

**Australian Bureau of Statistics – Macro Economic Research**

**Drug Policy Modelling Program Symposium**

**16 March 2012**

**Adam Gajewski and Derick Cullen**

This paper outlines the concepts, sources and methods used in experimental estimates of the illegal drug economy in Australia. The experimental estimates are the result of staff research and should not be regarded as official statistics. The results will be presented at the March 16 DPMP symposium to seek comment and feedback on the methodology for possible inclusion of these estimates in the Australian Accounts. This final report is for the Australian Institute of Health and Welfare, Department of Health and Welfare and the National Drug and Alcohol Research Centre.

Please do not distribute to anyone outside of your agencies until the work is presented on the 16<sup>th</sup> of March.

This work will be made public on the Drug Policy Modelling Program (DPMP) website shortly before or after the symposium date. Feel free to distribute or share the report with anyone who would be interested in such work once published.

**Measuring the Illegal Drug Economy of Australia in a National Accounts Framework**

**1.0 Introduction**

The Non-Observed Economy (NOE) comprises production activities that are illegal, underground, informal, or otherwise missed by the statistical system. Unless efforts are made to account for such activities, economic indicators are under estimated. A component of the NOE is 'Illegal Production', which includes the illegal drug economy. The 2008 System of National Accounts manual (2008 SNA) and Balance of Payments and International Investment Position Manual sixth edition (BPM 6) recommend that any illegal transactions occurring in a country should be treated the same way as legal transactions and therefore should be included in the country's national accounts. Capturing the value of illegal transactions may vary in importance for each country depending on the size of the markets. Although the 2008 SNA recommends coverage of all forms of illegal production, such production is not covered generally in the Australian System of National Accounts (ASNA).

This paper outlines the concepts, sources and methods used in an experimental estimate of the impact of the illegal drug economy in Australia. The experimental estimates are the result of staff research and should not be regarded as official statistics. The Australian Bureau of Statistics (ABS) seeks comment and feedback on the methodology for possible inclusion of these estimates in the Australian accounts.

Despite the clear guidance by the international standards, due to the difficulty in identifying and valuing illegal drug transactions, no explicit estimates have been included in the current ASNA. The ASNA states: *Because illegal goods and services, such as illicit drugs and illegal gambling, are purchased in the market, their production is included in the SNA93 production boundary. However, because of data limitations, illegal production is not covered in the ASNA,*

The Organization of Economic Cooperation and Development (OECD) handbook ("Measuring the Non-observed Economy") defines the NOE as activities which should be included in National Accounts, but are not covered in statistical surveys or administrative records used in the National Accounts compilation. The handbook outlines five components of the NOE:

**Table 1: Components of Non-Observed Economy**

Economic Underground - Units are deliberately under/over reporting and/or do not register with the tax office	1. Underground production (cash economy) - deliberate concealment of legal activities to avoid tax payments.
	2. Illegal production - covers activities forbidden by law where there is mutual consent (eg. illegal prostitution or illegal drug production).
	3. Informal sector production - broadly characterised as consisting of units engaged in the production of goods or services with the primary objective of generating employment and incomes to the persons concerned.
Other Non-Observed Economic activity	4. Household production for own final use - includes production of crops, livestock, construction of own houses, imputed rents, and domestic services.
	5. Statistical underground - production missed due to deficiencies in data collection e.g undercoverage of enterprises, non - response, under reporting.

Transactions in the underground economy that escape measurement have implications for the quality of the national accounts and other business statistics. The ABS has already undertaken extensive research and action regarding its treatment of the underground economy in the estimation of Gross Domestic Product (GDP). Currently, in the Australian National Accounts, explicit upward adjustments are made to account for underground activity. Additionally, a wide variety of data sources and cross checks are used that assist in the indirect capture of underground activity. It is therefore considered unlikely that the current estimates of GDP are understated to any significant degree due to missed underground activity. The ABS undertakes periodic reviews as part of an ongoing quality assurance program. This paper is a further effort to reduce any understatement due to missed activity.

## 2.0 Concepts

The Illegal Drug Economy is defined as the market for transactions involving illegal drugs where there is mutual consent between parties. Theft is not a transaction involving mutual consent and is not considered. Unreported transactions in legal drugs used, such as alcohol and tobacco, are a component of under-reporting, but are not covered in this paper.

2008 SNA, Chapter 6 paragraphs 43 - 45 states that:

*6.43 There are two kinds of illegal production:*

- a. The production of goods or services whose sale, distribution or possession is forbidden by law;*
- b. Production activities that are usually legal but become illegal when carried out by unauthorized producers; for example, unlicensed medical practitioners.*

*6.44 Examples of activities that may be illegal but productive in an economic sense include the manufacture and distribution of narcotics, illegal transportation in the form of smuggling of goods and of people, and services such as prostitution.*

*6.45 Both kinds of illegal production are included within the production boundary of the SNA provided they are genuine production processes whose outputs consist of goods or services for which there is an effective market demand.*

## 2.1 Conceptual Framework

The general framework used is based on a proposed method from the United Kingdom (Office for National Statistics - See References - OECD Workshop)

- Domestic supply of drugs = (domestic production - seizures) + (imports - exports)
- Demand = household consumption

This framework adjusts for the loss on domestic supply from police seizures, as well as making an important assumption on exports. Seizures at the border are reported by the Australian Federal Police (AFP) and Customs. According to analysis done by the Australian Institute of Criminology (AIC), Australian Crimes Commission (ACC) and the AFP the exporting of drugs from Australia is almost non-existent. Therefore it is assumed for this study that an export market does not exist. The AFP does however seize a large amount of drugs being imported into Australia.

Paragraph 12.48 of the SNA describes how 'uncompensated seizures' are treated in the national accounts:

*Governments or other institutional units may take possession of the assets of other institutional units...should be recorded as an increase in assets for the institutional unit doing the seizing and a decrease in asset for the institutional unit losing the asset under the entry for uncompensated seizures of assets.*

It is assumed that seized drugs at the border have entered the economy and are therefore included in these calculations for imports. The assumption is that domestic buyers have either pre-paid or partially paid the international supplier before delivery. Therefore, the seized imports are included as a cost to domestic wholesale suppliers.

The drugs that have entered the economy and are seized by the State Police are also included in calculations. These seizures, according to the ACC, generally target the production or wholesale level. This implies that retail level seizures are very minor and irrelevant to total seizures made. This study assumes that all State Police seizures are taken from domestic producers, not consumers, therefore they are included in domestic production costs.

