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## Prices Legalisation and Marijuana Consumption

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## Abstract

The debate concerning the legalisation of marijuana is intensifying. As the price of marijuana would most likely decrease following legalisation, the law of demand implies that consumption would rise. But by how much? This paper analyses the effect of legalisation on consumption by using data from a specifically-conducted survey of first-year students at The University of Western Australia. The results indicate that 53 percent of all students have consumed marijuana, with males exhibiting a higher intensity than females. The results also show that legalisation would cause consumption to increase by approximately 4 percent. Both legalisation and a 50-percent fall in the price would cause an 11-percent increase in marijuana consumption. For all consumers, the gross price elasticity, which includes the effects of both legalisation and a price change, is estimated to be  $-0.2$ . The net price elasticity, which takes out the legalisation effect, is found to be  $-0.1$ . Accordingly, marijuana consumption is estimated to be price inelastic. While these estimates are low, they are both highly significant, implying that “price matters”, as does legalisation, even for marijuana smokers.

## I. Introduction

Marijuana is the most widely used illicit drug in Western society, and probably in the whole world.<sup>1</sup> For Australia, according to the National Drug Strategy Household Surveys, 32 percent of people (aged 14 years and over) have tried marijuana. Expenditure on marijuana in 1995 has been estimated to be a little over \$5 billion (equivalent to about 1 percent of GDP), or \$351 per capita, which is roughly equal to that on wine plus spirits (Clements and Daryal, 1999).

In recent years, the debate concerning the legalisation of marijuana has intensified. Some argue that legalisation amounts to surrendering too easily, whilst others believe that the “war on drugs” is unwinnable. It is argued that instead of fighting against marijuana at considerable cost, it may be better to legalise it and even use it to generate tax revenue. Several studies have analysed the experience in the US where marijuana consumption has been decriminalised in some states.<sup>2</sup> Studies using data pertaining to the whole population in the US find a significant increase in marijuana consumption due to decriminalisation (Model, 1993, Saffer and Chaloupka, 1995, 1998). In contrast, other studies involving youths find that decriminalisation has no significant impact (Johnston et al., 1981, Theis and Register, 1993, Pacula, 1997). Evidently, as the general population consume less marijuana than the young, their consumption is more sensitive to changes in its legal status. Cameron and Williams (1999) analysed the Australian National Drug Strategy Household Surveys and found that decriminalisation leads to higher marijuana use. Using the same data (but in a different way), Clements and Daryal (1999) estimated the own-price elasticity of marijuana to be  $-.5$ . The only other comparable estimate of this price elasticity is by Nisbet and Vakil (1972), who found the elasticity to be in the range  $-.5$  to  $-1.5$ . Clements and Daryal (1999) also found that legalisation would increase total marijuana consumption by about 13 percent, with most of that accounted for by daily and weekly users.

From an economic perspective, one of the key issues regarding illicit drugs is the price responsiveness of consumption. If marijuana were legalised, in all likelihood its

<sup>1</sup> This paper is based on my UWA honours thesis (Daryal, 1999). I would like to acknowledge the excellent guidance and supervision of Kenneth Clements and the invaluable assistance of Barbara Moyser. I would also like to thank to Paul Miller for his help in conducting the survey, Jan Smith, and the financial assistance of an ECEL Research Grant.

<sup>2</sup> Decriminalisation of marijuana removes criminal penalties associated with the possession of small amounts for personal use. Legalisation involves a further step whereby all sanctions are removed, so that the status of marijuana would be like that of alcohol or tobacco and perhaps have restrictions on advertising and the sale to minors.

price would fall -- what would happen to the quantity demanded? The purpose of this paper is to answer this question. The structure of the paper is as follows. Section 2 applies demand theory to illicit commodities to analyse the effects of legalisation. Sections 3, 4 and 5 employ a specifically-conducted survey of first-year students at The University of Western Australia to estimate the effects of possible legalisation and a fall in the price of marijuana on consumption. Also, estimates of the price elasticity of demand for marijuana are presented. Concluding comments are contained in the final section.

## II. Legalisation and Demand Analysis

Demand theory indicates that the determinants of consumption are income (I), the price of the good in question ( $p_i$ ), the prices of other goods ( $p_o$ ) and other variables such as tastes:

$$q_i = q_i(I, p_i, p_o, \text{other variables}).$$

Consider the case of an illicit commodity such as marijuana. The consumption of marijuana involves risks of fines, in some cases imprisonment and, possibly, other costs associated with the shame of being caught. Consequently, the price of marijuana in its demand function ( $p_m$ ) should be interpreted as being made up of the conventional money cost ( $p'_m$ ) plus the expected "other costs" per unit:

$$(1) p_m = p'_m + \text{additional expected costs of engaging in illicit activity.}$$

Following Becker (1965),  $p_m$  can be termed the "full" price of marijuana.<sup>3</sup> The demand function for marijuana is thus

$$(2) q_m = q_m(I, p_m, p_o, \text{other variables}).$$

Legalisation of marijuana eliminates the risk of getting fined or imprisoned, so the second term on the right-hand side of equation (1) becomes zero. Hence following legalisation,

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<sup>3</sup> Becker (1965) considers the implications for consumption theory of both time and money being required to consume different goods. He uses the term "full price" to denote the sum of the money price of a commodity and its "time cost" (measured in dollars in opportunity cost terms). Thus, although Becker uses the term in a slightly different context, there are enough similarities in the basic idea to use it also for marijuana consumption.

the full price ( $p_m$ ) falls. As indicated in Figure 1, this causes a downward movement along the demand curve.

