The financial effects of tobacco tax increases on Maori and low-income households

Report for the Smokefree Coalition and Aparangi Tautoko Auahi Kore

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1 Summary and recommendations

Tobacco taxation is a blunt if often effective instrument for tobacco control. To obtain the maximum benefits for those smokers most needing help, it must be used within a well planned strategy and along with other sufficiently funded programs.

Because of the severity of nicotine addiction, when tobacco prices increase, in many cases the change in tobacco consumption by regular smokers is small. This means that unless smokers quit, a tobacco price increase has the risk of slightly increasing household spending on tobacco, and reducing the amount in the household budget available for other purchases. The degree to which smokers react to a tobacco price change is called the ‘price elasticity of demand’ for tobacco.

Project objectives

- To measure the elasticity of tobacco demand for Maori and low-income households that purchase tobacco.
- To assess the financial impacts of tobacco price increases for these households.

Methods

- We used tobacco availability data for 1982/83 to 1997/98; data on reported tobacco spending from the Household Economic Survey (HES) of Statistics New Zealand, for the years from 1987/88 to 1997/98; Consumer Price Index data from 1982, and 1996 census data on smoking prevalence within different types of households.
- HES data on ‘sole adult and children’ households (one adult, plus children under 15) was used to look at the impacts of tobacco price increases for Maori and for women.
- Tobacco consumption elasticities were estimated by a range of single regression equations.
- The financial impact was illustrated by comparisons with other household spending, by estimates of the savings from stopping smoking and by the net extra spending by those still smoking.

Data quality

The HES data were found to report only about 45% of overall tobacco spending by households. However, comparison against tobacco production data trends showed that the HES data was still a reasonable source for this exploratory work.

Elasticity results

- We found the overall price elasticity of demand during the 1988-1998 period for all smoking households to be probably in the range of -0.5 to -0.8. That is, for a 10% price increase, the number of cigarettes purchased by the average smoking household fell by between 5% and 8%.
- There is some indication that average ‘sole adult and children’ households and Maori ‘sole adult and children’ households reduced the number of cigarettes purchased after a price rise to a greater extent than other types of households.
- The results found are consistent with results from other published studies in New Zealand and elsewhere. Reported price elasticities for New Zealand have generally been
between -0.40 to -0.52. Reported price elasticities for whole populations in North America and Europe have clustered between –0.4 and –0.7, with much higher elasticities for some low-income groups and youth. In common with studies using similar survey data, the error margins associated with the estimates calculated for this report were quite wide.

Financial impact results
The results below do not include the savings from the reduced uptake of smoking by youth. Neither do the results include indirect savings such as lower health and death related costs and lower absenteeism.

For a 10% tobacco price increase (currently 80 to 90 cents per pack of 20 cigarettes) and for a range of overall price elasticity assumptions of between –0.50 and –0.80, the data for the 1988-1998 period would suggest that:

• 1-2% of all smoking households would stop buying tobacco. In ‘sole adult and children’ households with smokers who quit, the savings would be about $1700 a year on average.
• Where tobacco is still bought, an average low-income ‘sole adult and children’ household would spend about $100 more per year.
• A Maori ‘sole adult and children’ household continuing to smoke would also spend about $100 extra per year. A higher proportion of Maori in ‘sole adult and children’ households are smokers – about 51.5% as against about 42.5% of all ‘sole adult and children’ households.

These results are for average situations. There will be a wide range of reactions to tobacco price rises, including attempts by some smokers to inhale more nicotine per cigarette (ie, compensatory smoking involving inhaling deeper and smoking closer to the butt end). Where the adult is a heavy smoker, and/or reduces at a rate less than average, the extra costs would be appreciably higher. Where the smoker reduces more than average, and/or is a light smoker, the extra costs will be lower or there may be savings.

Discussion
The policy implications of tobacco taxation include the large effects of price on the uptake by youth of regular smoking, and the positive health and social consequences of a reduced uptake of smoking by youth within Maori and low-income households. There can also be very large health benefits from quitting and reduced consumption as a result of price increases. However, without sufficient policy changes to ensure that the position of these groups are improved, tobacco taxation increases could adversely affect the financial welfare of some of those in the most deprived populations.

The health, social and financial impacts of tobacco pricing policy on different groups should be taken into account when considering tobacco taxation. In particular, health and social policies need to provide for the consequences of lower smoking quit rates by those who are within the groups with the most social and economic deprivation.
At present government tobacco control spending is minute compared to both government revenues from tobacco and the tangible costs from tobacco use. A comprehensive range of smokefree measures instituted in conjunction with any tobacco taxation increases may increase the ability of the most deprived groups to quit or reduce smoking after such increases. The scale of the funding needed for such a program in New Zealand appears to be at least $50-80 million a year, by US government best practice guidelines.

**Recommendations**

**Equity and Treaty matters**

1. That tobacco taxation policy is integrated into an overall government policy to reduce social and economic inequalities and to ensure the fulfilment of Treaty of Waitangi provisions.

2. That the regressive effects of tobacco taxation be more effectively countered by tobacco control resources fully proportionate to the scale and severity of the addiction involved.

**Policy formation and research**

3. That the evaluation of tobacco taxation policy is based on joint work by all relevant government agencies, to ensure that the wider social and Treaty of Waitangi issues are sufficiently addressed. That joint work needs to be sufficiently staffed and resourced for joint policy design and associated research. In particular, that the Social Policy Agency and Te Puni Kokiri be more actively involved in deciding the official advice to government on tobacco taxation.

4. That the relationship between tobacco taxation policy and the overall tobacco control strategy be clearly articulated by government.

5. That as part of a surveillance and research policy more appropriate to the scale of harm of tobacco use in New Zealand, government continually monitors the effects of tobacco taxation and price on the most vulnerable groups of households. This should include tobacco spending surveys of sufficient size, frequency and resourcing to ensure (a) adequate data on the spending of ethnic groups, (b) sufficient sensitivity to measure a range of spending influences, and (c) adequate accuracy of expenditure reporting. The research strategy should also include qualitative and in-depth longitudinal studies of smokers, so as to better understand the process of quitting amongst smokers in these vulnerable households.
2 Introduction

Objectives: The objectives of the project were to:
- Measure the elasticity of tobacco demand for Maori and low-income households that purchase tobacco.
- Assess the financial impacts of tobacco price increases for these households.
- Briefly discuss the policy implications of the findings.

Background: This project should be seen as a preliminary effort using very limited resources. More extensive and ongoing work should be done in this area. This report should be read in conjunction with the preceding literature review by Wilson and Thomson 2000.1

Little econometric research has been done on the impact of tobacco taxation on low-income households, and virtually none on the impact for Maori. Ashton and St John (1985)2 discussed the relative effects of tobacco taxation in New Zealand for income groups. They found that for the third to bottom decile (by disposable income) of families with two adults and three children, over 4.5% of aggregate household disposable income went on tobacco. This compared with less than 1.5% for the top two disposable income quintiles.

Morrison Cooper (19893) reported that tobacco taxation in New Zealand was regressive. This Tobacco Institute publication did not report on the effect of tax increases. Darroch (1999)4 used individual HES data (rather than household data) and reported that Maori and Pacific had significantly higher price elasticities than Pakeha (New Zealand European), resulting in smaller increases in spending after any price rise.

Smoking, ethnicity and poverty: Smoking in New Zealand is concentrated in poorer families and amongst Maori and Pacific peoples. Research to date has shown a clear income gradient for smoking rates (higher in low-income groups) identified for some time in New Zealand (Pearce et al 19855, Jackson et al 19906, Kawachi et al 19917, Pearce and Bethwaite 19978, Whitlock et al 19979, Ministry of Health 1999a10, Howden-Chapman 200011).

The Ministry publication above (Taking the Pulse) indicated that in 1996-97 the most deprived quartile by NZDep96 score had 40% more current smokers than the next quartile (36.9% compared to 26%). NZDep96 is an index measuring deprivation at an area population level, based on social and material resources, and using the 1996 Census results (Crampton et al 200012). The most deprived quartile had 138% more smokers than the least deprived quartile (36.9% compared to 15.5%). There has been evidence of an increased smoking prevalence and a higher smoking uptake within areas of most deprivation for both Maori and Pakeha in all age groups, and for both men and women. The proportion of ex-smokers to smokers was lower for those in the most deprived areas, indicating that in the period up to 1996 giving up smoking was less likely for people in these groups (Crampton et al 200013).

It should be noted that the lower proportion of ex-smokers in these areas in 1996 sums up the rates of quitting smoking (or dying) over the lives of all those who had taken up
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smoking in the past. This summing may mask increases or decreases in the rate of quitting by particular groups over time. So, for instance, those in deprived area may have been less likely to quit in the 1980s or before, but this could be changing now. The possible explanations for the lower rate of ex-smokers in the most deprived areas include that these smokers were less likely to attempt to quit smoking and were more likely to relapse when trying to quit.

The impact of smoking on Maori health has been significantly greater than for non-Maori, with an estimated 31% of Maori deaths in 1989-93 being attributable to tobacco use (Laugesen and Clements 199814). The prevalence of smoking by Maori is almost twice that of Pakeha (49% compared to 25%)15 and for Maori women almost thrice (65% compared to 23%) that of non-Maori women for the poorest household income quintile (O’Dea and Howden-Chapman, 200016). Because of the resulting health disparities, tobacco control is thus a Treaty of Waitangi issue, requiring government action to meet its Treaty responsibilities.

The 1996 Census data also indicated that the most deprived areas had the highest smoking rates (Wilson and Borman 199817) and that smoking rates are highest among those with no qualifications, those on low incomes and those who are unemployed (Borman et al 199918). Some of this effect is related to the presence of Maori in these areas and groups. Low-income groups also have higher exposure to second-hand smoke (Whitlock et al 199819) as do people who live in overcrowded households (Howden-Chapman and Wilson 200020).

The relationship between low income and smoking is particularly strong for women (O’Dea and Howden-Chapman, 200021). However, there is also a higher smoking prevalence for Maori at all income levels (ibid; Crampton et al 200022).

The survey by Waldegrave, King and Stuart (199923) of low-income New Zealand households has one of the more sophisticated samples to find consumption by deprived groups. The sample was found by a combination of two measures. The first was the selection of geographic units with concentrations of households with incomes under $25,000 and children. The second was the use of the New Zealand Poverty Measurement Project poverty line of 60% of median, disposable household income. The survey found that 54% of the individuals surveyed had smoked in the last seven days, and over 70% of the Maori in the sample had smoked during this period.

The strong association between smoking and indicators of social disadvantage provides a contrast to approaches that ascribe smoking uptake and continuance to individual choice. The latter approaches appear to be less adequate in addressing the underlying questions of why disadvantaged people are drawn into nicotine dependence and are less likely to quit (Jarvis and Wardle 199924).

Tobacco taxation: Tobacco taxation has been recognised internationally as being one of the most effective means of decreasing tobacco consumption and the consequent adverse health impact of its use at a population level (Chollat-Traquet 199625; Townsend 199626; Meier and Licari 199727). A number of research studies elsewhere report significant prevalence and consumption effects for people in low-income households from tobacco tax increases.
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(Biener 1998\textsuperscript{28}, Farrelly and Bray 1998\textsuperscript{29}, Townsend 1994\textsuperscript{30} and 1996\textsuperscript{31}, Meier and Licari 1997\textsuperscript{32}). In almost all these studies, low-income smokers were more likely to quit and/or decrease consumption. One British study reported little difference for low-income smokers (Borren and Sutton 1992\textsuperscript{33}). For some of the detail of these studies, see Appendix One.

Nevertheless, there is concern about the potential adverse impact on low-income smokers and their families when smokers do not quit or cut down in response to increases in tobacco taxation (eg, in the UK setting, Marsh 1997\textsuperscript{34}). Such a concern has also been articulated in New Zealand (eg, Treasury 1997\textsuperscript{35}, Wilson and Thomson 2000\textsuperscript{36}). There is also concern that low-income smokers may attempt to extract more nicotine per cigarette after tobacco tax increases. Ways to do this include deeper inhaling, inhaling more often and smoking more of the cigarette – see section 7.3.3 below.
3 The context of the impact of tobacco taxation in New Zealand

3.1 The ways to find the groups affected most by tobacco taxation

Much of the following evidence uses income levels, ethnicity, gender and household types to identify some of the groups most likely to be affected by tobacco taxation. However, further indicators will also serve to identify groups affected strongly by tobacco taxation increases. These include deprivation and other indexes that more comprehensively measure risk indicators.

In Britain Marsh and McKay (1994) and Dorsett and Marsh (1998) used a range of indicators including work and education status, benefit dependency, marital status, and housing tenure. In particular, Dorsett and Marsh utilised an index of ‘relative material hardship’ using debt; the un-affordability of food, clothing and consumer durable items; and perceived financial problems. Another report looked at the relationship between social support, social capital and smoking prevalence (Cooper et al 1999).

At present, data on reported tobacco spending is available from Statistics New Zealand by income levels, ethnicity, gender and household type. The Ministry of Health report Taking the Pulse (1999a) also gives reported tobacco consumption by NZDep96 and education levels. Howden-Chapman (2000) reported tobacco consumption by occupational class, labour force status and household crowding.

In looking at the impact of tobacco taxation, we have concentrated on households with children. This is to help expose any evidence on the effect that tobacco tax increases have on children. Such a focus also assists in identifying the number of children who benefit when adults in their households reduce smoking or quit. That benefit can be from the lessened risk of physical harm from second-hand smoke, and from the reduction in the role-model influence on children for starting smoking. Physically, children are the group most vulnerable to second-hand smoke (eg, Mitchell et al 1997).

