Report on Tobacco Taxation in New Zealand

Volume II Appendices

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These appendices are to the report

Tobacco Taxation in New Zealand

One of two associated reports commissioned by

The Smokefree Coalition and ASH New Zealand

The other report is

Dedicated tobacco taxes - experiences and arguments

by George Thomson

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Appendix A: The Purposes of a Tax Specifically on Tobacco

Tobacco is taxed more heavily than any other commodity. This Appendix discusses the various reasons given for why tobacco taxes should (or should not) be so high, and the validity of those reasons.

The appendix has the following structure:-

1. The Revenue motive.
2. Other Motives for Taxation.
3. The 'externality' motive for tobacco taxation.
4. The 'merit bad' motive for tobacco taxation.
5. The arguments against heavy taxation of tobacco products.
6. Response to the above arguments.
7. Summary – the case for special taxes on tobacco.

1. The Revenue motive:

The primary motive of most taxes is of course to provide governments with revenue. Historically, large proportions of tax revenues in most jurisdictions have been provided by 'indirect taxes', that is taxes on transactions in goods and services, as against 'direct taxes' on income and wealth. Examples of this are import duties and excises, and sales taxes. Over the past century direct tax revenues have grown in importance, but indirect taxes, in New Zealand Goods and Services Tax above all, are still a very significant component of government revenues.

Again, historically, governments have found that the surest sources of indirect tax revenues are taxes on goods for which demand is 'price inelastic'. That is, quantities purchased of the commodity do not respond very significantly to changes in price. Arithmetically, the elasticity coefficient of a 'price-inelastic' commodity is less than one in absolute value (as against absolute values greater than one for goods for which demand is 'price-elastic'). This means that if the market price of a good goes up as a result of a tax, quantities purchased are not reduced by as much in percentage terms as the price is increased, so that the government can still expect to obtain useful revenue.

Because of the well-attested addictive properties of nicotine, purchases of tobacco products are not very responsive to changes in price. The demand for cigarettes and tobacco is, in economic terminology, 'price inelastic'. The empirical evidence confirming this statement is discussed later in this report. The meaning of 'price inelasticity' is that the percentage by which consumption in volume terms falls as the result of a price rise, is less than the percentage increase in the price rise. One consequence is that dollar expenditure on the commodity goes up after a price increase even though real consumption has fallen, and of course a percentage tax on expenditure will also increase. The implication is that 'price-inelastic' commodities, including tobacco products, are an excellent target for revenue gathering. Few governments have failed to realise this.

To say, however, that demand for tobacco is 'price-inelastic' is not to say that it is totally unresponsive to changes in price.. Consumption does fall – that is the justification for using tobacco taxation as an anti-smoking tool – but it falls by less than the percentage amount of any price increase.

In economics, one property of a tax seen as desirable is that the tax should alter pre-tax behaviour as little as possible. It can be shown that this requires that commodity taxes should be applied at rates inversely proportional to the price-elasticity of the commodity – so-called 'Ramsey taxation'. Thus taxes, for this objective, should fall much more on goods like tobacco whose demand is price-inelastic.

The problem with taxes on relatively 'price inelastic' commodities is that they tend to be those goods and services which feature largely in the household budget of the poor, and hence are a regressive form of taxation. Taxes on them put economic pressure on poorer households. As discussed later in this report, this is definitely an issue with tobacco taxation, given the higher prevalence of smoking found in many poorer households.

References in the literature to the revenue benefits of tobacco tax increases.

The revenue advantages of tobacco taxation receive mention in some of the literature.

Ahmad 2005, using a dynamic simulation model of health and economic impacts for the Californian market, concludes that "Additional tax increases would provide added health benefits and revenue to the state". Cnossen 2001 states that:

> *Tobacco taxes in the European Union are the highest in the world. These taxes are mainly rationalized as a quid pro quo for the social costs of smoking. This paper argues that the arguments are not as persuasive as is often believed. A more likely reason is that governments are addicted to this lucrative and cheap source of revenue.*

The Canadian Coalition for Action on Tobacco, stated, in the Executive Summary of a 2004 submission to the Canadian Minister of Finance, that

> *Higher tobacco taxes are a win-win for public health and public revenue. Tobacco tax increases by federal and provincial governments in recent years have led to significant declines in smoking while at the same time greatly increasing government revenue. Additional increases in tobacco taxes should be implemented in order to further advance these dual objectives.*

It is inevitable that tobacco tax increases should generate extra government revenue, so long as the demand for cigarettes is price-inelastic. There are presentational and ethical dangers, however, in making revenue gain an important rationale for such increases, given governments are already the major financial beneficiaries of cigarette sales.

2. Other Motives for Taxation

There are other non-revenue motives for taxes, unimportant for most of the taxation system, but certainly of importance when discussing tobacco taxation. The two important ones for the purposes of this discussion are:

- The 'externality' argument, that is that smokers should pay for the costs they impose on other non-smoking members of society;
- The 'merit bad'[2] argument, that tobacco products are a 'bad', not just because of the costs smoking imposes on other members of society, but also because of the costs to smokers themselves in terms of increased illness, reduced life expectancies, and reduced income. This is the main public health argument for increasing tobacco taxation – as an instrument of public health policy. The argument runs that smokers cause and incur these costs because of poor foresight and/or imperfect information about the consequences of smoking, and that therefore government is justified in implementing measures to deter smoking, including specific tobacco product taxes. This line of argument runs counter to the 'consumer sovereignty' argument important in much of the economic literature (as reflected for example in Tax Review 2001, and Cnossen). This says that consumers should be left to make their own purchasing choices, on the

[2] 'Merit bad' is a somewhat awkward term. It is coined as an opposite to what are known as 'merit goods'; commodities which society judges as 'good' and which should be made available, often compulsorily, even to those members of society who might not otherwise consume them. An example is education. For convenience we refer henceforth to 'bads' rather than 'merit bads'.

assumption that they know what they want and what is best for their individual and household welfare.

It is to be noted that the remedy for many 'bads' is simply to ban their use, as for example 'hard drugs'. It is unlikely, however, that simply banning the use of tobacco products would be practicable, or acceptable to a proportion of the general public, certainly at current levels of smoking.

Exploring these motives in more detail:

3. The 'externality' motive for tobacco taxation.

This argument for high taxes on tobacco products has considerable appeal. The argument that producers and consumers should be required to meet the additional costs imposed on non-participating members of society, against their will, has both popular support and the backing of economic theory.

There is an issue of whether the costs to non-smokers arise from smokers, or from those who organise and profit from the supply of tobacco. As most smokers do not wish to continue smoking and only continue due to addiction, it can be argued that the costs to non-smokers arise from the activities (or lack of activities) of the tobacco industry and government. It is difficult, however, to construct an 'externality tax' on manufacturers which is not largely passed on in higher prices to smokers.

There are also other difficulties in the application of the idea of an externality-based tax. A practical difficulty is in measuring the magnitude of the externalities. (The magnitude of these costs is discussed in more detail in Part B of this report and Appendix C.) More importantly, it appears possible that present taxation rates are in excess of the appropriate rates for correction of externality burdens. The points are, very briefly here, as follows:

- The actual additional health-care costs incurred annually by smokers, and passive smokers, and publicly funded by the New Zealand health system, appear to be of the order of $350 million. This is less than half the nearly $1 billion currently received annually by government from tobacco taxes.
- A more sophisticated cohort analysis of lifetime costs of smokers and non-smokers raises some keenly debated issues. The first is whether the life-time health-care costs of smokers are less than or greater than those of non-smokers. Although average health-care costs of smokers at any age exceed those of non-smokers (after adjustment for socio-economic status), the shorter life expectancy of smokers could still mean a lesser total lifetime cost. The choice of discount rate, in a cohort comparison, is important here – a higher discount rate will reduce more the present value of non-smokers health-care costs. (Arguments for and against can be found in Manning et al 1991;[3] and in Jha, Chaloupka and Brown 2000. Bonneux et al 1998,[4] make the more general case for the elimination of fatal diseases increasing life-time health-care costs).
- Smokers also in effect on average lose out on some of the pension income they would otherwise receive under New Zealand's universal NZ Superannuation pension from age 65. This can be regarded, somewhat cold-bloodedly, as repaying some of the additional health-care costs they cause.
- Another source of 'external costs' is the 'lost productivity' of smokers due to their greater work-force absence because of sickness, time taken in breaks to smoke, and premature

[3] Manning W G, Keeler E B, Newhouse J P, Sloss E M, and Wasserman J (1991). *The Costs of Poor Health Habits. A RAND Study.* Harvard University Press.

[4] Bonneux L, Barendregt J J, Nusselder W J, and Van der Maas P J (1998). "Preventing fatal diseases increases healthcare costs: cause elimination life table approach." *BMJ* 1998;316: 26-29 (3 January).

withdrawal from the work-force because of chronic smoking-caused illness, and earlier mortality. Much of this loss is borne by the smoker, but some, e.g. paid sick leave, by the employer and by profits in general. The magnitude of this external cost is not easily estimated, though certainly some estimates are substantial.

- Probably the most important external costs are those resulting from 'passive smoking ' or 'second-hand smoking' (SHS). This includes the effects of maternal smoking on new-born infants and their lifetime health. The precise extent of the health effects of passive smoking are more uncertain than those of active smoking, and the confidence intervals on estimates of its magnitude are undoubtedly wider. Woodward and Laugesen (2000) estimate an additional 388 deaths per annum caused in New Zealand by passive smoking, an additional 8 percent above those caused by active smoking, with a 'plausible range' of 180 to 621 deaths. Assuming the 8 percent can be applied to other consequences of passive smoking as well allows estimation of passive smoking externalities as a simple proportion of active smoking externalities. However more needs to be added for the effect of maternal smoking in causing Sudden Infant Death Syndrome (SIDS) and also additional Low Birth Weight (LBW) babies, with possible life-time health and quality of life consequences.[5] Most of the deaths from smoking occur in middle age or old age, with loss of life-years at the end of the life-span. In contrast, for infants affected by maternal smoking, the loss is the whole of a lifetime or the loss of some quality of life for a lifetime.

At this point it should be noted that in this report the practice is, at least initially, to put $ values on 'economic costs' (such as health-care and 'lost productivity' costs) only. 'Intangible costs' such as premature deaths, or lost life-years, or lost QALYs (Quality-Adjusted Life Years), or DALYs (Disability-Adjusted Life Years) are left in their natural units. Eventually, for cost-benefit analysis and decision-making purposes it might be necessary to put a $ value on a life-year or QALY lost. In the interim, however, it needs to be recognised that 'intangible consequences' such as lost life-years are not 'economic costs' (alternatively labelled 'opportunity costs'), and that their valuation in dollars is controversial and causes a lack of comparability between different sets of estimates. This is not to say that 'intangible consequences' of smoking in terms of mortality and quality of life are less important than the 'economic costs' – in fact they are considerably more important. But it is not particularly helpful, and often confusing, to put dollar values on them unless absolutely necessary.

- Returning to 'passive smoking' externalities, the economic costs of such would add of the order of an extra 8 percent to those of active smoking. The inclusion of 'intangible consequences' costs could add substantially to external costs. For the reasons discussed just above, however, these are thought better dealt with in the context of a tax aimed simply at discouraging consumption of 'bads', rather than in the context of trying to value external costs in order to calculate the best rate for an externalities-correcting tax.

- A further argument against using tobacco taxes as the corrective measure for 'external costs' is that in the case of 'second-hand' or 'environmental tobacco smoke', and in the case also of the effects of maternal smoking and passive smoking on the development of fetuses, there are other policy instruments which may address some of the problems more directly than does taxation. An example is the restricting of smoking in various public and work enclosed spaces, extended by the Smokefree Environment Amendment Act (SEAA) in late 2004 from most workplaces to cover restaurants, cafes and bars. Other relevant interventions include cessation help and health promotion interventions to encourage mothers-to-be to quit smoking, and to discourage smoking in homes and private cars. One effect of the SEAA provisions could be to reduce 'second-hand smoking' externalities.

[5] Adams et al 1999 *The Costs of Environmental Tobacco Smoke (ETS): An International Review.* Background Paper. WHO/NCD/TFI/99.11

To sum up, it is less obvious than sometimes supposed that current tobacco tax levels are justifiable in terms of external costs. It is also not at all easy to estimate what the appropriate level of such a tax should be.

4. The 'merit bad' motive for tobacco taxation.

Here the motive for the tax is uncomplicated. It is simply to discourage consumption of tobacco products in the interest of public health, because they are 'bad' – because of the harm that they directly and indirectly cause to individuals in society. The justification includes both 'internal' costs – the damage smokers do to themselves – and 'external' costs – the damage done to others.

Some label as 'paternalistic', the prevention or discouragement by government of behaviour which results in people doing harm to themselves. Another perspective is that the interdependence of societies means that harm to one group can be seen as harm to all, and therefore such harms need to be reduced. Many would argue that it is a legitimate role of government to try to discourage behaviours that are unequivocally harmful to individuals and other members of society. Examples of such government actions which are widely accepted by the public include legislation on drink driving, seat belts and cycle helmets, use and supply of illicit drugs, and health and safety in the workplace.

A further justification for taxing tobacco products as a public health measure is that it will reduce the uptake of smoking by young people. It can be assumed that young people, in particular, do not make fully rational decisions about smoking, due to a lack of maturity in decision-making, a lack of full knowledge of the addictive properties of nicotine, and of the long-term consequences of smoking. Another justification, with evidence to back it, is that a substantial majority of smokers regret starting to smoke.[6]

The stated purposes of tobacco taxation in New Zealand.

