kilograms of pure methamphetamine. Hood was planning to travel to South Australia to pick up the drugs. Police seized over two kilograms of methamphetamine plus several mobile phones and SIM cards, electronic scales and a box of glucose powder (used for 'cutting' the drug).

R v Burgess (2006). White was a street dealer of methamphetamine. White's father-in-law, Burgess, was White's supplier. Burgess supplied White with large quantities of methamphetamine every two days or

so in \$100 deals, which were packaged by Burgess. Burgess' wife delivered drugs to White or White collected drugs from her shop. She also collected the financial proceeds of retail sales from White.

Burgess stated that he supplied drugs to truck drivers who sold the drugs for him. He stated that he received drugs on credit. For example, a bag that contained 455g (1 pound) was worth \$20,000; he paid \$12,500 and owed the balance in credit. He said that he would often buy one pound and mix it with an additive to make two pounds. According to Burgess, his contacts within the trucking industry meant that he had the capacity to purchase large amount of amphetamines and cannabis.

Storage/stockpiling

According to KI 13, there are differences among groups as to the extent to which end product is stored prior to distribution, or distributed immediately upon manufacture:

Some groups want to dilute the drugs straight away but some groups will prefer to sell the drug a certain way or just want to offload it, so I don't think they sit on it for long. You know, the longer you are sitting on it, the greater the risk of someone discovering it on a search warrant. Or the biggest risk is... getting ripped off by the crooks. Just getting ripped off by people who are doing business with you. If you are a distributor, and the group that is supplying you, they know you are sitting on a stockpile, you know crooks being crooks, they'll just rip you. That's probably one of the main reasons we don't know much about it—people just don't talk about it, where they store stuff and how long they sit on it for.

KI 8 stated

I would say it would pretty much enter the market because a lot of the intel we get is that...word is put out before it is available, that it's coming and so there is a lot of activity; sort of like pre-sales to move it before they are run through (ie product is stolen) or before they are arrested. They want to get it out there and get their money recouped.

Drugs that are transported to Western Australia are 'as good as pre-sold' before they reach the state (KI 6)—'They don't want to be sitting on it—the longer you are sitting on it, the greater the risk'. He referred to one example where every three months a shipment was arriving in Western Australia and within two hours it had been on-sold.

These observations suggest that stockpiling of methamphetamine appears to be rare within Australia, which would accord with increased risks of detection and seizure if it were.

Interstate distribution

At the middle market levels, OMCGs again have the advantage of facilitating the development of interstate and regional chapters through which methamphetamine can be distributed (McKetin, et al., 2005). Common interstate transport modes include domestic air services, express post, courier and transport companies (Australian Crime Commission, 2003). The Australian Crime Commission (2003) notes the infiltration by OMCGs of the transport industry to facilitate the transport of drugs interstate. There is some evidence that large amounts (multiple pounds) were being transported to Western Australia from the eastern states (KI 6):

The large majority of the consumed methamphetamine in Western Australia comes from elsewhere—it is not produced locally in Western Australia. We have intercepted couriers off planes all the time and they are people who have been recruited and paid a minimal amount to bring over body-packed gear, gear that has been resealed in cigarette packets and the like...

Sometimes the drugs will be separated between two domestic flights to reduce the risks of the entire amount being intercepted (KI 6). The drugs may be transported from eastern states to Western Australia by train or plane (eg as freight) or may be carried over by passengers (KI 6). A common *modus operandi* is to pay commercial couriers to transport a package to a particular address. Another common method for transportation from eastern states to Western Australia, typically used by southeast Asian groups, is one where international students are paid to courier drugs or forced into interstate transportation due to

outstanding gambling debts. The amounts couriered in this way vary but can be up to one or two pounds (KI 6). Another method is to package the drugs into expensive cars that are shipped from the eastern states to Western Australia (KI 6).

The following case example describes an interstate distribution operation between Sydney and Perth.

R v Morres-George (2002). Morres-George and Rompel were involved in a criminal network that transported drugs between Sydney and Perth. Three couriers were paid to carry the drugs into Western Australia. Cash was to be transported from Sydney to Perth by one of the couriers and drugs returned by the other two. The bag containing the drugs was seized by police.

Risk management

Criminals who are involved in the wholesale distribution of methamphetamine perceive a number of risks and engage in strategies to neutralise or minimise these risks. For example, traffickers are aware of legislated sanctions and behave accordingly:

When you look at the schedule (in legislation)...the trafficable quantity (of methamphetamine) is 3 grams. Now to have 3 grams in normal powder methamphetamine is only about 3 to 6 dosage units, you know you could sell 3 to 6 dosages to people. But if you had three grams of ice, methamphetamine in that form, you are dealing with it by the point so therefore you've got up to about 30 sales ...So realistically from a cooks point of view, you are better off selling ice because even if you get caught with say 20 dosages, you are still under the trafficable quantity (KI 4).

5.4 Summary

This chapter has described the supply chains for methamphetamine in Australia, covering the manufacturing processes and distribution. The following features characterise the production of methamphetamine for Australia:

- Source countries differ for import of end product (eg Thailand, Canada) compared with precursors (eg China, India).
- Increasing restrictions on the availability of pseudoephedrine in Australia (eg Project STOP, rescheduling of pseudoephedrine-based products) have resulted in a trend of increasing bulk importations of raw pseudoephedrine. With this shift, the interception of precursors at the border will be a priority for law enforcement agencies (especially Customs and the AFP).
- This appears to be accompanied by a trend towards the greater importation of end product (as result of PSE restrictions) offset by trends in using pre-precursors within domestic manufacturing.
- The use of pre-precursors in manufacture is now growing as the availability of precursors is restricted.
- There are multiple sources for precursors and reagents (eg legitimate industry, break and enter, shell companies etc). Techniques and strategies used by criminal groups to obtain the required chemicals are likely to continue to evolve.
- The methamphetamine market is dynamic and constantly changing. For example, when a few cooks are imprisoned, their preferred methods are no longer common; but the processes can resurface when cooks with specialised knowledge and skill are released from prison.
- Pseudo-runners appears to be a reducing trend (given Project STOP and other restriction on the availability of pseudoephedrine)
- There has been a trend back to P2P-type methods in response to restrictions on the availability of pseudoephedrine. Drug law enforcement will be required to focus on the precursors and manufacture techniques utilised for P2P manufacture.

- There is some regional variation in manufacture methods across Australia. This may be to do with cooks' availability and their preferred method, but the variation also relates to access to chemicals (eg the Nazi method predominates in Western Australia possibly due to ready availability of ammonia). New methods continue to be invented and used within Australia. Law enforcement will continue to rely on intelligence gathering about manufacture methods to keep abreast of new manufacture processes as they emerge.
- The increased trend for importation of raw pseudoephedrine combined with the increasing popularity of P2P methods may result in larger operations growing and small labs being phased out. The shift to importation of raw pseudoephedrine in bulk and the increased use of P2P methods may lead to an increase in the number of large clandestine laboratories in Australia. The dismantling of clandestine laboratories will increasingly rely on successful investigations into organised criminal groups who operate large clandestine laboratories.
- The separation of manufacture into discrete steps at different sites may create the impression of small timers but, in fact, they are coordinated by large syndicates that split up the manufacture process as a coordinated risk management strategy.
- There are two separate supply chains for crystal and non-crystal forms of methamphetamine. Crystal methamphetamine is imported (mainly by Asian crime gangs) and then distributed within Australia (mainly by ethnically based groups). Non-crystal methamphetamine (powder and base) is mainly locally produced (eg by OMCGs) and is then distributed by a range of criminal networks (OMCGs, ethnic-based groups).
- Despite the finding of two separate supply chains, there is some evidence that local manufacture of crystal does occur and non-crystal forms of methamphetamine are also imported. As restrictions tighten, and as production methods change, the relative balance between these may continue to evolve.

Chapter 6: Results: Economic analysis

An economic approach was employed to compare drug law enforcement interventions. The costs (budget of the drug law enforcement interventions) divided by the impact (loss to illicit drug enterprises arising from seizures) creates a ratio that can be used to compare the interventions. Importantly, this cost-to-impact ratio does not reveal anything about the efficiency of the interventions, nor their relative cost effectiveness. Its utility lies in the rankings of the interventions. As noted from the outset, this is the first time this method has been attempted and the results should be viewed as the beginning of research in this area. This chapter reports the findings of average costs divided by average impact for different drug law enforcement interventions targeting various levels of methamphetamine supply chain. Sensitivity analyses are also reported.