## **2.2 Accounting Identities and Assumptions**

In terms of the formal accounting identities for estimation of GDP:

### **2.2.1 Measured by Expenditure**

$GDP(E) = \text{Household Final Consumption Expenditure} + \text{Government Final Consumption Expenditure} + \text{Change in Inventories} + \text{Gross Fixed Capital Formation} + \text{Exports} - \text{Imports}$

It is assumed that government final consumption expenditure on illegal drugs is zero, that is all final consumption is by households. Also it is assumed that gross fixed capital formation is zero (the same convention as for small tools) and that exports are zero (from crime intelligence sources - ACC). Change in inventories is estimated as zero. This assumption is made on the basis that distributors do not hold onto the drugs for a lengthy amount of time, in fear of being caught in possession by the police. The roll-over of inventories would be reasonably constant, as it is assumed distributors buy and sell much the same amounts over each time period. Given these assumptions the identity becomes:

$\text{Illegal drug contribution to GDP(E)} = \text{Household Final Consumption Expenditure} - \text{Imports}$

However, it should be noted that some components of these estimates are already included in the national accounts, but attributed to components other than those arising from the illegal drug economy. The principal components already included in the national accounts relate to domestic production costs (intermediate consumption) such as energy, water, and other materials measured from the supply side of drug production. It is probable that these intermediate consumption items have been attributed to household final consumption on the demand side in the national accounts, and therefore undercoverage of household final consumption attributable to the illegal drug economy is approximately equal to the total estimate less measured domestic production costs.

### **2.2.2 Measured by Production**

$GDP(P) = \text{Output} - \text{intermediate usage} + \text{net taxes on production}$

Output = total sales + change in inventories, where change in inventories is estimated to be zero.

Intermediate use = domestic production costs, including seizures and imports

Net taxes are assumed to be zero.

### 2.2.3 Measured by Income

$$\text{GDP (I)} = \text{Gross Mixed Income} + \text{Compensation of Employees} + \text{Gross Operating Surplus}$$

It is assumed that the illegal drug trade is carried out by unincorporated entities (sole proprietors or partnerships) and not corporations. Given the illegal and informal nature of the operations all income is assumed to accrue as Gross Mixed Income, and Compensation of Employees and Gross Operating Surplus are therefore zero.

Gross Mixed Income = domestic production value less costs (including seizures) plus distribution margins

### 2.2.4 Purchasers' Prices, Import Prices and Street Prices

It should be noted that purchasers' and importers' prices require an additional adjustment from street and border prices to account for changes in purity. This is done if researchers want a greater look into the dynamics of the drug market where price changes are affected by the change in quality/purity of the drugs.

The estimate assumes two value adding stages: the wholesale stage (production and imports) and the consumer stage (consumption expenditure). The price in the two markets can be determined through observing quality/purity changes of the drugs at both stages of value adding activity. In practical terms this is observed through prices and purities of seizures at border and street. It is understood (based on advice from the AIC) that prices at both stages are reasonably stable, but demand and supply adjustment is achieved by varying the purity of the drugs. For example, a higher purity for a nominal value indicates a lower price. To obtain better profits, distributors and producers cut their drugs with other substances such as sugar, caffeine, or washing powder. Quite often, the final product consumed on the street has been cut several times to be only 10-20% pure (each distributor level will cut the drug).

For the purposes of this study, both nominal and adjusted results are shown.

## 2.3 Scope of the Study

The greatest challenges in forming an estimate for the illegal drug market are data limitations and accuracy of the information available. For this reason many sources were used to help achieve the results and make any necessary assumptions. These sources are listed under 'Data Sources and References'. In Australia, there is a wide range of illegal drugs consumed; this includes cannabis, cocaine, MDMA caps (ecstasy), LSD (acid), methamphetamines, amphetamines, heroin, 'magic mushrooms', and a range of illegally purchased pharmaceuticals. Due to the nature of the market and data limitations, it is impossible to estimate the value added of each illegal drug consumed. This investigation is limited to the most commonly used drugs in Australia; these are cannabis, amphetamines (including methamphetamines and other similar forms of amphetamines), MDMA (ecstasy), heroin and cocaine. An annual time series has been derived over 7 years from 2004 to 2010.

## 3.0 Methodology

**Table 2: Summarised Methodology for each component**

Data Item	Method
3.1 Quantity Consumed	Quantity Consumed = Number of users * quantity of drugs consumed (for each type of drug)

3.2 Price Adjustments for Purity	Adjusted Price = Nominal Price [t] * ( Purity [t-1] / Purity [t] )  note: different purity adjustments are made for the wholesale and retail stages
3.3 Domestic Production Cost (includes Domestic Production Seizures Cost)	Domestic Production Cost = Unit Costs * Quantity of Production for each drug
3.4 Domestic Production Seizures Cost	Domestic Production Seizures Cost = Unit Costs * Quantity of Seizures for each drug
3.5 Import cost (a)	Import Cost = Wholesale/Import Price (nominal) * Quantity of Imports for each type of drug
3.6 Household final consumption expenditure (HFCE) (a)	HFCE = Street Price (nominal) * Quantity Consumed
3.7 Gross Value Added (GVA)	<ol style="list-style-type: none"> <li>1. GVA (I) = Distribution margins + (domestic output - domestic production cost)</li> <li>2. GVA (E) = HFCE - import cost</li> <li>3. GVA (P) = Output – Intermediate Usage</li> </ol>

**(a) Both can be calculated using adjusted prices**

Each component in table 2 is studied in detail below (HFCE and GVA are shown in results).

**3.1 Quantity Consumed**

3.1.1 Number of Users

Usage data is provided by the Australian Institute of Health and Welfare for 2004, 2007 and 2010. This data is collected every three years in the 'National Drug Strategy Household Survey' (NDSHS). For this study, the ABS has used 3 NDSHS reports for the years listed above. For the years in between 2004-2010 where usage data is not available, the ABS has modelled and imputed its usage numbers. The modelling was based on the AIHW data for 2004, 2007, and 2010. Other sources used included The Ecstasy and Related Drug Reports (EDRS) and The Illicit Drug Reports (IDRS), both produced annually by NDARC. The results for the modelled years should be interpreted with caution, as EDRS and IDRS reports are based on recent drug users and not the entire population (as is the case with the NDSHS). The EDRS is based on recent ecstasy users and the IDRS samples recent users who inject drugs.