Historically, tobacco taxes have been seen principally as an important contributor to government revenues. The then-notorious increases in the Nordmeyer "black budget" of 1958 were seen in addition as part of a package of measures to cut domestic consumer spending in response to a fall in primary produce export receipts. It is only from the 1970s onwards that the possible health gains from higher taxes are mentioned in NZ budget statements and discussions. (There is a useful historical discussion in Laugesen 2003.) It was from the mid-1980s that taxes began being increased in real terms with the stated objective of reducing smoking prevalence and the health-care costs associated with smoking. Very sizeable increases occurred in 1986 and 1988-89. It does not seem there was any serious attempt, in justifying these increases, to distinguish between the 'externality' and 'merit bad' arguments on the lines discussed above.

From 1990 a regime of indexation of tobacco excise rates to consumer price inflation has applied, initially at six-monthly intervals, and from the end of 1995 annually until the present day. At irregular intervals these indexation increases were supplemented by substantial additional increases in tax rates over and above inflation. These occurred in 1991, 1998, and 2000, with only indexation increases since 2000.In addition the excise rate on loose tobacco was increased substantially in 1995 to 'equalise' tax rates on factory-made and roll-your-own cigarettes.

For some twenty years now, the publicly stated reasons for tobacco tax increases have stressed the health gains from reduced smoking prevalence, and the contribution smokers make through their taxes to meeting their additional health-care costs. Revenue considerations have featured little in the debate, at least in New Zealand.

[6] Fong GT, Hammond D, Laux FL, et al.: The near-universal experience of regret among smokers in four countries: findings from the International Tobacco Control Policy Evaluation Survey. *Nicotine Tob Res* 2004, 6 Suppl 3:S341-51.

5. The arguments against heavy taxation of tobacco products.

Not everyone has accepted that heavy rates of taxation on tobacco products are justified. The arguments against fall under two main headings:

1. taxing tobacco more heavily than other products offends against the principle of 'consumer sovereignty', that consumers' purchasing decisions should be interfered with minimally by governments
2. the burden of tobacco taxation falls inequitably on the poor and disadvantaged, including, in New Zealand, Māori.

To quote again Cnossen (2001):

> *If tobacco taxes cannot be justified on externality grounds, then they flaunt horizontal and vertical equity notions.*
>
> *While the poor were the last to pick up smoking, they are also the last to quit. In short, tobacco taxes are highly discriminatory and regressive, more so than any other tax. It is impossible, moreover, to adjust for these shortcomings through the income tax and social benefit systems.*

And Tax Review 2001:

Executive Summary: Issues Paper.

> *Adverse impact on social equity*
>
> *Tobacco tax accounts for 38 percent of total excise revenue. It is paid by only 25 percent of the adult population. A person smoking one packet a day pays over $2,000 a year in GST-adjusted tobacco tax. "*
>
> *Tobacco tax, in particular, falls dramatically more heavily on disadvantaged people. Smoking prevalence is 37 percent among the most deprived New Zealanders, falling to only 16 percent for the least deprived. Smoking prevalence among Māori is about twice that of the general population. Among sole parents with dependent children, a notably low-income group, it is also very high, at 42 percent. No feasible change in other forms of taxation can address these large vertical and horizontal inequities.*
>
> *Because excises fare so poorly on normal criteria of fairness and efficiency in raising revenue, such taxes require a strong alternative justification.*
>
> Public spending externalities
>
> *Some submissions sought 'regular and substantial increases in tobacco excise' to modify lifestyles in pursuit of improved health outcomes to meet health system targets.*
>
> *Where smokers and drinkers incur additional medical expenses paid for by the individuals themselves, those costs will be factored into their decisions about smoking and drinking. That will not be true where public health care is provided free.*
>
> *We are not convinced that those concerns provide a robust basis for tax policy. It is not easy to justify singling out smokers and drinkers. The same public health rationale applies to other lifestyle choices that impose extra costs on the health system.*

And in subsequent Overview Paper:

> *For tobacco and gaming, present levels of taxation appear indefensible on externality grounds (even if the social spending argument were accepted).*

6. Response to the above arguments.

The 'consumer sovereignty' rationale for not heavily taxing tobacco should be rejected on the grounds of 'market failure', in that consumers are far from exercising perfectly rational foresight when they take up smoking, and find it very difficult to quit even if they wish to, due to the addictive nature of tobacco use.

The 'equity' consequences cannot, however, be put aside so readily. Tobacco taxation does, as stated in Tax Review 2001, bear more heavily on the poor, and on Māori. The converse of this is, of course, that those in these categories who do manage to quit do also gain substantially. Hence the case for encouraging quitting by taxation. However, those affected by tobacco taxation need also to be persuaded that they are not simply 'cash cows', and that government is prepared to give financial support to smokers' attempts to quit, thereby improving both health and household finances.

These equity issues, and possible remedies, have been discussed in detail in Section F of Volume I of this report, and are also discussed in the associated report by George Thomson.

7. Summary – the case for special taxes on tobacco.

- High taxes on tobacco are for governments a very effective means for gaining extra revenue.
- A revenue rationale for levying tobacco taxes is, however, unsatisfactory, indeed unethical. It in effect has governments sharing purposefully in the profits from consumption by its citizens of an addictive and toxic substance.
- The 'consumer sovereignty' argument against interfering with consumers' choices by singling out tobacco for especially high tax rates should be rejected. It does not take account of the significant 'market failures' in the market for tobacco products. These are, first, that young people take up smoking with imperfect knowledge of the consequences. Secondly, the addictive properties of nicotine make it difficult to reverse the original choice on becoming better informed. Thirdly, smoking imposes 'external costs' on the rest of the community, in the form of the additional publicly-funded health-care costs caused by smoking, and also the additional health-care costs resulting from 'passive smoking', plus, for the latter, other costs in terms of lost income from increased sickness, and increased premature mortality.
- Nor are 'external costs' a sufficient rationale in themselves for high tobacco taxes. It appears likely that smokers contribute considerably more in taxes than the net 'economic costs' to the rest of the community caused by their smoking. And that the 'non-economic external costs', such as morbidity and mortality caused by passive smoking, are sometimes better addressed more directly by means other than taxation, for example smoke-free legislation.
- The best rationale for high tobacco taxes is simply the 'public good' or 'public health' argument. Namely that, in addition to helping meet external costs, they deter smoking and hence promote the public good by improving the public health. High taxes reduce smoking prevalence and consumption, and thereby reduce not just external costs but also the 'internal costs' of smoking borne by the smokers themselves. In particular they reduce the increased illness and mortality caused by smoking.
- The greatest objection to tobacco taxation at the present level, and to further increases in tax rates, is that the tax is inequitable. It falls particularly heavily on persons in low-income households. It falls disproportionately on Māori also.
- A partial solution is to ensure that a growing proportion of tobacco taxation revenues is made available specifically to aid smokers in quitting, with a substantial part of these resources being directed to helping Māori and low-income households. This approach is

discussed in detail in the associated report by George Thomson on the setting-up and utilisation of a dedicated share of tobacco tax revenues for such purposes.

Appendix B: Estimation of New Zealand Tobacco Elasticities

The purpose of this Appendix is to provide the detailed under-pinning for the discussion on elasticities of demand for tobacco and smoking prevalence in parts A.3 to A.5 of section A in Volume I of this report. It documents the methodology and data sources for, and results from, estimating New Zealand tobacco price and prevalence elasticities.

Structure of this appendix:

1. Definitions.
2. Relevant elasticities.
3. Some previous estimates of New Zealand tobacco elasticities.
4. Model specification for current study.
5. Data.
6. Results.
    a) Demand elasticities.
    b) Prevalence elasticities.
7. Overall Conclusions.

1. Definitions.

Elasticities are a measure of 'responsiveness'. Typically they indicate the size of the percentage change expected in some 'outcome' variable, in response to a given change in some other variable on which it depends.

$$e = \frac{\%\text{ change in 'response' economic variable}}{\%\text{ change in 'causal' economic variable}}$$

If the absolute value of e is less than one (e.g. if 0.75 or –0.75) the value is commonly labelled as "inelastic". If the absolute value is greater than one (e.g. if –1.5 or 1.5) the value is commonly labelled as "elastic".

2. Relevant elasticities.

In the area of tobacco policy the important elasticities are:

- the 'price elasticity of demand' for tobacco products. That is the responsiveness of demand (quantity purchased e.g. number of cigarettes) to a change in real (inflation-adjusted) price.
- Note that the price elasticity can be either 'short-run' or 'long-run'. The former measures the immediate response to the price change; the latter the response over a longer time period. In general for most commodities the long-run response is more elastic than the short-run response, and this appears to hold for tobacco as well.
- the 'income elasticity of demand' for tobacco products. That is the responsiveness of demand to a change in real income.
- the 'price elasticity of supply' for tobacco products. That is, the responsiveness of quantity supplied to a change in real price. For the purposes of analyses of the tobacco products market it is common, and convenient, to assume this elasticity to be infinite in value. The meaning of this is that cigarette manufacturers are assumed to be able to meet any change in market demand at unchanged cost. This assumption allows analysis

of the tobacco products market to take the form of a single equation model, of demand only. That is what is done in the analyses reported here.

- The 'price elasticity of smoking prevalence'. That is the responsiveness of changes in proportion of persons who are smokers to a change in real price.

The purpose of the analyses reported here is to calculate both the price elasticity of demand for tobacco products and the price elasticity of smoking prevalence. Both are important parameters for tobacco control policy.

3. Some previous estimates of New Zealand tobacco elasticities.

Elasticities were calculated for the report by Thomson et al (2000); as follows.

Table B.1 Previous estimated elasticities from Deliveries data. Thomson et al (2000).

Price	Income	Trend	(% per yr)
82/83 to 97/98	-0.43	0.38	-2.4%
87/88 to 97/98	-0.75	0.22	-0.7%

These estimates were the result of a 'Double-Log'[7] formulation, using 'differenced data'[8] to reduce multicollinearity problems. The 'income proxy' series used in estimating these values were Real Household Income per head for the 1982/83 to 1997/98 period. Note that the differences in the estimated price and income elasticities between the longer and shorter periods were not statistically significant.

In addition, in a substantial 1981 paper Salter earlier estimated elasticities from data for the 1961-78 period, using both annual and quarterly data. As an income proxy she used retail sales data. She tested both linear and log-linear[9] specifications, also using 'lagged consumption' as a 'habit' or 'addiction' variable, and also for estimation of long-term elasticities. Her results using annual data were the more robust. In brief her preferred results might be summarised as

Short-term price elasticity	=	-0.08	(t-statistic –0.87)
Short-term income elasticity	=	0.46	(t-statistic 2.90)
Long-term price elasticity	=	-0.26	(t-statistic -0.87)

These price elasticity values are relatively low. A possible cause is that her study-period was one in which real cigarette prices were tending to fall, and consumers might well have been relatively insensitive to price changes of the magnitude seen in the 1960s and 1970s.

4. Model specification for current study.

It is assumed that supply is infinitely elastic so that a single demand equation model is sufficient. A Double-Log (or 'loglog') specification was used throughout in view of the convenient statistical and mathematical properties of the 'constant elasticity model'. In particular that the estimated coefficient value on the main explanatory variables equals the elasticity of the demand response to those

[7] That is, regressing log of the dependent variable – per capita consumption – on logs of the explanatory variables. See page 25 of Wilkins et al; World Bank Economics of Tobacco Toolkit; 2001.

[8] That is, current year's data less previous year's data.

[9] Salter appears to use 'log-linear' to label what Wilkins et al would call a 'Double-Log' formulation.

variables. It is of course unlikely that the actual demand function is precisely of this form, but it is convenient to assume so.

The estimated demand functions are therefore of the form (logs are natural) –

$$\text{Log } T = a + e * \log P + b * \log Y + c * t + d * \log T_{-1}$$

Where T = quantity of tobacco products released by manufacturers for consumption, in 'cigarette equivalents' per person aged 15 and over. (This is the best available proxy for actual consumption.)

P = real price of cigarettes relative to All Groups Consumer Prices Index.

Y = real private household consumption, all goods and services, per head

t = time, in years. Used as appearing to be the most suitable proxy for real income per head.

T_{-1} = Lagged quantity delivered per person 15+. That is, the dependent variable, but now for the previous year, and as an explanatory variable. a is the 'intercept' term; a constant

e is the (short-term) price elasticity

b is the (short-term) income elasticity

c measures the exponential rate of change over time, due to ongoing influences other than those specified in the equation.

d is the coefficient on the 'lagged' tobacco deliveries per head variable. It is included to represent the effect of 'habit', that is as a proxy for the effect of addiction. The coefficient is therefore expected to be positive. Also the coefficient 'd' is used to estimate 'long-term' elasticities, by multiplying the 'short-term' elasticities 'e' and 'b' by the factor 1/ (1 – d).

The estimated 'smoking prevalence' functions are the same, except that the dependent variable is Smoking Prevalence, rather than consumption per head.