3.2 Some groups of households with children affected by tobacco taxation

About 5% (almost 50,000) of all households in the 1996 Census had smokers and children, and had reported annual incomes of $15,000 per adult or less (note that this figure is not ‘equivalised’ as in the data discussed in section 4.1). There were over 14,000 such ‘single adult and children’ households, and over 35,000 such households with two or more adults.

3.2.1 ‘Sole adult and children’ households

In 1998 over a quarter of families contained only one parent, and almost a quarter (23.7%) of dependent children (under 15 years of age) were living with one parent (Statistics New Zealand 1998). In the 1996 Census, over 90% of the adults in ‘sole adult smokers and children’ households were women.
While one adult families are complex and diverse, they are on average more often economically disadvantaged than other household types. The opportunities for the adult to find suitable employment are more limited and the households are more likely to be in rented accommodation. Half of sole parents were not employed or seeking work, compared to 26% of parents in two-parent families (Statistics New Zealand 1998). Sole adults with children are more likely to be younger and more likely to have lower incomes. Furthermore, these households are over-represented in the major urban areas, where rents are higher.

There is increasing evidence from European research that sole parents have poorer health than parents in two-parent households (Baker et al, 1999; Whitehead et al, 2000). A number of overseas studies have identified lone parenthood as a barrier to quitting smoking (Jarvis, 1997; Graham and Der, 1999).

3.2.2 Poorer households
This section presents some of the census evidence about households reporting incomes of $15,000 per adult or less. This group of over 300,000 households is almost 30% of the total number of households (see Table 1 below). To place this arbitrary $15,000 cut-off in context, for all household types the bottom income decile in 1996-97 reported an annual income per household of under $13,100. The second decile reported an annual income of $13,100 to $18,499 per household (Statistics New Zealand 1997). This income measurement is not the same measure as the equivalised income deciles used for the Household Economic Survey spending data, and discussed in Section 4.1 below.

It must be noted that many households with smokers in the income deciles above the lowest may be equally affected by tobacco taxation. As shown in Table 14 in Appendix Four, the second-lowest reported overall income decile has the lowest reported spending. The average spending of the lowest overall decile is affected by self-employed people reporting losses for a particular year. However, this effect is not significant when looking at ‘sole adult and children’ households – see Table Nine in Appendix Two.

The tables below and in Appendix Two indicate the reported presence of smokers in households, from the 1996 Census. The purpose of the tables is to give an indication of the numbers involved. The figures do not allow for the different types of households and so do not show the increased prevalence of smoking with low incomes reported in section two above. The charts below and in Appendix Five give some further detail for the reported changes over time in the proportion of various types of households with smokers.
Table 1: Poorer households with children and reported smokers

<table>
<thead>
<tr>
<th>Income</th>
<th>Smokers and children reported#</th>
<th>Households with smokers#</th>
<th>All households in income group</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15,000 or under per sole adult household (with or without children)</td>
<td>14958 (10%)</td>
<td>39621 (25%)</td>
<td>153270 (100%)</td>
</tr>
<tr>
<td>$30,000 or under per two or more adult household (with or without children)</td>
<td>34257 (15%)</td>
<td>80490 (36%)</td>
<td>225387 (100%)</td>
</tr>
<tr>
<td>All incomes</td>
<td>170613 (13%)</td>
<td>416760 (33%)</td>
<td>1265979 (100%)</td>
</tr>
</tbody>
</table>

Figures from Statistics New Zealand, 1996 Census
# Shown as a percentage of all households in that income band

Note: Some households do not specify their income level or the smokers present

Table 2: Individuals - poorer smokers

<table>
<thead>
<tr>
<th>Income</th>
<th>All reported smokers</th>
<th>All adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15,000 or under per adult</td>
<td>280229 (23%)</td>
<td>1234101 (100%)</td>
</tr>
<tr>
<td>All incomes</td>
<td>609297 (22%)</td>
<td>2786220 (100%)</td>
</tr>
</tbody>
</table>

Figures from Statistics New Zealand, 1996 Census (Table 23 – see Appendix Three)

3.3 Ethnicity of households with children affected by tobacco taxation

The charts below show the reported proportion of children and adults living in households with smokers, from the Household Economic Survey (HES) of Statistics New Zealand. Because of a possible change over time in the level of under-reporting, these charts should be interpreted cautiously. If the reasons for not reporting tobacco use have increased, the data may partly be indicating this – ie the data may be reflecting an increase in under-reporting rather than a decline in the proportions of households using tobacco. A discussion of the under-reporting of consumption by the HES is given in section 5.1 below.

The size of the sample of some ethnic groups in the HES survey may mean that the charts should be used as an indication of medium term trends, rather than an exact record for the whole population. The fluctuations shown around the general downward trends may be due in part to random sample error – see Appendix Five.

However if the charts indicate the trends accurately, there appears to have been a significant move in the proportion of Maori in households with smokers. The proportion of Maori living in such households appears to have fallen from over 70% to under 60% between 1988 and 1998. The possible explanations include:

- A general decline of smoking amongst Maori (however this is not shown by surveys - see table 7.1 in Appendix 7).
- That the same proportion of individual smokers is increasingly clustering in a smaller proportion of households.
- Changes in the rate of reporting by some groups of households.
Chart 1. Proportions of children in "smoking" households - By ethnicity. All income levels combined.

Chart 2. Proportion of Adults living in "smoking" households. By ethnicity.
3.4 Some of the most at risk situations

Some of the worst situations for the impact of tobacco taxation are poorer households with a high child-to-adult ratio and a high smoker rate. These include the over 14,000 ‘sole adult smokers with children’ households with a reported income in the 1996 Census of $15,000 or under, and the over 8800 households with two or more smoking adults, three or more children and a reported income of under $30,000.

While these households are only 1% of all households with two or more adults, they represent at least 27,000 children. Over 4000 of these larger households with children reported incomes of $30000 or under, and two or more smokers. They represent at least 12,500 children.

In the 1996 Census there were over 25,000 other households reporting incomes of $30000 or under, and two or more smokers. For details of the household types mentioned above see the tables in Appendix Two.

Implications: The households with two or more smokers may, on average, have at least double the spending on tobacco. Even if using a low-price cigarette brand ($8 per 20) if two smokers each used a pack a day, the household would spend about $110 a week or $5800 a year. That would be at least 19% of the household income for a household with an annual income of $30,000 or under. A $1 per pack increase (about 12.5%) would equal about 2.4% of a $30,000 household budget, and be about $14 per week or $730 per year extra, if smokers did not cut down after the increase.

3.5 Low income individuals affected by tobacco taxes

Another way to look at the financial impact of tobacco taxation is to look at the numbers of smoking individuals.

- In the 1996 Census over 280,000 smokers reported a personal income under $15000. This group was 46% of all smokers.
- Because of the large numbers of low-income smokers, sub-groups that are numerically relatively large in health or social risk terms are easy to ignore. For instance there were over 13,800 Pacific peoples in this income bracket who were smokers.

The range of incomes for individual smokers can be seen in Appendix Three.
3.6 The context of tobacco taxation for Maori

Tobacco use amongst Maori has unique features, which are more than the effects of the socio-economic position of the ethnic group. Tobacco smoking by Maori is likely to be influenced by cultural and political factors that reflect the position of Maori as an indigenous minority. This minority has been marginalised by colonisation and the subsequent political structures and events. For example, smoking tobacco can be seen as a method of protest and defiance by some Maori teenagers, in the face of in the inability of the education system to provide for their needs. The implications of the different political context is that Maori responses to tobacco control efforts are not necessarily the same as those of non-Maori, and the pathways to change in smoking status are not necessarily the same for different ethnic groups.

When considering the impact of tobacco taxation increases on Maori, the context includes the larger proportion of Maori in high deprivation groups, the larger proportion with low food security, and the compounding effects of deprivation and tobacco use. Over half of Maori are in the three most deprived deciles as measured by NZDep96, compared to under 30% for non-Maori (Ministry of Health 1999b). About a quarter of Maori men, and a third of Maori women reported that their household could afford to eat properly only sometimes (Ministry of Health 1999c). This compared to only a tenth for Pakeha and ‘others’.

In the 1996 Census 54% of individual Maori ‘adult’ smokers reported a personal income of $15000 or under, compared to 43% of Pakeha. This highlights the way that tobacco taxation impacts on proportionately more Maori, due to the larger proportion both smoking and with low incomes. The numbers involved can be seen in Appendix Three.

Some of the situations with the most potential for harm from the impact of tobacco taxation are Maori households with smokers, with a high child-to-adult ratio. Of the almost 15,000 ‘sole adult smokers with children’ households with a reported income of $15,000 or under, in 1996:
- 37% (5037) of the women were Maori, who made up 90% of the
- 38% (5610) of the adults who were Maori.

Because of the much higher rate of Maori households that have smokers, compared to the general population, government tobacco control policy needs to take into consideration the normalisation effect through this higher rate of smoking (and the associated greater impact of second-hand smoke exposure). The challenge for tobacco control in Aotearoa (New Zealand) is to connect being auahi kore (smokefree) with the political aspirations of Maori. The challenge for government is to fully recognise inadequate tobacco control as a major contributing factor underpinning disparities between the health status of Maori and other New Zealanders. Policy changes that make tobacco control more relevant for Maori may be a significant influence in ‘closing the gaps’.
Table Three: Individual Maori and reported smokers (15 years and over)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Smokers reported#</th>
<th>Smoking not specified</th>
<th>All less ‘smoking not specified’</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maori</td>
<td>124497 (43%)</td>
<td>15465</td>
<td>286542 (100%)</td>
<td>302007</td>
</tr>
<tr>
<td>Not specified</td>
<td>4653 (25%)</td>
<td>84552</td>
<td>18615 (100%)</td>
<td>103167</td>
</tr>
<tr>
<td>All</td>
<td>572022 (24%)</td>
<td>187710</td>
<td>2410248 (100%)</td>
<td>2597958</td>
</tr>
</tbody>
</table>

From Statistics New Zealand, 1996 Census (Adults in private dwellings)
# Smokers as a percentage of all that ethnicity, less ‘smoking not specified’

Table Four: Proportion of individual smokers reporting income of $15000 or under (aged 15 and over)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Maori#</th>
<th>Pacific people#</th>
<th>Pakeha#</th>
<th>Total smokers</th>
<th>Total population with this income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>59%</td>
<td>50%</td>
<td>54%</td>
<td>55%</td>
<td>54%</td>
</tr>
<tr>
<td>All</td>
<td>54%</td>
<td>45%</td>
<td>43%</td>
<td>46%</td>
<td>44%</td>
</tr>
</tbody>
</table>

From Statistics New Zealand, 1996 Census (Adults in private dwellings)
# Percentage of smokers in that ethnic group reporting income of under $15000 or under.
Note that not all respondents give their ethnicity – see Table Three.

Table Five: Proportion of individual smokers reporting income of $15000 or under, as a percentage of all adults in their ethnic group (smokers and non-smokers) reporting this income

<table>
<thead>
<tr>
<th>Gender</th>
<th>Maori#</th>
<th>Pacific people#</th>
<th>Pakeha#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>46%</td>
<td>22%</td>
<td>35%</td>
</tr>
<tr>
<td>All</td>
<td>43%</td>
<td>26%</td>
<td>20%</td>
</tr>
</tbody>
</table>

From Statistics New Zealand, 1996 Census (Adults in private dwellings)
3.7 The context of tobacco taxation for women

“Female smokers are concentrated amongst those who have lost out in the process of social polarisation” (Graham, 199852)

The potential regressive effect of tobacco taxation has particular implications for low-income women. British studies have shown that women smokers are more disadvantaged than the broader population of women, both with respect to their socio-economic circumstances and their psychological health. The latter factor was the single most powerful predictor of high rates of tobacco consumption (Graham and Der, 199953).

Other British research has shown that for pregnant women, among the disadvantages associated with low socio-economic status, being in receipt of a means-tested benefit increased the odds of a woman not intending to give up smoking in the foreseeable future (Batten et al 199954).

New Zealand research also shows that women who smoke are more likely to be on low incomes, living in areas of high socio-economic deprivation, with less education and working in low status jobs or unemployed (Howden-Chapman, 200055). However, even controlling for all these factors, Maori women still have higher rates of smoking.
4 Data and methods

4.1 Data

The report uses:

- ‘tobacco products for consumption’ data for 1982/83 to 1997/98 from Statistics New Zealand (referred to here as tobacco availability data);
- reported tobacco spending data from the Household Economic Survey (HES) of Statistics New Zealand, for the years ending March 1988 to March 1998; and
- Consumer Price Index data from 1982, including Tobacco sub-group index data.

Since 1998 the HES survey is no longer carried out annually. The HES information was for the average spending of:

- ‘sole adult and children’ households (by the adult’s ethnic group) and
- households by income deciles for both ‘sole adult and children’ and all households.

Household income deciles were defined in terms of after-tax (disposable) income, adjusted (or ‘equivalised’) for household size and composition using the Revised Jensen equivalence Scale. These ‘equivalised household disposable income’ deciles are ranked from poorest (decile 1) to richest (decile 10). The ‘equivalised incomes’ can be thought of as providing an equivalent standard of living to that of a ‘two adult, no children’ household living on the same income measured in actual dollars. Adults are defined as those aged 15 years or over.

Resource constraints for this project meant that apart from ‘all households’ data by income decile, we could only obtain data for one particular type of household. We used the impact of price rises on ‘sole adult and children’ households to help indicate the impact of tobacco taxation for all deprived groups, and to indicate the impact for women, who are 90% of the adults in these households. These households are a sentinel group for monitoring the impact of social policy, for the reasons seen in Section 3.2.1 above.

When using HES data, the ethnicity of households can only be properly determined for households with only one adult. This was a further reason to use data on ‘sole adult and children’ households. The HES Standard Tables data (used in Appendix Four to estimate comparative expenditure by ethnic groups) use the ethnicity of the ‘householder’ to determine the allocation of households into ethnic groups.