— There are, of course, difficulties in observing the additional expected costs of engaging in illegal activity. Accordingly, we reformulate the demand function by substituting the right-hand side of equation (1) for the full price  $p_m$  in equation (2) and then absorb the additional expected costs term into the “other variables”, so that:

$$q_m = q_m(I, p'_m, p_o, \text{other variables [including additional expected costs]}).$$

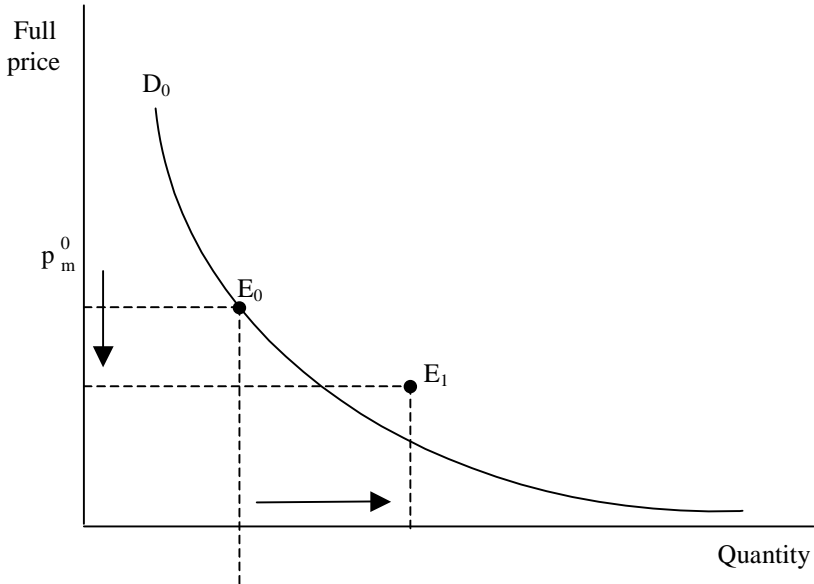
Thus legalisation now has the effect of shifting the demand curve when we have the money price ( $p'_m$ ) on the vertical axis, as indicated in Figure 2. In Figures 1 and 2 consumption increases by the same amount, from  $q_m^0$  to  $q_m^1$ .

Legalisation of marijuana would also be expected to lead to a reduction in the money price of marijuana as, most likely, new suppliers would enter the industry.<sup>4</sup> Accordingly, we next consider the effects on consumption of a fall in the money price following legalisation. This situation is illustrated in Figure 3. At the initial price  $p_m'^0$ , the shift of the demand curve from  $D_0 D_0$  to  $D_1 D_1$  with legalisation causes the quantity demanded to increase from  $q_m^0$  to  $q_m^1$ . A fall in the price of marijuana from  $p_m'^0$  to  $p_m'^1$  causes a movement along the new demand curve  $D_1 D_1$  from  $E_2$  to  $E_3$  and the quantity increases further, from  $q_m^1$  to  $q_m^2$ . Therefore, the corresponding equilibrium point is attained at  $E_3$  following both legalisation and a price fall. Accordingly, we can call the movement from  $E_0$  to  $E_3$  the “gross effect” of the price fall and legalisation, and the movement from  $E_2$  to  $E_3$  the “net effect” of the price fall.

<sup>4</sup> ~~An example of such a price fall~~ is provided by the Dutch experience. In that country so-called “coffee shops” emerged after the de facto legalisation of marijuana; and currently the price of a gram of marijuana in The Netherlands is around half of what it is in Australia (personal communication from The Trimbos Institute, The Netherlands Institute of Mental Health and Addiction, Utrecht).