It is important to point out that the derivation of both government spending and the loss to illicit drug enterprises were based on multiple assumptions (see Chapter 2). We endeavoured to keep those assumptions the same across all the various estimations we made. Therefore, the actual spending and loss figures are likely in themselves to represent significant inaccuracies from the 'real' or 'true' numbers. We calculated the estimates only for the purposes of the economic analysis, not for the figures themselves. Thus, the absolute value of the figures is not important, as we are comparing the relative ratio derived from the two figures across law enforcement interventions.

6.1 Summary of cost and impact data

Table 6.1 shows the methamphetamine budgets for the four interventions as estimated for the financial year 2006–07 (see Chapter 2 for the methods used; Table 2.5). As seen in Table 6.1, the estimated budget for end-product seizures at the border is of the largest magnitude. The smallest budget estimate is for clandestine laboratory detections, noting that this is likely to be an underestimate of the clandestine laboratory budgets due to the bottom-up method used to obtain the estimate.

Table 6.1: Drug law enforcement budgets for each level of intervention (\$) in 2006–07

	Main estimate
End-product seizures (border)	32,775,000
Precursor seizures (border)	16,308,000
Clandestine laboratory detections (domestic)	5,400,000
End-product trafficking seizures (domestic)	13,893,000

Seizure weight data are summarised for each intervention in Table 6.2. Precursor seizures at the border were reported in precursor weight and the remaining three were reported in end-product weight. The clandestine laboratory detections (domestic) have a wide weight range because of the assumptions of laboratory size and production capacity of each type of laboratory (see Chapter 2). Seizure weight of precursors at the border level has a minimum and maximum estimate due to two different estimation techniques, as detailed in Chapter 2 (see Table 2.8).

Table 6.2: Seizure weight for each level of intervention (g) in 2006–07

	Seizure weight		
	Min	Main	Max
End-product seizures (border)		81,755	
Precursor seizures (border)	48,080		332,004
Clandestine laboratory detections (domestic)	35,344		177,500
End-product trafficking seizures (domestic)		104,089	

The seizure weights shown in Table 6.2 were calculated to facilitate the economic calculations. The total seizure weights cannot be compared across law enforcement interventions in isolation, particularly as the two border interventions were based on national seizure data and the two domestic interventions were based on seizure data from three states only.

The loss to illicit drug enterprises due to drug law enforcement interventions were measured as the monetary replacement cost of seized product (as detailed in Chapter 2). As described in the Methodology, if there is end product seized, we applied a price–weight function, which was derived from the cost (total value) for that amount of methamphetamine and weight (gram). Two types of functions were derived—crystal and non-crystal. We valued each seizure weight for the crystal function and each seizure weight for the non-crystal function, and then we took the average of these two to be our main estimate. The lowest value became the minimum estimate and the highest value the maximum estimate. This method was applied to estimations of end-product seizures (border) and end-product trafficking seizures (domestic). We used a slightly different method for precursor seizures (border) and clandestine laboratory detections (domestic). For the precursor seizures (border) intervention, we had the seizure weights and we used the median price for methamphetamine precursor to derive the figure of loss to enterprises. Given that there was no information recorded on end product or precursors seized in clandestine laboratory detections (domestic), we derived the equivalent end-product seizure weight based on assumptions of one production cycle per clandestine laboratory and size of clandestine laboratory (see Chapter 2). The losses to illicit drug enterprises are summarised in Table 6.3.

Table 6.3: Loss to illicit drug enterprises due to drug law enforcement interventions (\$) in 2006–07			
	Low estimate	Main	High estimate
End-product seizures (border)	7,112,000	9,078,500	11,045,000
Precursor seizures (border)	1,683,000	6,652,000	11,620,000
Clandestine laboratory detections (domestic)	3,742,000	14,620,000	25,497,000
End-product trafficking seizures (domestic)	10,345,000	13,516,000	16,685,000

The losses incurred by illicit drug enterprises shown in Table 6.3 were calculated to facilitate the economic calculations. The total losses cannot be compared across law enforcement interventions in isolation, particularly as the two border interventions are based on national data and the two domestic interventions are based on data from three states only.

6.2 Initial results

The ratio of government spending to impact was calculated for each intervention based on the equation below:

$$\frac{\text{Budget of DLE activities}}{\text{Loss to illicit drug enterprises}}$$

Equation 5.1

The ratio represents the budget of drug law enforcement interventions against the loss to illicit drug enterprises. The lower the ratio, the better the intervention relative to the other interventions. By calculating a ratio of cost to impact on each law enforcement intervention, we assume that the drug law enforcement interventions are independent, which means the effects of upper level drug law enforcement interventions do not transfer the impacts to the lower level. The point estimates are provided in Table 6.4:

Table 6.4: Initial results: point estimates of cost-to-impact ratio

	Cost	Impact	Cost-to-impact ratio
End-product seizures (border)	32,775,000	9,078,500	3.61
Precursor seizures (border)	16,308,000	6,652,000	2.45
Clandestine laboratory detections (domestic)	5,400,000	14,620,000	0.37
End-product trafficking seizures (domestic)	13,893,000	13,516,000	1.03

The point estimates indicate a preference for clandestine laboratory detections. However, as will have been apparent, there are substantial uncertainties with the estimates of both costs and impact, hence we conduct sensitivity analysis and provide revised results that incorporate uncertainty (Monte Carlo simulation).

6.3 Sensitivity to key parameters

In our study, many of the values of parameters are derived from estimation. There is not a universal approach to dealing with uncertainties in the economic analyses (Briggs, Sculpher, & Buxton, 1994). Uncertainties can arise in the parameters and/or in the modelling approach. Due to the nature of our study, parameter uncertainty is the main concern given that our two major parameter estimates (government spending and loss to illicit drug enterprises) are based on multiple assumptions. In relation to the latter (loss to illicit drug enterprises), our estimates already build in the potential range of uncertainty (see Table 6.5). This is because our minimum estimate is derived from the lowest price/weight and our maximum estimate from the highest price/weight. For the government budget data, however, we needed to establish some ranges around the main estimate.

Previous studies estimating drug law enforcement have used different bounds in estimating federal or state budget. For example in Moore's study (2005b), the state/territory police drug budget was decreased by 10% for the low estimate and was increased by 10% for the high estimate. (A different method was deployed by Moore for the federal agencies). As documented in Chapter 2, the policing expenditures were estimated for the federal agencies (AFP and Customs) based on percentage of activity ascribed to illicit drugs and then the methamphetamine proportion calculated as a proportion of methamphetamine seizure numbers over all drug seizures. For the state police, the spending estimates were calculated based on proportions of offences and arrest numbers. There is no apparent logic as to a best approach to varying these estimates—the proportion of methamphetamine offences may be either over or underestimated as a proportion of policing costs. As a result, we apply an arbitrary percentage (in this case 20%) to derive ranges for the sensitivity analysis. This replicates Moore's approach. However noting the cognitive psychology literature that shows that humans substantially underestimate the uncertainty, we determined that the $\pm 10\%$ range (from Moore, 2005) seemed too narrow. Therefore, 20% up and down adjustment to the main budget figure was used to derive the low and high estimate. The budget range of $\pm 30\%$ was also included in further analysis (see later).

Table 6.5: Sensitivity analysis for drug law enforcement budgets in 2006–07

	Low estimate (-20%)	Main	High estimate (+20%)
End-product seizures (border)	26,220,000	32,775,000	39,330,000
Precursor seizures (border)	13,046,000	16,308,000	19,569,600
Clandestine laboratory detections (domestic)	4,320,000	5,400,000	6,480,000
End-product trafficking seizures (domestic)	11,114,000	13,893,000	16,672,000

Given the substantial uncertainties, we used Monte Carlo simulation to estimate the ratios. This method is most often used for analysing uncertainty where the goal is to determine how random variation, or lack of knowledge, may affect the sensitivity of the results. Effectively, the Monte Carlo simulation recognises that each data point has a probability that the true value lies between the ranges specified and it varies the values chosen within the ranges randomly, combining all the probabilities across the data sets. We created a parametric model, generated a set of random inputs from the range of cost and impact boundaries to calculate the cost-to-impact ratio and repeated the procedure 1,000 times, then analysed the distribution of results. The analysis was carried out in Excel 2007.