User data from the NDSHS is split into five categories: 'recent users' for every day, week, month, quarter and year. Although the headline recent user percentage has been estimated for each drug based on available information, the breakdown into the categories has been linearly estimated between the percentages given by AIHW in 2004, 2007 and 2010. The data is given as shown below for each drug category:

<b>Table 3: Recent Users</b>
% of total population whom are <b>recent users</b>
Of recent users , % who use every day
Of recent users , % who use once a week or more <b>(a)</b>
Of recent users , % who use about once a month
Of recent users , % who use every few months <b>(b)</b>
Of recent users , % who use about once a year

**(a) Assumption is made for category 'once a week or more' that users use twice a week**

**(b) Assumption is made for category 'every few months' that users use once a quarter**

From the above information, a total number of recent users can be calculated using the Australian population aged 14 or over. For this investigation, it is assumed there are no illegal drug users below the age of 14.

- Number of Recent users = (Population of Australians aged 14+) \* % of population whom are recent users

'Users on any one day' is calculated from the 'Number of Recent users'. For the at least once a week, month, quarter and year users, an 'average per day' number is created for each category. This process is shown below:

- $$NOd = (Re * Nr) + [(Rw * Nr) / 3.5] + [(Rm * Nr) / 30.42] + [(Rq * Nr) / 91.25] + [(Ry * Nr) / 365]$$

where

- NOd = The number of users on any one day
- Nr = Number of Recent users
- Re = Of recent users , % who use every day
- Rw = Of recent users , % who use once a week or more
- Rm = Of recent users , % who use about once a month
- Rq = Of recent users , % who use every few months
- Ry = Of recent users , % who use about once a year

Below is a table of the total number of 'recent users' for each drug over seven years:

<b>Table 4: The Total Number of Recent Users for each drug (a) (b)</b>							
	2004	2005 (c)	2006 (c)	2007	2008 (c)	2009 (c)	2010
Cannabis	1,853,134	1,882,146	1,862,404	1,571,879	1,597,663	1,769,361	1,894,801
Amphetamines	524,781	557,981	507,928	397,288	391,913	386,371	386,319
MDMA (Ecstasy)	557,580	554,650	535,018	604,569	626,708	649,969	551,884
Heroin	44,278	44,972	37,248	34,547	35,307	36,109	36,792
Cocaine	163,994	216,530	194,706	276,374	282,460	324,985	386,319

**(a) The source "Australian Institute of Health and Welfare" defines 'Recent Users' as users within the last 12 months.**

- (b) The recent user percentages have been applied to ABS statistics on populations aged 14+**  
**(c) Estimates for these years are modelled**

The above numbers highlight the popularity of cannabis among drug users. Over the seven year period the number of recent users has remained steady. Drugs that are gaining in popularity include MDMA (ecstasy) and cocaine, although MDMA usage, against the trend, fell in 2010 below its 2004 level. Amphetamine/methamphetamine and heroin are becoming less popular among Australians. These numbers are independent of one another, so a cannabis user could also be included in as an amphetamine and cocaine user.

### 3.1.2 Quantity of Drugs Consumed

For all drugs, with the exception of cannabis, an 'average quantity used by users on any one day' was calculated for the whole user population of the particular drug, whether used once a day or once a year. This average quantity used per person 'on any one day' was then multiplied by 'users on any one day' to estimate the total amount consumed on any one day in Australia.

For cannabis, the methodology differed depending whether users were regular or casual smokers. Regular smokers were classified as once a day or once a week users. Casual smokers were deemed as once a month, once a quarter and once a year smokers. Regular users smoked greater quantities compared to casual smokers on any given day. Yet although they smoked more, they also received greater discounts as they bought cannabis regularly in bulk. Information on quantities consumed was gathered from a variety of sources including the NDSHS reports, the EDRS reports and the IDRS reports.

Example: Cannabis Consumed (2007):

For Casual Smokers:

Average number of cones or joints smoked on any one day = 2.7  
Average quantity of cannabis in a cone or joint (grams) = 0.4  
The number of users on any one day (once a month, quarter and year users) = 11,175

Total amount of cannabis consumed on any one day = Avg number of cones or joints smoked on any one day \* Avg quantity of cannabis in a joint (g) \* The number of users on any one day  
Total amount of cannabis consumed on any one day =  $(2.7 * 0.4 * 11,175) / 1000$   
Total amount of cannabis consumed on any one day = 12.07 kilograms

It is recognised that joints and cones differ in size and use, yet for simplicity they have been combined into one category for consuming cannabis.

For Regular Smokers:

Average number of cones or joints smoked on any one day = 3.9  
Average quantity of cannabis in a cone or joint (grams) = 0.46  
The number of users on any one day (once a day and week users) = 323,134

Total amount of cannabis consumed on any one day = Avg number of cones or joints smoked on any one day \* Avg quantity of cannabis in a joint (g) \* The number of users on any one day  
Total amount of cannabis consumed on any one day =  $(3.9 * 0.46 * 323,134) / 1000$   
Total amount of cannabis consumed on any one day = 579.70 kilograms

It is recognised that joints and cones differ in size and use, yet for simplicity they have been combined into one category of consuming cannabis.



Therefore,

Total amount of cannabis consumed over the course of the year =  $(579.7 + 12.07) * 365 = 215,996.13$  kilograms

The total consumption amounts are shown below in table 5. The AIHW consumption data is presented in table 6.

(b)	2004	2005	2006	2007	2008	2009	2010
Cannabis	282,959	277,803	265,405	215,996	214,095	231,075	240,873
Amphetamines	6,391	6,236	5,101	3,573	3,251	2,944	2,687
MDMA (Ecstasy) (a)	2,750	3,057	3,275	4,097	3,901	3,595	2,597
Heroin	2,476	2,387	1,870	1,636	1,534	1,429	1,312
Cocaine	1,301	1,711	1,523	2,136	2,031	2,120	2,220

**(a) For MDMA (Ecstasy) it was assumed that 1 tablet = 0.333 grams as the data was provided in tablet denominations.**

**(b) Numbers have been rounded**

Consumption patterns mirror user numbers. Although cannabis consumption dominates the drugs market, it has gradually fallen over the seven years. Amphetamines and heroin have also become less popular. MDMA has grown and then fallen away over the last three years. Cocaine consumption has been growing steadily over the seven years.