5. Data

Table B.2. Data-set used for estimation of Tobacco Elasticities

Data used in Econometric Analyses of tobacco Consumption and Prevalence Data

Calendar Year	Cigarettes delivered per adult 15+	Real Price Index: Cigarettes & Tobacco Jun-99	Private Household Consumption. Per capita June '99 prices		Lagged Cigarettes delivered per adult 15+	Prevalence: Percent of 15+ population smokers.
	Number	= 1,000	$		Number	%
	Cigpc	Price	PHCpc	Time	Prevcigpc	PrevAll
1975	3253.5	379.8	13431.1	1	3140.8	
1976	3170.2	369.3	13013.5	2	3253.5	
1977	3168.4	377.1	12735.8	3	3170.2	
1978	3072.4	361.1	12789.8	4	3168.4	
1979	2974.1	361.9	13053.3	5	3072.4	
1980	2858.4	365.1	13100.6	6	2974.1	
1981	2906.4	367.1	13273.0	7	2858.4	
1982	2833.7	372.6	13018.7	8	2906.4	
1983	2770.4	401.1	13200.5	9	2833.7	33
1984	2778.0	396.7	13886.1	10	2770.4	32
1985	2493.0	418.4	14000.4	11	2778.0	30
1986	2308.2	467.8	14547.8	12	2493.0	30
1987	2332.0	528.6	14304.6	13	2308.2	30
1988	2325.6	539.4	14672.4	14	2332.0	29
1989	1894.0	641.1	14838.1	15	2325.6	27
1990	1989.3	673.5	14615.3	16	1894.0	28
1991	1796.0	745.6	14093.7	17	1989.3	26
1992	1628.2	813.4	13992.9	18	1796.0	27
1993	1598.2	817.1	14195.0	19	1628.2	27
1994	1530.3	806.2	14750.2	20	1598.2	27
1995	1537.5	796.0	14984.0	21	1530.3	27
1996	1559.7	834.6	15342.8	22	1537.5	26
1997	1498.6	860.6	15655.4	23	1559.7	26
1998	1431.8	937.1	16007.8	24	1498.6	25
1999	1364.6	999.2	16600.8	25	1431.8	26
2000	1409.8	1107.6	16736.5	26	1364.6	25
2001	1191.2	1194.5	16984.1	27	1409.8	25
2002	1250.9	1198.2	17333.0	28	1191.2	25
2003	1075.1	1222.7	17852.3	29	1250.9	25
2004	1060.9	1231.3	18403.7	30	1075.1	23
2005	1100.9	1240.8	18857.1	31	1060.9	23.5

Notes:
1. Cigarettes per capita include loose tobacco 'cigarette equivalents', calculated as one cigarette equivalent per 0.80 gm of loose tobacco.
2. Real Price Index: Cigarettes & Tobacco sub-group Consumer Price Index (CPI), CPYQ.SE9G1, relative to All Groups CPI.
3. Private Household Consumption series from NZ System of National Accounts (SNA); divided by total resident population all ages, deflated by CPI.
4. Prevalence data from AC Nielsen annual surveys.

6. Results.

A: Demand elasticities.

The first two of the tables starting on the following page are for estimates of demand elasticities. The first table covers the whole period from 1975 till 2005. The second is for the shorter period from 1984 to 2005, excluding the pre-1984 period during which there appears to have been no substantial real cigarette price changes.

In each case both 'un-differenced' and 'differenced' results are given. Un-differenced results are in terms of the logs of the data in the above data-set (with the exception of the 'time' variable, for which exponential growth is assumed). The problem with these data is that there is high multi-collinearity between a number of the explanatory variables, with real price and real incomes both increasing strongly with time, whilst lagged consumption per head is falling. This is clearly apparent in the two correlation coefficient tables just below. Multi-collinearity in itself does not lead to biased estimates, but it certainly causes a large increase in standard errors of the elasticity estimates, and hence reduces the precision of the individual estimates. A possible solution is to fit the equations to 'differenced' data. That is, data in the form of changes from the previous year. This at least eliminates the 'Time' variable – the time trend independent of economic causes can now be regarded as being shown by the intercept term. The price paid is a relative increase in the size of error terms.

A priori expectations are for a negative price elasticity, a positive income elasticity, and a positive coefficient on the lagged dependent variable.

Correlation Coefficient Matrix 1975-2005

	LnCigpc	*LnPrice*	*LnPHCpc*	*Time*	*LnPrevcigpc*
LnCigpc	1				
LnPrice	-0.989128	1			
LnPHCpc	-0.925983	0.918946	1		
Time	-0.987342	0.976949	0.942471	1	
LnPrevcigp	0.985417	-0.983706	-0.929667	-0.984137	1

Correlation Coefficient Matrix 1984-2005

	LnCigpc	*LnPrice*	*LnPHCpc*	*Time*	*LnPrevcigpc*
LnCigpc	1				
LnPrice	-0.981852	1			
LnPHCpc	-0.858727	0.838055	1		
Time	-0.978122	0.974064	0.920813	1	
LnPrevcigp	0.968935	-0.968458	-0.862063	-0.980131	1

Table B.3 Demand Equation estimates – 1975 to 2005

Dependent Variable: Annual 'Cigarettes Released' per person aged 15+

1975 to 2005

Undifferenced LnCigpc

Equations: All log-linear Regression Coeffficients

(95% confidence intervals)

Period	Variables	Intercept	Lnprice	LnPHCpc	Time	LnPrevCigpc	Adj. R^2	F (Signif.)
1975-2005	All	8.6	-0.397 (-0.60; -0.19)	0.113 (-0.31; 0.54)	-0.018 (-0.030; -0.007)	0.091 (-0.22; 0.40)	0.987	551.3 ***
1975-2005	Less lagged dependent variable	9.7	-0.43 (-0.59; -0.27)	0.105 (-0.32; 0.53)	-0.02 (-0.030; -0.010)		0.987	752.5 ***
1975-2005	Less Time	9.7	-0.49 (-0.71; -0.26)	-0.17 (-0.63; 0.28)		0.35 (0.04; 0.65)	0.982	537 ***
1975-2005	Less Time & lagged dependent variable	15.6	-0.71 (-0.83; -0.60)	-0.36 (-0.81; 0.09)			0.979	694.5 ***
1975-2005	Price only	12.7	-0.8 (-0.84; -0.76)				0.98	1312 ***
1975-2005	Price and Time only	10.7	-0.43 (-0.59; -0.27)		-0.019 (-0.027; -0.011)		0.999	1159 ***

Differenced DLnCigpc

Equation: Regression Coeffficients

(95% confidence intervals)

Period	Variables	DLnprice	DLnPHCpc	Time (Intercept	DLnPrevCigpc	Adj. R^2	F (Signif.)
1976-2005	All	-0.61 (-0.99; -0.24)	-0.36 (-1.25; 0.53)	-0.025 (-0.053; 0.003)	-0.49 (-0.79; -0.18)	0.38	6.9 0.0014
1976-2005	Less lagged dependent variable	-0.57 (-1.01; -0.14)	-0.21 (-1.25; 0.82)	-0.011 (-0.042; 0.20)		0.15	3.6 0.4
1976-2005	Price only	-0.56 (-0.99; -0.13)		-0.014 (-0.041; 0.013)		0.18	7.28 0.012

Note: *** P < 0.001

Table B.4 Demand Equation estimates – 1984 to 2005

Dependent Variable: Annual 'Cigarettes Released' per person 15+

1984 to 2005

Undifferenced LnCigpc

Equations: All log-linear Regression Coeffficients

(95% confidence intervals)

Period	Variables	Intercept	Lnprice	LnPHCpc	Time	LnPrevCigpc	Adj. R^2	F (Signif.)
1984-2005	All	7.2	-0.36 (-0.75; 0.03)	0.3 (-0.64, 1.23)	-0.027 (-0.068; 0.013)	-0.001 (-0.48; 0.47)	0.97	159.9 ***
1984-2005	Less lagged dependent variable	7.2	-0.36 (-0.73; 0.02)	0.3 (-0.51, 1.11)	-0.027 (-0.056; 0.011)		0.97	225.8 ***
1984-2005	Less Time	11.8	-0.55 (-0.82; -0.28)	-0.24 (-0.73; 0.25)		0.22 (-0.14; 0.57)	0.97	101 ***
1984-2005	Less Time & lagged dependent variable	15.5	-0.7 (-0.82; -0.57)	-0.36 (-0.82; 0.11)			0.97	290.7 ***
1984-2005	Price only	12.6	-0.78 (-0.85; -0.71)				0.96	531 ***
1984-2005	Price and Time only	10.6	-0.45 (-0.72; -0.18)		-0.018 (-0.034; -0.003)		0.97	346 ***

Differenced DLnCigpc

Equation: Regression Coeffficients

(95% confidence intervals)

Period	Variables	DLnprice	DLnPHCpc	Time (Intercept)	DLnPrevCigpc	Adj. R^2	F (Signif.)
1985-2005	All	-0.69 (-1.29; -0.09)	-0.59 (-2.16; 0.98)	-0.02 (-0.08; 0.04)	-0.47 (-0.86; -0.09)	0.37	4.9 0.012
1985-2005	Less lagged dependent variable	-0.8 (-1.49; -0.12)	-0.81 (-2.59; 0.96)	0.011 (-0.05; 0.073)		0.17	3.06 0.072
1985-2005	Price only	-0.67 (-1.29; -0.06)		-0.008 (--0.053; 0.038)		0.17	5.2 0.034

Note: *** P < 0.001

Taking first the results for the 1975-2005 period. The un-differenced equations point reasonably consistently to a short-term price elasticity of about –0.40, a short-term income elasticity of about 0.11 (although the income elasticity coefficients are throughout not significantly different from zero). Also the coefficient on the lagged dependent variable is 0.09, implying long-term price and income elasticities about one-tenth higher (= 1/(1-0.09)); namely –0.44 and 0.12 respectively. The time trend is about 2 percent per annum downwards, presumably reflecting societal changes in smoking habits rather than economic factors.

The 'differenced' equations for 1975-2005 imply somewhat higher price elasticities (-0.55 to –0.60) but otherwise add little. The signs are wrong on the 'income' variable and the lagged dependent variable.

The results for the shorter period 1984 to 2005 do not suggest any significant change is needed to the conclusions for the 1975-2005 data-set.

B: Prevalence elasticities.

The results of the 'prevalence' analyses are given in the following table. The results appear rather more robust and consistent than those above for demand elasticities.

Again the income variable appears to be of little value for the estimations. The results point fairly generally to a 'prevalence elasticity' of the order of -0.20. Perhaps the soundest specifications are those limited to just price and 'trend' variables – namely the third equation in the 'un-differenced' series, and the second in the 'differenced' series. These show price elasticities of prevalence of –

0.17 and –0.18 respectively, plus a gentle, though statistically non-significant, downwards time trend.

Table B.5 Prevalence Equation estimates – 1984 to 2005

Dependent Variable: Smoking Prevalence all persons aged 15+

1984 to 2005

Equations: All log-linear **Undifferenced** LnPrevall

Regression Coeffficients (95% confidence intervals)

Period	Variables	Intercept	Lnprice	LnPHCpc	Time	LnPrevCigpc	Adj. R^2	F (Signif.)
1984-2005	All	5.2	-0.19 (-0.43; 0.05)	-0.07 (-0.53; 0.39)	-0.001 (-0.017; 0.015)	0.007 (-0.50; 0.52)	0.890	43.1 ***
1984-2005	Less lagged dependent variable	5.2	-0.19 (-0.40; 0.02)	-0.07 (-0.51; 0.38)	-0.001 (-0.017; 0.015)		0.895	60.9 ***
1984-2005	Less 'Income' variables	4.5	-0.17 (-0.32; -0.02)		-0.003 (-0.011; 0.005)		0.9	95.8 ***
1984-2005	Less Time & lagged dependent variable	5.5	-0.2 (-0.26; -0.14)	-0.09 (-0.31; 0.14)			0.9	96.3 ***
1984-2005	Price only	4.8	-0.22 (-0.26; -0.19)				0.9	195.2 ***

Equation: **Differenced** DLnprevAll

Regression Coeffficients (95% confidence intervals)

Period	Variables	DLnprice	DLnPHCpc	Time (Interce	DLnPrevCigpc	Adj. R^2	F (Signif.)
1985-2005	All	-0.27 (-0.60; 0.07)	-0.21 (-1.08; 0.66)	-0.007 (-0.036; 0.022)	-0.58 (-1.01; -0.16)	0.26	3.33 0.044
1985-2005	Price only	-0.18 (-0.53; 0.16)		-0.005 (-0.030; 0.020)		0.01	1.23 0.28

Note: *** P < 0.001

7. Overall Conclusions.

Demand elasticities.

The results are consistent with an overall price elasticity of demand of about –0.45, with a short-term elasticity perhaps somewhat lower at about –0.40. These values are statistically significantly different from zero. The 'income' variable makes in general a very poor contribution to overall fit, with the best estimate of the income elasticity of demand being about 0.12, but this is not statistically significantly different from zero.

Equations with only the price variable as explanatory variable give higher price elasticities, of around –0.80. But these elasticities are over-estimates as there were undoubtedly other factors, such as smoke-free legislation and changes in social attitudes to smoking, driving down consumption in addition to the increases in the real price of smoking. The addition of a time trend to try and account for these other factors yields lower values for price elasticities (though for the 'differenced' data still as high as –0.56 and –0.67). On the available data it is not possible to completely separate the effects of price increases from the effects of 'social' trends.

Prevalence elasticity.

The results here are rather more robust and consistent. They point to a 'price elasticity of prevalence' of about –0.20.

Appendix C: The Health Costs and Economic Costs of Smoking to New Zealand

Contents:

Tables:

The process followed in this Appendix is to –

- Discuss the estimates in Easton's 1997 report *The Social Costs of Tobacco Use and Alcohol Misuse*
- Update these, with changed assumptions where necessary, to 2005.
- Cross-check against the Collins and Lapsley (2005) estimates for New South Wales in 1999, allowing for different population size.

Key sources:

Key sources in the literature on the topic of 'estimating the costs of substance abuse' are as follows:

1. Eric Single et al. WHO. 2nd edition. 2003. *International guidelines for estimating the costs of substance abuse.* Provides guidance on the theoretical and measurement issues involved.

And the following applications in Australia and New South Wales in particular.

2. Collins and Lapsley. 2002. *Counting the cost: estimates of the social costs of drug abuse in Australia in 1998-9*. Commonwealth Department of Health and Ageing.
3. Collins and Lapsley. 2005. *Counting the costs of tobacco and the benefits of reducing smoking prevalence in NSW.* NSW Department of Health.

I: Easton's 1997 estimates of 1990 Smoking Costs.

Easton's 1997 paper *The Social Costs of Tobacco Use and Alcohol Misuse*, estimated social costs for New Zealand in 1990. Table 1 below summarises his results.