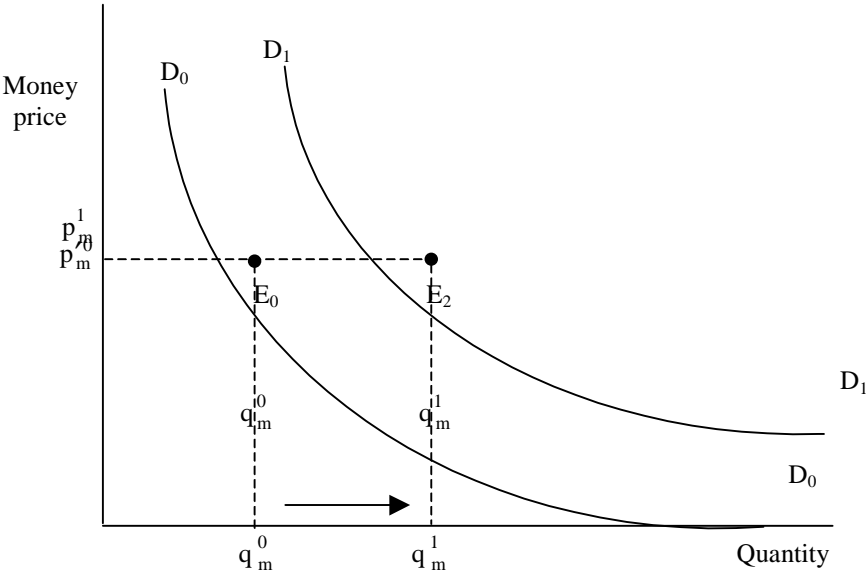
**Figure 1:**

A Movement Along the Demand Curve for Marijuana Due To Legalisation



**Figure 2:**

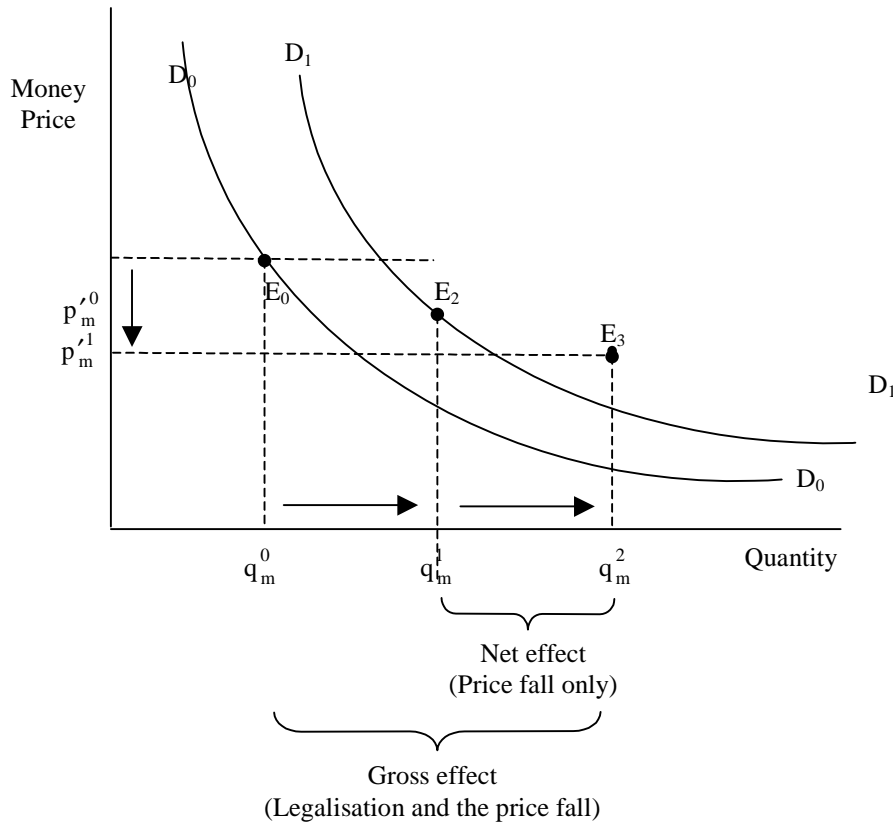
A Shift of the Demand Curve for Marijuana Due to Legalisation





**Figure 3:**

A Shift of the Demand Curve Following Legalisation and a Price Fall



In the above analysis, we have considered the effect of legalisation in shifting the demand curve up and to the right. It should be acknowledged, however, that there is a possibility that the demand curve may shift in and to the left following legalisation. This would be the case if legal sanctions endowed marijuana with the status of a “forbidden fruit” which consumers found to be an attractive attribute. This could be the case for young people in particular. Going back to the discussion of the full price of marijuana, above equation (1), if the forbidden fruit attribute is present the component of the full price representing the additional expected costs of engaging in illicit activity is in fact negative. Such an attitude was revealed in a recent TV program entitled “The Heroin Wars” where a heroin addict was asked what would happen if heroin were to be legalised. He responded that consumption was unlikely to increase substantially because: “Once it is legalised you take the thrill out of it. Part of the high is doing it on the sly.” (SBS, 1999). Although this refers to heroin, it would not be completely unreasonable to expect that the same line of

argument might apply also to marijuana. It may be that the demand curve for marijuana shifts up and to the right for some consumers, and down and to the left for others; the movement of the market demand curve would then depend on the relative strength of the two opposing forces. In Section 4, we provide some evidence regarding this issue.

### III. The Survey

The data used in our analysis was collected by way of a survey in 1998 of students enrolled in the first-year unit at UWA, Macroeconomics, Money and Finance 102. Table 1 gives the characteristics of the students enrolled in the unit and the respondents to the survey. The survey asked if respondents have ever consumed marijuana, how often they consume it and the sex of participants. The survey was administrated in such a way that confidentiality was guaranteed.

Table 2 shows that 53 percent of all respondents have used marijuana, and are classified as “users”; while 47 percent claimed to have never consumed it, and are classified as “non-users”.<sup>5</sup> Consumption of marijuana is higher amongst males than

**Table 1:**

Characteristics of Students Enrolled  
in Macroeconomics, Money, and Finance 102  
AT UWA AND THE SAMPLE

Characteristic	Enrolled in unit	Sample
Number of students	582	327
Number of respondents	-	281
Response rate (percent)	-	86
Sex (percent)		
Male	52	48
Female	48	52
Age (years)		
Median	18	-
Mean	19	-
Origin (percent)		

<sup>5</sup> Once age is controlled for, this finding is consistent with other surveys; see, e.g., the Penington Report (1996, p. 13).

Local	75	-
International	25	-

Source of the enrolment data: Unit coordinator and lecturer Paul Miller.

**Table 2:**

Ever Used Marijuana?

(Number of respondents; percentages are in parenthesis)

Response	Male	Female	All
Yes	82 (60)	67 (46)	149 (53)
No	54 (40)	78 (54)	132 (47)
Total	136 (100)	145 (100)	281 (100)

females -- 60 percent of all male students have consumed it, compared to 46 percent of all females.<sup>6</sup> The hypothesis of independence of consumption and gender is rejected on basis of a chi-square test at the 5 percent significance level.<sup>7</sup> Table 3 presents the results for users classified by frequency of use and by gender. Consider first the results for “all” users, given in the last column. As can be seen, weekly consumption is the most popular frequency, while only a small proportion consume it daily. Interestingly, 20 percent are no longer users; these people tried it at some stage and have not used it in over a year. The most popular frequency for males is weekly (33 percent), whereas for females it is occasional (28 percent). Both daily and weekly consumption is considerably higher

<sup>6</sup> This also agrees with prior results; see the Penington Report (1996, p. 13).