		2004	2007	2010
Meth/amphetamines (grams)	Conservative	4,485,256	3,030,012	2,395,860
	Midpoint	8,145,870	7,091,506	4,745,272
	Speculative	13,328,862	12,929,570	8,018,671
Cannabis (cones/bongs)	Conservative	n.a.	866,550,498	981,655,319
	Midpoint	n.a.	993,402,9831	1,135,011,593
	Speculative	n.a.	1,180,671,946	1,362,088,713
Cannabis (joints)	Conservative	n.a.	46,068,569	67,954,323
	Midpoint	n.a.	65,596,517	94,111,975
	Speculative	n.a.	93,778,360	131,809,313
Cocaine (grams)	Conservative	n.a.	371,926	1,412,584
	Midpoint	n.a.	926,032	2,294,515
	Speculative	n.a.	1,691,072	3,487,615
Ecstasy (Pills)	Conservative	7,362,513	9,837,781	5,953,909
	Midpoint	18,724,036	25,044,674	13,895,723
	Speculative	34,605,660	46,437,982	24,531,239

Heroin (Hits)	Conservative	4,948,311	9,524,129	3,190,075
	Midpoint	5,473,111	12,630,364	4,846,433
	Speculative	6,227,699	17,164,072	7,281,075

(a) Data is weighted to represent the Australian population 14+

(b) Data source: This data has been collected from the NDSHS by the AIHW. It has been, on request, provided to the ABS by the AIHW.

(c) Total consumption amounts exclude outliers

The study's consumption estimates are generally similar to the midpoint consumption amounts provided by AIHW. It varies in between the conservative and midpoint numbers. AIHW consumption amounts for cannabis and heroin will vary depending on the assumptions chosen for average quantities consumed in joints or cones for cannabis, and the average quantity used in one hit for heroin. As well as presenting our results, further analysis was conducted using the same methodology as presented in this paper, but using the AIHW speculative consumption data.

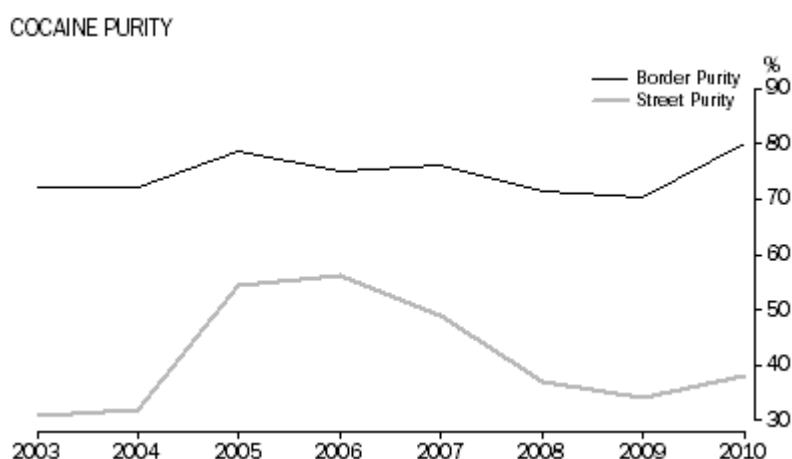
AIHW advised to use conservative or speculative consumption data (the study deferred from this as data was not available for 2004) and confirmed that the speculative data provides a useful upper range estimate of the drug economy. (See 4.6 below)

### 3.2 Price Adjustments

Purity and price data is collected by the Australian Crimes Commission (ACC) by state and by type of drug. Some additional price data was collected from the AIC and AFP. The purity data does not represent the purity figures for all seizures of that drug type, only those that have been analysed at a forensic laboratory. The purity percentages for this investigation were chosen based on the largest samples available. Cannabis is not considered for purity testing, as the quality is assumed to be consistent. It is recognised that the levels of THC or CBD in cannabis could be used for quality or purity estimation, but a lack of any such data does not enable price adjustments.

Examples of purity in the drug market are shown below:

**Graph 1: Cocaine Purity**



The gap between purities at border and street level reflects the demand and supply patterns of each drug. If the street purity and border purity are close together, it is evident that demand for the particular drug is low, as wholesale dealers are not cutting their product due to a fall in the amount of buyers. If the gap between both purities is large, this is an indication that the demand is high for the drug and wholesale dealers are cutting their product more and more to accommodate for the increase

in buyers. The cocaine street purity (shown above) from 2006 to 2009 fell each year, which indicates that dealers are cutting cocaine more and more to supply the increase in demand. Border purity has remained fairly stable around the 70% level, indicating that supply from overseas has remained stable.

Street prices and purity are shown below:

<b>Table 7: Nominal and Adjusted Street Prices (\$ per gram) (a)</b>									
		2003	2004	2005	2006	2007	2008	2009	2010
Cannabis	Nominal (bulk discount regular users) (b)	-	22	22	20	22	20	20	20
	Nominal	-	32	30	30	28	29	31	33
	Adjusted	-	32	30	30	28	29	31	33
	Street Purity (%)	-	-	-	-	-	-	-	-
Amphetamines	Nominal	-	295	302	323	277	281	280	270
	Adjusted	-	192	419	358	183	374	204	442
	Street Purity (%)	13	20	14	13	20	15	20	12
MDMA (Ecstasy) (\$ per tablet) (c)	Nominal	-	40	41	40	40	36	34	37
	Adjusted	-	42	49	34	43	51	34	41
	Street Purity (%)	32	31	26	31	28	20	19	17
Heroin	Nominal	-	300	300	310	300	310	300	300
	Adjusted	-	243	375	359	335	251	268	366
	Street Purity (%)	22	28	22	19	17	21	24	19
Cocaine	Nominal	-	300	328	340	327	327	365	353
	Adjusted	-	292	192	329	375	433	397	315
	Street Purity (%)	31	32	55	56	49	37	34	38

(a) Numbers and percentages have been rounded

(b) Nominal bulk discount calculated based on the 14g (half ounce) price

(c) MDMA (Ecstasy) prices are given per tablet

The adjusted prices are calculated using the previous year's purity over the current year's purity, multiplied by the current nominal price. In the table above, the nominal prices have been adjusted by the purities of the drugs; with the exception of cannabis which is considered to have consistent purity. Cannabis prices have remained constant, indicating a stable market with only minimal changes. Cocaine street prices have risen indicating a rise in demand from users. Adjusted prices are higher for the last three years showing that dealers are cutting the drug more and more (purity is falling) to accommodate for the extra demand. The only drug not to follow its demand patterns is MDMA; the demand for the drug has risen, yet the street price has fallen. A possible explanation might be the large increase in supply and the fall of the wholesale nominal prices. This is an indication that the increase in supply exceeds the increase in demand, therefore causing the price to fall.