Table 1 Easton's estimates of the Social Costs of Tobacco Use New Zealand 1990

	$mn.
Intangible	
Effect of population mortality	14,000
Effect of population morbidity	7,250
Tangible	
Reduced production from mortality	400
Reduced production from morbidity	145
Additional resources from consumption	580
Additional resources from not having to treat induced diseases and other consequences	205
Smoking-induced fires	15
Less Benefits from consumption	-125
Total Intangible Costs	**21,250**
Total Tangible Costs	**1,220**
Tangible Costs as percentage of GDP	**1.7 percent**
Population Loss: 70,000 (of 3.35 million December 1990)	2.0 percent

The items in Easton's table are as follows.

Intangible effect of population mortality.

This consists of the life-years lost because of the diminished population resulting from tobacco-caused premature mortality. Easton calculates this loss as 70,000 life-years in 1990, on the basis of the estimated average reduction in life expectancy for smokers. That is, an extra 70,000 people would have been alive, increasing population by about 2 percent. Each life-year lost is then valued at $200,000, on the basis of New Zealanders being willing to pay in 1990 prices approximately $2 million to save a 'statistical life'.[10] [11]

Intangible effect of population morbidity.

This is the burden of the poorer health-related quality of life as a result of previous smoking. In what Easton calls a 'heuristic indirect estimate' he assumes that the 28 percent of the population who

[10] This 'Value of Statistical Life' of $2 million, in 1990, was estimated by the Ministry of Transport on the basis of 'willingness-to-pay' surveys carried out at that time (Miller and Guria. 1991). It has subsequently been adjusted in line with changes in the average ordinary time wage rate, reaching a value of approximately $2,750,000 by 2005.

[11] The link from 'Value of statistical life' to the 'Value of a statistical life-year' assumed a discount rate of 10 percent per annum. Also it assumed that the 'statistical life' is valued at about average population age, which would be in the mid-30s currently, representing the value of remaining years of life expectancy at that age.

were smokers in 1990 (about 725,000) suffered on average a 5 percent deterioration in the quality of their health. This loss is valued at $10,000 per person, leading to the estimated $7,250 million.

Note that Collins and Lapsley chose not to attempt the measurement of 'pain and suffering (i.e. morbidity costs). That is they do not include in their estimates an item equivalent to this of Easton's.

Reduced production from mortality.

Of the 70,000 'missing lives' some 11,000 were estimated as being below the age of 60, of whom 79 percent (between ages 35 and 59) would have been in the labour force, or 8,700, amounting to 0.55 percent of the labour force. Therefore GDP would also have been 0.55 percent larger, by $400 million.

Reduced production from morbidity.

Easton used an earlier Collins and Lapsley estimate (1996) of a production loss (excluding absenteeism) in Australia from tobacco-induced morbidity equal to 0.06 percent of GDP. For New Zealand this would equate to $45 million. Absenteeism was estimated at one working day per year for smokers and ex-smokers, numbering 400,000, giving a net production loss of $90 million. The total is around $135 million a year.

Additional resources from consumption.

Consumption expenditure on tobacco products was estimated at $580 million without excise duty (but including GST).

Health sector spending.

This is obtained by adjusting the Phillips et al (1992) estimate of $185.4 million for 1989 to $205 million in 1990.

Benefits from consumption.

Using the earlier Collins and Lapsley (1996) estimate that 89 percent of all tobacco consumption in Australia was addictive, Easton assumed that consumption benefits amounted to 11 percent of outlays (including excise duties) or $125 million.

Other costs.

A further cost estimated by Easton, and added here to the above table, was that of smoking-induced fires, assessed by him at a order of magnitude of about $15 million per year. Litter costs were also mentioned, but no attempt made to value them.

It is of interest to update Easton's estimates, using the same general approach, but in some cases better data and assumptions.

II: Easton's estimates, updated to 2005

Lost population.

Quite complex modelling of the demographic 'counter-factual' is required in order to estimate population numbers and structure as they would have been in the absence of tobacco consumption. The methodology of such a model for the New South Wales population is described in Appendix A of Collins and Lapsley (2005), and some of its limitations also discussed. Note that in this, as in most such modeling, no attempt has been made to quantify births that did not take place because of lives lost through tobacco usage.

Modeling in this detail has not been carried out for New Zealand. However, Collins and Lapsley include a table for New South Wales with a breakdown by age and gender of the estimated

additional population in the absence of smoking. That table (Table 24, Appendix A; op. cit.) is shown below.

The demographic histories and population structures of Australia and New Zealand are similar, so it is reasonable to suppose that similar results, appropriately adjusted for population size, would also hold for New Zealand. The following table 3 applies these results for NSW to estimate the additional population New Zealand would have had in 2005, had it not been for tobacco. The total is 62,800 or 1.5 percent of New Zealand's estimated resident population of 4.1 million in calendar year 2005. Of the total 51,000 or 82 percent would have been aged 65 or over.

These 62,800 persons would have been alive in 2005 if they had not smoked tobacco. The loss due to mortality in that year is therefore 62,800 life-years.

In comparing this estimate with that of Easton's, that is 2.0 percent of population 'missing', it is to be noted that Easton made use of the smoking prevalences of the time, which were of course higher than currently.

Table 2. Estimated additional NSW population in the absence of smoking June 1999

Age	Male	Female	Total
0-4	75	13	88
5-9	133	63	196
10-14	233	158	391
15-19	237	170	407
20-24	333	247	580
25-29	384	293	677
30-34	522	386	908
35-39	647	456	1,103
40-44	848	560	1,408
45-49	1,172	650	1,822
50-54	1,690	736	2,426
55-59	2,341	840	3,181
60-64	4,165	1,424	5,589
65-69	7,321	2,434	9,755
70-74	11,370	3,963	15,333
75-79	13,854	5,459	19,313
80-84	11,305	5,299	16,604
85+	12,613	7,779	20,392
Total	69,243	30,930	100,173

Source: Collins and Lapsley, 2005. Table 24, Appendix A.

These numbers were scaled down by a factor of 0.587, representing the ratio of New Zealand's population to that of New South Wales in 2001. (New Zealand's population at census of 6 March 2001; New South Wales population at 7 August 2001, from www.citypopulation.de). The resulting numbers were then adjusted for New Zealand resident population growth from 1999 to 2005, separately for males (7.0 percent growth) and females (6.7 percent growth). The results are as in Table 3.

Table 3. Estimated additional New Zealand population in the absence of smoking 2005

Age	Male	Female	Total
0-4	47	8	55
5-9	83	39	123
10-14	146	99	245
15-19	149	106	255
20-24	209	155	364
25-29	241	183	424
30-34	328	242	569
35-39	406	285	692
40-44	532	351	883
45-49	735	407	1,142
50-54	1,061	461	1,521
55-59	1,469	526	1,995
60-64	2,614	891	3,505
65-69	4,594	1,524	6,118
70-74	7,135	2,481	9,616
75-79	8,694	3,418	12,112
80-84	7,095	3,317	10,412
85+	7,915	4,870	12,785
Total	43,454	19,363	62,817

Valuation of lost life-years.

Lost life-years are a sensible 'natural unit' measure of the most important cost of smoking, and it is in general unnecessary to attempt to put a dollar value on lost life-years.[12] Because, however, this is a common practice, as in both Easton and in Collins and Lapsley,[13] the calculations are gone through here also.

In brief the 'Value of Statistical Life' in New Zealand was estimated by the Land Transport Safety Authority, using 'willingness-to-pay' methods, as being NZ$2 million in April 1991. Adjustment for earnings growth since has taken the value to approximately $2.75 million in 2005. Following the Easton approach, but assuming that a discount rate of 5 percent per annum is more appropriate than his 10 percent per annum,[14] gives the 'Value of a Statistical Life-year' as being NZ$137,500 in

[12] Amongst the problems introduced are that two estimation methods of valuing life are used in different papers and give quite different results. The 'human capital' method, calculating the discounted stream of lost earnings, gives much lower values than the theoretically preferable 'willingness-to-pay' approach. (*The Economist.* December 4th 1993. 'The price of life. Why an American's life is worth twice as much as a Swede's.'). However, both Easton's work, and that of Collins and Lapsley, use a 'willingness-to-pay' approach. One reason for the difference in estimates between the two sources is that Collins and Lapsley assume the 'Value of a Statistical Life' is at time of birth, as against Easton's assumption that it is at 'average age'. The most important influence, however, is the discount rate used.

[13] Collins and Lapsley appear to value a life-year at about A$48,000 in 1999.

[14] A discount rate of 10 percent per annum was more or less standard for public sector investments in New Zealand through the 1990s. Recently lower rates have gained greater acceptance. Pharmac has adopted a discount rate of 3.5 percent for evaluation of pharmaceuticals proposed for subsidy. The rate of 5 percent is used here as reasonably typical of rates used in other jurisdictions such as Australia.

2005 dollars. This is as against NZ$200,000 in 1991 dollars in Easton's original (1997) calculations.[15] [16]

For these numbers the total mortality cost of 62,817 persons missing from the population because of smoking in New Zealand in 2005 is estimated as $8,637 million.

Population Morbidity.

Easton's approach, for which he claims no great accuracy, assumes that lost 'health-related quality of life' can be calculated as assuming 750,000 current smokers on average suffer a deterioration in quality of life of 5 percent. This can be regarded as encompassing also increased morbidity of ex-smokers and passive smokers. The health loss in a year is therefore 37,500 Quality-adjusted Life Years (QALYs). Valued a QALY at NZ$137,500, the same as a life-year, this total monetary value of the loss is NZ$5,156 million.

Other information suggests this could be on the high side. Analysis of detailed data in the Ministry of Health's 1999 publication *Our Health: Our Future,*[17] using Disability-adjusted Life Years (DALYs) rather than QALYs, suggests a DALY to YLL (Years of Life Lost) ratio of about 1.3 is more appropriate for smoking as a risk factor.

Using this ratio of 1.3 implies an annual health loss due to tobacco-induced morbidity of 18,845 QALYs, which could be valued at NZ$2,591 million in 2005. That is, this alternative approach reduces the estimates by nearly a half. For the tables and discussion that follow, it is assumed that this more conservative estimate, than that of Easton's, is the appropriate value.

Lost production from mortality.

Updated estimates have been calculated here, based on the 'additional population' Table 3 above for New Zealand. Average earnings from Wages and Salaries, and Self-employment, sourced from the June quarter 2005 NZ Incomes Survey, are applied to these population numbers. An initial adjustment of the source data is to derive estimated average earnings by gender in each age-group, applying the over all ages gender ratio. The two tables following contain the relevant source data. Note that the average earnings numbers are for the whole population in each age-group, whether in the work-force or not.

[15] The difference between the estimate used here and that of Easton is due in good part to differences in the discount rate used. This is when matching the sum of future discounted life years to Land Transport's 'Value of Statistical life'. Contrary to what might be expected, the higher the discount rate, the lower the sum of discounted life-years, and hence the higher each life-year's value needs to be to match the Value of Statistical life.

[16] An additional issue here is that results in the literature suggest that the worth of life-years, and QALYs, varies with the age of the recipient. People tend to give more preference to an extra life-year being received by a child rather than by an old person. Busschbach et al 1993.

[17] The publication calculates the "burden of disease" for various conditions and 'risk factors', including smoking, in the form of DALYs, made up of the sum of Years of Life Lost from premature mortality, plus any morbidity or disability-caused reduction in the quality of life.

Table 4. Average weekly income, by gender. June Quarter 2005. New Zealand.

$	Aged 15 years and over		
	Wages and Salaries	**Self-employment**	**Sum**
Males	485	156	641
Females	283	51	334
Total	381	102	483

Source: Labour Market Statistics 2005. From NZ Income Survey.

Ratios:		
	Males/Total	1.327
	Females/Total	0.692

The ratios at the foot of Table 4 are applied to the age-group average earnings in Table 5 to get the average earnings by age-group and gender in the right-hand columns of that table.

Table 5. Average weekly income, estimates by gender and age-group. June Quarter 2005. New Zealand.

Age-group	Wages and Salaries	Self-employment	Sum	Estimated Male	Estimated Female
15-19	117	2	119	158	82
20-24	335	9	344	457	238
25-29	488	40	528	701	365
30-34	535	106	641	851	443
35-39	530	147	677	898	468
40-44	552	168	720	956	498
45-49	553	205	758	1,006	524
50-54	501	175	676	897	467
55-59	443	174	617	819	427
60-64	318	143	461	612	319
65 +	36	25	61	81	42
Total	381	102	483	641	334

Source: Statistics NZ. *NZ Income Survey* . June quarter 2005

Applying these Table 5 income estimates to the 'additional' populations' in Table 3 gives the required estimates of lost production in employment. The estimated lost production amounts to NZ$568 million in 2005.

Lost production from morbidity.

Following Easton, and in the absence of more detailed data such as that referenced in Collins and Lapsley, it is assumed that there is a production loss (excluding absenteeism) due to tobacco-induced morbidity of 0.06 percent of GDP, and a further loss due to absenteeism of another 0.12 percent. New Zealand's GDP in the year to March 2006 was NZ$155,855 million. The two components amount to NZ$94 million and NZ$187 million respectively, or NZ$280 million in total.

As in Collins and Lapsley, no attempt is made here to estimate costs of reduced on-the-job productivity, apart from the morbidity component above.

Resources diverted to tobacco consumption.

Laugesen (2006) provides two alternative estimates of total retail spending on cigarettes in recent years. The two different sets of estimates are for the two sources of manufacturers' data – 'released from bond', and 'reported volume of sales'. In brief the two estimates of retail spending on cigarettes (including 'hand-rolled') for calendar year 2005 are $1,652 and $1,572 million respectively.

Excluding, as in Easton, estimated excise duties paid in 2005 of NZ$981 million (not including GST), the resources diverted for tobacco consumption amount approximately to around NZ$650 million.

However, against this should be offset the 'consumption benefits' of tobacco consumption. As in Easton's paper, this is taken as the 11 percent of 'non-addictive' consumption, measured in market prices (and so now including excise duties), amounting to about NZ$180 million in 2005.

Healthcare costs.

Health-care costs are in general publicly-funded in New Zealand, and so costs caused by smoking can for the most part[18] be labelled as 'external' costs. A proportion of GP and prescription fees is, however, met out of pocket (or from private insurance).