<sup>7</sup> After the survey was completed and the results analysed, it became apparent that if the study were repeated the questionnaire could have been made even stronger by differentiating between local and international students. International students make up about 25 percent of the enrolment in the unit surveyed, and the majority of these students are from Singapore and Malaysia (Paul Miller, personal communication). As in these countries the possession of marijuana leads to very severe punishment, it could be that international students are less likely to use marijuana. Also, the monetary cost of education is much higher for international students than local students. Hence, it could be argued that international students are more inclined to concentrate on their studies and have less time available for recreational marijuana use. There is also a possibility that international students were underrepresented in the survey because a disproportionate share of them may have refused to participate. If we were to conduct the survey again, we would possibly include a question that distinguishes between local and international students.

amongst males than females, implying that males consume marijuana more frequently than females. However, the hypothesis of independence of gender and the frequency of marijuana consumption is not rejected on the basis of a chi-square test at the 5 percent significance level. Accordingly, frequency of consumption does not differ significantly between males and females.

#### IV. The Effects of Legalisation

Legalisation of marijuana would eliminate the criminal sanctions and penalties associated with its consumption. As this would decrease the “full” price, consumption would be expected to rise. The question is, by how much would it rise?

**Table 3:**

Frequency of Marijuana Consumption

(Percentages of respondents)

Frequency of consumption	Male	Female	All
Daily	9	1	6
Weekly	33	25	30
Monthly	17	25	21
Occasional	21	28	23
No longer	20	21	20
Total	100	100	100

The relevant question of the survey asked, “Suppose marijuana is legalised. Assume there is no price change. How much would your consumption of marijuana change?” Table 4 presents the responses, cross-classified by type of consumer and gender. All the estimated consumption changes are positive and the majority are significant at the 5 percent level. These findings do not support the “forbidden fruit” idea, whereby consumption would fall with legalisation as it would eliminate an attractive characteristic

of marijuana. As indicated by the last entry in row 6, for all users, marijuana consumption is estimated to increase by approximately 8 percent following legalisation. As the estimated increase in consumption of those who currently are non-users is less than 1 percent (row 7, column 4), legalisation does not draw in a substantial number of new users. In general, males are relatively more responsive to legalisation than are females; the consumption of all males is estimated to increase by 6 percent, while that of all females increases by 3 percent (see row 8). Considering the differing types of consumer, daily users (row 1, column 4) have the largest response to legalisation, as expected, but this is not significant at the 5 percent level. The estimated rise for weekly, monthly and occasional users (males and females) is estimated to be 9, 8, and 7 percent, respectively, all of which are significant at the 5 percent level. None of the females who are no longer users say that their consumption will increase with legalisation, whilst for males in this category, consumption increases by 5 percent (see row 5). Going down columns 2-4, it can be seen that, in general, more frequent users are more responsive to legalisation than are less frequent users, as one would expect.

**Table 4:**

Percentage Change in Consumption of  
Marijuana Due to Legalisation

(Standard errors are in parenthesis)

Type of consumer (1)	Males (2)		Females (3)		All (4)	
1. Daily users	21.25	(14.80)	.00	(.00)	18.89	(13.70)
2. Weekly users	8.15*	(4.07)	11.18*	(5.08)	9.32*	(3.19)
3. Monthly users	6.79*	(3.38)	9.12*	(4.07)	8.06*	(2.79)
4. Occasional users	10.88*	(4.27)	3.89*	(1.96)	7.29*	(2.35)
5. No longer a user	4.69	(4.67)	.00	(.00)	2.50	(2.48)
6. All users	9.09*	(2.28)	6.19*	(1.78)	7.79*	(1.49)
7. Non-users	.19	(.18)	.38	(.24)	.30*	(.15)
8. All types	5.55*	(1.42)	3.07*	(.86)	4.27*	(.82)

Note: The symbol “\*” denotes significant at the 5 percent level.

The survey also asked, “Suppose marijuana were legalised. Assume that the price of marijuana decreases by 50 percent. How much would your consumption of marijuana change?” In this case, not only are criminal sanctions and penalties associated with marijuana consumption eliminated, but also its price decreases by 50 percent. As illustrated in Figure 3, here two analytically distinction changes occur, (i) the demand curve for marijuana shifts rightward due to legalisation; and (ii) the price decrease causes a downward movement along the new demand curve. As a result of the combined workings of these two effects, consumption rises, by more than in the case of legalisation with the price held constant. The average increases in consumption, following legalisation and the price decrease, are presented in Table 5. The effect is largest for daily users, who say that their consumption will increase by 36 percent. Weekly, monthly and occasional users say that they will increase consumption by 31, 28, and 13 percent, respectively. The effect on the consumption of “no longer users” and “non-users” is very small and insignificant, 2 and 1 percent, respectively. “All users” state they will increase their consumption by 21 percent, while consumption increases by 11 percent for all types of consumers.