Both the HES and the Census data for individual smokers (Appendix Three) use a hierarchic approach to allocate individuals of mixed ethnicity to particular groups (Statistics New Zealand 199756).
4.2 Methods

The possible influences on tobacco consumption include regulations, prices, information/advertising, ‘public opinion’, the extent of private smokefree environments, income changes and the addictiveness of the product (ie, nicotine levels). Any appraisal of price effects needs to be aware that the relationships between influences are complex, and that price changes are seen by smokers within a framework of many personal and societal pressures (Chapman 1993\textsuperscript{57}). Smokers will have different socially created abilities to react to influences. Further discussion of the range of influences on consumption is included in Appendix Six.

Estimates of price elasticity of tobacco demand

Because of the addictive properties of the nicotine in tobacco products, we would expect that for smoking households:

1. the demand for tobacco products would be relatively price inelastic (for a price rise of 10%, the quantity purchased would fall by less than 10%, so that tobacco spending would rise, but by less than 10%)
2. the demand for tobacco products would be income inelastic (for an income fall of 10%, demand would fall by less than 10%). This is for changes of income over time.

However, the ‘cross-sectional’ income profile, at a given point in time, does not follow this pattern. A lower proportion of households purchases tobacco products in the top two income deciles.

It should be noted, however, that the two above assumptions do not apply to ‘starting smokers’ and ‘potential smokers’, particularly young people. For them the decision to purchase tobacco could be expected to be more price-sensitive. Some research results confirm this (Townsend et al 1994\textsuperscript{58}, Grossman 1989\textsuperscript{59}, Grossman and Chaloupka 1997\textsuperscript{60}, Lewit et al 1997\textsuperscript{61}, Warner 1998\textsuperscript{62}).
The effects of tobacco tax increases
June 2000

George Thomson, Des O’Dea, Nick Wilson, Papaarangi Reid, Philippa Howden-Chapman

The calculations
The calculations were of the simplest possible form. Simple log-linear functions have been estimated first from time-series data on ‘cigarettes delivered’ and then from the time-series and cross-sectional tobacco spending data supplied from the HES.

The functions are of the form –

\[
\log T = a + e \log P + b \log Y + k t
\]

Where:
- \(T\) = quantity of tobacco products purchased
- \(P\) = price
- \(Y\) = household income
- \(t\) = time, in years

- \(a\) is a constant
- \(e\) is the price elasticity
- \(b\) is the income elasticity
- \(k\) measures the exponential rate of change over time, due to factors other than price and income.

In fact the preferred formulation was in terms of first differences of the above equation. This has the advantage of removing the time variable, which tends to be correlated with both price and income, leading to poorer estimates.

The variables used to calculate elasticities from the tobacco availability data, for the period 1982/83 to 1997/98, were:

- Demand – ‘Cigarette equivalents delivered’ per person aged 15 and over
- Price - Tobacco component of CPI
- Income – Real household income per capita, from ‘System of National Accounts’ Household Income and Outlay table 4.1
- Time – years from 1982/83 = 1

The detailed results are given in Appendix Five.

For the estimates based on expenditure data, the overall price elasticity of tobacco demand has been broken down into two components:

- the ‘smoking prevalence elasticity’ – the responsiveness of households to price changes, indicated by changes in the proportion of households with members who smoke;
- the ‘ongoing expenditure elasticity’ – the responsiveness of households to price changes, indicated by the amount of tobacco spending, for those households whose members continue to smoke or who start smoking.

These two component elasticities make up the overall price elasticity of demand.
Below is a summary of the proportions of HES households reporting tobacco spending, with some of their details. The spending amounts given are those reported by survey respondents. As detailed in section 7.3 below, for our financial impact calculations we have allowed as well for under-reporting.

<table>
<thead>
<tr>
<th>Household Type</th>
<th>Number of households</th>
<th>Average Equivalised Income</th>
<th>% of hhlds purchasing tobacco products</th>
<th>Av annual purchases 'Smoking' hhlds</th>
<th>Av annual purchases All hhlds</th>
</tr>
</thead>
<tbody>
<tr>
<td>All households</td>
<td>1,162,550</td>
<td>$33,500</td>
<td>30.8%</td>
<td>$1,320</td>
<td>$410</td>
</tr>
<tr>
<td>'Sole adult' * households</td>
<td>66,960</td>
<td>$18,650</td>
<td>42.4%</td>
<td>$770</td>
<td>$330</td>
</tr>
<tr>
<td>Pakeha adult</td>
<td>43,900</td>
<td>$19,100</td>
<td>40.9%</td>
<td>$810</td>
<td>$330</td>
</tr>
<tr>
<td>Maori adult</td>
<td>16,200</td>
<td>$18,500</td>
<td>51.4%</td>
<td>$755</td>
<td>$390</td>
</tr>
<tr>
<td>Decile 1</td>
<td>19,800</td>
<td>$12,750</td>
<td>41.2%</td>
<td>$820</td>
<td>$340</td>
</tr>
<tr>
<td>Decile 2</td>
<td>15,400</td>
<td>$16,550</td>
<td>44.4%</td>
<td>$670</td>
<td>$310</td>
</tr>
<tr>
<td>Decile 3</td>
<td>11,400</td>
<td>$18,400</td>
<td>47.2%</td>
<td>$650</td>
<td>$310</td>
</tr>
<tr>
<td>Decile 4</td>
<td>9,800</td>
<td>$20,900</td>
<td>42.5%</td>
<td>$750</td>
<td>$320</td>
</tr>
</tbody>
</table>

Source: Household Economic Survey. Tabulations from Statistics NZ

*Sole adult households are defined to include only those with children aged under 15
5 Results

5.1 Under-reporting of spending on tobacco products

The table below compares 1995/96 expenditure as reported in the Household Economic Survey analyses supplied to us by Statistics NZ, with the estimated retail value of cigarettes ‘released for consumption’ in 1995/96 – assuming a retail price per packet of 20 cigarettes of about $5.43 at that time. The ‘released for consumption’ figures are provided by Statistics New Zealand (Ministry of Health 199963).

<table>
<thead>
<tr>
<th>Production-based estimate 1995/96</th>
<th>Expenditure-based estimate 1995/96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarettes 'released for consumption'</td>
<td>HES reported household spending</td>
</tr>
<tr>
<td>Census 1996</td>
<td>HES 1995/96</td>
</tr>
<tr>
<td>Total population</td>
<td>3,618,300</td>
</tr>
<tr>
<td>Population aged 15+</td>
<td>2,786,200</td>
</tr>
<tr>
<td>Population covered</td>
<td>3,147,150</td>
</tr>
<tr>
<td>Approx %age of census</td>
<td>87.0%</td>
</tr>
<tr>
<td>Households covered</td>
<td>1,146,560</td>
</tr>
<tr>
<td>Production 1995/96</td>
<td></td>
</tr>
<tr>
<td>Cigarette equivalents per person aged 15+</td>
<td>1477.25</td>
</tr>
<tr>
<td>Approx price per pack of 20</td>
<td>$5.43</td>
</tr>
<tr>
<td>Estimated expenditure</td>
<td></td>
</tr>
<tr>
<td>Per person aged 15+</td>
<td>$400.78</td>
</tr>
<tr>
<td>Estimated expenditure</td>
<td></td>
</tr>
<tr>
<td>Per household</td>
<td>$370.65</td>
</tr>
<tr>
<td>Total adult population $mn</td>
<td>1,116.6</td>
</tr>
<tr>
<td>Total all households $mn</td>
<td>425.0</td>
</tr>
</tbody>
</table>

Extent of under-reporting 1995/96

HES-based estimate as %age of production-based estimate 38.1%
Allowing for population not covered by HES 43.8%

In brief, recorded expenditure appears to be only 38.2% of the expenditure that would be expected from ‘delivery’ statistics.

A couple of things reduce the expenditure “gap” somewhat. There is probably some ‘wastage’ of deliveries, and perhaps stock accumulation, but this is most unlikely to be more than a percent, at the very outside. Secondly, HES covers only private households (and over-represents some household types e.g. pensioners and sole parent households, with low average tobacco expenditure) and so excludes the expenditure of those not living in private households (who might possibly on average have heavier tobacco spending).

As shown in the above table, the HES in 1995/96 covered only about 87% of the population. Adjusting for this, assuming those not in private households smoke the same as those who do dwell in private households, HES respondents appear to have reported 43.8% of their actual expenditure. Those living in institutions may have a heavier rate of smoking than the whole populations.
Was 1995/96 a ‘typical’ year? The chart compares trends in the estimates of ‘real consumption’ per household from HES, over the period 1987/88 to 1997/98, valued in June 1999 dollars (left-hand scale), with ‘cigarette equivalents’ delivered per adult over the same period (right-hand scale).

**Chart 2a**

The trends in the two series are very similar – a steady decline until 1992/93, and then a levelling-off. The average number of adults per household is probably declining, which would explain the tendency for the ‘cigarettes delivered’ series to decline less. It is clear, however, that the extent of under-reporting is fairly consistent over time.

Recent data for by British women found no evidence of socio-economic differentials in under-reporting smoking (Prescott-Clarke and Primatesta, 1998). However, research work in New Zealand is needed on the factors for, and degrees of under-reporting of tobacco consumption and smoking prevalence.

**Conclusion.** There is massive under-reporting of expenditure on tobacco products. It has to be assumed, for analytical purposes, that under-reporting does not vary too much over time, nor between different household types, on which we have no information. The under-reporting will not affect the elasticity values estimated in this report, if the under-reporting is consistent over time. It would, however, affect the estimates of the extra spending resulting from a tax increase. These need to be scaled up by the amount of any under-reporting.
5.2 Elasticities from New Zealand tobacco availability and HES data

The analyses were focused on obtaining estimates of price elasticities rather than income elasticities. In general the most reliable results were those for ‘all smoking households’, rather than for particular ethnic or low-income groups, or for particular household types. The figures below indicate the pattern of the results found, and the detailed results are shown in Appendix Five.

**Overall price elasticity of demand for all households**

-0.50 to –0.80

That is, for a 10% price rise, the overall quantity of tobacco consumed fell by between 5% and 8%. This can be compared with the lower range of figures found in New Zealand studies from 1981 to 1991 of long run price elasticities for the general population of smokers (James 199565). That range was from -0.41 to -0.52. There is some suggestions from our calculations (though not statistically significant at the 95% confidence level) of higher (negative) elasticities for ‘sole adult and children’ households, and for Maori ‘sole adult and children’ households. The details are in Table A5.1 in Appendix Five.

The component elasticities within the overall price elasticity were consistent with the range of figures below.

‘Smoking prevalence elasticity’ – the responsiveness to a price rise of the proportion of households with smokers

-0.10 to –0.20

That is – for a 10% price rise, 1-2% of households reporting smokers stopped reporting smokers. The details are in Table A5.3 in Appendix Five. The range of the effects from price changes at different times, in different circumstances, may be appreciably larger. In particular, there may be a ‘shock effect’ from a large price increase leading to a proportionately bigger reduction in the number of smokers. A large price increase (eg $1 rather than 20 cents) would be more recognisable. The larger impact of such a price rise on personal or household budgets may be more likely to act as a precipitating factor in quitting, compared to a smaller price rise.

‘On-going expenditure elasticity’ – the responsiveness to a price rise of the quantity of tobacco consumed by those households continuing to report tobacco spending after the change

-0.40 to –0.60

That is, for a 10% price rise, the quantity consumed by those continuing to smoke fell by 4-6%. There were inconsistencies in some of the results, but the above ranges give a good general picture. The details are in Table A5.2 in Appendix Five.
6 The financial effects on households

6.1 The context of household spending

The possible financial hardship from increasing tobacco taxation can be crudely considered by examining the cost of smoking as part of total spending for some average household types. However, to add depth to that examination, we need to look at the proportions of various types of households that smoke more and less than average. The data on individual smokers below can start to illustrate the types of households that will be more or less affected by taxation. We can also see indications of the proportions of those types of households that are more or less affected. Note that the 25% of the adult population who reported as smokers used an average 15 cigarettes per day (MoH 1999a).

The Ministry of Health 1996-97 health survey: Data from this survey has been used to create the table below. There is some indication from these data that Maori are smoking less per smoker than Pakeha – but this is not at a significant level. Of note however, is that those with no qualifications were significantly less likely to be light smokers than those with higher education.

Table Seven: Reported number of cigarettes smoked among smokers by socio-demographic variables (percentages adjusted for cluster sampling) (based on Ministry of Health 1999a)

<table>
<thead>
<tr>
<th>Key socio-demographic variable</th>
<th>1-10 cigs per day (%)</th>
<th>11-20 cigs per day (%)</th>
<th>21+ cigs per day (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maori</td>
<td>47.3</td>
<td>40.8</td>
<td>11.8</td>
<td>Maori smokers appear to have a lower volume of smoking intensity than Pakeha (but not at a statistically significant level)</td>
</tr>
<tr>
<td>Pakeha/ NZ European</td>
<td>40.3</td>
<td>46.0</td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td><strong>NZDep96</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (least deprived)</td>
<td>48.5</td>
<td>41.1</td>
<td>10.4</td>
<td>No statistically significant differences.</td>
</tr>
<tr>
<td>2</td>
<td>38.0</td>
<td>45.5</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>43.1</td>
<td>45.1</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>4 (most deprived)</td>
<td>45.5</td>
<td>42.0</td>
<td>12.6</td>
<td></td>
</tr>
<tr>
<td><strong>Family income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-$20,000</td>
<td>44.8</td>
<td>41.8</td>
<td>13.4</td>
<td>No statistically significant differences.</td>
</tr>
<tr>
<td>$20,001-$30,000</td>
<td>40.3</td>
<td>45.2</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>$30,001-$50,000</td>
<td>49.0</td>
<td>40.1</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>$50,001+</td>
<td>42.5</td>
<td>44.4</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No qualifications</td>
<td>38.2</td>
<td>45.9</td>
<td>15.9</td>
<td>Those with no qualifications were significantly less likely to be a light smoker (1-10/day) than those with the highest level of qualifications.</td>
</tr>
<tr>
<td>School or post school only</td>
<td>39.8</td>
<td>47.7</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>School &amp; post school only</td>
<td>52.7</td>
<td>38.1</td>
<td>9.2</td>
<td></td>
</tr>
</tbody>
</table>
Another part of the context of the financial impact is the levels of food insecurity in different groups. As mentioned above, about a quarter of Maori men, and a third of Maori women reported that their household could afford to eat properly only sometimes (Ministry of Health 1999c68). For Pacific people nearly 40% report this level of food insecurity. Over a quarter of women in the bottom NZDep96 quartile and over 30% of women in the 19-24 age group reported that their household could afford to eat properly only sometimes.