Easton's 1997 estimate of $205 million for 1990 is closely based on the 1992 paper by Phillips et al. The total cost for 1989 in 1989 dollars was estimated by them as $185.15 million. The general approach in such studies is to decide, from the literature, those diseases which are in part attributable to smoking. The list of such diseases has been expanding.[19] Then to take, again from the literature, the "attributable fraction" of morbidity and /or mortality for each disease which is estimated as being due to smoking. These proportions are then applied to the available data on the costs of treating each condition.

The results from Phillips et al are given in the following table. It has not been possible to establish whether or not these estimates excluded GST. Note that an estimate for the smoking-attributable cost of care for Low Birth Weight (LBW) babies is included.

[18] Apart from smokers' and ex-smokers' own contribution s through taxes.

[19] US Surgeon General 2004. National Cancer Institute 2004.

Table 6. Phillips et al (1992) estimates: 1989 Smoking-caused health-care costs

GST status unknown	Estimates in 1989 dollars $mn	Av. Earnings increase	Adjusted to 2005 dollars $mn
Hospital health-care costs	118		
plus Costs of caring for LBW cases attributable to smoking mothers	10		
Total hospital	128	57.2%	201.2
Non-hospital health-care costs (incl. Patient costs)			
GP consults, Lab tests etc	19.3		
Prescriptions	37.85		
Total non-hospital	57.15	57.2%	89.8
Overall total	**185.15**	**57.2%**	**291.1**

Source:
Phillips D, Kawachi I, & Tilyard M (1992). "The Costs of Smoking Revisited". NZ Med J vol 105, pp. 240-2.

It is helpful to convert these numbers to dollars of today. The postulated increase is 57.2 percent, assuming costs will have increased by the same proportion as Average Weekly Earnings (AWE) over the period 1989 to 2005, rather than by the lower increase in the CPI, of about 43 percent. This is on the basis that health-care is a labour-intensive industry.

This brings the estimated cost in 1989 to $291 million, in 2005 dollars.

There is some indication that smoking-caused health-care costs in fact fell in the 1990s. This is not implausible, given the drop in smoking prevalence over the period, from 27 percent in 1989 to 23.5 percent in 2005, and also the more pronounced preceding drop in the 1980s, from 33 percent in 1983 (AC Nielsen survey). Lung cancer deaths among males are known to have dropped significantly, and also the incidence of cardiovascular disease. Tobacco-attributable deaths among males fell from about 3,500 annually around 1980 to around 2,500 in 2003 (*Tobacco Trends 2006;* Page 19). Female deaths have continued to increase, but may have recently levelled off at around 2,000 per year.

Against this, the recognition of a more extensive range of diseases for which smoking is a contributory factor tends to increase the overall estimate.

Overall, the health-care costs attributable to smoking might still be of the order of around NZ$300 million to $350 million.[20] An estimate of NZ$350 million is assumed here.

[20] Reviewers of this report have commented on the lack of an updated estimate based on New Zealand data, the last such being that by Phillips et al (1992). Some work is continuing on this. The principal author should be contacted for further information.

Cross-checking with NSW health-care costs.

The population of New South Wales is about 6.5 million. Collins and Lapsley estimated the gross health care costs attributable to smoking to be A$801.2 million in 1998/99 (Table 3, Page 12). This includes a substantial component of A$259 million for 'Nursing Home costs', not included in New Zealand totals. The total is also before deducting cost savings of A$324 million for those prematurely dead.

Scaled down for respective population sizes (approximately 6.5 to 4 mn), this A$801.2 million equates to about $470 million for New Zealand. These are Australian dollars of course, usually worth of the order of NZ$1.15 each, though this might not be the right exchange rate for health-care costs.

This amount of A$470 million is significantly higher than that assumed above for New Zealand in NZ$ terms in 2005. Nursing Homes might account for much of the difference – the A$259 million, scaled down to A$152 million, would explain the difference. More work is needed to check the discrepancy.

Smoking-induced fires.

As an approximation, with not much useful information available, Easton estimated an amount of $25 million for the annual property damage resulting from smoking-caused fires. Collins and Lapsley's estimates for New South Wales in 1998/99 are that the tangible costs of smoking-attributable fires amounted to A$17.5 million (and loss of life intangible costs to a further amount of A$10 million).

An amount for New Zealand in 2005 of about NZ$15 million in tangible costs seems appropriate.

Summary of the estimates above.

All the above components are now brought together in the table below, similar in format to the table in Easton's 1997 paper. There is some rounding of the numbers in the table, so as not to indicate a degree of precision which is not actually achieved. Also the dollar valuations of the 'intangible' items are bracketed, as an indication that they are very much dependent on the dollar value, which here is NZ$137,500 in 2005 dollars, placed on a Life-year or QALY.

Table 7 Estimates of the Social Costs of Tobacco Use. New Zealand. Updated to 2005.

	$mn.	Life-years/QALYs lost
Intangible		
Effect of population mortality	(8,600)	62,800
Effect of population morbidity	(2,600)	18,850
Total Intangible Costs	**(11,200)**	**81,650**
Population Loss	(62,800 of 4.1 million in 2005) 1.5 percent	
Tangible		
Reduced production from mortality	570	
Reduced production from morbidity	280	
Resources diverted for tobacco consumption	650	
Resources required to treat induced diseases and other consequences	350	
Smoking-induced fires	15	
Less Benefits from tobacco consumption	-180	
Total Tangible Costs	**1,685**	
Tangible Costs as percentage of GDP	**1.1 percent**	

The resource costs to New Zealand of smoking amounted therefore to almost NZ$1.7 billion in 2005, about 1.1 percent of GDP. Turning to intangible costs, there would have been an additional 62,800 persons alive in 2005, but for smoking. That number equals about 1.5 percent of current total population. Smoking-caused morbidity adds nearly another third to this cost in terms of lost Quality-adjusted life-years. For the $ value put on these in the above table, the total of intangible costs comes to $11.2 billion, nearly seven times greater than total tangible costs. However this amount is very dependent on the value put on a life-year, here $NZ137,500. Easton used a value of $200,000 in 1990 prices, which in terms of the Value of Statistical Life of about $2.75 million in that year would give value per life-year of $275,000; double that used in the above table. The New South Wales estimates of Collins and Lapsley used a value of just under A$50,000 in 1999. This would equate to a New Zealand dollar value of the order of half the NZ$137,500 used in the above table.

III: Cross-check against Collins and Lapsley estimates for New South Wales.

The NSW estimates are adjusted here to approximate NZ equivalents, taking account of differences in population size (New Zealand's population of approximately 4 million being about 60 percent of the New South Wales population), and of the currency exchange rate. The assumptions are that the two jurisdictions have a similar population structure, smoking prevalence, and cost structure. They give an approximate estimate, for use only as a cross-check on the magnitude of the New Zealand estimates in Table 7. Table 8 gives the results.

Table 8. 1998/99 NSW estimates of 'Tangible' Cost components converted to approximate 2005 NZ equivalents.

$mn	NSW A$mn	Adjusted to NZ popn size A$mn	Adjusted to NZ currency NZ$mn	Adjusted to 2005 prices NZ$mn
Health-care Costs				
Net	476.8	279.7	329.0	396.1
Total net production costs	719.4	422.0	496.4	597.7
Resources used in abusive consumption	577.0	338.4	398.2	479.4
Costs of smoking-attributable fires				
Total, incl. Intangible	27.3	16.0	18.8	22.7
Overall Total	**1,800.5**	1,056.1	1,242.4	**1,495.9**

Source: Collins and Lapsley, 2005. Extracts from table 9, page 15.
Populations from www.citypopulation.de
Assumed exchange rate NZ$1 = A$0.85
Price adjustment 1999 to 2006 based on Average Weekly Earnings change

Note that both Health-care costs and Total production costs are 'net'. The latter includes losses to unpaid labour in the household, as well as lost paid labour in the workforce. Most of the 'health-care costs' are 'external', that is met by society as a whole. Most of the 'net production costs' are 'internal', borne by smokers and their households, though there is a reasonably sizeable 'absenteeism' component, of an estimated A$151 million. In total these costs convert to an NZ equivalent totalling about NZ$1.5 billion in current values.

This is not too far different from the results of updating Easton's work, as given in Table 7. The total there is $1.7 billion in 2005.

Comparison of 'intangible costs'.

Collins and Lapsley estimate the intangible cost from 'loss of life' as being A$4,794 million in 1998/99. Carrying through the same calculation as just above for tangible costs, gives a New Zealand equivalent in 2005 of NZ$3,980 million.

The actual New Zealand estimate in Table 7 above is NZ$8,600 million. The difference in magnitudes is due to the much higher worth assigned a life-year in the New Zealand calculations.

IV: Conclusions

- The tangible costs of smoking to New Zealand in 2005 were of the order of NZ$1.7 billion, or about 1.1 percent of GDP.
- The intangible costs were of the order of 62,800 life-years lost in 2005 to smoking-induced premature mortality, and 19,000 Quality-adjusted Life-years lost in 2005 to smoking caused morbidity.
- These estimates should not be assumed to be very accurate. Error margins could well be ± 25 percent or more.

Appendix D: Analyses of Household Economic Survey (HES) tabulations on purchases of tobacco products 2000/01 and 2003/04.

Special tabulations for June years 2000/01 and 2003/04 were obtained for this report from Statistics NZ's triennial Household Economic Survey. The survey is a sample of private residential households. The tabulations consisted of data from the surveyed households, classified into income deciles, on whether or not they had purchased any tobacco products during the survey period, and the total spent on such purchases (but see Appendix E on 'under-reporting'). In addition the tabulations provided information on the ethnicity and adult/child composition of the households.

The reason for obtaining the samples was to obtain information to help in assessing the impact of tobacco tax increases by household income level, and also by ethnicity. In addition some information is obtained on trends in tobacco purchasing.

Contents:

Some information from earlier HES analyses for the years 1987/88 to 1997/98 is also included in the statistical material in this Appendix. Results for these earlier years, however, represent a smaller proportion of the total New Zealand population than do the 2000/01 and 2003/04 analyses. Thus the 2003/04 survey represents 1,494,300 households, compared with 1,162,500 households in 1997/98. (Source: Tabulations from Statistics NZ.)

In particular, it should be noted that the bottom household deciles in the latest 2000/01 and 2003/04 tabulations have a different composition from past years. They now include 'atypical' negative and zero income households. These are often households which are only temporarily in a low-income position, and which are maintaining expenditure levels consistent with previous higher income levels. Care is needed therefore in interpreting Decile 1 averages.

1. The Data Source: Household Economic Survey information on tobacco purchasing households.

An important information source for this report is the Household Economic Survey (HES). This survey is carried out every three years by Statistics New Zealand, and up to 1997/98 was carried out every year. For this report special tabulations for the June years 2000/01 and 2003/04 were purchased from Statistics New Zealand. In addition, similar tabulations for the March years 1987/88 to 1997/98 were available from earlier work on tobacco taxation (Thomson et al; 2000).

The tabulations ranked households into ten deciles of 'Equivalised Household Disposable Income' – from Decile 1, the lowest incomes, to Decile 10, the highest. Disposable Income is income of the household after estimated tax deductions and receipt of benefits and pensions. 'Equivalised' means the process of adjusting household income to allow for the number of persons in the household. That is, it attempts to adjust for the fact that a household with only one or two persons requires a smaller income to have the same 'standard of living' as a larger household. Two different 'equivalence scales' were specified for the tabulations for 2000/01 and 2003/04 received from Statistics New Zealand.

i) The Revised Jensen Scale (RJS). This has historically been the scale normally used in New Zealand income analyses, and was the one used in analyses of the earlier 1987/88 to 1997/98 data. It applies different weights to children and adults.

ii) The Luxembourg Incomes Study scale (LIS). This scale is one of those used in the analyses carried out by a multi-national agency based in Luxembourg. The version used here simply divides household income by the square root of the number of persons in the household.

By and large the two scales give broadly similar results, and so the bulk of the results reported in this paper are based on the RJS scale. The household tabulations provide for each decile

i) The proportion of households who report any purchase of tobacco products.

ii) The number of children and adults living in households which report purchase of tobacco products.

iii) Average household expenditure on tobacco products for households that report such expenditure.

iv) Average household disposable income, and average total household expenditure on all items, for all households in the decile.

For the benefit of those contemplating similar analyses in future, it is worth commenting that the downwards gradient of smoking prevalence with increasing household income is less marked than it appears to be with other 'socio-economic status' indicators; for example the census-based Deprivation Index measure of socio-economic ranking for localities. A possible contributory reason could be the lower smoking prevalence of 'pensioner households'. Future analyses could benefit from exploring the use of alternatives to household income for ranking households, such as the Deprivation Index.

2. Under-reporting.

An important point to note is that, from the earlier work reported in Thomson et al (2000), household purchases of tobacco products are very much under-reported by survey respondents. After comparing reported household purchases with data on quantities released by the tobacco companies, the conclusion reached in that report was that only about 45 percent of spending on tobacco products was reported. There is known to be under-reporting for other commodities, also, such as alcoholic beverages and milk. The under-reporting could be a result of 'stigma', or of failure by survey respondents to remember and record small routine purchases, or both.

The extent of under-reporting is investigated further for this report in Appendix E, drawing also on recent reports by Laugesen (2005, 2006). The conclusion reached is much the same as in the earlier report. Namely that spending on tobacco products is under-reported, by a half or more. For subsequent calculations in this report it is assumed, conservatively, that only 50 percent of spending on tobacco products is recorded in the HES data.

3. Trends in Prevalence of household tobacco purchasing over time.

(Note that 2000/01 and 2003/04 rates may not be strictly comparable to those in earlier years.)

Prevalence rates of persons living in those households which report any purchase of tobacco products are the first information to be extracted from the HES survey data. Chart D.1 shows a more or less steady decline in the proportion of such from around 40 percent in the late 1980s, to around 30 percent for 2000/01 and 2003/04. The proportions for children are a little higher.