**Table 5:**

Percentage Change in Consumption of Marijuana  
Due to Both Legalisation and a 50-Percent Price Decrease

(Standard errors are in parenthesis)

Type of consumer (1)	Males (2)	Females (3)	All (4)
1. Daily users	37.50* (12.50)	25.00 (26.2)	36.11* (11.10)
2. Weekly users	28.33* (4.89)	36.46* (5.69)	31.47* (3.73)
3. Monthly users	28.92* (7.11)	26.46* (6.01)	27.57* (4.53)
4. Occasional users	18.82* (5.81)	8.06* (2.65)	13.29* (3.22)
5. No longer a user	2.19 (1.64)	.71 (.71)	1.50 (.98)
6. All users	22.25* (2.87)	18.65* (2.77)	20.64* (2.01)

7. Non-users	.83	(.59)	.96	(.96)	.91	(.67)
8. All types	13.75*	(1.95)	9.14*	(1.55)	11.37*	(1.25)

Note: The symbol “\*” denotes significant at the 5 percent level.

An element-by-element comparison of Table 5 (legalisation and a 50-percent fall in the price) and Table 4 (legalisation only) reveals that consumption is usually more responsive to legalisation and the price fall than to legalisation by itself. However, the change in consumption of those who are no longer users and non-users is not substantially different in these two cases. The hypothesis of independence of the effects of (i) legalisation only and (ii) both legalisation and a 50-percent price decrease is rejected on the basis of a chi-square test. This means that the price of marijuana has a significant impact on consumption. This can clearly be seen in Figure 4, which plots the consumption changes for all respondents (i.e., males and females). The solid curve, representing the effects of both legalisation and the price decrease, almost always lies above the broken curve that represents the legalisation-only effects. Also, as both curves slope downwards, consumption of frequent users is more sensitive to changes in the legal environment and the price.

As mentioned in Section 1, Clements and Daryal (1999) found that legalisation would increase total marijuana consumption by about 13 percent, whereas our estimate of the effect of legalisation by itself is about 4 percent (see the last entry in column 4 of Table 4). The reason for the substantial difference is because the current study is heavily slanted towards young adults. By contrast, Clements and Daryal (1999) reweighted the findings of the same survey by the estimated total population of marijuana users in order to make the results more representative of what would happen to per capita consumption in Australia as a whole.

## V. Price Elasticity of Demand

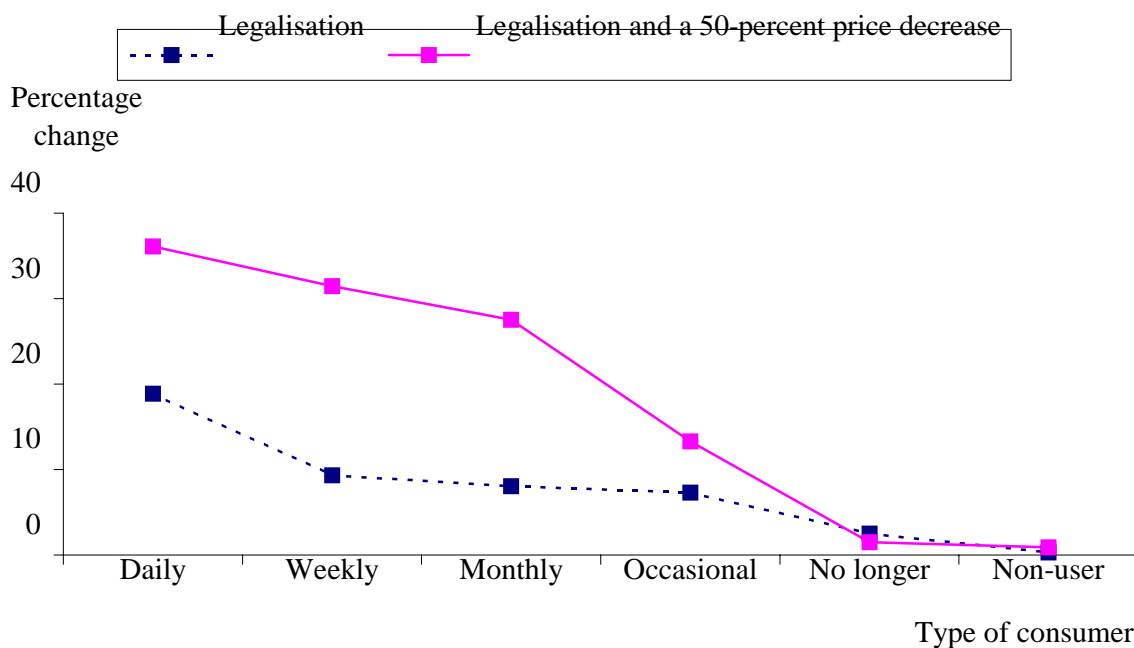
The purpose of this section is to estimate price elasticities of demand for marijuana. Two types of price elasticities are estimated, “gross” and “net”. The gross price elasticity is associated with the responsiveness of consumption due to the impact of both legalisation and the change in its price. The net elasticity eliminates the effect of legalisation, and measures only the degree of responsiveness of the quantity demanded to changes in

its price. These two elasticities correspond to the gross and net effects identified in Figure 3.

The gross elasticities are computed by dividing each element of Table 5 by -50, the fall in the price of marijuana. The upper panel of Table 6 gives the results. The pattern of the elasticities by type of consumer is obviously the same as that in Table 5. The gross price elasticity for all respondents, all males and all females is estimated to be -.23, -.28 and -.18, respectively (row 8). These estimates are significantly different from 0 and -1 at the 5 percent level. The responses of non-users are very small and not significantly different from zero.