6.2 The change in the real cost of tobacco over time

Changes in the average impact of the cost of smoking can be seen by looking at changes in average consumption and cost per cigarette equivalent. Smoking prevalence and consumption figures are taken from Ministry of Health figures – see Appendix 7, and tobacco prices from Statistics New Zealand Key Statistics.

In 1988 the prevalence of adult smoking was 29%, and the average annual consumption for all adults of cigarette equivalents was 2317. So smoking adults used an average 7990 cigarettes per year. The average cost of smoking in 1988 dollars was 15.55 cents per cigarette, so the average cost per smoker per year was $1242.45. In 1998 dollars this was $1620.39 per year.

In 1998 the smoking prevalence was 25%, and the average annual consumption for all adults was 1371 cigarette equivalents. So smoking adults used an average 5484 cigarettes per year. The average cost per cigarette was 32.96 cents per cigarette, for an annual cost of $1807.

So while average consumption per smoker was reduced by about 30%, the average annual real cost of smoking rose by 11%.

The implications of these figures include:
- The average smaller consumption – down from 22 to 15 cigarettes per day - means that average smokers may be more able to quit given a significant stimulus or help. However if cigarettes are more addictive, and/or smokers are extracting more nicotine per cigarette, then the ability to quit may not be enhanced.
- The average amount in real terms that an average smoker (who does not cut down) would pay extra after a price rise has increased by 11% between 1988 and 1998.

6.3 Comparing tobacco and other spending

Data from the 1996-97 Household Economic Survey (Statistics New Zealand 199769) on tobacco, housing, food and other spending are detailed in the tables in Appendix Four.

The comparisons below are to examine the effect of tax rises on food available for children, in the worst case of no reduction of smoking by adults. However, as the extra money
needed for tobacco will usually be taken from a range of discretionary spending areas (transport, apparel, alcohol, household operation, leisure) and the range will not necessarily include food, any such worst case effect will nearly always be much smaller or absent.

We stress that the figures below are an approximation, to begin to give some context to the impact of tobacco tax rises. To compensate for the under-reporting of tobacco spending, we have added 122% to the reported amounts.

**Table 7a: Comparisons of spending amounts for households in 1996-97**  
(Statistics New Zealand HES 1997 with 122% added to reported tobacco spending)  
See Appendix Four for fuller details

<table>
<thead>
<tr>
<th>Households</th>
<th>2nd lowest income decile (not equivalised)</th>
<th>‘Maori’ (by ethnicity of ‘householder’)</th>
<th>‘Sole adult and children’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of 10% housing cost increase</td>
<td>$13</td>
<td>$13</td>
<td>$16</td>
</tr>
<tr>
<td>Amount of 30% tobacco cost increase</td>
<td>$10.50 (19% of food spending)</td>
<td>$14.60 (16% of the food spending)</td>
<td>$8.50 (12% of the food spending)</td>
</tr>
</tbody>
</table>

**Using the data**

Users of these data need to be aware of the approximations involved. They need also to be aware that the data masks both the worst cases and possible ameliorating effects. Worst case situations include where food is the item that households find easiest to cut down on. While the data above show some consequences for some groups, they are not able to reveal the effect of tobacco tax rises on the worst case situations – often low-income heavy-smoking lone parents, with no qualifications, in rental property, who are not able to give up or reduce smoking. Table Seven above gives some indication of the proportions of households more or less affected by light or heavy smoking.

However, it is the nature of any spending changes which result from tobacco tax rises, that will determine the impact on poverty. Reduced expenditure on healthy food, education, housing and health services might all have adverse health impacts and intensify the poverty trap. Reduced expenditure on alcohol and gambling may have health benefits, and some spending reductions may be neutral in terms of health and welfare.

**6.4 The financial effects, allowing for the under-reporting of spending on tobacco**

From comparison with statistics on ‘cigarettes delivered’ by manufacturers, it appears that Household Economic Survey respondents could be reporting less than half of actual spending. The detailed calculation of the under-reporting is shown in section 5.1 above.

This will not affect the estimated elasticity values if the under-reporting is consistent over time. It will, however, affect the estimates of the extra spending resulting from a tax.
increase. These estimates need to be adjusted upwards for the different household types to the extent that spending is under-reported in the survey. We have no information on whether some household types are more accurate reporters than others, though it is known that sole parent households and pensioner households are more likely to agree to being in the survey.

In 1995-1996, the estimated consumer spending on tobacco was $1116 million (see section 5.1 above). For the over 350,000 households with smokers (see Table 8), this was an average spending of over $3100 per household. The current average retail price of cigarettes is now about $8.40 a packet of 20, after the May 2000 tobacco tax rise. At that price a household using one packet a day would spend about $3050 per year.

### 6.4.1 Tobacco spending by those who do not stop after a 10% price increase

Tables 8(a) and 8(b) below show some results of calculations for assumed values of elasticities, for a 10% tobacco price increase. The spending figures have not been adjusted for under-reporting. In the absence of information on the differing rates of under-reporting for different groups, a 122% increase of the spending figures would bring them in line with the tobacco availability figures (see section 5.1 above).

Table 8(a) has ‘moderately low’ price elasticity assumptions –

- On-going expenditure elasticity of -0.40
- Prevalence elasticity of -0.10

This is equivalent to an overall price elasticity of demand of –0.50. In other words, 1.0% of smoking households would stop smoking (about 0.3% of all households), while those that continued to smoke reduced their purchases by 4% to offset the 10% price increase. These amounts are for the ‘average’ smoking household. Some households would have considerably higher, and some lower, expenditures than average.

#### For the ‘moderately low’ assumptions

*Allowing for under-reporting*, in households where smokers did not stop, they would spend approximately an extra $100 per year on average if a ‘sole adult and children’ household, or about $175 if a general household.

Table 8(b) has the ‘high-elasticity’ case –

- On-going expenditure elasticity of -0.60
- Prevalence elasticity of -0.20

This is equivalent to an overall price elasticity of demand of –0.80
In other words, 2% of smoking households would stop smoking, while those that continued to smoke reduced their purchases by 6% to offset the 10% price increase.

For the ‘high-elasticity’ case

Allowing for under-reporting, in households where smokers did not stop, they would spend approximately an extra $70 per year on average if a ‘sole adult and children’ household, or about $115 if a general household.

6.4.2 Worse case situations

For households with two smokers, each smoking a $8 pack a day of cigarettes, ($5800 a year for the household) if neither stopped smoking after a 10% price increase, and they cut down at the same rate as the general population, on average they would spend approximately an extra $320 a year (with ‘moderately low’ elasticity assumptions) or $200 (with ‘moderately high’ elasticity assumptions).

6.5 Conclusions

Tobacco consumption elasticities cannot be estimated with great precision and therefore the financial impact of price increases can only be approximate. For low elasticities the extra paid for cigarettes by those who continue to smoke exceeds the savings for those who quit. For high elasticities, savings by those quitting could exceed extra spending by those not quitting.

Typical additional spending per year for those who do not quit would, for a 10% tax increase, would be of the order of $100 for a low income ‘sole adult and children’ household (a quite high proportion in this group being Maori); and up to an extra $175 for households in general. These are average figures, adjusted upwards to allow for under-reporting. For high tobacco consumption households the costs could be appreciably higher. Table Seven above gives some indication of the proportions affected more or less by light and heavy smoking.
*Note: In the tables below ‘Sole adult’ households refers to ‘Sole adult and children’, that is, one adult and children under 15 years of age. The figures have not been adjusted upwards to allow for under-reporting.

Table 8(a) Low Elasticities Effects of 10% price increase

<table>
<thead>
<tr>
<th></th>
<th>Bottom decile 'Sole adult' Household</th>
<th>'Average' 'Sole adult' Household</th>
<th>'Average' Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ of June 1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average equivalised disposable income</td>
<td>$12,750</td>
<td>$18,650</td>
<td>$33,500</td>
</tr>
<tr>
<td>Number of households 1995/96 to 97/98</td>
<td>19,800</td>
<td>66,960</td>
<td>1,162,550</td>
</tr>
<tr>
<td></td>
<td>Maori 16,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'Smoking' households</td>
<td>8,158</td>
<td>28,391</td>
<td>358,065</td>
</tr>
<tr>
<td>Percent</td>
<td>41.2%</td>
<td>42.4%</td>
<td>30.8%</td>
</tr>
<tr>
<td>Percent of Maori</td>
<td></td>
<td>51.4%</td>
<td></td>
</tr>
<tr>
<td>Av. Tobacco $/year</td>
<td>$820</td>
<td>$770</td>
<td>$1,320</td>
</tr>
<tr>
<td></td>
<td>Maori $755</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assumed elasticities</td>
<td>Price -0.4</td>
<td>Proportion -0.1</td>
<td></td>
</tr>
<tr>
<td>Assumed price increase</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households giving up</td>
<td>82</td>
<td>284</td>
<td>3581</td>
</tr>
<tr>
<td>of which Maori</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>their savings</td>
<td>$66,892</td>
<td>$218,611</td>
<td>$4,726,463</td>
</tr>
<tr>
<td>of which Maori</td>
<td>$62,867</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households not giving up</td>
<td>8,076</td>
<td>28,107</td>
<td>354,485</td>
</tr>
<tr>
<td>of which Maori</td>
<td>8,244</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Their extra spending/hhld Maori</td>
<td>$49</td>
<td>$46</td>
<td>$79</td>
</tr>
<tr>
<td>Maori</td>
<td>$45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total extra spending</td>
<td>$397,340</td>
<td>$1,298,549</td>
<td>$28,075,192</td>
</tr>
<tr>
<td>Maori</td>
<td>$373,432</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Net effects

| Those giving up | $66,892 | $218,611 | $4,726,463 |
| Those not       | $397,340| $1,298,549| $28,075,192|
| Extra spending  | $330,448| $1,079,938| $23,348,729|

Maori giving up $62,867
Maori not $373,432
Extra spending $310,565
Table 8(b)  High Elasticities  Effects of 10% price increase

<table>
<thead>
<tr>
<th>$ of June 1999</th>
<th>Bottom decile 'Sole adult' Household</th>
<th>'Average' 'Sole adult' Household</th>
<th>'Average' Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average equvalised disposable income</td>
<td>$12,750</td>
<td>$18,650</td>
<td>$33,500</td>
</tr>
<tr>
<td>Number of households 1995/96 to 97/98 Maori</td>
<td>19,800</td>
<td>66,960</td>
<td>1,162,550</td>
</tr>
</tbody>
</table>

| 'Smoking' households | 8,158 | 28,391 | 358,065 |
| Percent | 41.2% | 42.4% | 30.8% |
| Percent of Maori | 51.4% |
| Av. Tobacco $/year Maori | $820 | $770 | $1,320 |

Assumed elasticities
- Price: -0.6
- Proportion: -0.2

Assumed price increase: 10%

| Households giving up | 163 | 568 | 7161 |
| of which Maori | 167 |
| their savings Maori | $133,785 | $437,222 | $9,452,927 |
| of which Maori | $125,735 |

| Households not giving up | 7,994 | 27,823 | 350,904 |
| of which Maori | 8,160 |
| Their extra spending/hhld Maori | $33 | $31 | $53 |
| Total extra spending Maori | $262,218 | $856,955 | $18,527,736 |

| Net effects |
| Those giving up | $133,785 | $437,222 | $9,452,927 |
| Those not | $262,218 | $856,955 | $18,527,736 |
| Extra spending Maori giving up | $128,433 | $419,733 | $9,074,809 |
| Maori not | $125,735 |
| Extra spending Maori giving up | $246,440 |
| Extra spending | $120,705 |
7 Discussion

7.1 The limitations of this work

Budget constraints for this project meant that when ordering Statistics New Zealand Household Economic Survey data, only tobacco consumption data of all households by income decile, and from ‘sole adult and children’ households was used. This information was only for 1988 – 1998. Further resources would have enabled the use of additional HES data for:

- All sole adult households (not just ‘sole adult and children’). Those data would have produced a larger group of households where the accurate analysis of impacts by ethnicity was possible. However, it would have had the disadvantage of creating a more heterogeneous group.
- All households by ‘householders’ ethnicity. Those data would have been less accurate than the above, but in the absence of other spending data by ethnicity, would still have provided valuable information for ethnic groups.
- Further particular types of households potentially at risk of adverse impact from tobacco taxation. These include ‘smoking’ households with two or more adults and two or more children.
- Individual (rather than household) spending data by age, ethnicity, gender, and income. While these data can give inaccurate pictures, due to the transfers within households, it would be valuable to compare with household data.
- Unit household data. This information about the reported spending of individual households, rather than groups of households, would only be available through the use of the Statistics New Zealand data laboratory.