Wholesale prices and purity are shown below:

<b>Table 8: Nominal and Adjusted Wholesale Prices (\$ per kilogram) (a)</b>									
		2003	2004	2005	2006	2007	2008	2009	2010
Cannabis	Nominal	-	6,000	6,500	8,000	7,500	7,500	7,538	8,305
	Adjusted	-	6,000	6,500	8,000	7,500	7,500	7,538	8,305
	Border Purity (%)	-	-	-	-	-	-	-	-
Amphetamines	Nominal	-	115,000	137,000	137,000	137,000	160,000	155,000	160,000
	Adjusted	-	124,881	118,406	147,379	130,528	157,723	157,444	153,138
	Border Purity (%)	73	68	78	73	76	77	76	80
MDMA (Ecstasy) (\$ per 1000 tablets) (b)	Nominal	-	20,000	18,950	14,500	14,250	16,500	13,730	11,300
	Adjusted	-	17,962	17,881	14,960	12,037	19,129	12,990	11,136
	Border Purity (%)	66	74	78	76	90	77	82	83
Heroin	Nominal	-	200,000	200,000	200,000	200,000	210,000	210,000	210,000
	Adjusted	-	211,923	197,353	256,604	151,429	205,594	198,087	219,256
	Border Purity (%)	71	67	68	53	70	72	76	73
Cocaine	Nominal	-	171,666	171,666	171,666	175,000	171,666	194,500	201,000
	Adjusted	-	171,666	157,706	180,375	171,564	182,919	198,373	175,969
	Border Purity (%)	72	72	79	75	76	72	70	80

**(a) Numbers and percentages have been rounded**

**(b) MDMA (Ecstasy) prices are given per 1000 tablets**

Cannabis wholesale prices have remained reasonably stable increasing slightly over seven years. MDMA (Ecstasy) purity increased to 90% in 2007 suggesting there was a healthy supply coming into Australia from overseas. The popularity of the drug is growing around the world, not just in Australia. The AFP advised that nominal prices of heroin remained stable over the seven year period at \$200,000 per kilogram. Its purity fluctuated greatly; falling over the first four years and then rising over the next three years. This explains the large fluctuations in the adjusted prices. The cocaine nominal price rose in 2009, but was stable for the previous years. The purity has remained fairly stable over the time period.

Movements in prices both at street and wholesale level are affected by many factors and are generally very volatile. Some factors affecting price movement could be weather patterns influencing the making of the drugs (overseas and in Australia) or large enforcement actions by the police disrupting supply patterns.

### 3.3 Domestic Production Cost

Domestic Production is estimated for three drugs: amphetamines, cannabis, and MDMA. Information from multiple sources (AIC, AFP, NDARC - See references) determined the domestic production proportion for these drugs in Australia. Production percentages are:

- Amphetamines - 90% domestically produced, 10% imported
- MDMA (ecstasy) - 5% domestically produced, 95% imported
- Heroin - 0% domestically produced, 100% imported
- Cocaine - 0% domestically produced, 100% imported
- Cannabis - 100% domestically produced, 0% imported.
  - Outdoor (bush) 30% and indoor (hydroponic) 70%

MDMA (ecstasy) is a difficult drug to estimate for producer costs, as many Australian producers import precursors required for making MDMA, but then make the final product in Australia. Due to the large amount of precursor imports, the drug is still considered as being significantly influenced by imports.

Unit production costs for Amphetamines and MDMA are taken directly from the sources (ACC and 'Cost of Meth' paper) and aggregates are calculated as follows:

#### 3.3.1 Amphetamine method:

Total cost of domestic production = (Cost of domestic production per kilogram) \* (Total kilogram amount consumed over the year) \* % domestically produced (0.9)

#### 3.3.2 MDMA (Ecstasy) method:

Total cost of domestic production = (Cost of domestic production per tablet) \* (Total amount of tablets consumed over the year) \* % domestically produced (0.05)

Cannabis production has been calculated using two methods: Outdoor (bush) and Indoor (hydroponic) production.

#### 3.3.3 Cannabis Indoor/Hydroponic:

Indoor (hydroponic) methodology - Assumed to be 70% of total domestically produced cannabis (based on advice from NDARC)

- The methodology is based on the RAND working paper (see references)  
<http://extension.oregonstate.edu/catalog/html/sb/sb681/>
- Cost of Production per pound = materials + lighting + labour + rent (lighting and rent are adjusted based on % changes)
- Cost of production per kilogram = (Total cost per pound) / 0.4536
- Cost of production = [(Cost of Production per kilogram) \* (Total Consumption over the course of the year in kg)] \* 0.7

#### 3.3.4 Cannabis Outdoor bush:

Outdoor (Bush) methodology - Assumed to be 30% of total domestically produced cannabis

- All cost data was gathered from Oregon State University (see references) <http://extension.oregonstate.edu/catalog/html/sb/sb681/>
- Total cost per acre = tillage and planting + hemp seed + fertilizer + irrigation + forage chopper + raking + baling, large square bales + loading and trucking + operating capital interest + pick-up + truck + general overhead + land rent + other machinery and equipment
- Cost of production per pound = (Total cost per acre) / 575
- Cost of production per kilogram = (Cost of production per pound) / 0.4536
- Cost of Production = [(Cost of Production per kilogram) \* (Total Consumption over the course of the year in kilograms)] \* 0.3

<b>Table 9: Domestic Production Cost (a)</b>							
	2004	2005	2006	2007	2008	2009	2010
<b>Total Cannabis Outdoor cost (in \$ Thousands)</b>	<b>247</b>	<b>241</b>	<b>229</b>	<b>187</b>	<b>186</b>	<b>200</b>	<b>209</b>
Cannabis Outdoor cost per kilogram (b)	3	3	3	3	3	3	3
<b>Total Cannabis Indoor cost (in \$ Thousands)</b>	<b>86,591</b>	<b>86,307</b>	<b>83,984</b>	<b>71,851</b>	<b>78,034</b>	<b>91,796</b>	<b>105,690</b>
Cannabis Indoor per kilogram (b)	424	433	445	465	508	554	612
<b>Total Amphetamines cost (in \$ Thousands)</b>	<b>41,726</b>	<b>40,605</b>	<b>34,037</b>	<b>24,480</b>	<b>22,585</b>	<b>21,955</b>	<b>19,124</b>
Amphetamines cost per kilogram (b)	7,055	7,055	7,055	7,055	7,055	7,055	7,055
<b>Total MDMA (Ecstasy) cost (in \$ Thousands)</b>	<b>217</b>	<b>258</b>	<b>251</b>	<b>373</b>	<b>295</b>	<b>270</b>	<b>195</b>
MDMA (Ecstasy) cost per tablet (b)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total heroin cost (c)	-	-	-	-	-	-	-
Total cocaine cost (c)	-	-	-	-	-	-	-
<b>Total Domestic Production Cost</b>	<b>128,782</b>	<b>127,412</b>	<b>118,500</b>	<b>96,890</b>	<b>101,100</b>	<b>114,221</b>	<b>125,218</b>