Chart D.1 Population percent in tobacco purchasing households. 1987/88 to 2003/04. HES Survey.

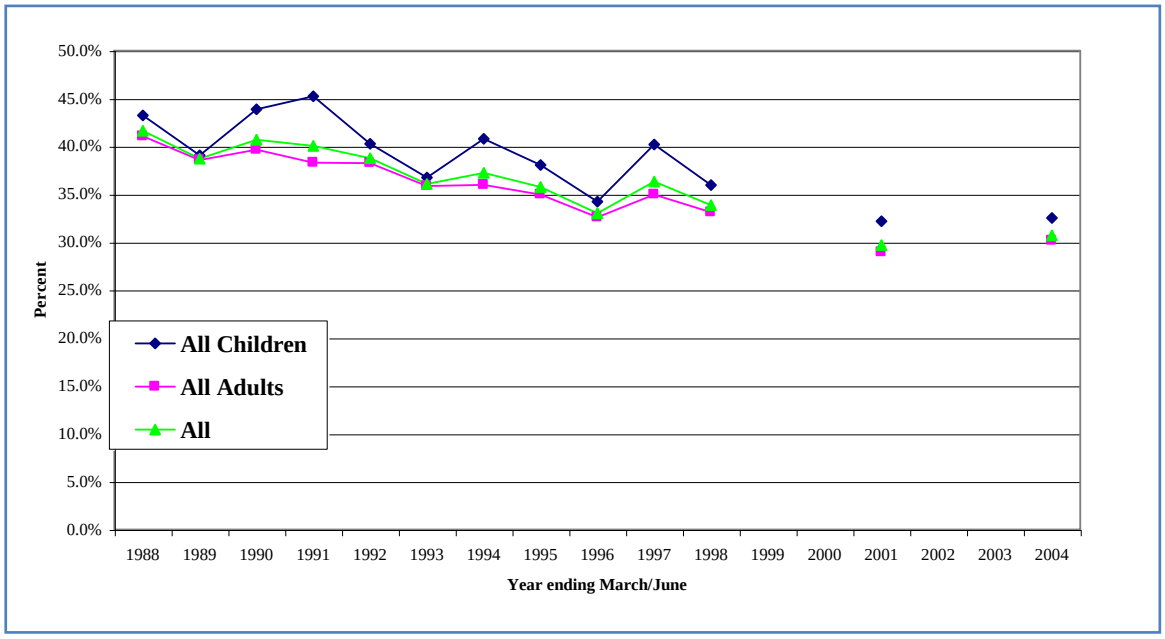


Chart D.2 shows the trends in proportions by ethnicity (the 'Other' ethnicity group has been omitted as too erratic). Māori percentages are significantly higher than Pākehā, around double the proportions, with Pacific Islanders intermediate. All ethnic groups show, however, a general downwards trend since the early 1990s, though it is less clear, visually, whether there has been a significant reduction for Māori and Pacific peoples since the mid-1990s. The chart gives an indication of the degree of exposure to 'passive smoking'.

Finally, Chart D.3 shows trends in the actual proportion of households reporting any tobacco product purchase. Again there is a steady downwards trend. (An 'ethnic' breakdown of this trend is not possible – individuals can be attributed 'ethnicity' but not households.)

Chart D.2 Percent living in tobacco purchasing households. 1987/88 to 2003/04. By ethnicity. HES survey.

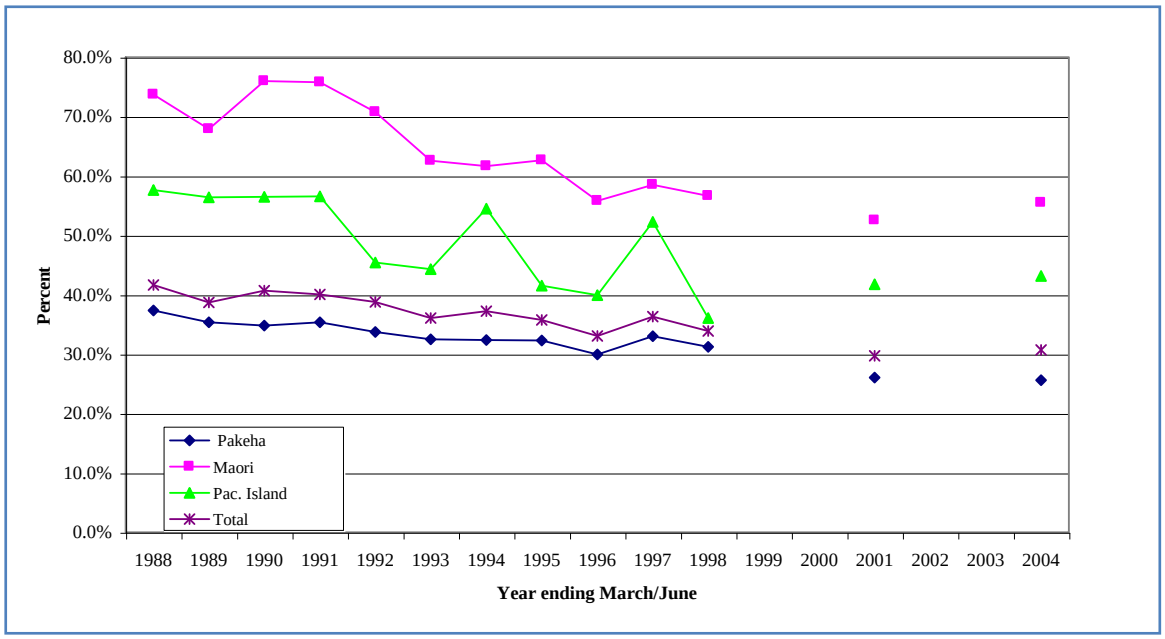
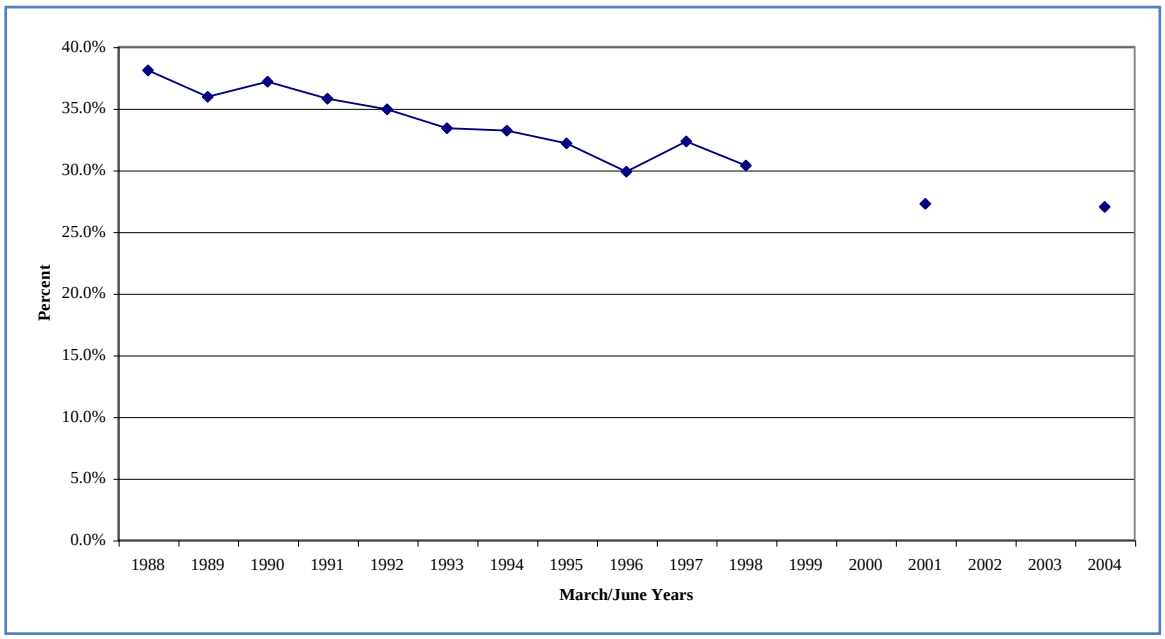


Chart D.3 Percent of HES households recording tobacco purchases. 1987/88 to 2003/04. (Assuming no change in proportion 'not reporting'.)



Tables D.1 and D.2 give some additional statistical detail for 2000/01 and 2003/04. Thus in 2003/04 tobacco-purchasing households numbered 404,000 or 27 percent of all households in the surveyed population (which is very nearly the whole of New Zealand's population). The number of adults (15+) living in these tobacco-purchasing households numbered 929,000 or 30.2 percent of all adults.

Table D.1 Numbers of households in HES reporting purchase of Tobacco products – and numbers living in these households 2000/01 and 2003/04

	Year ending June	
	2001	2004
Household numbers		
All Households	1,431,800	1,494,300
Tobacco-purchasing households	390,300	403,700
Purchasers as percent of all	27.3	27.0
Adults (15+) in households:		
All Households	2,928,500	3,077,700
Tobacco-purchasing households	848,200	928,700
In purchaser hhlds as percent of all	29.0	30.2
Individuals (adult and children) in households:		
All Households	3,804,400	3,957,500
Tobacco-purchasing households	1,130,200	1,215,000
In purchaser hhlds as percent of all	29.7	30.7

This means also that there were, in 2003/04, 286,000 children under 15 in households that reported buying tobacco products, of whom 117,000 were Māori (Table D.2).

Calculations very similar to those in table F.1 in Volume I give an estimated population of adult smokers in 2000/01 of 748,000, and 755,000 in 2003/04. These are lower, by 12 and 19 percent respectively, than the Table D.1 numbers above of adults living in tobacco-purchasing households. The difference gives an indication of the number of non-smokers sharing accommodation with one or more smokers.

Table D.2 below for Māori corresponds to Table D.1 above for the total population.

Table D.2 Number of Māori living in HES households reporting purchase of Tobacco products. 2000/01 and 2003/04

	Year ending June	
	2001	2004
Māori Adults (15+) in households:		
All Households	357,600	385,200
Tobacco-purchasing households	179,900	218,300
Purchasers as percent of all	50.3	56.7
Māori Total (adults and children) in households:		
All Households	537,400	603,400
Tobacco-purchasing households	282,200	334,900
In purchaser hhlds as percent of all	52.5	55.5
Individuals (adult and children) in households:		
All Households	3,804,400	3,957,500
Tobacco-purchasing households	1,130,200	1,215,000
In purchaser hhlds as percent of all	29.7	30.7

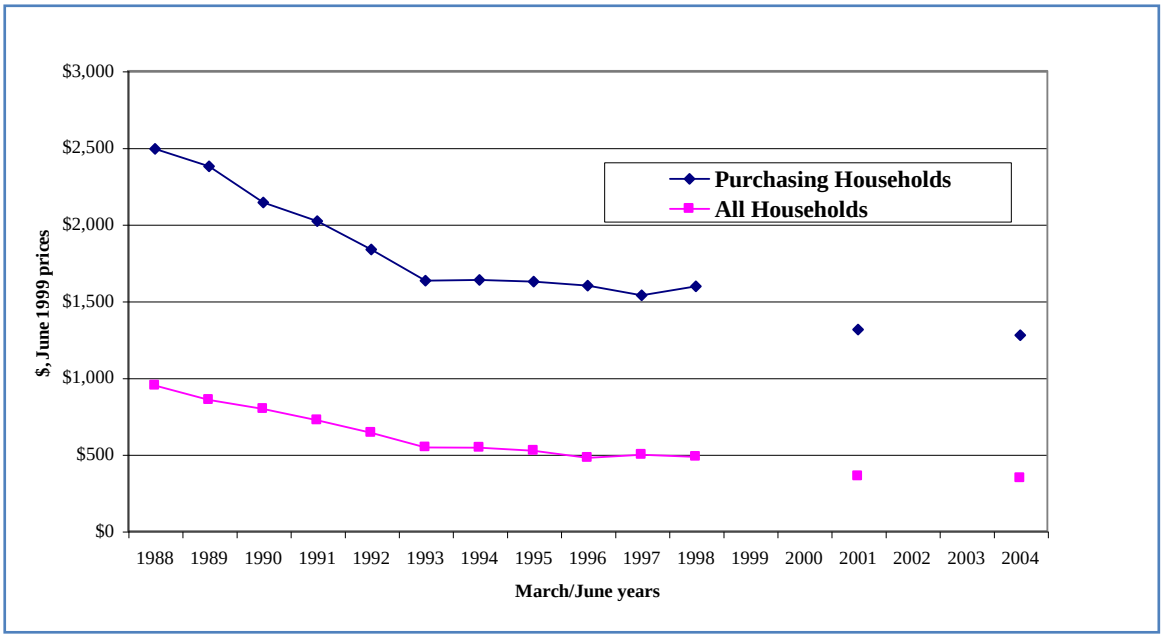
Again for comparison, the number of Māori Adult (15+) smokers is estimated at 183,000 for 2000/01 and 195,000 for 2003/04.

4. Trends in real purchases of tobacco products.

(Note that 2000/01 and 2003/04 averages may not be strictly comparable to those in earlier years.)

Chart D.4 shows average household spending on tobacco products since 1987/88. This is after deflation by the CPI Tobacco Products sub-group price index, so in effect shows trends in real consumption (assuming the degree of under-reporting is constant over time). The graph confirms the significant decline in the early 1990s, followed by relative stability, and then apparently a further decline between 1997/98 and 2000/01. Incidentally it is this period from 1998 to 2001 that brackets the last major real increase in tobacco tax rates.

Chart D.4 Average real household spending on tobacco products (June 1999 $). All households, and households reporting purchases.



5. Purchase of, and Spending on, tobacco across household income deciles.

Chart D.5 shows the proportion of tobacco purchasing households across household income deciles in 2000/01 and 2003/04, on the RJS equivalisation scale. The profile is, frankly, a puzzle, particularly for 2003/04.