Furthermore, because of the concentration on quantitative analysis, a number of questions best answered by qualitative research were not considered in detail. Some of these are mentioned in the section below.

This work has been largely concerned with the immediate financial consequences for households with smokers. It does not explore the ways in which prices rises interact with other motives and pressures to increase, reduce or quit using tobacco. Neither does it do more than suggest the range of ways in which a range of individuals reacts to the same pressures. We repeat that the relationships between price and other factors for consumption and prevalence are complex, and that price change is seen by smokers as one of many influences – such as family, smokefree work or social areas, and medical advice.

For a more wide ranging discussion on the wider social and economic impacts of tobacco taxes, see Wilson and Thomson (200071).

7.2 The value of future research

Further econometric work could use the available data in more complex ways. A more detailed study could be done by using unit data from the HES (rather than group data) for a
The effects of tobacco tax increases  

June 2000

George Thomson, Des O’Dea, Nick Wilson, Papaarangi Reid, Philippa Howden-Chapman

period of rapid price changes. This would involve the use of the Statistics New Zealand data laboratory, and require data on the dates when households were in the survey. The use of unit data would help our understanding of the range of spending changes for different groups after price changes. In particular it would help give the proportion of households or individuals that reported no or little change in spending.

Other quantitative ways of assessing the impact of tobacco price changes on particular groups include looking at other consumption data, and at smoking prevalence data. This data includes:

- Smoking prevalence - AC Nielsen survey smoking prevalence data
- Tobacco consumption - Weekly retail sales data

Qualitative research could look at some of the factors around:

- the reporting of smoking and tobacco consumption by different groups
- the responses to tobacco price rises, including:
  - quitting and reducing consumption,
  - compensatory smoking behaviour when reducing consumption
  - the effect on the consumption of other goods and services
  - the other supporting factors which help precipitate quitting or support reduction
  - the effects of multiple and predicted price rises.

Such qualitative work would enable some of the social and micro-economic context of smokers to be found, in which the effects of tobacco prices can be placed with more accuracy. This context includes behavioural rituals such as the sharing of cigarettes.72

Further work is also necessary to integrate this quantitative and qualitative evidence of effects of tobacco price changes with other influences on quitting and smoking rates.

We were struck by the absence of New Zealand research work on the impacts of tobacco taxation, especially considering the scale and majority proportion of tobacco sales revenue going to government, and the social groups involved. Research in this area is hampered by the sample size of the existing HES expenditure survey and the lack of annual data since 1998. The sample size (approximately 3000 households per year) means that there is sometimes insufficient numbers for the robust analysis of the spending of particular ethnic and social groups. A tobacco spending survey targeted to the needs of tobacco control policy would be more likely to provide adequate accuracy for the reporting of spending.

Tobacco control research also needs information from in-depth longitudinal studies of smokers, so as to better understand the process of quitting when price and other influences are used. Such information would help in the design of health promotion, smoking cessation, product control, smokefree environments, and tobacco marketing controls, as well as in the formation of taxation policy.
7.3 Potential health policy implications

Tobacco taxation needs to be seen as part of an overall tobacco control program, and as part of an overall social and economic program. The health impacts of tobacco pricing policy on all groups in society should be made clear in any decisions on tobacco taxation increases. These health impacts will include the proportion of women, Maori, and those in low-income households likely to live longer due to quitting, reducing, or not starting smoking.

7.3.1 The health impact evidence elsewhere

Moore (199573) reported for the United States that:
“tobacco tax increases in the previous year cause a significant decrease in the mortality rates.”

This included a 1% decrease in cardiovascular disease and asthma mortality for a 10% increase in tobacco tax. Some of the range of the health impact of tobacco use is detailed by Bartecchi et al (199474).

Research on identifying tobacco-related health impacts (Doll 199875) would suggest that reductions in tobacco consumption should reduce the age-specific incidence rates of approximately 40 medical conditions. While the decline in ischaemic heart disease and stroke tends to occur relatively rapidly, other conditions such as lung cancer may not decline for decades after a decline in smoking.

The particular benefits from tax increases, for households with pregnant women and/or children, are stressed by Aligne and Stoddard (199776) and Adams and Young (199977). Much of these avoided costs are in the short term, so even when policy makers decide to heavily discount future benefits, the advantages of protecting mothers and children from tobacco smoke remain.

7.3.2 The evidence in New Zealand on the health impact of smoking

Some of the detail of smoking-related illness amongst Maori is described by Bullen and Beaglehole (199778). The evidence of the changes in New Zealand tobacco use related to tax rises can be used to calculate health gains, when used with evidence of tobacco-related health impacts. Two principal examples of this evidence on the health and social impact are Laugesen and Clement’s study on smoking mortality amongst Maori (199879), and Easton’s on the social and economic costs of New Zealand smoking (199780).

Other work suggests that during the decline in tobacco consumption over the last 15 years there have been ongoing reductions in tobacco-related diseases including ischaemic heart disease (IHD) and stroke (MoH 199781; PHC 199482). Sudden infant death syndrome (SIDS) has also declined in recent years and tobacco exposure is an important risk factor in the New Zealand setting (Mitchell et al 199783). Declines in IHD and stroke have also
occurred among Maori. These favourable disease trends may be partly due to reduced tobacco-exposure (due to interventions that include taxation) but other factors such as dietary change (for IHD) and changes in sleeping position (SIDS) are also important.

7.3.3 Compensating behaviour

While the quantity purchased may decline after a price rise, smokers may partially compensate by choosing cigarettes higher in nicotine, by inhaling deeper, by inhaling more often (and letting less of the tobacco burn without inhalation) and by smoking closer to the butt end of the cigarette. Thus there may be a reduction in consumption without a related reduction in health effects. In jurisdictions where tobacco is taxed by such variables as cigarette or pack units, smokers can react to price increases by a move to longer or bigger cigarettes.

One of principal publications on compensatory smoking (Evans and Farrelly 199884) suggests that compensating behaviour largely reduced the health benefits of tax increases, especially for young adults aged 18-24 years. However, the relevance of this United States research for New Zealand may be affected by the tobacco taxation system differences between the countries. The United States taxation system may encourage the use of larger volume cigarettes when the taxation is on cigarette or packet unit rather than weight.

Significant levels of compensatory behaviour will not erode the health benefits of decreased purchases for smokers who buy substantially less, who quit completely and for non-smokers exposed to second-hand smoke. Indeed, non-smokers would tend to benefit from reduced second-hand smoke exposure if smokers tended to smoke less frequently while extracting more nicotine (and tar) from each cigarette smoked for themselves. Furthermore, the ability to smoke a cigarette more intensely than normal is an acquired ability among experienced smokers and so higher tobacco prices should continue to deter youth from taking up regular smoking.

7.3.4 The context for the health impact

The general relationship between poverty and smoking is described by Smeeth and Fowler (199885), writing about the British situation:

“Smoking increases socio-economic health inequalities in two ways. Higher rates of smoking among those with the lowest incomes mean that the burden of disease due to smoking is highest in these groups. …. By exacerbating the poverty of those on the lowest incomes, the health effects of smoking go way beyond the direct effects of tobacco fumes.”

Further comment on the health effects of poverty intensification for smokers and the households in which they live is given by Lynch et al (199786). Because they are more likely to quit or reduce smoking with price rises; poorer smokers appear to gain greater
health benefits from tobacco tax rises compared to richer smokers, who generally gain more from health education (Warner et al 1995, Townsend 1996).

7.3.5 **Summary of health benefits**

A summary of some of the major potential health benefits from a tobacco tax rise that reduced consumption significantly include:

- Reduced incidence of health problems among infants whose mothers smoked during pregnancy (e.g., low-birth-weight, birth complications, perinatal death, behavioural problems in childhood).
- Reduced incidence of diseases in children that are associated with exposure to second-hand smoke (glue ear, respiratory infections, SIDS, asthma),
- Reduced incidence of diseases among smokers themselves (particularly ischaemic heart disease, stroke, chronic respiratory disease and lung cancer).
- Probable mental and physical health benefits to families/whānau due to lower financial strain (where smokers quit, or reduce consumption at a greater rate than the tax increase effect).

Note that these benefits would occur only with reduced consumption, and where the compensatory smoking behaviour did not negate the reduced consumption. For a wider discussion of health benefits see Wilson and Thomson (2000).

7.4 **Wider policy implications**

7.4.1 **Wider context**

The wider policy context includes the place of tobacco taxation within government revenue and spending, and the place of overall economic and social costs of tobacco to New Zealand within the national economy.

Annual government revenue from tobacco sales during 1998-99 was $637 million from customs and excise receipts and about $148 million from GST (Statistics New Zealand Yearbook 1999). This income represents almost 2.5% of the total government revenue (Statistics New Zealand 1999). The government revenue from tobacco can also be compared to the estimated tangible costs in 1990 of tobacco use in New Zealand, of $1220 million (1990 dollars) (Easton 1997). There is considerable argument about the correct costing of tobacco use – for a discussion see Wilson and Thomson (2000). The total identifiable amount spent by government on tobacco control has been less than $13 million annually (Laugesen 1999, Ministry of Health 1998), and for 2000-2001 is projected to be just over $16 million (Cynthia Maling of the Health Funding Authority at the Smokefree Conference, May 2000). This latter figure includes cessation spending from the Personal Health budget, as opposed to Public Health spending.
7.4.2 **Policy options**

Beyond the health implications, tobacco taxation policy should also acknowledge the social and financial impact of such policies on different groups. Irrespective of whether deprived groups are more responsive to tobacco price rises than the general smoking population, it would be helpful (for both health and equity benefits) to adopt a wide range of tobacco control measures in conjunction with any tobacco taxation increases. Those measures would need to increase the ability of deprived groups to respond favourably to price rises by deciding to quit or reduce smoking.

To ensure that there is no increased hardship for families, in the situations where smokers do not reduce their smoking at least in proportion to tobacco price increases, policy makers can consider a range of options. A truly comprehensive and adequately resourced tobacco control policy would give the background support for such quitting and reduction. The scale of the funding needed for such a program in New Zealand appears to be at least $50-80 million a year, by US government best practice guidelines (CDC 1999). However to ensure the targeted and intensive cessation support necessary to enable those in the groups with the most social deprivation to quit, this budget would probably need to be raised.

Particular options include expanding tobacco control mass media campaigns, promoting smoking cessation to Maori and low-income groups, fully subsidising nicotine replacement therapy (NRT) for these groups, allowing NRT to be sold in supermarkets, and expanding Quitline services (including culturally appropriate services).

The integration of tobacco control methods may also ensure that tax rises are more effectively complemented. Such integration should include:

1. The design of media campaigns to:
   - help move smokers into a stage of awareness where they are more likely to consider quitting after a price rise, and then more likely to act,
   - create a supportive environment for those who have given up after a price rise.

2. A timetable of significantly large tobacco tax increases (eg 50 cents every six months for two years). This would help smokers and their supporters to identify a date for quit attempts, remove some of the barriers to successful quitting, and gain support for their efforts to get through nicotine withdrawal.

3. The provision of sufficient cessation resources (including the Quitline) to ensure that the services can successfully handle the numbers of those needing help before and after tobacco price rises. The resources should include cessation maintenance programs for those in the period up to six months after quitting. These programs are needed to help ex-smokers deal with relapses, stress and any weight gains.

4. The provision of a high input ‘gold standard’ level of cessation support services targeted to those in households most vulnerable to harm from tobacco price rises.
5. The design of the wider health promotion activities to support price caused cessation attempts. This would include the ongoing smokefree sponsorship work and communication work to produce media coverage of tobacco-related topics.

6. A sufficient tobacco control research and evaluation program to inform future tobacco taxation and tobacco control policies.

Tobacco taxation needs also to be considered as part of overall tax and incomes policy. Policy options are needed to counter the adverse health and social effects of regressive taxation, including tobacco taxation. The integration of tobacco tax policy into wider equity, Treaty and tax and incomes policy, requires joint policy formation work. This work should involve all relevant agencies, such as the Ministry of Health, Treasury, Te Puni Kokiri, Youth Affairs, Women’s Affairs, and the Social Policy Agency. The work should have a budget to ensure that it is sufficiently staffed and resourced.

7.5 Summation

Tobacco taxes are a broad impact intervention. They benefit smokers who quit, reduce the consumption of tobacco and make quitting attempts move up the personal agenda of smokers who continue to smoke. They benefit non-smokers exposed to second-hand smoke, and young people who are less likely to smoke.

However, tobacco taxes, their health and social effects, and the social wage need to be seen in the same picture. Without sufficient policy changes to ensure that the position of Maori and low-income households are improved, tobacco taxation increases could adversely affect the financial welfare of some of those within Aotearoa who are in the most deprived sectors of the population. At present government tobacco control spending is minute compared to both the government revenues from tobacco and the tangible costs from tobacco use.

The impact of tobacco taxation on Maori and low-income households needs to be seen as a part of overall government policy towards those two groups. The very large health benefits from quitting and reduced consumption need to be ensured by comprehensive and greatly improved tobacco control investment. Moves to improve a wider range of social and economic indicators for these groups will also help lessen any adverse impacts of tobacco taxation, and help make tobacco control measures more productive.
Appendix One: Some overseas reports of price elasticity of tobacco demand

**Biener** (1998\textsuperscript{96}) reported that as a result of an average 15% retail price rise in January 1993 in Massachusetts, 3.5% of adults surveyed reported they had stopped smoking\textsuperscript{3}. The survey was conducted 10-15 months later. The consumption figures were distorted by a trade price drop after six months.