(a) Total costs are adjusted for seizure costs (discussed under 3.4)

(b) Domestic costs of production were gathered from multiple sources, these are listed under 6.0

(c) There is no domestic production of heroin and cocaine in Australia

The cost of production for cannabis has risen over the seven years, this is mainly due to the increasing popularity of 'hydro' marijuana rather than 'bush'. As it has become increasingly difficult for producers to grow cannabis outdoors, they have switched to indoor production for safety reasons. Also, hydroponic cannabis has grown in popularity among users, therefore suppliers are adjusting their methods of production. This comes at a greater cost as indoor production is much more expensive. The estimated cost of production per kilogram of consumable hydroponic cannabis is \$404.00, compared to \$3.00 for a kilogram of consumable outdoor/bush cannabis.

For both amphetamine and MDMA production, the cost has remained consistent over the five years. The amphetamine trend follows the expected pattern where consumption has fallen, causing the value of production to fall as well - there is less production occurring as assumed by the methodology. The MDMA cost of production has remained nearly constant, even though consumption and users have risen. This is explained by the amount of seizures made by the AFP over the five years. The weight of the seizures made for 2007 was 2617 kilograms and in 2009 it was only 6 kilograms. This explains the large peak in 2007.

### 3.4 Domestic Production and Import Seizures Cost

All seizure data is collected from the ACC and is split into state police and AFP seizures (street and border seizures respectively). The domestic production seizure cost is included in the domestic production cost.

For cannabis and amphetamines, state seizures were included in total unit production costs, yet for MDMA there was only AFP data available. The seizures were broken down to 5% for the domestic production cost and 95% for import seizures (included in import values as it is assumed the transaction has occurred). The AFP seizures of cocaine, amphetamines and heroin have been included in import costs. Also, the state police seizures of cocaine and heroin (100% imported) are not included in calculations, as the seizure numbers are close to zero and irrelevant for these calculations.

### 3.5 Import Cost

Imports are relevant to four drugs: amphetamines (10% imported), MDMA (95% imported), heroin (100% imported) and cocaine (100% imported). Using an adjusted wholesale price (using border purity) and the total quantities consumed, it is possible to determine the amount imported for each drug into Australia. The methods are shown below:

<b>Table 10: Method for Total Cost of Importation</b>		
	<b>Method</b>	<b>Percentage Imported</b>
<b>Amphetamines (a)</b>	(Dealer purchase price per kilogram) * (Total kilogram amount consumed over the year)	10%
<b>MDMA (Ecstasy) (a)</b>	(Dealer purchase price per 1000 tablets) * (Total amount of tablets consumed over the year)	95%
<b>Heroin (a)</b>	(Dealer purchase price per kilogram) * (Total kilogram amount consumed over the year per kilogram)	100%
<b>Cocaine (a)</b>	(Dealer purchase price per kilogram) * (Total kilogram amount consumed over the year per kilogram)	100%

**(a) Dealers/distributors purchase prices per kilogram are equal to the wholesale prices.**



### 3.5.4 Total Imports

	2004	2005	2006	2007	2008	2009	2010
Cannabis	-	-	-	-	-	-	-
Amphetamines	210	107	82	53	94	110	54
MDMA (Ecstasy)	165	186	138	202	185	141	84
Heroin	495	512	384	342	344	332	288
Cocaine	223	328	275	481	460	511	520
<b>Total (Nominal Prices)</b>	<b>1,094</b>	<b>1,133</b>	<b>880</b>	<b>1,077</b>	<b>1,083</b>	<b>1,093</b>	<b>946</b>
<b>Total (Adjusted Prices)</b>	<b>1,125</b>	<b>1,074</b>	<b>1,013</b>	<b>951</b>	<b>1,134</b>	<b>1,079</b>	<b>890</b>

**(a) In this table, Import Values for each drug is calculated using nominal wholesale prices and the total is also shown in adjusted (volume) terms**

**(b) Total import costs are adjusted for seizure costs (discussed under 3.5)**

The total value of drugs being imported into Australia (at wholesale prices) has remained stable over the seven years. Any wholesale price movements will directly impact import values. Amphetamine and heroin imports have dropped off as the demand for both drugs is falling. MDMA imports have fallen over the seven years despite an increase in demand. This is explained by a rise in supply that exceeds the increase in demand. Border purity has increased driving wholesale prices down.

## 4.0 Results

### 4.1 Household Final Consumption Expenditure

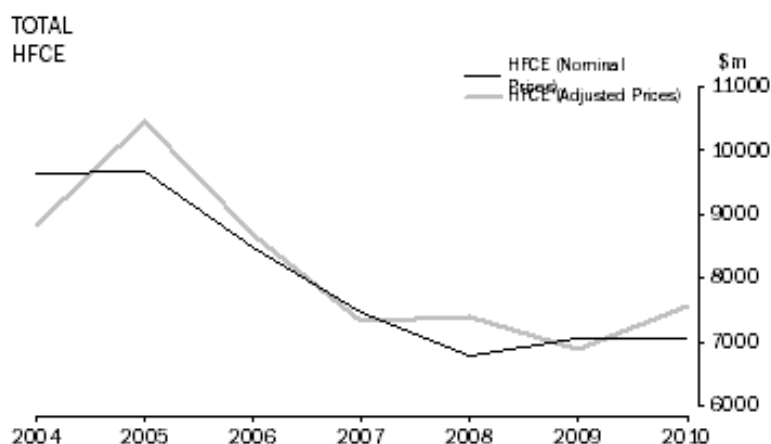
The Household Final Consumption Expenditure is the dollars spent by consumers on drugs. That is the total consumed amount multiplied by the nominal street prices. It must be noted that this process can also be done using adjusted prices to calculate an adjusted volume term for HFCE.