Chart D.5 Proportion of households reporting tobacco purchases. 2000/01 and 2003/04. By disposable household income decile.

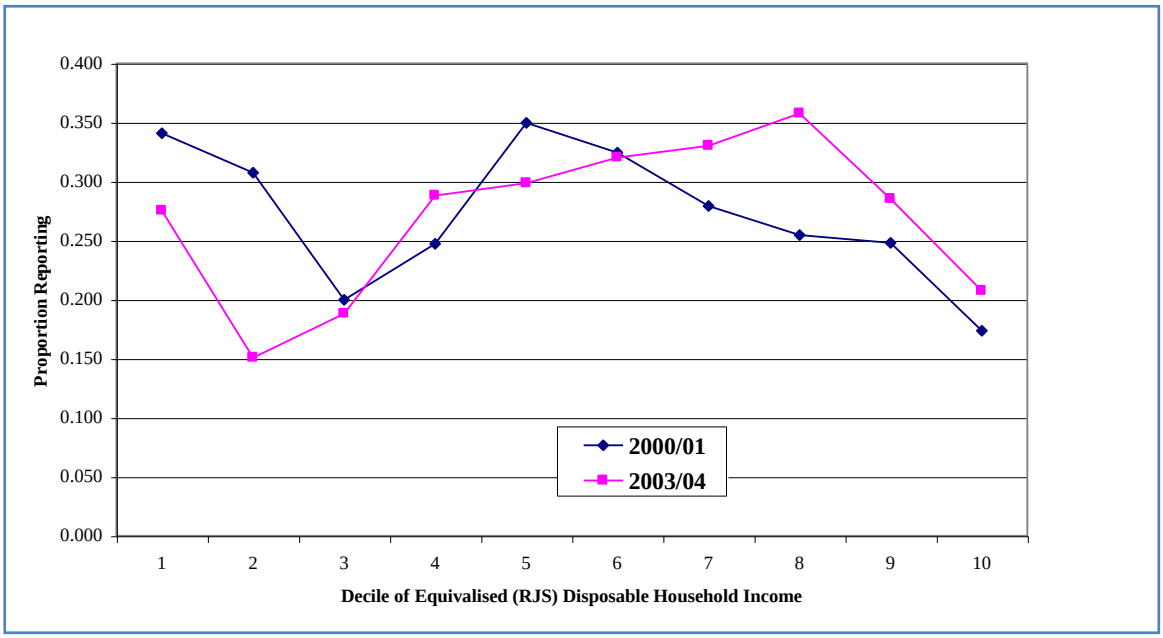
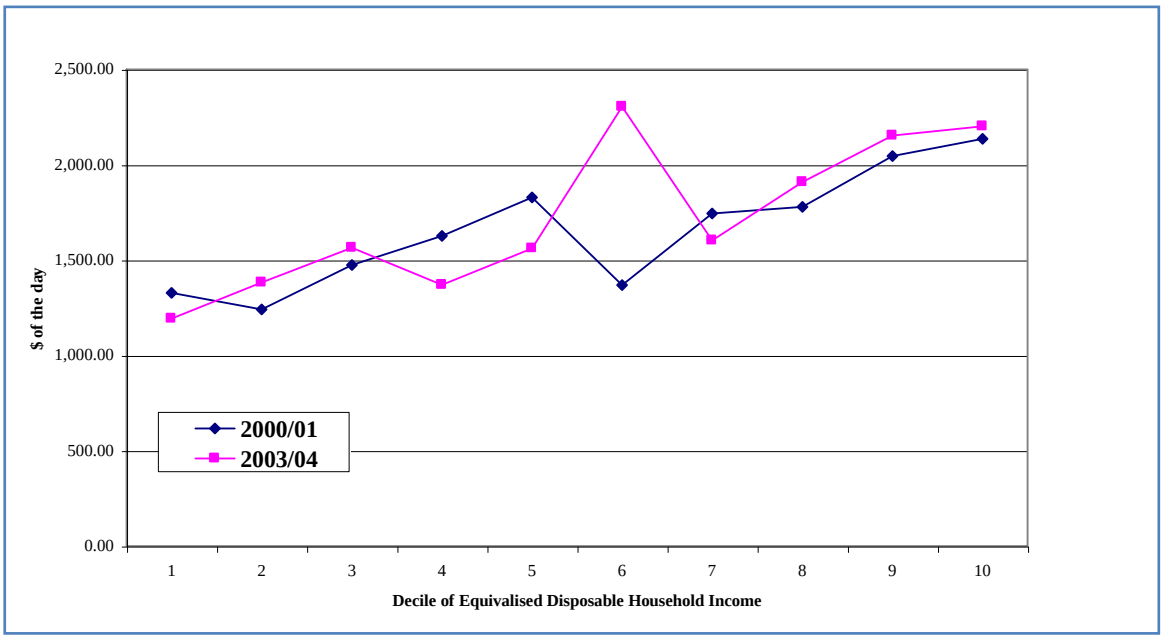


Chart D.6 shows average spending on tobacco products across deciles in 2000/01 and 2003/04 for those households purchasing such. Better-off 'smoking' households clearly spend more on average on tobacco. Again the assumption is made here that the degree of under-reporting is constant, across deciles.

These averages represent of course the potential average financial gains available to those households which succeed in 'quitting' the purchase of tobacco products.

Chart D.6 Average annual household spending on tobacco products, by purchasing households, by household income decile. 2000/01 and 2003/04.

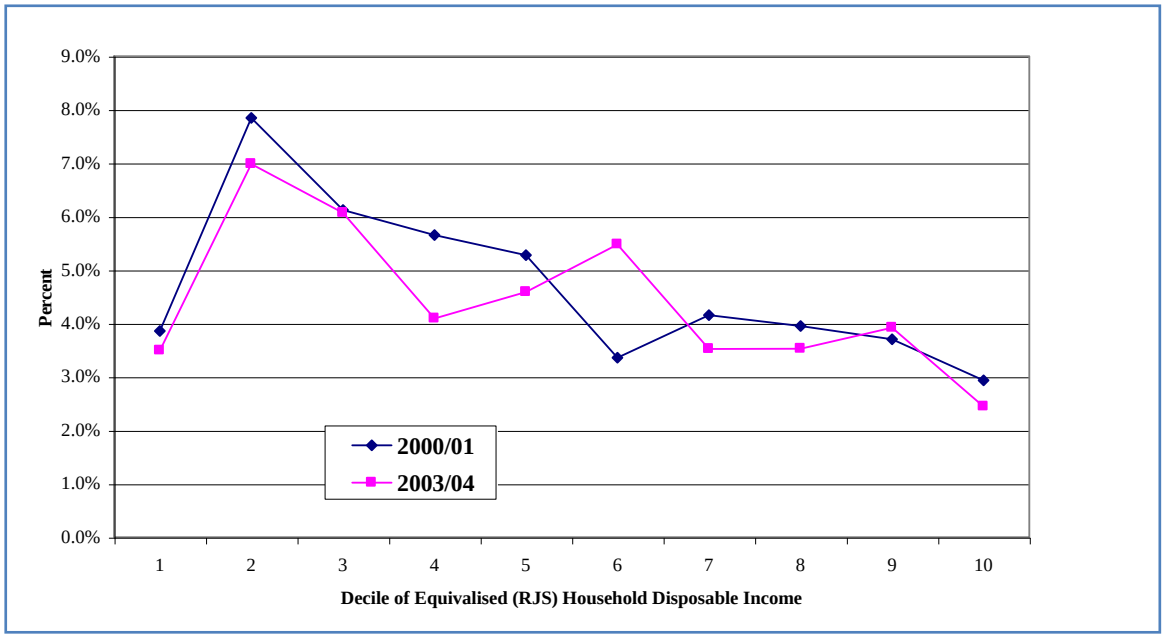


The relevant issue here is how heavily these average purchases influence household financial well-being, and what would be the financial consequences of tax increases. Chart D.7 shows spending on tobacco products by purchasing households as a percentage of average household expenditure in each income decile. Decile 1 is 'anomalous', including households with negative and zero incomes, and is best ignored. (Average household spending in this decile is at a level more characteristic of households in the 4th and 5th deciles.) Spending on tobacco in decile 2 by tobacco-purchasing households is in the range 7 to 8 percent of total household spending. The proportion falls to less than 3 percent in the top decile.

It should be noted that assuming under-reporting of tobacco purchases to be of the order of 50 percent, and assuming this under-reporting is constant across deciles, then the true percentages will be roughly double those shown in the chart.

Clearly a substantial tax increase will have quite an impact on households such as those in Decile 2 already allocating 7 to 8 percent (or around 14 to 16 percent after allowing for assumed under-reporting) of their total spending to tobacco products. There were incidentally 22,500 households in this decile who reported purchasing tobacco products in 2003/04. (There were 44,000 such households in Decile 2 in 2000/01. The changes in numbers should be assumed to be a result of survey sampling error, rather than showing any significant trend.)

Chart D.7. Expenditure on tobacco products as percent of total household spending. By household income decile. 2000/01 and 2003/04.



6. Calculation of the financial impact across deciles of tobacco tax increases.

Tables D.3 and D.4 show the estimated impact of tax-caused price increases on spending of 'non-quitting' households, first for a price increase of 20 percent, and then 50 percent. This is for HES data for the year 2003/04.

The assumptions about price elasticities underlying the numbers are:

- That the overall price elasticity of demand for tobacco has a value of –0.5. The meaning of this is that, for a price rise of 20 percent, the quantity of cigarettes purchased will fall 10 percent, but because of the 20 percent price rise, spending will still increase by a net 10 percent.[21]
- Also that the 'price elasticity of smoking prevalence' has a value of –0.20 (meaning that a price increase of 20 percent will lead to a reduction in prevalence of 4 percent; that is for a prevalence of 25 percent a reduction of 1 percent to 24 percent).
- From these two elasticities the 'non-quitting price elasticity of demand' has a value of –0.30. This is for purchases by 'non-quitters'. This means that quantities purchased by 'non-quitters' would fall 6 percent for a 20 percent price rise, but spending would still increase by a net 14 percent.
- It is also assumed here that these elasticities apply to households in the same way as to individuals.
- A further assumption is that tobacco purchases are under-reported by 50 percent; that is only a half of purchases are reported in the survey results. Also that this under-reporting applies equally across household income deciles. The amounts in Tables D.3 and D.4 are after doubling of reported expenditure.

[21] These percent numbers are more exact for small changes, but are still a reasonable approximation for large changes.

Table D.3 Effect of a 20 percent real price rise on tobacco purchases. Using 2003/04 HES data.

Assumed price and prevalence elasticities of -0.50 and -0.20
Spending data doubled to correct for assumed 100 percent under-reporting of purchases.

Disposable Hhld Income Deciles. Equivalised (RJS)	Number of Tobacco-Purchasing Households	Average pre--tax Spending by Purchasing Households $(2003/04)	Number of Quitting Households	Saving per Quitting Household $(2003/04)	Number of Non-Quitting Households	Increase in spending per Non-Quitting Household $(2003/04)
1	41,100	$2,385	1,644	$2,624	39,456	$348
2	22,500	$2,766	900	$3,043	21,600	$403
3	28,100	$3,128	1,124	$3,441	26,976	$456
4	42,900	$2,739	1,716	$3,013	41,184	$399
5	44,700	$3,122	1,788	$3,434	42,912	$455
6	47,700	$4,609	1,908	$5,070	45,792	$672
7	49,500	$3,206	1,980	$3,527	47,520	$468
8	53,500	$3,818	2,140	$4,199	51,360	$557
9	42,400	$4,306	1,696	$4,737	40,704	$628
10	31,200	$4,404	1,248	$4,844	29,952	$642
Total	403,700	$3,489	16,144	$3,837	387,456	$510

Table D.4 Effect of a 50 percent real price rise on tobacco purchases. Using 2003/04 HES data.

Assumed price and prevalence elasticities of -0.50 and -0.20
Spending data doubled to correct for assumed 100 percent under-reporting of purchases.

Disposable Hhld Income Deciles. Equivalised (RJS)	Number of Tobacco-Purchasing Households	Average pre--tax Spending by Purchasing Households $(2003/04)	Number of Quitting Households	Saving per Quitting Household $(2003/04)	Number of Non-Quitting Households	Increase in spending per Non-Quitting Household $(2003/04)
1	41,100	$2,385	4,110	$2,981	36,990	$928
2	22,500	$2,766	2,250	$3,458	20,250	$1,076
3	28,100	$3,128	2,810	$3,910	25,290	$1,217
4	42,900	$2,739	4,290	$3,424	38,610	$1,065
5	44,700	$3,122	4,470	$3,902	40,230	$1,214
6	47,700	$4,609	4,770	$5,761	42,930	$1,792
7	49,500	$3,206	4,950	$4,008	44,550	$1,247
8	53,500	$3,818	5,350	$4,772	48,150	$1,485
9	42,400	$4,306	4,240	$5,383	38,160	$1,675
10	31,200	$4,404	3,120	$5,505	28,080	$1,713
Total	403,700	$3,489	40,360	$4,361	363,240	$1,358

For a 20 percent price rise, the extra spending by non-quitting households averages $510 per year (or nearly $10 per week) if under-reporting is allowed for. This amounts to about 1.2 percent of

average annual total household expenditure on all goods and services ($43,400), and about 1.1 percent of average actual household disposable income ($46,150). The amounts increase proportionately for a price rise of 50 percent.

Increases of such magnitude will not cause undue financial hardship for most households in higher income brackets. The impact will, however, be more painful in the bottom income brackets. Additional spending amounts to $8 or $9 per week on average for Decile 2 and Decile 3 households, for a 20 percent price increase, allowing for under-reporting. These amounts may appear small. They are not so for Decile 2 households on an average weekly disposable income of around $350. (Annual average actual disposable income in this decile was $18,300 in 2003/04, and in Decile 3 $22,400.)