**Farrelly and Bray** (1998\textsuperscript{a97 1998b98}) used two types of multiple regression models on summed national surveys in the USA (n =355,246). “A probit (limited dependent variable) was used to estimate the change in the probability of smoking (one for current smokers and zero for all other respondents) for a change in the inflation-adjusted price. An ordinary least squares model, restricted to current smokers (n=112,657) with self-reported cigarettes smoked per day as the independent variable, was used to estimate the relation between inflation-adjusted price and quantity of cigarettes consumed. Both models controlled for “year, region …, age, sex, ethnicity, education, marital status, family income and urbanicity.”

They reported a range of prevalence elasticities from –1.31 to –0.05 and consumption elasticities from -0.58 to –0.10, for different age, ethnic and income groups.

The CDC editor noted that ‘because the analysis is based on pooled cross-sectional surveys, the estimates of price elasticity could underestimate the long term response to price changes that would be observed from longitudinal surveys.’ The editor also argued that the study does not fully control for other demand factors.

**Meier and Licari** (1997\textsuperscript{99}) used a ‘pooled time series of all US states (tobacco consumption) from 1955 through 1994’. To deal with non-stationary data they used differenced data and a lagged dependence variable. They tested for autocorrelation using a pooled Lagrange multiplier, and for autocorrelation of up to five lags using a White test.

**Townsend et al** (1994\textsuperscript{100}) used British random sample surveys (1972-1990) and found a range of consumption price elasticities from –1.0 (low status men – plus a prevalence elasticity of –0.61!) to near zero (high status groups), summed at -0.5 for men, and -0.6 for women. Prevalence elasticity for all men was at -0.08 and all women at –0.23.

They used multiple regression analysis – a single equation model for each group, for consumption and prevalence. (Log of average consumption/adult for a particular year against real disposable income per head, real tobacco price, a health publicity variable, and one for random error.)

To get the most appropriate equation they
* excluded terms not significant at the 5% level,
* examined the R\textsuperscript{2} statistic, adjusted for degrees of freedom
* used the Durbin Watson statistic for serial correlation.
Townsend (1996) gives a table of elasticities from a meta analysis and four other non-USA studies, which gives price elasticities from –0.4 to -0.7, and income elasticities from -0.3 to -0.5 (except for New Guinea at -0.9).

The effects for youth
Chaloupka and Wechsler (1995) used a survey of 17,592 US college students. They used ordered probit methods and then as a second step least squares methods. They found a price elasticity of smoking prevalence of –0.62 and -0.71 for different samples. They found price elasticity of consumption from conditional demand equations of –0.85 and -0.69 for the different samples – giving overall price elasticity of demands between –1.367 and –1.476.

Grossman and Chaloupka (1997) showed that significant increases in quitting by youth from tax increases, and that that such changes may affect decisions to start regular smoking (they found that a 10% increase in price resulted in a 7% decrease in teenage smoking prevalence).

Lewit et al 1997 showed a significant price impact on smoking prevalence by 13-16 year olds, with boys (-1.51) markedly more sensitive to price than girls (-0.32). They found price elasticities of -0.87 (both genders) for prevalence and –0.95 for intent to smoke.

They used two US surveys in 1990-1992 with a total sample of 15,432. Multivariate logistic regression models were used. Price elasticities were “estimated at the mean level of the dependent and price variables in the sample”.

Warner (1998). A review of a number of studies indicated that for both quitting and consumption reduction, tax increases have been shown to affect youth two to three times as much as adults.
Appendix Two: Some groups of households with children affected by tobacco taxation

Table Nine: Sole adult smoking households with children

New Zealand households with one adult and one or more children reporting smokers by income, gender and ethnicity of adult

Figures from Statistics New Zealand, 1996 Census

*Note:* A small % of households do not specify their smoking status or ethnicity

<table>
<thead>
<tr>
<th>Income</th>
<th>Pakeha</th>
<th></th>
<th>Maori</th>
<th></th>
<th>Pacific people</th>
<th></th>
<th>Total</th>
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<tr>
<td></td>
<td></td>
<td>Gender</td>
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<td>M</td>
<td>F</td>
<td>All</td>
<td>M</td>
<td>F</td>
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<tr>
<td></td>
<td></td>
<td>of adult</td>
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<td></td>
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<tr>
<td>Loss</td>
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<td>12</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
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<td>90</td>
<td>93</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>0- $5000</td>
<td>27</td>
<td>546</td>
<td>573</td>
<td>51</td>
<td>468</td>
<td>519</td>
<td>9</td>
<td>72</td>
</tr>
<tr>
<td>$5-10000</td>
<td>183</td>
<td>1653</td>
<td>1836</td>
<td>183</td>
<td>1395</td>
<td>1578</td>
<td>27</td>
<td>144</td>
</tr>
<tr>
<td>$10-15000</td>
<td>489</td>
<td>5514</td>
<td>6003</td>
<td>336</td>
<td>3117</td>
<td>3453</td>
<td>42</td>
<td>315</td>
</tr>
<tr>
<td>$15000+</td>
<td>708</td>
<td>7815</td>
<td>8523</td>
<td>573</td>
<td>5037</td>
<td>5610</td>
<td>78</td>
<td>537</td>
</tr>
</tbody>
</table>

Note: A small % of households do not specify their smoking status or ethnicity.
Table Ten: Larger poor smoking households with a high child ratio

New Zealand households with *two adults only, and three or more children* reporting smokers by income

<table>
<thead>
<tr>
<th>Annual income</th>
<th>With smokers*</th>
<th>With two smokers**</th>
<th>Total households</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15000 or less</td>
<td>1203 (46%)</td>
<td>477 (18%)</td>
<td>2592 (100%)</td>
</tr>
<tr>
<td>$15001-$20000</td>
<td>1437 (47%)</td>
<td>648 (21%)</td>
<td>3024 (100%)</td>
</tr>
<tr>
<td>$20001-$25000</td>
<td>1626 (49%)</td>
<td>705 (21%)</td>
<td>3297 (100%)</td>
</tr>
<tr>
<td>$25001-$30000</td>
<td>3054 (46%)</td>
<td>1347 (20%)</td>
<td>6615 (100%)</td>
</tr>
<tr>
<td>$30000 or less</td>
<td><strong>7320 (47%)</strong></td>
<td><strong>3177 (20%)</strong></td>
<td><strong>15528 (100%)</strong></td>
</tr>
<tr>
<td>Not reporting incomes</td>
<td>3396 (38%)</td>
<td>1017 (11%)</td>
<td>8934 (100%)</td>
</tr>
<tr>
<td>All incomes</td>
<td>22092 (35%)</td>
<td>8058 (12%)</td>
<td>63624 (100%)</td>
</tr>
</tbody>
</table>

* With households with smokers as a percentage of all households in the income band
** With households with two smokers as a percentage of such households

Figures from Statistics New Zealand, 1996 Census

*Note:* There are also other types of households with such high child/‘adult’ ratio, such as those with three adults and six or more children.
Table Eleven: Other larger poor smoking households

New Zealand households with *more* than two adults and three or more children reporting smokers by income

Figures from Statistics New Zealand, 1996 Census

<table>
<thead>
<tr>
<th>Annual income</th>
<th>Two or more smokers**</th>
<th>All households with smokers*</th>
<th>Total households including ‘smokers’</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15000 or less</td>
<td>129 (26%)</td>
<td>244 (50%)</td>
<td>486 (100%)</td>
</tr>
<tr>
<td>$30000 or less</td>
<td><strong>885 (33%)</strong></td>
<td><strong>1569 (59%)</strong></td>
<td><strong>2661 (100%)</strong></td>
</tr>
<tr>
<td>Not reporting incomes</td>
<td>681 (7%)</td>
<td>5235 (56%)</td>
<td>9267 (100%)</td>
</tr>
<tr>
<td>All incomes</td>
<td>6981 (31%)</td>
<td>12426 (56%)</td>
<td>22293 (100%)</td>
</tr>
</tbody>
</table>

* With households with smokers as a percentage of all households in the income band
** With households with more than one smokers as a percentage of all households in the income band
Table 12: Poorer smoking households (two plus adults)

New Zealand households with two or more adults (with and without children) reporting smokers by income

Figures from Statistics New Zealand, 1996 Census

<table>
<thead>
<tr>
<th>Annual income</th>
<th>With smokers*</th>
<th>One smoker</th>
<th>Two or more smokers</th>
<th>Total households</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15000 or less</td>
<td>13290 (41%)</td>
<td>8397</td>
<td>4893</td>
<td>32118 (100%)</td>
</tr>
<tr>
<td>$15001-$20000</td>
<td>21105 (32%)</td>
<td>13899</td>
<td>7206</td>
<td>65115 (100%)</td>
</tr>
<tr>
<td>$20001-$25000</td>
<td>15384 (38%)</td>
<td>9519</td>
<td>5865</td>
<td>39948 (100%)</td>
</tr>
<tr>
<td>$25001-$30000</td>
<td>30711 (35%)</td>
<td>19245</td>
<td>11466</td>
<td>88206 (100%)</td>
</tr>
<tr>
<td>$30000 or less</td>
<td>80490 (36%)</td>
<td>51060</td>
<td>29430 (13%)</td>
<td>225387 (100%)</td>
</tr>
<tr>
<td>Not reporting incomes</td>
<td>64959 (37%)</td>
<td>40803</td>
<td>24156 (14%)</td>
<td>177501 (100%)</td>
</tr>
<tr>
<td>All incomes</td>
<td>338442 (41%)</td>
<td>210351</td>
<td>128091 (14%)</td>
<td>943548 (100%)</td>
</tr>
</tbody>
</table>

* With households with smokers as a percentage of all households in the income band

A number of points from the table can be highlighted:

- In 1996, 80,490 of these households reported incomes of $30000 or under, and smokers. They are 8.5% of all households with two or more adults.
- Some low-income bands (e.g., $10-15000) have a higher proportion (45%) of smoking households than the general population of households (41%).
- 29,430 households reported incomes of $30000 or under, and two or more smokers.
Appendix Three: Some groups of individuals affected by tobacco taxation

Table 13: Reported smokers aged 15 years or over, by income level and ethnicity
Figures from Statistics New Zealand, 1996 Census (Usual residence) Table 23 – Sex and personal income by smoking status and ethnic group.

<table>
<thead>
<tr>
<th>Income band</th>
<th>Gender</th>
<th>Maori#</th>
<th>Pacific people#</th>
<th>Pakeha #</th>
<th>Total smokers</th>
<th>All population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss/ Zero</td>
<td>Female</td>
<td>4092 (25%)</td>
<td>810 (.05%)</td>
<td>10827 (66%)</td>
<td>16365 (17.5%**)</td>
<td>93270 (100%)</td>
</tr>
<tr>
<td>$1-$5000</td>
<td>Female</td>
<td>9480 (28%)</td>
<td>1575 (.05%)</td>
<td>22245 (65%)</td>
<td>34086 (19.5%**)</td>
<td>174339 (100%)</td>
</tr>
<tr>
<td>$5001-$10,000</td>
<td>Female</td>
<td>15138 (27%)</td>
<td>2109 (.04%)</td>
<td>37695 (67%)</td>
<td>55980 (22.8%**)</td>
<td>245742 (100%)</td>
</tr>
<tr>
<td>$10001-$15000</td>
<td>Female</td>
<td>16716 (27%)</td>
<td>2226 (.04%)</td>
<td>41049 (67%)</td>
<td>60912 (23.4%**)</td>
<td>260124 (100%)</td>
</tr>
<tr>
<td>$15000 &amp; under</td>
<td>Female</td>
<td>45426 (25%)</td>
<td>6720 (.04%)</td>
<td>111816 (67%)</td>
<td>167343 (21.6%**)</td>
<td>773475 (100%)</td>
</tr>
<tr>
<td>All income bands</td>
<td>Female</td>
<td>76263 (25%)</td>
<td>13506 (.04%)</td>
<td>206181 (68%)</td>
<td>301908 (21%**)</td>
<td>1436256 (100%)</td>
</tr>
</tbody>
</table>

| Loss/ zero        | All    | 6036 (25%)      | 1590 (.07%)     | 14553 (60%)    | 24060 (17.5%**) | 137559 (100%) |
| $1-$5000          | All    | 15444 (28.5%)   | 3372 (.06%)     | 32976 (61%)    | 54216 (20%**)   | 271236 (100%) |
| $5001-$10,000     | All    | 26628 (26%)     | 4716 (.045%)    | 68376 (66%)    | 103059 (24.8%**) | 414594 (100%) |
| $10001-$15000     | All    | 24477 (25%)     | 4203 (.04%)     | 67701 (68%)    | 98892 (24.1%**) | 410712 (100%) |
| Loss-$15000       | All    | 72585 (26%)     | 13881 (.04%)    | 183606 (65%)   | 280229 (22.7%**) | 1234101 (100%) |
| All income bands  | All    | 135465 (22%)    | 30804 (.05%)    | 423276 (69%)   | 609297 (21.87%**) | 2786220 (100%) |

*Includes non-smokers

**Smokers as a percentage of all in income group. Note that an allowance for those who do not respond to this question would increase this percentage slightly. Because the Census form is filled in by an individual in a household, smokers may be under-reported, especially young smokers.

# Numbers of smokers, and ethnic group as percentage of smokers in that income group. Note that not all respondents give their ethnicity.
Appendix Four: Data on comparative expenditure

To get the approximate spending by particular groups, we have combined aggregate data and the percentage of households reporting particular spending. So for instance if the average weekly spending on tobacco by lone adults with children was reported at $6.70 and 30% of these households reported tobacco spending, the average reported spending by smoking lone adults with children was approximately $22. We stress that this is an approximation, to begin to give some context to the impact of tobacco tax rises. To compensate for the under-reporting of tobacco spending, we have added 122% to the reported amounts. This may be a worst case.