**Figure 4:**

Change in Consumption of Marijuana Due to Legalisation and a Price Decrease



Recall that Table 5 gives the effects on consumption of both legalisation and the price fall, while Table 4 deals with the effects of legalisation only. Accordingly, the effects of the price fall can be isolated by subtracting the elements of Table 4 from the corresponding elements of Table 5. Dividing by -50 then gives an estimate of the net price elasticity. The lower panel of Table 6 gives the results. Amongst all respondents (column 4), weekly users are the most responsive group to changes in the price of marijuana, followed by monthly users, daily users and occasional users. The estimates of net price elasticities of all respondents, all males and females are estimated at -.14, -.16



and -.12, respectively. These estimates are also significantly different than 0 and -1 at the 5 percent level. Amongst males, the most responsive group is monthly users, followed by weekly, daily and occasional users. Amongst females, the weekly users are the most responsive group to changes in the price of marijuana, followed by daily, monthly and occasional users. The net price elasticity for all non-users is estimated to be -.01 and insignificantly different from zero.<sup>8</sup>

**Table 6:**

PRICE ELASTICITIES OF DEMAND for Marijuana

(Standard errors are in parenthesis)

Type of consumer (1)	Males (2)	Females (3)	All (4)
<u>Gross Price Elasticities</u>			
1. Daily users	-.75* (.25)	-.50 (.53)	-.72* (.22)
2. Weekly users	-.57* (.10)	-.73* (.11)	-.63* (.07)
3. Monthly users	-.58* (.14)	-.53* (.12)	-.55* (.09)
4. Occasional users	-.38* (.12)	-.16* (.05)	-.27* (.06)
5. No longer a users	-.04 (.03)	-.02* (.01)	-.03 (.02)
6. All users	-.45* (.05)	-.37* (.06)	-.41* (.04)
7. Non-users	-.02 (.02)	-.02 (.02)	-.02 (.02)
8. All types	-.28* (.04)	-.18* (.03)	-.23* (.03)
<u>Net Price Elasticities</u>			
9. Daily users	-.33* (.16)	-.50 (.53)	-.34* (.15)
10. Weekly users	-.40* (.11)	-.51* (.10)	-.44* (.08)
11. Monthly users	-.44* (.12)	-.35* (.11)	-.39* (.08)

<sup>8</sup> For “males” and “all” who are “no longer users”, the estimated net price elasticities are positive, but not significant. This happens because the respondents in these categories stated that their consumption would increase following legalisation by more than it would following both legalisation and the price reduction. Careless reading of the questionnaire, or marking the wrong option by mistake may have caused this.

12. Occasional users	-0.16*	(.07)	-0.08*	(.04)	-0.12*	(.04)
13. No longer a users	.05	(.06)	-0.01	(.01)	.02	(.04)
14. All users	-0.26*	(.08)	-0.25*	(.07)	-0.26*	(.05)
15. Non-users	-0.01	(.01)	-0.01	(.02)	-0.01	(.01)
16. All types	-0.16*	(.05)	-0.12*	(.04)	-0.14*	(.03)

Note: The symbol “\*” denotes significant at the 5 percent level.

Interestingly, the results of Table 6 reveal that the consumption of the more frequent users is more price responsive than that of the less frequent users. This can be understood in terms of the Slutsky equation:

$$(3) \quad \varepsilon_u = \varepsilon_c - \left( \frac{pq}{M} \right) \eta,$$

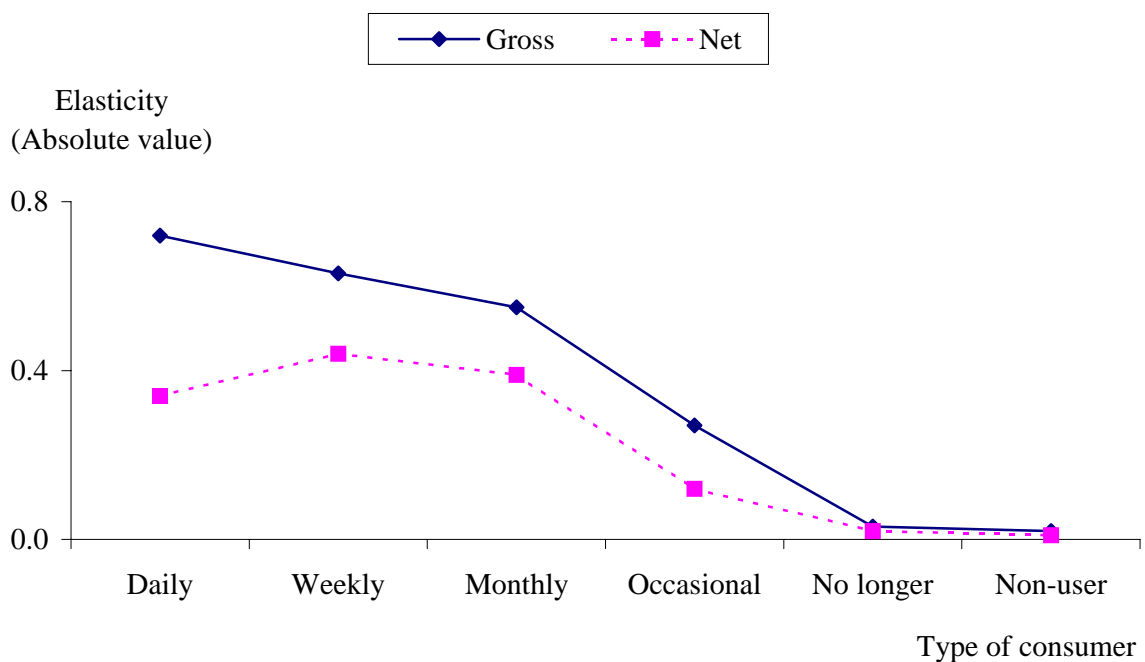
where  $\varepsilon_u$  is the uncompensated price elasticity ( $\varepsilon_u < 0$ );  $\varepsilon_c$  is the compensated counterpart ( $\varepsilon_c < 0$ );  $(pq/M)$  is the budget share, the share of total expenditure ( $M$ ) devoted to the good in question; and  $\eta$  is the income elasticity. Consider the case where  $\varepsilon_c$  is a constant and  $\eta$  is a positive constant; the income elasticity will be positive when the good is normal, as seems reasonable in the case of marijuana. We can think of less frequent consumption of marijuana as representing a fall in the quantity consumed ( $q$ ) over a given period. Thus, as  $q$  falls with  $p$  and  $M$  remaining constant, the budget share falls. According to equation (3), the absolute value of the uncompensated price elasticity,  $|\varepsilon_u|$ , also falls with the budget share. This explains why the price elasticities (both net and gross) in Table 6 tend to fall with the frequency of consumption.