6.4 Main results

The results are summarised in Table 6.6.

Table 6.6: Results of economic analysis (Monte Carlo simulation)

	Rank	Mean estimate	Std. Deviation	Coefficient of variation	5th percentile	95th percentile
End-product seizures (border)	3	3.65	0.61	0.17	2.69	4.77
Precursor seizures (border)	3	3.18	1.88	0.59	1.39	7.34
Clandestine laboratory detections (domestic)	1	0.48	0.30	0.62	0.21	1.12
End-product trafficking seizures (domestic)	2	1.04	0.18	0.18	0.78	1.39

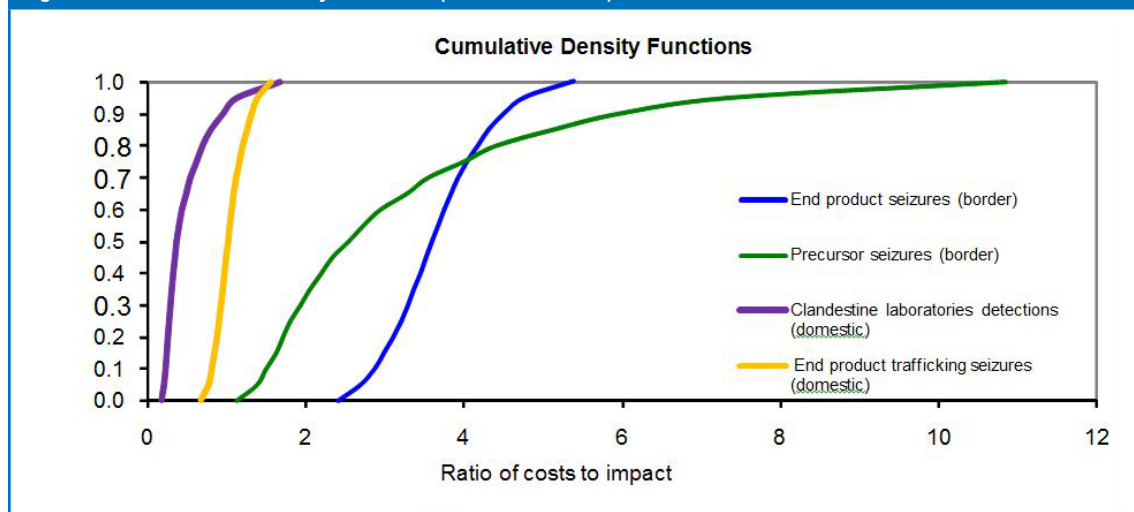
The derived ratios revealed that the highest ranked intervention, in terms of average costs to impact, was clandestine laboratory detections. Ranked second was end-product trafficking seizures (domestic); third was precursor seizures and the lowest ranked intervention relative to all four was end-product border seizures.

Importantly, however, the coefficients of variation are large for some interventions (precursor seizures and clandestine laboratory detections). This suggested the need for some further testing of the extent to which some of the interventions were significantly different from each other. In order to examine the extent of meaningful difference between the cost-impact ratios, we examined the whole probability density of the four ratios by plotting the cumulative density functions (CDFs). Figure 6.1 compares the four CDFs, representing the 95% and 5% probabilities. For example, there is a 95% probability that the ratio will fall below 4.77 for end-product seizures (border) and a 5% probability that the ratio falls below 2.69 (see Table 6.6).

Examination of the Figure reveals that the purple CDF (clandestine laboratory detections) is always to the left of the yellow, green and blue CDFs (end-product trafficking seizures (domestic), precursor seizures (border) and end product seizures (border), respectively). Thus, clandestine laboratory detections (domestic) will be ranked highest among the four. This is despite the fact that it has a higher coefficient of variation than the other three. Similarly, the yellow CDF (end product trafficking seizures (domestic)) is always to the left of the green (precursor seizures (border)) and blue (end product seizures (border)) CDFs. This means that the cost-to-impact value of the end product trafficking seizures (domestic) is always smaller than the other two. Thus, it is the second preferred among the four.

It is a different story when comparing the border CDFs. The green curve (precursor seizures) shows that there is an 80% probability that its ratio value will be less than the blue curve (end-product seizures). However there is a 20% probability that the green curve will have values greater than the blue. Thus, the difference between the two may be marginal and we cannot choose between the two options at border level.

Figure 6.1: Cumulative density functions ($\pm 20\%$ cost data)



Another way of summarising the results is provided in Table 6.7. This Table makes apparent some of the drivers to the result—clandestine laboratory detections have the lowest law enforcement spending estimate, yet produce high amounts of seized drugs. End-product seizures at the border have the highest spending estimate but not the highest weight of seized drugs.

Table 6.7: Main results and key drivers

	Rank	Ratios (Monte Carlo)	Govt spending (\$)	Loss to illicit drug enterprises (\$)	Seized weight (kg)
End-product seizures (border)	3	3.65	32,775,000	9,078,500	81 kg
Precursor seizures (border)	3	3.18	16,308,000	6,652,000	48 to 332 kg
Clandestine laboratory detections (domestic)	1	0.48	5,400,000	14,620,000	35-177 kg
End-product trafficking seizures (domestic)	2	1.04	13,893,000	13,516,000	104 kg

Importantly, we need to determine the extent to which the result is driven by uncertainty in these figures or whether it is a robust finding.

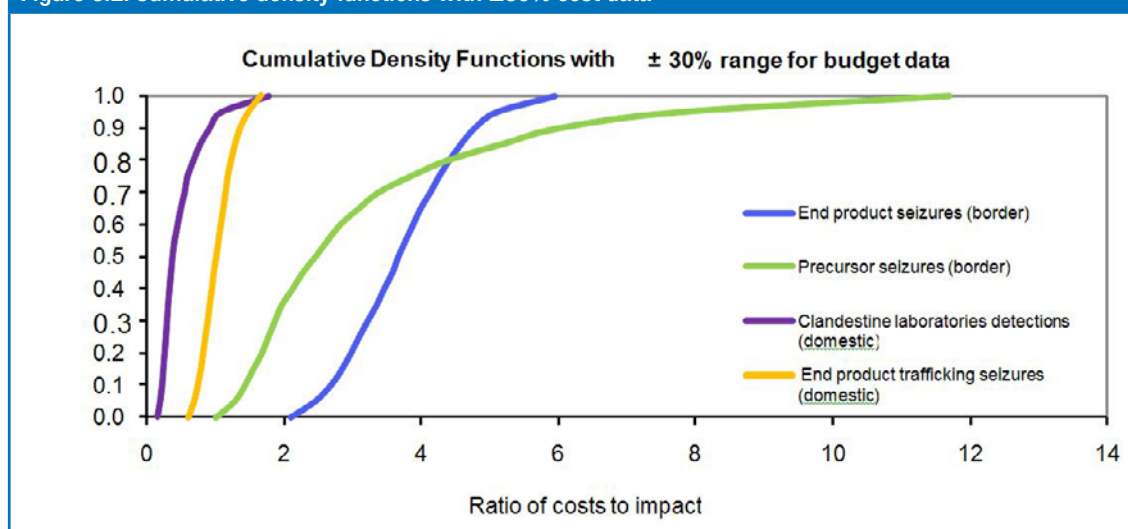
Uncertainty in cost estimates ($\pm 30\%$)

As noted earlier, we chose our main cost uncertainty to be $\pm 20\%$ (and used this in the main results). We also ran the analysis with $\pm 30\%$. The results are provided in Table 6.8. Again, we report the results of comparisons with CDFs (see Figure 6.2). It can be concluded that the $\pm 30\%$ budget range has not impacted on the results. The rank order of the interventions is the same.