Table 14: Average weekly expenditure by household income decile, year to March 1997 (Statistics New Zealand 1997106 with 122% added to reported tobacco spending)

<table>
<thead>
<tr>
<th>Spending area</th>
<th>Income decile*</th>
<th>$13,100 to $18,499</th>
<th>$53,900 to $68,199</th>
<th>Expenditure - all income groups ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under $13,100</td>
<td>$13,100 to $18,499</td>
<td>$53,900 to $68,199</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average spending ($)</td>
<td>Average if consumed ($)</td>
<td>Average if consumed ($)</td>
<td>Average if consumed ($)</td>
</tr>
<tr>
<td></td>
<td>%‡</td>
<td>Average spending ($)</td>
<td>%‡</td>
<td>Average if consumed ($)</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>10.3</td>
<td>30</td>
<td>34.3</td>
<td>10.5</td>
</tr>
<tr>
<td>Alcohol</td>
<td>9.0</td>
<td>40</td>
<td>22</td>
<td>4.8</td>
</tr>
<tr>
<td>Housing</td>
<td>129.6</td>
<td>130</td>
<td>130.6</td>
<td>130</td>
</tr>
<tr>
<td>Food</td>
<td>71.9</td>
<td>70</td>
<td>56.1</td>
<td>55</td>
</tr>
<tr>
<td>Health services</td>
<td>9.6</td>
<td>50</td>
<td>19</td>
<td>6.9</td>
</tr>
<tr>
<td>Total net expenditure</td>
<td>448.4</td>
<td>100</td>
<td>448</td>
<td>366.6</td>
</tr>
</tbody>
</table>

Notes:

* This covers the two lowest income deciles, and the eighth income decile for comparison. As the lowest income group has some self-employed and a higher total spending than the second-lowest group, the latter can be used for examining the context of tobacco tax rises on the worst-off. This data is not equivalised to adjust for household size, so the larger incomes (and greater tobacco spending) may reflect greater numbers of adults in the households.

† The average spending for only the households reporting spending on that particular area (eg, tobacco, alcohol). So for an income decile spending an average $9.60 for all households on an item (eg, tobacco), and where 30% of all the household decile reported such spending, then the average spending in those households was approximately $32 on tobacco. When making comparisons within the tables it should be noted that the households spending money on tobacco are not necessarily those spending on alcohol.

‡ The approximate percentage of such households reporting expenditure in a particular area. This may be affected by some households not reporting particular...
types of spending (eg, alcohol). For housing and food virtually all households report some spending.
Table 15:  *Average weekly expenditure by ethnic group of householder, year to March 1997* (Statistics New Zealand 1997\(^{107}\) with 122% added to reported tobacco spending)

<table>
<thead>
<tr>
<th>Spending area</th>
<th>Maori</th>
<th></th>
<th>Paciata/ NZ European</th>
<th></th>
<th>Pacific peoples *</th>
<th></th>
<th>All ethnic groups †</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average spending ($)</td>
<td>% ‡</td>
<td>Average if consumed ($) ‡</td>
<td></td>
<td>Average spending ($)</td>
<td>% ‡</td>
<td>Average if consumed ($) ‡</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>24.3</td>
<td>50</td>
<td>48.6</td>
<td>16.5</td>
<td>29</td>
<td>57</td>
<td>17</td>
</tr>
<tr>
<td>Alcohol</td>
<td>10.7</td>
<td>40</td>
<td>27</td>
<td>16.7</td>
<td>57</td>
<td>29</td>
<td>3.2</td>
</tr>
<tr>
<td>Housing</td>
<td>132.0</td>
<td>132</td>
<td>117.6</td>
<td>118</td>
<td>137.8</td>
<td>138</td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>91.7</td>
<td>90</td>
<td>110.3</td>
<td>110</td>
<td>95.6</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Health services</td>
<td>6.9</td>
<td>50</td>
<td>14</td>
<td>16.6</td>
<td>71</td>
<td>23</td>
<td>4.2</td>
</tr>
<tr>
<td>Total net expenditure</td>
<td>546.5</td>
<td>100</td>
<td>546</td>
<td>662.1</td>
<td>100</td>
<td>662</td>
<td>514.3</td>
</tr>
</tbody>
</table>

**Notes:**

* The sample sizes are so small that these figures are only indicative.
† Includes all other ethnic groups eg, Asian people.
‡ See explanatory footnotes to Table 14.

Table 16  *Average weekly expenditure by household type, year to March 1997* (Statistics New Zealand 1997\(^{108}\) with 122% added to reported tobacco spending)

<table>
<thead>
<tr>
<th>Spending area</th>
<th>1 adult, 1 or more children</th>
<th></th>
<th>2 adults, 3 or more children</th>
<th></th>
<th>All types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average spending ($)</td>
<td>%</td>
<td>Average if consumed ($) *</td>
<td></td>
<td>Average spending ($)</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>14.2</td>
<td>50</td>
<td>28.4</td>
<td>15.60</td>
<td>33</td>
</tr>
<tr>
<td>Alcohol</td>
<td>3.0</td>
<td>17</td>
<td>18</td>
<td>8.2</td>
<td>50</td>
</tr>
<tr>
<td>Housing</td>
<td>161.1</td>
<td>160</td>
<td>233.2</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>70.4</td>
<td>70</td>
<td>151</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Health services</td>
<td>4.2</td>
<td>33</td>
<td>13</td>
<td>13.3</td>
<td>67</td>
</tr>
<tr>
<td>Total net expenditure</td>
<td>446.7</td>
<td>100</td>
<td>446</td>
<td>831.4</td>
<td>10</td>
</tr>
</tbody>
</table>

**Note:**  See explanatory footnotes to Table 14.
Appendix Five: Report on the econometric analyses

Des O’Dea

The primary basis for the conclusions of this section is the analysis using tobacco availability data (‘cigarettes released for consumption’). However this only gives results for the whole population of smokers. So expenditure data, taken from the Household Expenditure Survey (HES) was used to examine the changes for both all households by income level and for ‘sole adult and children’ households by ethnic and income group.

The analyses are throughout in terms of years, ending March.

1 Tobacco availability-based estimates of elasticity.

Estimates of overall price and income elasticities of demand were calculated from data on annual ‘cigarettes delivered per adult’. These results can be compared with earlier work by Salter (using both annual and quarterly data) and Evans and Meads (using monthly data). However, the analyses here have not yet been extended to include the lagged response models in those two papers. Arguably this is not necessary for annual data.

In what follows, it should be noted that a price increase for a good which is price inelastic has the concurrent effect of reducing available income, so that the actual outcome is a compound of both price and income effects, even if income is otherwise unchanged. The result is that the estimated price elasticity is higher than the ‘income-compensated price elasticity’. This ramification is not further investigated in this report.

The calculations

The variables used, for the period 1982/83 to 1997/98, were:

- Demand – ‘Cigarette equivalents delivered’ per person aged 15 and over
- Price - Tobacco component of CPI
- Income – Real household income per capita, from ‘System of National Accounts’ Household Income and Outlay table 4.1
- Time – years from 1982/83 = 1

The average expenditures given in this report are these deflated values, or volumes, expressed in dollars of June 1999. Dividing the Tobacco CPI index by the All Groups index gives a measure of real tobacco prices, the ratio of tobacco prices to the prices of all goods.

The assumption in our calculations is that changes in this real price (because of tax changes or for other reasons) lead to changes in quantities consumed. Our objective is to estimate the magnitude of this response, for various kinds of New Zealand households. Other factors also influence tobacco consumption, e.g. Quit smoking campaigns, cessation of advertising, etc., and part of the estimation problem is to separate such effects from the effects of price
changes. Also, the level of incomes can be expected to influence a household’s spending on tobacco products; if it is a ‘smoking’ household.

The income variable was used in preference to GDP per capita, which will overstate income growth in this period, because of the increased share of GDP going to non-New Zealanders.

The demand equation was first estimated in undifferenced form. The results are given in table A5.4 (equation (i)).

Because of the quite high correlation between ‘Time’ and the other explanatory variables, and possible consequent multicollinearity problems, the equation is also estimated in differenced form. (equation (ii)). The results are stable for the two equations, giving a price elasticity of about –0.40; and a time trend downwards due to social change, anti-smoking campaigns, etc., of about 2.5 percent per annum. The income elasticities differ, at 0.53 and 0.38, but the difference is not statistically significant.

Finally, the parameters are re-estimated for the shorter time period 1987/88 to 1997/98, so as to provide results for the same period as the HES data. The estimated price elasticity is higher, and income elasticity lower, although none of the changes are statistically significant. There is a hint, however, that the downwards trend from other factors petered out in this period. Certainly from the mid-90s onwards, volumes delivered ceased to fall at the same rate as previously (see chart in section 5.1 above).

### Table A5.4. Elasticities estimated from ‘Cigarettes delivered’ data.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Parameter estimates (p value)</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>Price</td>
</tr>
<tr>
<td>(i) Undifferenced 82/83 to 97/98</td>
<td>5.02</td>
<td>-0.41</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>(ii) Differenced 82/83 to 97/98</td>
<td>-0.024</td>
<td>-0.43</td>
</tr>
<tr>
<td></td>
<td>(0.151)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>(iii) Differenced 87/88 to 97/98</td>
<td>-0.007</td>
<td>-0.75</td>
</tr>
<tr>
<td></td>
<td>(0.677)</td>
<td>(0.018)</td>
</tr>
</tbody>
</table>
Comments:-

- The price and income elasticities are of the a priori expected signs, and also the magnitudes appear sensible. Price elasticity ranges from –0.41 to –0.75.
- The ‘social’ trend downwards was about 2.5% per year for the period as a whole, but could have petered out in the last 10 years.
- The price elasticity values are considerably higher (in absolute magnitude) than those reported for New Zealand by either Salter (1981), for annual data, (short-run, for the same equation as (i) here, a value of –0.15 and long-run –0.26) or Evans and Meads (1991) for monthly data (value of –0.13 for a price increase).

2 HES-based estimates of elasticity.

A: Data

Prices

Quarterly prices data from Statistics New Zealand’s Consumer Price Index (CPI) were obtained for the period June 1987 to June 1999; for:

- the All Groups index
- the Tobacco sub-group.

The Household Economic Survey information on consumption of tobacco products reports spending in the dollars of the period reported. The CPI tobacco sub-group index is used to deflate this HES information; giving trends over time in the ‘volume’ or ‘quantity’ of tobacco consumed.

Chart 3 shows the quarterly index of real tobacco prices for 1988–1998; and Chart 4 the annual equivalent. The major real increases can be seen to be in 1988–89, 1991, and 1998.
Chart 3. Tobacco Price Index, deflated by All Groups CPI

Chart 4. Deflated annual Tobacco Price Index
**Shifts in spending**

Annual data from the Household Economic Survey (HES), for years ending March 1988 to March 1998, were supplied by Statistics NZ on whether surveyed households did or did not purchase tobacco products during their reporting period; and if they did, how much they spent. (Converted to annual spending.)

This information was obtained for:

(a) ‘Sole adult and children’ households
   - by ethnicity of adult (using ‘broad’ definition of Maori)
   - by income level

(b) All households
   - by income level

Income level was defined in terms of the household income decile – from 1 the lowest to 10 the highest – to which the household belonged. The measure of household income used was ‘Disposable’ income (that is ‘after-tax and benefits’ income), equivalised to take account of household size and composition, using the Revised Jensen equivalence Scale (RJS). Thus the actual income of a large household is scaled down to a lower ‘equivalent’ income which takes account of the extra number of persons in that household. The benchmark point on the scale is the household of two adults and no children, given a scale value of unity.

**Survey error**

The HES was a survey covering about 3,000 households annually. That is, it had a sampling fraction, in 1997/98, of a little under 1 in 400 New Zealand households (for a sampling frame totalling about 1,160,000 households).

This means that numbers surveyed are small in some categories for which information was supplied – for example ‘sole adult and children’ households, by decile and/or ethnicity. Relative sampling errors can therefore be large (taking into account as well as the possible sampling errors associated with simple random sampling, their increase by the ‘design effect’ factor of the cluster sampling used for the survey).

It should be noted also that some cells in the tables supplied by Statistics NZ were suppressed, because sample numbers were too small. This applied in particular to deciles 5 and upwards for ‘sole adult and children’ households, and ethnicities other than ‘European/Pakeha’ and ‘New Zealand Maori’.

This general problem of survey error (which can include non-sampling error such as response bias, in addition to sampling error) is apparent in the fluctuations in some of the charts presented here.
Caution is needed, therefore, in making comparisons over time for population sub-groups. This is particularly the case for household groups whose population number is less than 50,000; or even 100,000.

**B: Prevalence and consumption evidence**

Chart 5 shows the proportion of all households recording some expenditure on tobacco. There is a clear downwards trend over the decade, from a little under 40 percent in 1987/88 to about 30 percent currently. The chart also includes estimated 95% confidence intervals about the annual proportions. These have been calculated on the basis of the standard sampling error formula for a simple random sample, and then scaled up by a ‘design effect’ factor of 1.5, to take account of the complex ‘cluster sample’ design actually used. It is possible the actual ‘design effect’ should be larger (the 1.5 is based on experience of other surveys), but it seems apparent that the downwards trend is in fact statistically significant.

This downwards trend holds in general for individual deciles (results not given here), although the decline over the past decade is most marked for the 10th, or top-most, income decile, falling from above 30 percent to just above 20 percent. There appears to be no substantial differences in the proportion of ‘smoking’ households across much of the income range, until the top two deciles, for which the proportion does fall. (Evidence for this is not charted here.)

Some caution should be used with this and following charts, due to a possible change over time in the level of under-reporting. If the reasons for not reporting tobacco use have strengthened, the charts could partly be indicating this. However the data in section 5.1 above, while it indicates a very considerable degree of under-reporting in the HES data, also suggests that the extent of under-reporting has been relatively constant over time.