Figure 5 plots of the estimated gross and net price elasticities for all respondents. The shape of the plot for the gross elasticity is identical to that for the effects of both legalisation and a 50-percent price decrease given in Figure 4. Regarding the net price elasticity, the plot is proportional to the vertical distance between the two curves in Figure 4. It can be seen that the gross elasticity is always higher than its net counterpart, as one would expect.

The point estimates of the elasticities presented in Table 6 differ noticeably across consumers. Are these differences significant? We test the hypothesis that the elasticities are the same by means of t- and F-tests. Table 7 gives the results in the form of probability values (the area in the right-hand tail of the relevant distribution corresponding to the observed value of the test statistic). Rows 1, 2 and 5 of the table indicate that price elasticities of “more frequent users” (daily, weekly and monthly) are insignificantly different at the 5 percent level. On the other hand, the elasticities of occasional and no longer smokers are significantly different from each other and from those of the more frequent users; see rows 3, 4 and 6-10 of Table 7. Also, row 11 indicates that the hypothesis that all consumers have the same elasticity is rejected at the 5 percent level.

**Figure 5:**

Gross and Net Price Elasticities of Demand for Marijuana



In the view of the finding that the more frequent users (daily, weekly and monthly) all possess the same price elasticity, we now pool the data across the three groups and estimate a common elasticity. Table 8 gives the results. For both sexes the gross and net price elasticities are estimated at  $-0.6$  and  $-0.4$ , respectively. As expected, these pooled elasticities are consistent with their unpooled counterparts given in Table 6. Note also that in many cases, pooling reduces the standard errors substantially to yield more precise estimates.

Next, we use t-statistics to test whether the elasticities differ amongst males and females. The results show that for each group of consumers the elasticities are insignificantly different for male and females; see Daryal (1999) for details. The findings of this section indicate that there are three distinct groups of consumers with respect to marijuana: More frequent users, who have a gross price elasticity of  $-.6$  and a net elasticity of  $-.4$  (from the last column of Table 8). Occasional users, having a gross elasticity of  $-.3$  and a net elasticity of about  $-.1$  (last column of Table 6). No longer users, having a gross and net elasticity close to zero (last column of Table 6). These elasticity values apply to both males and females.

Nisbet and Vakil (1972) also conducted a survey of university students. They divided respondents into three groups, (i) non-users; (ii) direct purchasers of marijuana; and (iii) those who did not purchase but consumed it. Nisbet and Vakil use a somewhat obscure terminology by referring to the data pertaining to all groups as “market survey” data, and to group (ii) above as “actual purchase” data. The price elasticity they estimate from the market survey data is substantially lower (in absolute value) than that from the actual purchase data ( $-.5$  vs.  $-1.5$ ). We can think of Nisbet and Vakil’s market survey data as corresponding our “all types” of consumers; and their actual purchase data as corresponding to our “more frequent” users (daily, weekly and monthly).

**Table 7:**

Tests of Identical Price Elasticities

(Probability values for test statistics)

Null hypothesis that price elasticity of consumer X equals that of Y		Gross price elasticity			Net price elasticity		
X	Y	Male	Female	All	Male	Female	All
1. Daily	Weekly	.654	.457	.621	.268	.184	.479
2. Daily	Monthly	.436	.761	.218	.287	.112	.322
3. Daily	Occasional	.027*	.018*	.022*	.019*	.021*	.024*
4. Daily	No longer	.001*	.001*	.001*	.001*	.001*	.001*
5. Weekly	Monthly	.736	.742	.693	.481	.801	.792

6.	Weekly	Occasional	.013*	.019*	.014*	.021*	.012*	.016*
7.	Weekly	No longer	.001*	.001*	.001*	.001*	.001*	.001*
8.	Monthly	Occasional	.021*	.018*	.012*	.011*	.012*	.011*
9.	Monthly	No longer	.001*	.001*	.001*	.001*	.001*	.001*
10.	Occasional	No longer	.026*	.019*	.022*	.019*	.015*	.021*
11.	H <sub>0</sub> : Elasticities of all five types of consumers are the same		.001*	.001*	.001*	.001*	.001*	.001*

Notes: 1. t-statistics are used for pairwise tests in rows 1-10; and F-statistics for testing the equality of all elasticities in row 11.