Table 6.8: Results of ratio values with $\pm 30\%$ range of cost data

	Rank	Mean estimate	Std. Deviation	Coefficient of variation	5th percentile	95th percentile
End-product seizures (border)	3	3.71	0.79	0.21	2.45	5.10
Precursor seizures (border)	3	3.16	2.01	0.64	1.28	7.79
Clandestine laboratory detections (domestic)	1	0.47	0.29	0.60	0.19	1.07
End-product trafficking seizures (domestic)	2	1.04	0.23	0.23	0.69	1.48

Figure 6.2: Cumulative density functions with $\pm 30\%$ cost data



6.5 Threshold analysis

The clandestine laboratory detections were ranked the highest in costs to impact terms. To determine at which point drug law enforcement targeting the rest of supply chain levels can achieve same ratio as clandestine laboratory detections (domestic), we employed a threshold analysis.

There are two options to improve the impact, either to increase the loss to illicit enterprises by having more seizures or to reduce the police spending. We believe the first option is more feasible than the latter. Thus, we only explore how much greater seizures weights are needed to achieve a similar ratio. The result is provided in Table 6.9. Working from the loss to illicit drug enterprises, at end-product seizures (border) level drug law enforcement agencies have to make \$69.73 million dollars worth of seizures (up from \$9.0m) and \$34.70 million for precursor seizures (border) level (up from \$6.7m) and \$29.56 million for end product trafficking seizures (domestic) level (up from \$13.5m).

To translate the loss into seizure weight, we have to define the price of end product and precursor. If we assume the unit price for methamphetamine was \$217,035/kg (derived from the average of non-crystal form), then police need to make 279 kg of extra border end-product seizures and 74 kg extra at end-product trafficking seizures (domestic). With the unit price of precursor at 35,000/kg, it would take another 11,350 kg of precursor seizure at the border to achieve the same ratio as clandestine laboratory detections.

Table 6.9: Threshold analysis

	Loss has to be	Loss change	Increase in seizure weight, kg	Unit price \$/kg (assumption)
End-product seizures (border)	\$69,734,000	+60,656,000	279	217,035
Precursor seizures (border)	\$34,698,000	+28,046,000	801	35,000
End-product trafficking seizures (domestic)	\$29,560,000	+16,044,000	74	217,035

Note: 1) Unit price of end price is calculated as the average price of non-crystal methamphetamine from our price table.

2) Unit price of precursor is derived from previous chapter as \$35,000/kg.

Another way of thinking about the extent to which ranking of costs to impact across the four interventions is insensitive to our estimates is to vary the law enforcement budget estimates. Doubling the clandestine laboratory budget estimate (from \$5,400,000 to \$10,800,000), produces the same rank order. The cost-to-impact remains lowest for clandestine laboratory detections, even with a doubled spending estimate. Therefore, it is unlikely that our results are explained by an underestimate of the clandestine laboratories budget. Likewise, if we halve the impact (seizure value) of clandestine laboratory detections, the results showed that there is still a 70% probability that the relative order of cost-to-impact ratios stays the same.

If we halve the end-product border seizure budget (from \$32,000,000 to \$16,000,000), the relative order of costs to impact again does not change—clandestine laboratory detections still have the lowest ratio (most preferred option), followed by end-product trafficking seizures (domestic). The order of the two border interventions does change under this scenario, with end-product seizures (border) becoming more preferable than precursor seizures (border).

Finally, of the three states, we had the least data available for Queensland and hence the Queensland estimates were most open to uncertainty. If we exclude Queensland from the analysis (ie to take out both the Queensland law enforcement budget and the Queensland estimate of loss to illicit drug enterprises), the order of the cost-to-impact ratio for the four interventions does not change.

Given the number of tested scenarios, the CDF results and the sensitivity analyses, we are confident that our main finding regarding clandestine laboratory detections achieving on average the greatest impact for the associated costs relative to the other three is highly robust.

6.6 Summary and implications

The key findings of the economic model are that clandestine laboratory detections are the least costly and result in the largest replacement costs to illicit drug enterprises. Efforts directed at clandestine laboratory detections appear to achieve the greatest impact at the least cost when compared with the other three interventions, according to the metric used here.

This result appears robust—halving the monetary value of the loss to illicit drug enterprises for clandestine laboratory does not change the rank order; neither does doubling the clandestine laboratory budgets. Interventions at domestic levels still have lower values (better) than those interventions at the border when impact is measured as the value of seized product.

This result makes sense as clandestine laboratories represent the production level of the market. Production capacity of laboratories can be large and therefore one single law enforcement effort directed at a clandestine laboratory has the potential to result in significant loss of product in the illicit market.

Our results appear broadly consistent with the extremely limited research on cost-effectiveness using economic models—Rydell and Everingham (1994) found that domestic enforcement was more cost effective than interdiction (border control) and source country control. Source-country interventions by drug law enforcement agencies were found to be the least cost effective of all the programs examined. While we were not able to include source country interventions in our analysis, the two border interventions were ranked lower than domestic policing for methamphetamine consistent with Rydell and Everingham's work (1994) on cocaine.

Limitations of the economic model

The costs and impacts were not recorded in an incremental way, therefore, what we calculated was not marginal costs but average costs. This means that the results cannot be generalised for any increase in impact, or comparative increase (or decrease) in budgets. We calculated a single point representing the average costs and average impacts at a single time point. In reality, there are a range of points along a continuum between costs and impacts, depicted as a line or curve between costs and impacts. The assumption of a curve or line is that the relationship between costs and impacts varies at different levels of expenditure. That is, for example, the financial loss to the drug enterprises is an increasing function of government law enforcement expenditure. We do not know other points along the curve and hence our analysis does not accommodate marginal effects; that is, for any increase in costs, the comparative increase (or decrease) in impact.

This economic model examined policing agencies only and did not take a societal perspective. In the current study, expenditure on law enforcement activities directed towards methamphetamine referred to policing costs, such as operational costs, overhead costs and so on. Other drug law enforcement costs, such as the costs of courts, administration of justice and incarceration costs were not included because the economic model focuses on policing, rather than the broader criminal justice system. Future research could adopt the broader, taxpayer (societal) perspective, rather than policing agency perspective.

The budget estimates were difficult in the absence of detailed data—we used provider arrests (as reported in the IDDR, ACC) as the main multiplier to establish the proportion of the police budget attributable to methamphetamine (the remaining proportion would be attributable to other illicit drugs). This assumes that policing costs are relatively similar irrespective of whether the drugs seized are cocaine, heroin, cannabis or methamphetamine. This was a necessary assumption given limited data. Given the extent of sensitivity analyses (Monte Carlo and others) plus the threshold analysis, we found that changing the policing costs estimates was largely insensitive to the main results.

We were unable to use purity-adjusted prices in our economic model and had to resort to using prices alone. There is very limited data available in Australia to permit estimates of purity adjusted price (in fact, no data

connected purity and price, except for judges' comments and this was limited material). We were unable to determine whether criminal networks adjust price, purity and/or both in order to maximise profits. The use of price alone (unadjusted by purity) may underestimate the differences between the law enforcement strategies and hence potentially have resulted in a different rank order, because prices can remain stable (flat) while purity is adjusted. Therefore, we see less difference between the policing strategies by using price alone, rather than purity adjusted price.

We were unable to obtain enough price data for end product and precursors purchased from overseas and had to apply the domestic prices instead for interventions at border levels. This may overestimate the replacement costs at border level (prices overseas are relatively lower than domestic). However, when deriving the results of the order of the ranks, this impact is minimal because even by overestimating the replacement costs, the ratio of cost to impact are still lower than for the other interventions (domestic), which means they are still the least preferred interventions on this particular metric.

The measure of policing impact was the monetary value of seized methamphetamine (or precursor). This is an imperfect impact measure. Drug law enforcement that results in seized product can also impact on the overall capacity of a criminal network. A seizure can disrupt the organisational capacity of the criminal network and in that sense, the weight of the seizure is largely irrelevant—for a small network, it may disrupt their operational capacity; for a larger network or syndicate, it may have minimal impact.

Furthermore, as noted elsewhere, the total loss to illicit drug enterprises is comprised of three components—replacement costs, opportunity costs and avoidance costs. Replacement costs include the value of the product itself, but also other replacement costs including equipment and the like. Thus, using seizure weights measures only one part of the overall potential law enforcement impact.