As a cross-check, 1996 census data also obtained from Statistics NZ showed an overall 33 to 35 percent (depending on classification of those ‘not specifying’ whether they smoked or not) of households to have at least one adult smoker. This is consistent with the 1995/96 and 1996/97 percentages given in Chart 5. (For comparison, about 47 percent of households had ‘smoking’ members at the 1981 census.)

Chart 6 shows the proportion of individuals living in “smoking” households – for adults, children (under 15), and all persons. The downward trend is again apparent. The fluctuations about the trend in the ‘child’ proportions are a result of the smaller number of children overall. (Approximately 800,000 children aged under 15 in the survey population in 1997/98; compared with about 2.4 million adults. The overall sampling fraction is about one in 385.)

Charts 6(a) and 6(b) give estimated confidence intervals for the adult and child proportions. The estimates in this case are based on guidelines given by Statistics NZ (1996/97 Household Economic Survey Background Notes. Page 22.)
Chart 5. Proportion of All Households reporting Smoking Expenditure. Approximate 95% Confidence Intervals. HES, Statistics NZ.

Chart 6. Proportions living in "smoking" households: Children (under 15) and Adults - All Ethnicities
Charts 1 and 2 repeated here give corresponding proportions by ethnic group, first for children, and then adults. Pakeha, and the ‘Other’ ethnic group (not shown in the charts because of the large fluctuations due to small sample size), have the lowest proportion. Maori are highest, with still in excess of 50 percent living in a ‘smoking’ household, while Pacific peoples are intermediate.
Turning now to ‘sole adult and children’ households, Chart 7 shows the proportion of “smoking” households. It is clear a significantly higher proportion of such households are ‘smoking’ than for all households. However, there appears to be a downward trend, as for households in general. The 1996 census showed 43 to 52 percent of ‘sole adult and children’ households to be ‘smoking’, suggesting perhaps a higher proportion than shown by HES data, although the difference is probably well within the range of sampling error. For comparison the 1981 census proportion of ‘smoking’ ‘sole adult and children’ was about 50 percent. The decline between 1981 and 1996 in ‘sole adult and children’ households smoking is less than that in all households smoking.

Even for ‘smoking’ households the quantity of tobacco that is reported being purchased is falling. Chart 8 shows the fall in average quantity purchased by smoking households, for both ‘sole adult and children’ households and all households. The decline seems to have ceased since about 1993, however. The decline, and recent levelling-off, is also shown in the ‘cigarettes delivered’ statistics (Appendix 7.)

‘Sole adult with children with smokers households’ on average spend substantially less than ‘All households with smokers’ on tobacco products. In part this is because by definition such a household has only one adult, whereas the average number of adults over all households was 2.00 in the 1997/98 survey, and in ‘smoking’ households 2.18. Annual reported tobacco expenditure by ‘sole adult and children’ households in 1997/98 (in June 1999 prices) was under $1,000. This compared with an average reported tobacco spending for all households of over $1,500. See section 5.1 above for a discussion of the under-reporting.
Chart 7. Percent of ‘Sole adult with children’ households with spending on Tobacco

Chart 8. Average reported spending by “smoking” households on Tobacco.
‘Sole adult’ households and all households

George Thomson, Des O’Dea, Nick Wilson, Papaarangi Reid, Philippa Howden-Chapman
C: Results

In general it was not possible to get plausible estimates for individual deciles, particularly for ‘sole adult and children households’, or by ethnicity. Nor in general were good estimates obtainable from equations including income changes over time. Too much additional variability is introduced by the sampling errors associated with income measures.

Also estimates of elasticities for ‘All households’ seemed generally of poorer quality than for ‘smoking households’, presumably because of the combination of sampling errors in measuring the two components, average expenditure of smoking households, and the proportion of all households which were smoking households.

The better results were not always statistically significant, but were of the right sign, and with plausible magnitudes.

In the table following:

- **The coefficient values** in the columns headed ‘price’ and ‘income’ are the estimated price and income elasticities respectively.
- **The ‘intercept’ coefficients** represent average annual growth. Thus -0.036 is equivalent to a decline of approximately 3.6 percent per year.
- **The probability values**, in italics, are the estimated probabilities of getting the given values, or greater, by chance, if the true value is zero. We would like these probabilities to be low, preferably less than 0.05, so that we can say that the given values are unlikely to have been obtained by chance.

Tables A5.2 and A5.3 estimate the ‘component’ elasticities separately – namely the ongoing ‘consumption’ elasticity for those households which continue to be ‘smoking’ after a price change; and the ‘prevalence’ elasticities, giving changes in the proportions of households which are smoking. It can be shown that the two elasticities must sum to the overall demand elasticity.

For sole adult households, consumption elasticities are of the order of –0.8. Prevalence elasticities are quite high, showing a greater tendency to ‘quit’ than might be expected a priori. Again, however, none of these estimates are statistically significant.

For all households, price elasticities of consumption are in the range –0.5 to –0.6, and are statistically significant. Unfortunately, however, the prevalence elasticities are of the wrong sign – a positive value implies that a price increase pushes up the proportion of smoking households.
The effects of tobacco tax increases

June 2000

Table A5.1 Tobacco demand. Estimated Price and Income elasticities

A: All Sole person households, smoking and non-smoking

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Deciles 1 to 4 data-set (only 38 observations because sample for 1992 Q4 too small)

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B: All households; smoking & non-smoking

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Table A5.2  Estimated 'ongoing consumption' elasticities

A: Smoking Sole person households

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Deciles 1 to 4 data-set (only 38 observations because sample for 1992 Q4 too small)

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B: All Smoking households

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Deciles 1 to 10 data-set

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### Table A5.3 Estimated 'prevalence' elasticities

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#### Deciles 1 to 4 data-set (only 38 observations because sample for 1992 Q4 too small)

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#### B: All Smoking households

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*George Thomson, Des O’Dea, Nick Wilson, Papaarangi Reid, Philippa Howden-Chapman*
Conclusion:
Overall the tobacco availability data based elasticity estimates appear sensible, are statistically significant, and are in the range –0.4 to –0.8.

The HES-based estimates are not inconsistent with these values, but it is difficult to establish statistically significant values.

It appears best, therefore, to assume a plausible range of values for the elasticities, given the above results, and investigate the implications of these values.

Two sets of price elasticity values have been chosen, to investigate the sensitivity of the estimated impact of a price increase. These are –

**Moderately low**
- ‘Consumption elasticity’ of -0.40
- ‘Prevalence elasticity’ of -0.10
- **Total price elasticity of demand of** -0.50

**Moderately high**
- ‘Consumption elasticity’ of -0.60
- ‘Prevalence elasticity’ of -0.20
- **Total price elasticity of demand of** -0.80
Appendix Six: The influences on tobacco consumption and smoking prevalence

Introduction and definitions

The possible influences on tobacco consumption include regulations, prices, information/advertising, ‘public opinion’, private smokefree environments and income changes. Any appraisal of these aspects needs to be aware that the relationships between factors are complex, and such factors as price change are seen by smokers within a framework of many personal and societal influences (Chapman 1993109).

The regulatory context includes local and national laws on the retailing of tobacco (eg, age limits, advertising, health warnings), on smokefree environments, and harmful constituents. Beyond legislation and bylaws, regulation can include the imposition of smokefree environments within government agencies.

‘Public opinion’ is defined here as the cumulative effects of public statements for and against tobacco and tobacco control, beyond the awareness raising effect. So for instance the government statements about tobacco and tobacco control in late 1989 (Thomson and Wilson 1997110) may be seen as changing the social legitimacy of tobacco both sales and use. The authors argue that the social legitimacy of tobacco use is a factor separate from the information levels about tobacco harm. Changes in legitimacy have effects such as changes in the media practices about showing smokers. For instance in 1986, Television Telethon participants were asked not to smoke on camera (NZ Herald 27.6.86).

Beyond opinion, tastes and fashion may also change for the whole population or particular groups of smokers.

The background to consumption changes during 1988-98

The background includes the baseline in 1988, the underlying tobacco control momentum and the general economic and social background during 1988-98.

The baseline of attitudes and pressures

The 1988 baseline included the accumulated pressure for change in smoking habits that had been articulated by health advocates, particularly by ASH (employing a full-time advocate since 1983). A February 1989 article in Management highlights some of the changes in social attitudes within the 1982-88 period:

“Less than a decade ago the idea of a smokefree working environment was distinctly remote. ... Smokers dominated the workplace with often flagrant disregard for others ... This, however, has changed within the space of only two or three years. ... Signs proclaiming smokefree zones have become commonplace in offices, factories, restaurants, and public buildings, and awareness of the health hazards of
smoking has made it the second-most important health issue next to AIDS” (Hutchinson 1989, p.65).

**Underlying tobacco control momentum**

Underlying the factors influencing consumption during 1988-98 is the overall momentum of declining average per capita consumption in New Zealand from 1975 onwards. This decline means that the influences on consumption (such as price) need to be seen as influences for changes either:

1. beyond what was already happening (the marginal influence) or
2. to maintain the trend in the face of countervailing influences.

For instance tobacco consumption might be predicted to decrease by say 3% in a year on the basis of past declines. If the decline was in fact 8%, the extra 5% might be attributed to a marginal influence, or combination of influences.

On the other hand, if there was a countervailing influence perceived or measured, such as the increased addictiveness of cigarettes or a change in youth culture in favour of smoking, then that might result in a predicted decline of only 1%, given the absence of other new influences. Thus if the decline for a year was in fact 4%, then 3% might be attributed to new positive influences such as price increases or media campaigns.

Youth smoking may be a particular area where the influence of price is masked by other factors. So real price increases since 1982 may have only helped stem other influences on the youth rates of smoking uptake, which otherwise may resulted in a much greater rise in youth smoking rates.

**The economic and social background**

Some of the relevant background for 1988-1998 includes:

- Periods of recession during these years.
- Changes in real income for some groups. While indexation has kept tobacco taxes (and generally prices) in step with inflation, increases in real incomes can make tobacco more affordable. So from July 1991 to December 1993 the real price (for average incomes) stayed the same, and then to November 1995 fell by almost 2% (Laugesen 1996[11]). However, for low-income groups, real income (especially after housing) may not have shared this rate of rise in average real income.

**The ways of measuring the influences on consumption**

Of the possible influences on tobacco consumption – such as regulations, prices, information/advertising, and income changes - in this report we are particularly interested in price and income.
For the retail price the variables include:

- The type of tobacco and pack used as a standard – eg, a filter tip 25 cigarette pack.
  Within the type there may be considerable price differences for brands (eg, $6.50-$8)
- The way that the price variations by region and outlet are averaged to get a standard
  price (eg, the Statistics New Zealand price for the Consumer Price Index).
  (Note that a price rise may include both tax and trade increases)

Income is part of relative costliness – the relationship of tobacco prices to a particular other
item or to income. Two such measures are used in *Tobacco Statistics 1996* (Laugesen
1996112). They are ‘minutes to earn 20 cigarettes’ which allows for real price and income
changes and the ‘cigarettes per Big Mac hamburger’. The latter gives a relationship over
time to a ‘teenage currency’ and also allows some international comparisons.
Appendix Seven: Prevalence and consumption information

From the Ministry of Health *Tobacco Facts*, May 1999

**Figure 1**: Prevalence of cigarette smoking, ages 15 years and over, by ethnic group, 1990-98

Source: AC Nielsen (NZ) Ltd (formerly OTR Spectrum Research)
Table A 7.1: Percentage prevalence of cigarette smoking in New Zealand, 1976-98

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Technical notes:
1) Unspecified responses have been excluded from the Census of Population and Dwellings statistics. Annual AC Nielsen (NZ) Ltd estimates have been calculated from the average of the quarterly results.
2) From July 1989 to March 1996, the youngest age group OTR Spectrum Research reported was 16-24 years. Adjustment for the expected proportion of smokers aged 15-24 years from those aged 16-24 years has been made.
3) From April 1996 to June 1998, the youngest age group reported by AC Nielsen (NZ) Ltd was 18-24 years. Adjustment for the expected proportion of smokers aged 15-24 years from those aged 18-24 years has been made.
4) Smoking prevalence figures include the smoking of both manufactured and roll-your-own cigarettes.
5) Caution should be taken in comparing Census data with survey data. Definitions of ethnicity, the sample frames and the question used to ascertain smoking differ between the two sources. Confidence intervals for the survey estimates are wider for sub-groups of the population.
6) Prior to 1997, only one ethnic group could be classified. From 1997 onwards, multiple ethnic groups could be selected. Therefore ethnic specific data may not be comparable prior to, and from, 1997 onwards.
7) AC Nielsen (NZ) Ltd has revised 1996 and 1997 data, therefore some figures may differ from those published previously.
Figure 2: Tobacco products released for consumption per adult aged 15 years and over, 1970–98

Cigarette equivalents per adult 15+ years

Source: Statistics New Zealand
The effects of tobacco tax increases  
June 2000

George Thomson, Des O’Dea, Nick Wilson, Papaarangi Reid, Philippa Howden-Chapman

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Table A7.2: Tobacco products released for consumption in New Zealand, 1970–98

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Source: Statistics New Zealand

Technical notes:
1) Cigarette equivalents per adult for 1991–98 are calculated using resident population estimates obtained from Statistics New Zealand. These are mean year ended population estimates and include New Zealand residents temporarily overseas and are adjusted for Census undercount.
2) One gram of loose tobacco is counted as equivalent to one manufactured cigarette. With the use of filters, the average manufactured cigarette contains less than one gram of tobacco.
3) Calculations of cigarette equivalents are based on excise data on manufactured cigarettes and loose tobacco released for sale. Loose tobacco is mainly cigarette tobacco but includes a small amount of pipe tobacco. Cigars are not included.
4) Data for 1997 and 1998 are provisional.
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