2. Daily = daily users; weekly = weekly users; and so on.

3. The symbol “\*” denotes that the probability value does not favour the null hypothesis.

**Table 8:**

Price Elasticities of Demand for  
Marijuana for More Frequent Users

(Standard errors are in parenthesis)

Males		Females		All	
<u>Gross Price Elasticities</u>					
-0.60*	(.12)	-0.63*	(.12)	-0.61*	(.10)
<u>Net Price Elasticities</u>					
-0.40*	(.10)	-0.43*	(.10)	-0.41*	(.09)

Note: The symbol “\*” denotes significant at the 5 percent level.

Accordingly, if we use our net elasticity for all types of consumers of -.1 and that for more frequent users of -.4, we can make a rough comparison of the two sets of estimates as follows:

<u>Type of consumer</u>	<u>Nisbet and Vakil</u>	<u>Current study</u>
All types (or all respondents)	-0.5	-0.1
More frequent users (or actual purchases)	-1.5	-0.4

As can be seen, the absolute values of both price elasticities estimated by Nisbet and Vakil (1972) are considerably higher than our estimates. On the other hand, the ratios of Nisbet and Vakil's two elasticities is  $1.5 / .5 = 3$ , while the ratio for ours is  $4 / 1 = 4$ . This shows that the price responsiveness of more frequent users relative to all types of consumers is not too different in the two studies. However, it should be kept in mind that Nisbet and Vakil's study refer to data that are now almost 30 years old. Tremendous economic, social and cultural changes have taken place since then that could have well affected the price responsiveness of marijuana consumption.

As mentioned in Section 1, Clements and Daryal (1999) estimated the price elasticity of demand for marijuana to be -0.5. There is a substantial difference between the values of the elasticity estimated by the current study and -0.5. This difference can be accounted for by the large price fall analysed here. We consider the effects on consumption of a 50 percent price fall, while Clements and Daryal (1999) consider the more usual case of a marginal price change. It seems plausible that the demand curve for marijuana becomes less elastic as the magnitude of the price change rises.

## VI. Summary and Conclusions

The aim of this paper is to inject an economic perspective into the current debate regarding marijuana legalisation. Using a specifically-conducted survey of marijuana consumption patterns, we estimated the effects of legalisation and the price elasticity of demand. The main results can be summarised as follows:

- More than half of all respondents have used marijuana.
- Marijuana consumption is significantly higher amongst males than females -- 60 percent of all males have consumed it, compared to 46 percent of all females.

- Consumption of marijuana is estimated to increase by about 4 percent if it were legalised and by about 11 percent following both legalisation and a 50-percent fall in its price.
- Price is a significant determinant of marijuana consumption. While marijuana consumption is estimated to be price inelastic, estimates of most of the price elasticities are significantly different from zero.
- Two types of price elasticities of demand for marijuana were estimated, gross and net. The gross price elasticity includes the effects of both legalisation and a price change, while the net version excludes the legalisation effect. The price elasticity of demand for marijuana differs significantly with the type of consumer. For more frequent users (daily, weekly and monthly), gross and net price elasticities are estimated to be  $-0.6$  and  $-0.4$ , respectively. Occasional smokers having a gross price elasticity of about  $-0.3$  and net elasticity of about  $-0.1$ . Regarding those who are no longer users, they have gross and net price elasticities close to zero. For a given type of consumer, males and females share the same elasticity value.

## Works Cited:

- Becker, G. S. (1965). "A Theory of the Allocation of Time." Economic Journal 75: 493-517.
- Cameroon, L. and J. Williams (1999). "Substitutes or Complements? Alcohol, Cannabis and Tobacco." Paper presented at the 28<sup>th</sup> Conference of Economists, Economic Society of Australia, La Trobe University, September.
- Clements, K. W. and M. Daryal (1999). "The Economics of Marijuana Consumption." Paper presented at the 28<sup>th</sup> Conference of Economists, Economic Society of Australia, La Trobe University, September.
- Daryal, M. (1999). The Economics of Marijuana. Unpublished BEc Honours thesis, The University of Western Australia.
- Johnston, L., P. O'Malley and J. Bachman (1981). Marijuana Decriminalisation: The Impact on Youth, 1975-1980. Ann Arbor, Michigan: Institute for Social Research.
- Model, K. (1993). "The Effect of Marijuana Decriminalisation on Hospital Emergency Drug Episodes: 1975-1980." Journal of the American Statistical Association 88: 737-47.
- National Drug Strategy Household Survey (computer file, various issues). Canberra: Social Data Archives, The Australian National University.
- Nisbet, C. T. and F. Vakil (1972). "Some Estimates of Price and Expenditure Elasticities of Demand for Marijuana Among UCLA Students." Review of Economics and Statistics 54: 473-75.
- Pacula, R. L. (1997). "Does Increasing the Beer Tax Reduce Marijuana Consumption?" Journal of Health Economics 17: 577-85.
- Penington Report (1996). Drugs and Our Community: Report of the Premier's Advisory Council. Melbourne: Victorian Government.
- Saffer, H. and F. Chaloupka (1995). "The Demand for Illicit Drugs." Working Paper No. 5238, National Bureau of Economic Research.
- Saffer, H. and F. Chaloupka (1998). "Demographic Differentials in the Demand for Alcohol and Illicit Drugs." Working Paper No. 6432, National Bureau of Economic Research.
- SBS (1999). "The Heroin Wars." April 12, telecast at 8.00 pm.
- Thies, C. and F. Register (1993). "Decriminalisation of Marijuana and the Demand for Alcohol, Marijuana and Cocaine." The Social Science Journal 30: 385-99.