The final chapter now considers all of the results together, both qualitative and quantitative.

Chapter 7: Discussion

This chapter summarises the main results and associated drug law enforcement implications, across both the economic modelling findings and the qualitative findings. The chapter concludes with identification of limitations and directions for future research.

Previous research has measured the impact of drug law enforcement through changes in market indicators (price, perceived purity, availability), drug-related crime (drug seizures, arrests, other related crime rates) and health-related harms (hospital admissions, drug-related deaths, treatment numbers). However, this work has almost never included an economic assessment. In conducting an economic evaluation, a single metric capable of being translated into a monetary value is required. This perforce limits the outcome measure. In our case, it was the value of the seized product. This gives a limited perspective on law enforcement outcomes and excludes effects such as public safety and deterrence, and therefore means that we underestimate the overall societal impact of drug law enforcement. We have also focused on the impact of discrete law enforcement interventions and have not included estimates of the cumulative impact of the interventions across drug types. Law enforcement interventions taken together may have an impact that is greater than the summed impact of individual interventions.

Drug law enforcement may increase the costs of manufacture and distribution (by seizing products and assets), increase the risks of arrest and imprisonment (opportunity costs) and increase the operational costs of running a business (costs of new avoidance strategies adopted against drug law enforcement). The aggregate costs are the losses to illicit drug enterprises due to drug law enforcement activities. A comprehensive analysis would include each of these aspects and calculate ‘total loss’ due to drug law enforcement. However, we were not able to cost each of these components and hence used only replacement costs (seizures) to represent the loss. To the extent that replacement costs of seizures is proportional to the other costs incurred as a result of law enforcement intervention (ie risk premiums and avoidance costs), replacement costs can be used as a proxy for the total costs imposed. Nonetheless, the use of seizure weights alone remains a significant limitation in the analysis. Poret (2003) argued that the largest costs incurred by dealers are the costs incurred by the risk of detection, arrest, conviction and punishment. Future research should attempt to cost these other elements in evaluating drug law enforcement.

The economic model results indicate that the highest ranked intervention, in terms of average costs to impact, was clandestine laboratory detections. Ranked second was end-product trafficking seizures (domestic); third was precursor seizures and end-product border seizures (with no meaningful difference between these two). We tested these results against a number of uncertainties and conducted threshold analysis. In each case, the result was the same—clandestine laboratory detections were the preferred intervention when compared with the other three on the measure of cost-to-impact.

Clandestine laboratory detections are likely to be most impactful because of the potential for large production capacity in the one site. By seizing a single laboratory, law enforcement can potentially prohibit the production of a large amount of methamphetamine (up to 4.5 kilograms in our modelling). Given what is known about the methamphetamine supply chains and manufacture in particular, if a production cycle is halted, the methamphetamine needs to be replaced (eg by purchasing methamphetamine from a criminal associate in order to on sell to customers).

The economic results regarding clandestine laboratories supplement the qualitative results on changing trends in clandestine laboratory production methods. The increased trend for importation of raw pseudoephedrine combined with the increasing popularity of P2P methods may result in an increase in larger clandestine laboratories in Australia.

The low ratio of costs to impacts for clandestine laboratory detections suggests that offshore activities by law enforcement, where these activities include clandestine laboratory detections may also be particularly

effective. We were not able to evaluate the source country interventions. However, given the very large production cycles common in off-shore manufacture ('superlabs' that can produce more than 4.5kg per cycle), source country interventions need to be evaluated in future research and compared with the other law enforcement interventions covered in this report.

The central role of cooks (as described in Chapter 3) also reinforces this finding regarding clandestine laboratories. Given the specialised nature of the skills required for large scale production, and our data revealing that networks cooperate and share cooks, police efforts directed towards arresting these individuals are likely to produce substantial returns.

Domestic end-product trafficking seizures achieved lower (better) costs-to-impact ratios than either of the two border interventions. There are a number of reasons why this may be the case. First, policing the border is costly. The geographic expanse of the Australian border is vast and requires the operation of two parallel agencies (Customs and the AFP). By contrast, for any one state, domestic end-product trafficking seizures are conducted by only one agency (the domestic police agency). Second, as we have seen from the detailed description of the methamphetamine supply chain (see Chapter 5), the supply chain is bifurcated into an importation supply chain and a supply chain driven by domestic production (see Figure 1). The two parallel supply chains merge at the wholesale trafficking level. Thus, border seizures will impact only on the first supply chain—importation of end product. By contrast, domestic trafficking seizures will impact on both supply chains. Put another way, domestic police have a large pool of methamphetamine 'stock' from which to seize drugs—methamphetamine that is successfully imported plus methamphetamine that is locally produced. Therefore, compared with a relatively expensive border control, the relatively cheaper domestic policing has a higher probability of making seizures of methamphetamine. Similar results may not be found for other illicit drugs such as cocaine and heroin, as the supply chains for these other drugs are not bifurcated in the same way.

Our economic model results appear broadly consistent with the extremely limited research on cost effectiveness using economic models. Rydell and Everingham (1994) found that interdiction cost 1.5 times as much as domestic enforcement and source country interventions cost twice the amount of interdiction. Source-country interventions by drug law enforcement agencies were therefore found to be the least cost effective of all the programs examined. While we were not able to include source country interventions in our analysis, the two border interventions were ranked lower than domestic policing for methamphetamine consistent with Rydell and Everingham's work (1994) on cocaine.

Our economic model did not include the relative impact of precursor regulations and the enforcement of these regulations. Previous research by Cunningham, Liu and colleagues (Cunningham & Liu, 2003b, 2005, 2008; Cunningham, et al., 2009) and by Dobkin and Nicosia (2009) has suggested that the controls on precursor chemicals in Canada and the United States have been effective in the short term (eg evidence that the regulations and associated enforcement action increased methamphetamine price, and decreased purity).

As previously discussed, an important caveat to our results relates to the cumulative impact of law enforcement interventions. Multiple law enforcement interventions directed at different market levels are likely to exert a synergistic impact on traffickers that is greater than the sum of individual interventions. The current project did not examine the impact of multi-pronged interventions.

Due to the methodology and datasets utilised, the impact of precursor chemical seizures at the border may be an underestimate. The estimate of the impact on illicit drug syndicates would possibly be greater if seizures of precursor chemicals were converted to the total weight of methamphetamine; that is, the weight of methamphetamine that would have been produced from the precursors had they not been seized. The replacement costs of this methamphetamine could then be calculated. Nonetheless, given our findings regarding the specialised nature of some criminal groups, especially those who import precursors, our methodology appears reasonable. As groups importing precursors are not likely to be involved in methamphetamine manufacture or distribution, the impact of precursor seizures on these groups is likely to be restricted to the replacement costs of the seized precursors rather than the total methamphetamine that could have been produced.

Similarly, the impact of precursor chemical seizures at the border may be overvalued in the economic model as we based replacement costs on the price paid in Australia (average=\$35,000 per kilogram) rather than the arguably more relevant overseas costs (around \$35 per kilogram). Using the price overseas as a replacement cost for illicit drug syndicates who import precursors would possibly reduce our estimate of the impact of this intervention (we could not apply the overseas precursor price data because of limited data points). For imported methamphetamine (end product), we also used the domestic price. This may lead to overestimating the value of the loss (replacement costs) due to seizures but this would not change the rank order of the cost-to-impact ratio.

Our economic model results only apply to methamphetamine and caution should be taken in attempting to extrapolate to other illicit drugs. For example, border interventions may be less effective for methamphetamine due to the nature of domestic manufacture capability. For other overseas agriculturally grown drugs—such as heroin and cocaine, the order of cost-to-impact of drug law enforcement may change.

The analysis of Australian prices and purity of methamphetamine revealed some important new findings. As expected, we found that the different forms of methamphetamine (crystal versus non-crystal) did differ in price, with crystal forms having higher prices than non-crystal forms. As the prices move down the supply chain, the price difference decreases. Importantly however, we did not find a systematic relationship between higher weights associated with greater purity.