The HFCE for the seven year period is shown below:

	2004	2005	2006	2007	2008	2009	2010
Cannabis	6,274	6,152	5,359	4,778	4,323	4,677	4,889
Amphetamines	1,885	1,883	1,648	990	914	824	725
MDMA (Ecstasy)	330	376	394	490	418	362	288
Heroin	743	716	580	491	476	429	394
Cocaine	390	560	518	699	664	774	783
<b>Total (Nominal Prices)</b>	<b>9,623</b>	<b>9,688</b>	<b>8,499</b>	<b>7,448</b>	<b>6,794</b>	<b>7,065</b>	<b>7,079</b>
<b>Total (Adjusted Prices)</b>	<b>8,824</b>	<b>10,442</b>	<b>8,687</b>	<b>7,316</b>	<b>7,404</b>	<b>6,874</b>	<b>7,574</b>

**(a) In this table, HFCE for each drug is calculated using nominal street prices and the total is also shown in adjusted (volume) terms**

**Graph 2: Household Final Consumption Expenditure**



Both series move in the same direction, but as expected there is much more volatility in the volume adjusted series due to purity changes. HFCE has fallen by over two billion dollars from 2004 (\$9.6b in nominal terms) to 2010 (\$7.1b in nominal terms). This fall can again be attributed to the fall in demand for cannabis, amphetamines, and heroin.

#### 4.2 Gross Value Added

To calculate the Gross Value Added by the drug market trade, all production and import costs are subtracted from HFCE. The results are shown below:

	2004	2005	2006	2007	2008	2009	2010
Cannabis	6,274	6,152	5,359	4,778	4,323	4,677	4,889
Amphetamines	1,675	1,776	1,565	937	819	714	672
MDMA (Ecstasy)	165	190	256	289	233	221	205
Heroin	248	204	196	149	132	97	105
Cocaine	167	233	243	218	204	263	263
<b>Total (Nominal Prices)</b>	<b>8,529</b>	<b>8,555</b>	<b>7,619</b>	<b>6,371</b>	<b>5,711</b>	<b>5,972</b>	<b>6,133</b>
<b>Total (Adjusted Prices)</b>	<b>7,699</b>	<b>9,367</b>	<b>7,674</b>	<b>6,365</b>	<b>6,270</b>	<b>5,796</b>	<b>6,684</b>

The total Gross Value Added from the illegal drug economy in 2010 was \$6.1 billion (nominal prices). The gross value added has fallen over the seven years by over two billion dollars (the fall in adjusted volumes is not as large). This is largely driven by the large reduction in value in the cannabis and amphetamine market, as well as a smaller fall the heroin markets. Amphetamines have been decreasing in popularity steadily over the seven years, but experienced a large drop in 2007 due to a large fall in users. The value of cocaine has been increasing as expected with the demand for the drug increasing and street prices rising. Although the demand for MDMA (ecstasy) has been rising over the last ten years, there was a substantial reduction in value added and HFCE from 2007 to 2010, due to a fall in users.

### 4.3 Overall Summary

The impact of the illegal drug economy to the whole economy is shown below:

- **Total GVA (nominal prices) as a percentage of 2010 Australian GDP is 0.5%**

where Australian GDP (nominal) in June 2010 was equal to \$1.285 trillion

- **Total HFCE (nominal prices) on illegal drugs as a percentage of 2010 Australian HFCE is 1%**

where Australian HFCE (nominal) in June 2010 was equal to \$698 billion

- **Total Imports (nominal prices) from illegal drugs as a percentage of 2010 Australian imports is 0.4%**

where Australian Imports (nominal) in June 2010 was equal to \$259 billion

### 4.4 Supply/Use Table

A Supply/Use table is shown below for the year 2010:

<b>Table 14: Supply-Use table (Adjusted Prices) for the year 2010 (a)</b>						
<b>Supply (in \$m)</b>	<b>Agriculture</b>	<b>Manufacturing</b>	<b>Retail (b)</b>	<b>Domestic Supply</b>	<b>Imports</b>	<b>Total Supply</b>
Cannabis	2000	-	2888	4888	-	4889
Cocaine	-	-	244	244	455	699
Heroin	-	-	179	179	301	480
MDMA (Ecstasy)	-	4	232	236	82	319
Amphetamines	-	370	766	1136	51	1188
<b>Total</b>	<b>2,000</b>	<b>375</b>	<b>4,309</b>	<b>6,684</b>	<b>890</b>	<b>7,574</b>
<b>Use (in \$m)</b>	<b>Intermediate Use</b>		<b>Final Use (HFCE)</b>		<b>Total Use</b>	
Cannabis	-		4889		4889	
Cocaine	-		699		699	
Heroin	-		480		480	
MDMA (Ecstasy)	-		319		319	
Amphetamines	-		1188		1188	
<b>Total</b>	-		<b>7,574</b>		<b>7,574</b>	

(a) Numbers have been rounded

(b) Distribution margins

The above table shows which industries and sectors are affected from the inclusion of the illegal drug economy. An analysis broken down by industry and sectors is essential for these results to be included in the ABS accounts. Cannabis production would appear in agriculture, MDMA (Ecstasy) and amphetamine production would be considered in manufacturing, and any margins made by

distributors would be recorded in the retail industry. All imports of drugs are considered for total supply and would impact the Rest of the World sector. There is only final use of drugs, which is HFCE, but there is no intermediate use.

#### 4.5 Industry Contribution to GDP

A further breakdown of industry contribution from the illegal drug market to GDP is shown below:

<b>Table 15: Contribution to GDP by Industry for the year 2010 (Adjusted Prices)</b>				
<b>(in \$m)</b>	<b>Agriculture (a)</b>	<b>Manufacturing (a)</b>	<b>Retail (b)</b>	<b>Total</b>
Total Supply (a) (b)	2000	375	4309	<b>6,684</b>
Intermediate Use	106	19	-	<b>125</b>
<b>Gross Value Added (Production and Income approach)</b>	<b>1,894</b>	<b>355</b>	<b>4,309</b>	<b>6,559</b>

**(a) For Agriculture and Manufacturing: Value made by domestic producers selling to distributors.**

**(b) Distribution margins (Total = Expenditure GVA method)**

The drugs market will contribute to the agriculture, manufacturing, and retail industries' results. Household spending will increase through HFCE and the Rest of the World sector will be impacted from the imports of drugs. The intermediate use is the domestic production costs incurred by producers to make the drug; this would already be captured in the national accounts, but recorded elsewhere, for example: electrical use in hydroponic cannabis production is recorded as HFCE. The gross value added of the manufacturing and agriculture industries is the value of drugs sold by producers to distributors minus any production costs. The retail gross value added are the margins made by distributors selling to consumers.