The quantity discount coefficient β is a useful indicator of the size of price mark-ups. We calculated the first estimate for the quantity discount function for both forms of methamphetamine in Australia. The exponent β_1 (quantity discount estimate) for crystal methamphetamine was 0.8727; and for the non-crystal form of methamphetamine it was 0.8453. From these results, methamphetamine seems to be subject to the following pricing rule—for every 10% increase in transaction size, the unit price will fall by 1.21% for crystal form and by 1.47% for non-crystal form. The power law relationship can also describe price mark-ups. If the drugs were adulterated ('cut') four to 10 times by dealers before selling to the next dealer/consumer, the mark-ups can be about 119% to 146%. The mark-ups will be higher with more adulteration. By comparing the quantity discount coefficient with those of other illicit drugs in overseas markets, the high β estimate in Australia may mean that running a methamphetamine drug business in Australia may pose lower risks than in the United States, although this is completely suppositional. More research is needed to find out the quantity discount difference at different levels of supply chain, so that it will better inform drug law enforcement as to which linkage generates the most profit.

A rich examination of the methamphetamine supply chain has been carried out to reveal the structure and interactions among the linkages. While the central role of organised crime groups, such as OMCGs, has been noted previously, we also observed significant diversity in players within the methamphetamine markets, including multiple ethnic groups, other crime syndicates and individuals operating autonomously. Key features of the methamphetamine market operations and structures in Australia revealed that there are four types of groups operating within the methamphetamine market—corporate style, socially bonded, freelance and groups that are blends of two or more types. We found evidence of vertical integration (including employment arrangements) in corporate style groups (eg OMCGs) and in a group that appeared to be a blend of corporate and freelance structures. One example of freelance operations is cooks who often subcontract their services to many criminal groups.

The existence of vertical integration within the methamphetamine market has important policing implications—law enforcement may be more effective when it is targeted at those groups that control several supply chain levels, as the removal of these groups is likely to exert a greater impact on the methamphetamine market compared with groups who are involved at only one level.

We found evidence of cooperation between criminal groups. The effectiveness of law enforcement operations are likely to be enhanced when detailed intelligence is collected on relationships and connections between groups prior to arrests being secured. The additional resources and time spent mapping out these networks may lead to more effective arrests that have a greater likelihood of breaking up several interconnected criminal groups.

Established criminal groups appear to use established techniques and trafficking routes that were once used for other drugs such as heroin. Thus, law enforcement strategies used successfully against heroin are therefore likely to also be effective against methamphetamine.

It is clear from the research that the methamphetamine market is dynamic and constantly changing. Increasing restrictions on the availability of pseudoephedrine in Australia (eg Project STOP, rescheduling of pseudoephedrine-based products) have resulted in a trend of increasing bulk importations of raw pseudoephedrine. With this shift, the interception of precursors at the border will be a priority for law enforcement agencies (especially Customs and the AFP). In addition, the shift to using pre-precursors is a notable trend. Drug law enforcement will need to be responsive to the changes in chemicals used. New methods continue to be invented and used within Australia. Law enforcement will continue to rely on intelligence gathering about manufacture methods to keep abreast of new manufacture processes as they emerge.

There are a number of avenues for future research. The current study did not evaluate the relative effectiveness of source country interventions or precursor regulation. Previous research has been somewhat equivocal on the effectiveness of source-country interventions (and source-country interventions include a wide variety of interventions). The results of our economic model suggest that source country interventions that target large manufacturing operations may indeed be relatively effective (given the significant result for domestic interventions against manufacture operations). Further research is required to investigate this empirically. Previous research suggests that precursor regulation can be an effective law enforcement intervention against methamphetamine (and possibly other synthetic drugs such as ecstasy). Future research is needed to collect relevant data on these law enforcement interventions and to include them in economic modelling.

Future research could attempt to collect more comprehensive data on the elements of the losses to illicit drug enterprises that were not included in our analysis. This could include estimates of risk compensation (risk premiums). However, more detailed price and purity data at every market level would be required (to estimate profits and therefore risk premiums), or high level dealers could be interviewed and their estimates of profits used to estimate risk premiums. This type of research could also test the assumption that the different components of the risks and prices 'tax' fluctuate at the same rate dependant on risk posed by law enforcement (ie avoidance costs, replacement costs and risk premiums increase at the same rate when law enforcement intensity increases).

Given that the supply chain for methamphetamine is different to that of plant-based drugs such as cocaine and heroin, the results of this study are unlikely to generalise to other law enforcement directed at other illicit drugs. The methodology utilised in the current project could however be applied to other illicit drugs such as cocaine and heroin. This will not only permit conclusions to be drawn about the relative effectiveness of law enforcement against cocaine and heroin, but may also lead to some conclusions about the law enforcement interventions, which are more or less effective against synthetic versus plant-based illicit drugs.

This work represents the first attempt to conduct a comprehensive qualitative and quantitative analysis of the methamphetamine market(s) beyond retail level in Australia. The research contains a number of limitations. Nonetheless, the study provides a valuable methodological approach that can be built upon by further research and when better data on price and purity becomes available. We hope the study will be a springboard for such further work.

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Appendices

Appendix A: Key informants

Name	Title	Organisation
Alan Morton	Detective Senior Sgt	Organised Crime Squad, WA Police
Ben Machado	Sergeant	Chem Ops, NSW Police
Bernie Edwards	Detective Inspector	Purana Taskforce
Brian Wilkins	Detective Superintendent	State Drug & Property Crime Group, QLD Police
Dan Coghlan	Dr	Chemical Drugs Intel Unit, NSW Police
Geoff Brown	Sergeant	Drug Desk, Victoria Police
Jason Kelly	A/Senior Sergeant	Purana Taskforce, Victoria Police
Marty Mickelson	Detective Inspector	Illicit Lab Investigation Team, QLD Police
Mike Perkal	Forensic Chemist	Victoria Police
Nick Iorfino	Detective Inspector	Drug Squad, NSW Police
Paul Willingham	Detective Inspector	Head of Special Intelligence Operation, Amphetamine Type Substances & New Synthetic Drugs, ACC
Richard Pieper	National Drugs Coordinator	AFP
Steve McIntyre	Detective Senior Sgt	Clandestine Laboratory Squad

Appendix B: Interview schedule for KI interviews

Domestic

Obtaining precursors within Australia

What costs are involved in obtaining precursors?

Which precursors are obtained? What other chemicals are obtained?

What are the characteristics of the individuals/groups involved?

What methods are used for the acquisition of precursors (chemical factories/warehouses, break and enters of chemists, armed robberies of chemists, pseudo-runners, forging prescriptions, feigning illness at GPs, use of front companies)?

What risks/costs are involved for each method?

How much of the precursor/other chemical is acquired using each method?

What are the usual wages paid to pseudo-runners?

What are the methods and costs for storage of precursors and other chemicals?

What is the incidence of local sourcing of precursors versus importation?

To what extent is there infiltration of chemical industries to source precursors/other chemicals?

Delivery of precursors to manufacture sites

What connections exist between the individuals who obtain precursors and those who deliver the precursors to manufacture sites?

What are the characteristics of the individuals/groups involved?

What methods of transportation are used?

What are the costs of transport?

Over what distances is the precursor transported (eg interstate)?

What modifications are made to vehicles for transportation?

What other methods are used to attempt to evade law enforcement intervention/seizures?

Manufacture of meth

Are different chemical processes used to produce powder, base and crystal (if yes, ask each of the following questions for each form of the drug)?

What are the characteristics of the individuals/groups involved in manufacture?

Where/what sites are used for manufacture? (Rural versus urban? Use of hotel/motel rooms?)

What is the time taken for the manufacture process?

What are the characteristics of the cooks? Are they typically contractors or employees? Some other arrangement?

How much is typically produced?

What are the risks?

How do cooks learn the process of manufacture?

Where are the materials sourced from (eg glassware)?

What the costs of manufacture?

How/where is the drug stored following manufacture?

What methods are used during the manufacture process to evade detection/seizure by law enforcement?

Distribution through trafficking networks (high-level distribution)

Are different distribution networks used to produce powder, base and crystal (if yes, ask each of the following questions for each form of the drug)?

Are different distribution networks used for locally produced versus imported meth?

What are the characteristics of the individuals/groups involved in high level distribution?

What connections exist between the cooks and those involved in high level distribution?

What methods are used to transport the drugs? What are the costs involved? What are the risks involved for each method?

Over what distances is the drug transported? Interstate?

What are the costs of the drug at this level?

What other costs are involved (eg substances for cutting the drug)?

How much of the drug is typically transported/distributed at this level?

How many levels? Is there a hierarchy?

Are contractors/employees used for transportation/distribution?

What methods are used for storage? Costs? Risks?

What methods are used to evade law enforcement detection/seizures?

Transports/couriers (mid-level distribution)

Are different distribution networks used to produce powder, base and crystal (if yes, ask each of the following questions for each form of the drug)?

What are the costs involved?

How much of the drug is transported? That is, what size are packages?

What methods are used for transportation/distribution?

What methods are used to evade law enforcement/seizures?

What risks are involved?

What methods are used for storage?

International

Obtaining precursors (offshore)

What precursors are used? What other chemicals? Where are the precursors and other chemicals sourced from?

In which countries?

Who is involved in obtaining precursor chemicals? How do they go about it?

What are the costs involved in sourcing the chemicals?

What methods are used to avoid detection by law enforcement personnel?

Importation of precursors into Australia

Which precursors and other chemicals are imported into Australia?

Which countries are the source of these precursors?

Who is involved? What are the typical characteristics of the individuals/groups involved?

Which routes are used to import the chemicals?

What methods of transportation/shipment are used to import the chemicals?

What techniques are used to avoid detection by law enforcement personnel?

Delivery of precursors to manufacture site (offshore)

What connections exist between the individuals who obtain precursors and those who deliver the precursors to manufacture sites?

What are the characteristics of the individuals/groups involved?

What are the costs? What are the transport costs?

What types of transportation/shipments are used?

Manufacture of meth (offshore)

Which countries are involved in meth manufacture?

What methods of production are used? What are the costs involved? What are the risks involved?

Does the method for production differ for powder/base/crystal?

How long does production take? Does the time taken differ for powder/base/crystal?

Importation of end product to Australia

Are there differences in the way/s powder/base/crystal are imported into Australia? (If yes, ask the following questions for each form of the drug)

What are the characteristics of the individuals or groups involved in importation?

Which countries is meth being imported from?

What transport routes are used?

What methods of shipment are used (air/sea/mail)?

What techniques are used to evade law enforcement personnel/seizures?

What costs are involved in the importation?

What are the risks involved in importation (for each method of import)?

Concluding comments/questions

Do you have any other comments? Anything not covered?

If you think of anything, please get in touch.

Is it ok to contact you if we have further questions down the track?

Can I confirm your contact/postal details so we can send summary of interview results to you?

Appendix C: List of cases

Adams v R; CCA 2006/61	R v Wilkins [2007] NSWDC 65
Alameddine v R [2006] NSWCCA 317	R v WILSON [2002] NSWCCA 288
R v Robert James BURGESS (2006) NSWCCA 319	R v Zdravkovic [2004] NSWSC 431
R v Campbell [1999] NSWCCA 332	R. v. HEARD [2000] NSWCCA 107
Diesing & Ors v R [2007] NSWCCA 326	R v Arian [1999] NSWCCA 331
DO, Van Nghiem v R [2008] NSWCCA 34	R v B D [2001] NSWCCA 184
Hamieh v R [2007] NSWCCA 277	R v Bigic [2000] NSWCCA 9
Jackwitz v R; Franklin v R [2006] NSWCCA 419	R v CHEIKH; R v HOETE [2004] NSWCCA 448
LANGHAM v R [2006] NSWCCA 306	R v Coates & Murphy [2002] NSWCCA 481
MRN v R [2006] NSWCCA 155	R v COOK [2002] NSWCCA 240
R v 'S' [2000] NSWCCA 13	R v Ha [2004] NSWCCA 386
R v Bera [2001] NSWCCA 205	R v Hansel [2004] NSWCCA 436
R v Bimahendali [1999] NSWCCA 409	R v Karabatsos [2002] NSWCCA 526
R v Bowman & Anor [2002] NSWCCA 449	R v Leslie KALACHE [2000] NSWCCA 2
R v Bowman [2001] NSWCCA 449	R v Marchando [2000] NSWCCA 8
R v El-Azzi [2004] NSWCCA 455	R v Marchione [2002] NSWCCA 131
R v Emanuel [2004] NSWCCA 267	R v Morres George [2002] NSWCCA 419
R v Kouroumalos [2000] NSWCCA 453	R v Nguyen; R v Pham; R v Vu; R v To [2005] NSWCCA 362
R v Lin & Lau [2006] NSWDC 143	R v Novakovic [2004] NSWCCA 437
R v Jaouhar [2003] NSWCCA 266	R v Pedavoli [2002] NSWCCA 87
R v PARKER [2002] NSWCCA 330	R v Drury [2006] NSWDC 47
R v Rao [2006] NSWDC 91	R v Scott [2000] NSWCCA 313
R v Roberts [2004] NSWSC 514	R v Spicer [2003] NSWCCA 108
R v Zerafa [2003] NSWCCA 101	R v TO Si Thanh [2007] NSWCCA 200
R v Williams [2005] NSWCCA 355	R v Walsh and Little [2005] NSWSC 125
R v Marchando [2003] NSWCCA 71	R v Watkins [2000] NSWCCA 151
R v Thomson [2000] NSWCCA 294	R v. DOLMAN [2001] NSWCCA 99
R v Tolley [2004] NSWCCA 165	SCICLUNA v R [2007] NSWCCA 120
R v W [2002] NSWCCA 192	

Appendix D: Estimating the costs of incarceration

There has been little effort to evaluate the cost of incarceration for inmates, partly because overall it is difficult to quantify and researchers appear to lack interest in this topic. Imprisonment may impose costs on inmates by way of foregone income, impair prospects of job stability and harm marital/family attachments (Brown, 2004; Donohue & Siegelman, 1998; Lott, 1992).

The opportunity cost of wage loss while in prison cannot be directly observed and is usually estimated through forgone earnings the individual would make in their best alternative job plus a risk premium²². There is no research that has evaluated the opportunity cost of imprisonment wage loss for criminals. However, researchers from other disciplines have estimated the opportunity cost of an individual's time. Some examples are decisions to improve transportation networks (which may save workers' commuting time), health policies on the health and cost effect of using home care (which values the caregivers' time), environmental policies that improve the quality of outdoor recreation activities (which may involve recreationists' travel time and on-site time) and so on.

In the labour demand literature, often the wage rate is used as a proxy of an individual's time when individuals work with flexible hours²³. They can perfectly substitute between work and time at the marginal cost of wage rate. For example, Morey et al. (1991) assumed that the value of time for all individuals in a sample group in marine recreational fishing was equal to the average minimum wage rate. Yet the difficulty lies in other situations²⁴ if individuals are unemployed most of time or may not earn observable wage, which is true for some cases in our research. Clearly, if a person chose not to do the paid work then s/he must attach more value to the benefit obtained using the time in another way than to benefits s/he would accrue being employed. The only exception is where the person is unable to find work. Others have introduced another indicator – the shadow wage. Researchers (Feather & Shaw, 2000; Lew & Larson, 2005, 2008) incorporated different work involvement activities by measuring the SVLT (shadow value of leisure time) for the opportunity cost of time.

In a labour market, it is generally assumed that the value of individual's time in an activity is at maximum equal to the wage rate or at minimum zero (Cesario, 1976; McConnell 1975; McConnell & Strand, 1981). Moreover, the upper bound can be of two or three times the wage rate in the sensitivity analysis (Shaw, 1992). The authors would argue that the opportunity costs of incarceration time on wage loss would be no different to the situation of leisure and recreation activities except that the former activity is passively complied with because of the illegal activities. Thus, in our study, the proxy is the average weekly wage in Australia of AUD\$856.9 in 2006–07 (Australian Bureau of Statistics, 2006, 2007) and the upper bound is three times the wage rate.