#### 4.6 Experimental estimates using AIHW speculative consumption data

Table 16 shows results for 2010 when using speculative consumption numbers supplied by the AIHW (table 6):

<b>Table 16: Experimental estimates using Speculative AIHW consumption data for 2010</b>			
<b>(in \$m)</b>	<b>Results using Speculative Data (Nominal Prices)</b>	<b>Study's Results (Nominal Prices)</b>	<b>Percentage Difference</b>
Cannabis HFCE	7,768	4,889	59%
Amphetamines HFCE	2,165	725	199%
MDMA HFCE	908	288	215%
Heroin HFCE	437	394	11%
Cocaine HFCE	1,229	783	57%
<b>Total Household Final Consumption Expenditure</b>	<b>12,507</b>	<b>7,079</b>	<b>77%</b>
<b>Total Gross Value Added (expenditure method)</b>	<b>11,011</b>	<b>6,133</b>	<b>80%</b>
<b>Total Imports Value</b>	<b>1,496</b>	<b>946</b>	<b>58%</b>
<b>Total Domestic Production Cost</b>	<b>233</b>	<b>125</b>	<b>86%</b>

Using speculative consumption data, total GVA of the drug market as a percentage of 2010 GDP is **0.9%**. As a percentage of the Australian GDP, the illegal drug economy is only a small component, whether using conservative, midpoint or speculative data. Results using speculative data are however, a large absolute change from the study's results (HFCE is 77% higher). This information is useful as it gives an upper range estimate of the illegal drug economy. We hope to receive feedback and comments on which methodology is appropriate.

#### 5.0 Conclusion

Results for the 2010 year suggest Gross Value Added (GVA), Household Final Consumption Expenditure (HFCE) and Imports for the illegal drug economy is 0.5%, 1.0% and 0.4% of total Australian GDP, HFCE and Imports respectively. This paper has applied the OECD recommended methodology to estimate the value of the illegal drug economy in Australia.

It must be noted, that any estimate on such a topic will raise estimation issues. Where necessary, data was adjusted or imputed based on the advice given from a variety of sources. Simplifying assumptions were made where necessary. The greatest challenges in forming these estimates is data shortages in prices, production and consumption amounts. As an example, the only source available

for usage data, 'The National Drug Strategy Household Survey' (done by the Australian Institute of Health and Welfare), is released only every 3 years. Due to this data limitation, usage numbers for 2005, 2006, 2008 and 2009 have been modelled based on the usage numbers of 2004, 2007 and 2010, and the IDRS and EDRS reports from NDARC.

The proposed methodology can be used into the future. After peer review, it is hoped these estimates will be considered for inclusion in the Australian System of National Accounts. The ABS is inviting feedback and comments on the methodology.

## 6.0 Data Sources and References

Some other factors to be considered when utilising the data to develop this assessment:

- The absence of essential information from some records - Required Imputation
- Differences in data between state jurisdictions
- Insufficient drug identification - drugs are sometimes mixed for consumption

The table below lists the critical sources used for obtaining the data - all sources were used in a combination to form this estimate:

**Table 16: Data Sources**

<b>Source</b>	<b>Data</b>
Australian Crime Commission	Pricing, purity, production costs and seizures
Australian Federal Police	Pricing and seizures
National Drug and Alcohol Research Centre	Pricing, usage and consumption
Australian Institute of Criminology	Purity
Australian Institute of Health and Welfare	Users and consumption
Jonathan P. Caulkins, RAND Working Paper - Estimated cost of production for legalised cannabis	Production costs
World Drug Report 2005, MEDFELS 'Cost of Meth' paper	Production costs

References are listed below:

ABS 2010a, Australian Bureau of Statistics, Consumer Price Index Dec 2010, (cat. no. 6401.0)

ABS 2010b, Australian Bureau of Statistics, National Income, Expenditure and Product Dec 2010, (cat. no. 5206.0)

ABS 2010c, Australian Bureau of Statistics, Population by Age and Sex, Australian States and Territories June 2010, (cat. no. 3201.0)

Chris Groom, Tom Davies, Stephen Balchin - Office for National Statistics, Inclusion of Illegal Drugs' transactions in the UK National accounts, Paper is based on OECD/UNESCAP/ADP Workshops.

Australian Institute of Health and Welfare, National Drug Strategy Household Survey - Data on the consumption and usage of drugs in Australia.

Australian Crime Commission (ACC), Illicit Drug Data Reports, Data and information on illegal drugs in Australia - Source for MDMA cost of production, prices, purity and seizure data.

National Drug and Alcohol Research Centre (NDARC) - University of New South Wales, 'Illicit Drug Reporting System' (IDRS) Reports.

National Drug and Alcohol Research Centre (NDARC) - University of New South Wales, 'The Ecstasy and Related Drugs Reporting System (EDRS).

Jonathan P. Caulkins, Estimated cost of production for legalised cannabis, RAND Working Paper, July 2010 - Source for Hydroponic Cannabis Production.

Dr. John Wade, Dr. Linda Keena, MEDFELS - Meth Education for Elementary Schools, Cost of Meth, April 2007 - Source for Amphetamine/Methamphetamine cost of production.

United Nations Office on Drugs and Crime, World Drug Reports for 2004-2010 - World Drug Report for 2005 was another source for Amphetamine/Methamphetamine cost of production.

Dale Gieringer - Drug Policy Foundation Conference 1993, Economics of Cannabis Legalisation, 1993.

Kate Willis - National Cannabis Prevention and Information Centre, Cannabis supply into and within Australia, 2008.

Andreas Schloenhardt - Australian Institute of Criminology, The market for amphetamine-type stimulants and their precursors in Oceania.

Daryl T. Ehrensing - Oregon State University, Feasibility of Industrial Hemp Production in the United States Pacific North-west, 1998.

Reserve Bank of Australia, Exchange Rates, [www.rba.gov.au](http://www.rba.gov.au).

Australian Federal Police – Confidential Statistics

Australian Institute of Criminology – Confidential Statistics

Australian Bureau of Agriculture and Resource Economics (ABARE), Australian vegetable growing farm - An Economic Survey, 2007/08 - Source for outdoor cannabis production

**Contacts for more information:**

**Adam Gajewski - [adam.gajewski@abs.gov.au](mailto:adam.gajewski@abs.gov.au)**

**Derick Cullen – [d.cullen@abs.gov.au](mailto:d.cullen@abs.gov.au)**