If prisoners worked in legitimate jobs before incarceration, the length of incarceration would also cause lost experience, which is another component to the opportunity cost of imprisonment. Donohue and Siegelman (1998) cited from their previous work, estimating that the value of the cost of year of lost experience could be as high as US\$10,000 (in 1993 dollars). Lott (1992) measured the income loss of drug criminals once they returned to the legitimate labour force as to the impact of stigma and estimated that the reduction in income from a drug conviction accounted for between 35 and 96 percent of the total average pecuniary penalty. While we think it is likely that loss to future employment opportunities in job experience and in families' attachment are high, we do not include these in our estimation because their magnitude is uncertain and we choose to be

22 For more discussions on risk premium, see Reuter & Kleiman (1986).

23 Examples of flexible workers are self-employed professionals and individuals working second jobs or part-time jobs, etc.

24 In labour supply economics, four conventional categories describe the involvement of individuals with a labour market: (i) workers with flexible hours; (ii) non-workers who are unemployed and two types of workers with fixed work hours; (iii) over-employed who prefer fewer working hours; and (iv) under-employed workers who work fewer than they would prefer.

conservative in making our estimations. In this study, we only include the opportunity cost of the wage loss of incarceration, home detention, periodic detention and community service orders.

After an intensive literature review, only NSW BoCSAR issued the criminal courts statistics, which included the number of persons found guilty for amphetamine offences (as the principal offence) and the average penalty (eg months imprisonment). This includes information for both local courts and high courts. However, Victoria Sentencing Advisory Council had records of sentencing outcomes but only for local courts. The penalties vary between states. With limited data, it is very difficult to apply those data to other states. The original plan to estimate the risks of arrests and imprisonment was therefore dropped even though it is an important component of the losses.

Appendix E: Different legislation on drugs (methamphetamine)

State	Name of Legislation	Trafficable quantity	Small quantity	Indictable quantity	Commercial quantity	Large commercial quantity	Marketable quantity	Dangerous	Particular dangerous	Pages
NSW	Drug Misuse and Trafficking Act 1985	3g	1g	5g	250g	1,000g				Schedule 1
QLD	Drugs Misuse Regulation 1987							2g	200g	38–39
VIC	Drugs , Poisons and Controlled Substances Act 1981	3g	0.75g		100g	750g				26
Federal	Criminal Code Act 1995	2g			750g		250g			473

Appendix F: Estimation for Queensland replacement cost in end product trafficking seizures (domestic)

For Queensland, we do not have seizure weights of methamphetamine from the domestic end-product trafficking seizures level and therefore could not estimate the replacement cost in the same way as we were able for Victoria and NSW. To overcome this, we had to estimate the replacement cost of seizures for Queensland from the costs of Victorian and New South Wales seizures. Two steps were required: estimating weight and estimating cost. Table F.1 shows the data obtained from police services in Victoria and New South Wales and the IDDR report (2006–07). Victorian and NSW Police reported domestic seizures of amphetamines and the IDDR report recorded the total ATS seizure weight for Victoria, New South Wales and Queensland, but did not detail to methamphetamine level. From state police data sources and the IDDR report (2006–07), the proportion of methamphetamine (over 3g) against the total ATS seizure weights for Victoria and New South Wales was 32% and 79%, respectively. We assume that the proportion for Queensland falls between the range of the other two states and chose the high value as the main estimate. Combining the three estimates, we derived 10.32 kg as the low estimate and 25.34 kg as the high estimate (main estimate) for Queensland.

Table F.1 Estimation of methamphetamine seizure weight for QLD

Item		Vic	NSW	Qld estimation	
				Low	High
Domestic seizure Amphetamines (police data, kg)	>3g	18.63	60.12	10.32	25.34
	Total seizure	19.08	61.90		
ATS seizure (IDDR 2006/07,kg)	Total seizure	23.59	186.87	32.09	
% of Amphetamines(>3g)/total ATS		79%	32%		

With the total methamphetamine seizure weights (above 3g) estimated, we move to step two—calculating the cost of seizure. The price–power relationship functions are not used because we do not have each single seizure weight but only the total weight. So we have to take another approach. We speculate that there is a positive relationship between seizure weight and replacement cost and the rule will apply to Victoria, New South Wales and Queensland.

The replacement costs for Victoria and New South Wales were calculated based on detailed seizure weight for each seizure, which reported three values for replacement cost—minimum, medium and maximum. We did regression analysis based on weight and replacement costs to estimate the replacement cost for Queensland. Three regressions analysis were made to derive the value of minimum, maximum and main estimate. With minimum replacement cost of Victoria and New South Wales and their seizure weights, we estimated the relationship of the data in SPSS (the 18th version). The best fit relationship is exponential function ($Y=ce^{(b)X}$, where Y =replacement cost, X =seizure weight). The parameter estimates of c and b are reported in Table G.2. With the seizure weight of 25.34kg, Y estimate (for minimum) was 2.12m. Next, we applied the same approach to the estimate for high and median categories.

Table F.2 Parameter estimates for regression results

	MIN	MEDIAN	MAX
c	867,918	1,339,431	1,829,166
b	.035	.031	.028

Table F.3 Estimation of QLD seizure replacement cost at end product trafficking seizures (domestic)

State	Replacement cost, \$			Seizure weight, kg
	MIN	MEDIAN	MAX	
Vic	1,570,000	2,326,500	3,083,000	18.63
NSW	6,652,000	8,265,000	9,878,000	60.12
Qld	2,123,000	2,927,000	3,724,000	25.34

Note: 1, QLD seizure weight is estimated.

2, QLD replacement cost figures are those included in the results with rounding.

Appendix G: Raw data for precursor prices: International and domestic

Table G.1 Summary of raw data on prices and mark-ups for methamphetamine precursors, pre-precursors and reagents

	Supply chain	Wt	Price paid	Price sold / value	Source
pseudoephedrine	International (import)			25 kg Drum: Retail = "few thousand"; black-market = up to \$1m	KI 4
pseudoephedrine	International		Pay 50c per pse tablet purchased in bulk; e.g. 5 million pseudoephedrine tablets	\$30-40	KI 2
pseudoephedrine	International (south east Asia)	Kg		Retail value in SE Asia: 40 dollars a kilogram through to 120 dollars a kilogram	KI 4
pseudoephedrine	International (China, Asia)	Kg	\$40 kg purchased in China (e.g., on internet)	sold in Australia for \$15,000 a kilogram	KI 3
pseudoephedrine	International (China, Asia)	Kg	\$2500 kg purchased in China	\$35k to \$40 k	KI 12
pseudoephedrine	International (Canada)	Kg	\$2500 kg purchased in Canada	\$35,000 kg	KI 12
Cold and flu tablets	Domestic		\$15 (domestic pharmacy)	\$60-\$90 per box of 24	KI 1
Cold and flu tablets	Domestic			\$100 per box	KI 8
pseudoephedrine	Domestic		\$800 for 840 cold and flu tablets	\$2400 and \$3200 (when on-sold by offender)	R v Ha 2004
pseudoephedrine	Domestic	Kg	\$2000 pallet of pse tablets	\$10,000 to \$20,000 per kg on black market	KI 2
pseudoephedrine	Domestic	Kg		Retail value = \$6,000 Black market value = \$250,000 per drum (25 kg)	KI 2
pseudoephedrine	Domestic	Kg		\$30,000 a kilogram to buy on back market; \$160 per kg retail	KI 7
Pseudo tablets	Domestic			Paid \$10,000 to buy packets; for every packet he brought back, he got an additional \$50	KI 4
Pseudo tablets	Domestic		30 tablets (60 mg pseudoephedrine)= \$10.00		Cherney, 2005

Table G.1 Summary of raw data on prices and mark-ups for methamphetamine precursors, pre-precursors and reagents

	Supply chain	Wt	Price paid	Price sold / value	Source
Hypophosphorous acid (reagent)		Litre		estimated that could cost up to \$2000 per litre on the black market	KI 4
Sodium acetate (pre-precursor)	Domestic			\$4000 on black market (2x bags) \$400-\$500 is normal retail price (both are selling price of company)	KI 9

1 From AFP raw data, the categories related to meth precursor are pseudoephedrine and phenylacetic acid.

2 For prices extracted from IDDR and IDRS, the minimum and maximum prices are the lowest and highest prices across all eight Australian jurisdictions.

3 For prices extracted from IDDR and IDRS, the minimum and maximum prices are the lowest and highest prices across all eight Australian jurisdictions.