Offsetting this of course is the reduction in expenditure by those households which quit spending money on tobacco products. This saving – in terms of 'post-tax' prices, for a price increase of 20 percent - amounts to a substantial $3,837 a year per 'quitting' household, averaged over all income deciles. For lower income deciles the annual savings from quitting would amount to $3,043 in Decile 2 ($59 per week), and $3,441 in Decile 3 ($66 per week).

7. Financial impact on Māori.

The impact on Māori will be more severe, because more smoke, and more are members of lower-income households. Table D.5 shows the spread of Pākehā and Māori adult populations respectively across deciles for 2003/04.The right-hand columns are for all households, whether purchasing tobacco products or not. Māori are significantly more concentrated in the lower-income deciles, Pākehā in the higher-income deciles. The left-hand columns are restricted to those adults who are members of tobacco-purchasing households. The relative concentration of Māori in lower income deciles is even more marked.

Table D.5 Decile proportions by ethnicity – Pakeha, Māori, and All. 2003/04

Equivalised Household Disposable Income (RJS Scale) Deciles	Adults					
	In Tobacco-purchasing Households			In All Households		
	European /Pakeha	NZ Maori	All	European /Pakeha	NZ Maori	All
1	0.056	0.115	0.086	0.063	0.097	0.094
2	0.035	0.047	0.044	0.080	0.067	0.078
3	0.042	0.114	0.065	0.081	0.116	0.086
4	0.087	0.142	0.108	0.093	0.137	0.098
5	0.103	0.082	0.109	0.098	0.098	0.101
6	0.132	0.125	0.128	0.106	0.113	0.110
7	0.163	0.095	0.131	0.114	0.085	0.104
8	0.122	0.202	0.140	0.104	0.167	0.110
9	0.150	0.045	0.110	0.130	0.054	0.108
10	0.109	0.034	0.078	0.131	0.067	0.111
Total	1.000	1.000	1.000	1.000	1.000	1.000

Source: HES special Tabulations
'All' includes Pacific and 'Other' ethnicities.

8. The Distribution of smokers by Household Income decile, and Ethnicity.

The proportions in Table D.5 above give the distribution not of smokers as such, but of adults living in tobacco-purchasing households. There is, however, a reasonably close correspondence between the total number of such adults, and the total number of smokers.

The Table D.5 proportions are therefore used to allocate the total population of smokers over 2003/04 household income deciles, both for Māori and All ethnicities.

The results are given in Table D.6.

Table D.6 Number of smokers 2003/04. By Māori / non- Māori ethnicity and household income decile.

Equivalised Household Disposable Income (RJS Scale) Deciles	Estimated Number (000) of Smokers 15+ 2003/04		
	Maori	**non-Maori**	**All**
1	22.4	42.9	65.3
2	9.1	24.2	33.3
3	22.2	26.9	49.0
4	27.8	53.6	81.4
5	16.0	66.0	82.0
6	24.3	72.6	96.9
7	18.6	80.7	99.3
8	39.3	66.7	106.0
9	8.8	74.0	82.8
10	6.6	52.6	59.2
Total	195.0	560.2	755.0

Derivation:

Total numbers of Maori and All Smokers from population data and AC Nielsen prevalence surveys.

Total number of non-Maori smokers as All less Maori.

Allocation across deciles is in proportion to number of adults in tobacco-purchasing households in each decile.

9. Reduced numbers of smokers from Tobacco Tax increases.

From the information in the previous table, and given an estimated value of the 'prevalence elasticity', it is possible to calculate how many fewer smokers there will be as a result of a tobacco tax increase.

For example, assuming a prevalence elasticity of –0.20, a tax and price increase of 20 percent will reduce both smoking prevalence and the number of smokers by 4 percent. That is, a smoking prevalence rate of 25 percent (as seen for the population as a whole) will be reduced to 24 percent, and a smoking prevalence rate of 50 percent (as seen among Māori) will be reduced to 48 percent. For a tax and price increase of 50 percent, the overall reduction would be one-tenth, in both prevalence and numbers of smokers.

Table D.7 provides the results of such calculations for tax increases leading to price increases of 20 and 50 percent respectively.

Table D.7 Estimated reduction in number of smokers for price increases of 20 percent and 50 percent.

Equivalised Household Disposable Income (RJS Scale) Deciles	Assuming prevalence elasticity of **-20%** Reduction in Numbers (000)			
	Maori		**All**	
	Price increase of		Price increase of	
	20%	50%	20%	50%
1	0.9	2.2	2.6	6.5
2	0.4	0.9	1.3	3.3
3	0.9	2.2	2.0	4.9
4	1.1	2.8	3.3	8.1
5	0.6	1.6	3.3	8.2
6	1.0	2.4	3.9	9.7
7	0.7	1.9	4.0	9.9
8	1.6	3.9	4.2	10.6
9	0.4	0.9	3.3	8.3
10	0.3	0.7	2.4	5.9
Total	7.8	19.5	30.2	75.5

For the assumed prevalence elasticity of –0.20, a price increase of 20 percent leads to there being in total 7,800 fewer Māori smokers, and 30,200 fewer smokers of all ethnicities. The corresponding numbers for a 50 percent price increase would be 19,500 fewer Māori smokers and 75,500 fewer in all.

These reductions are quite substantial numbers, even if only a relatively small proportion of the total number of smokers. Their accuracy depends of course on the accuracy of the underlying numbers, in particular on the accuracy of the estimated prevalence elasticity (which could also vary for sub-populations – the absence of a fall in Māori smoking prevalence in the 1990s implies a close to zero prevalence elasticity for Māori). If the prevalence elasticity were halved to –0.10, the reduction in the number of smokers would be only half those shown in the table. Conversely a higher prevalence elasticity than –0.20 would give larger reductions in the number of smokers.

Appendix E: Under-reporting of Spending on Tobacco Products in Household Economic Survey (HES)

To estimate the financial impact of a tobacco tax increase on household budgets, it is necessary to correct for the known under-reporting by households of their expenditure on tobacco products. The evidence for under-reporting, and estimates of the degree of under-reporting, are given in this Appendix.

Previous estimates:

In Thomson et al (2000) it was noted (page 23) that there was significant under-reporting in the estimates of spending on tobacco products available from the Household Economic Survey (HES). This was identified by comparing the HES estimates against data on the volume of cigarettes 'released for consumption' and putting the appropriate retail value on the latter.

Thus for 1995/96 the HES estimates appeared to account for only 38 percent of total expenditure based on manufacturers' data. Even adjusting for the HES at that time covering only about 87 percent of the population, the reported spending covers only 44 percent of the expected total.

From the data examined in the 2000 report the extent of HES under-reporting appeared reasonably stable over time. It was not possible to check whether under-reporting varies with household income or socio-economic differentials. A paper analysing data for British women found, however, no evidence of socio-economic differentials in under-reporting smoking (Prescott-Clarke and Primatesta, 1998).

Estimates by Laugesen:

The following Table E.1 gives estimates from Laugesen (2006) of total retail spending on cigarettes in recent years. The two different sets of estimates are for the two sources of manufacturers' data – 'released from bond', and 'reported volume of sales'. In brief the two estimates of retail spending on cigarettes (including 'hand-rolled') for calendar year 2005 are $1,652 and $1,572 million respectively.

Table E.1 Estimates from Laugesen (2006) of Total Expenditure on Cigarettes.

Estimates of Total Expenditure on Cigarettes (Current Prices)

	Based on tax paid releases from bond			Based on reported volume sales		
	Manuf. Cigarettes	Hand-rolled Cigarettes	Total	Manuf. Cigarettes	Hand-rolled Cigarettes	Total
			$mn			$mn
Year						
1990	987.6	109.6	1,097.2	987.6	109.6	1,097.2
1996	1,043.1	215.2	1,258.3	1,017.2	220.4	1,237.6
1997	1,026.1	247.1	1,273.1	1,036.2	235.9	1,272.1
1998	1,011.5	279.0	1,290.5	1,021.8	267.2	1,288.9
1999	1,035.5	293.7	1,329.2	1,056.8	283.3	1,340.0
2000	1,192.6	381.0	1,573.6	1,029.5	330.7	1,360.2
2001	1,084.9	390.0	1,474.9	1,046.7	366.0	1,412.7
2002	1,239.5	413.1	1,652.6	1,135.6	395.3	1,530.9
2003	1,062.8	423.7	1,486.5	1,165.6	425.9	1,591.5
2004	1,057.9	468.4	1,526.4	1,062.9	447.3	1,510.2
2005	1,127.9	523.6	1,651.5	1,081.1	491.2	1,572.3

Source: M Laugesen 2006. Tobacco Returns Report 2005. Tables H.1 to H.3

Comparing Laugesen and HES Estimates

The second Table E.2 compares HES estimates with these totals for selected years. In the mid-1990s it seems HES respondents were reporting only about 38 percent on average of their spending on cigarettes, very much in line with the estimate in Thomson et al (2000).

For 2000/01 and 2003/04 it appears that around 45 percent of total spending was being reported by HES survey respondents. Note that these latest two surveys appear to represent a larger proportion of total population than the surveys earlier (1,494,300 households in 2003/04, compared with 1,162,500 households in 1997/98).

Table E.2: Comparison of Laugesen Estimates with HES Estimates of Spending on Tobacco Products.

Comparison of Expenditure Estimates based on Manufacturers' data with Estimates from Household Economic Survey (HES)

	HES estimated expenditure	Estimates based on		HES as % of	
		- releases from bond	- reported volume sales	- releases from bond	- reported volume sales
Yr ending March	$mn	$mn	$mn		
1991	462.9	1097.2		42.2%	
1997	483.7	1262.0	1246.2	38.3%	38.8%
1998	484.5	1277.5	1276.3	37.9%	38.0%
Yr ending June					
2001	635.1	1524.3	1386.4	41.7%	45.8%
2004	704.2	1506.4	1550.8	46.7%	45.4%

Note - manufacturers' estimates for 1991 are calendar year 1990, whereas HES estimates are March Year 1991.

Conclusion:

Less than half of actual retail spending on tobacco products is reported in the Household Economic Survey (HES).

Appendix F: Supplementary Source Tables

This Appendix provides source data for some of the charts and analyses both in the main report, Volume I, and in the other appendices in this volume.

The first three tables provide source data used in particular for the estimation of elasticities; in Section A.4 of Volume I, and Appendix B in this volume.

The remaining tables provide data referred to in Section F of Volume I, and Appendix D in this volume; on the distribution of health gains and financial consequences resulting from tobacco tax increases.

The two sets of tables are labelled A and F respectively.

Elasticity Estimation Material

Table A.1	Real Prices of Tobacco Products. 1975 to 2005
Table A.2	Tobacco Products Released for Consumption. Total and Per Capita (15+). 1970 to 2005. (Corrected and Adjusted)
Table A.3	Smoking Prevalence Rates (15+). 1976 to 2005 Males and Females

Material relevant to distribution of health gains and financial consequences of tobacco tax increases

The first few tables are largely from the AC Nielsen surveys. These annual surveys were supplemented by the New Zealand Tobacco Utilisation Survey (NZTUS), for the Ministry of Health, in the March quarter of 2006. For now just the AC Nielsen survey is drawn on for this report.

Table F.1	Prevalence of Cigarette Smoking (15+). By ethnicity, 1990-2005.
Table F.2	Prevalence of Cigarette smoking(%), 15+ years, by age, gender and ethnicity. 2004.
Table F.3	Age-standardised cigarette smoking prevalence (%), 15+ years, by gender and ethnicity. 2004.
Table F.4	Prevalence of Cigarette smoking(%), 15+ years, by labour force status and gender, 2004
Table F.5	Prevalence of Cigarette smoking(%), 15+ years, by household income and gender, 2004
Table F.6	Life Expectancy at Birth – 1995-97 Abridged Life Tables. All Deprivation Groups
Table F.7	Māori Life Expectancy at Birth – 1995-97 Abridged Life Tables. By Deprivation Group
Table F.8	Approximate estimate of effect of Smoking on Life Expectancy at Birth. 1995-97. By Ethnicity.

Table A.1 Real prices of Tobacco Products. 1975 to 2005

Calendar Year	CPI (June 1999 = 1,000)		
	Cigarettes & tobacco	All Groups	Cigs relative to All Groups
1975	59.6	157.1	379.8
1976	67.9	183.7	369.3
1977	79.2	210.1	377.1
1978	84.9	235.3	361.1
1979	96.9	267.5	361.9
1980	114.5	313.4	365.1
1981	132.7	361.5	367.1
1982	156.7	420.0	372.6
1983	180.8	450.8	401.1
1984	189.8	478.6	396.7
1985	231.0	552.4	418.4
1986	294.6	625.4	467.8
1987	382.5	723.9	528.6
1988	415.5	770.0	539.4
1989	522.3	814.0	641.1
1990	581.8	863.7	673.5
1991	660.8	886.2	745.6
1992	728.2	895.2	813.4
1993	740.8	906.7	817.1
1994	743.7	922.5	806.2
1995	761.9	957.2	796.0
1996	817.1	979.0	834.6
1997	852.6	990.7	860.6
1998	940.1	1003.2	937.1
1999	1001.3	1002.0	999.2
2000	1139.8	1028.3	1107.6
2001	1260.5	1055.3	1194.5
2002	1298.3	1083.5	1198.2
2003	1348.0	1102.5	1222.7
2004	1388.5	1127.8	1231.3
2005	1441.8	1162.0	1240.8

Source: Statistics NZ & Reserve Bank
Cigarettes & Tobacco sub-group
CPYQ.SE9G1 supplied by Stats NZ

Table A.2. Tobacco Products Released for Consumption. Total and Per Capita (15+). 1970 to 2005. (Corrected and Adjusted).

Year	Loose tobacco (tonnes)	Manufactured cigarettes (millions)	Cigarette Equivalents Per Capita (15+) Loose tobacco	Manufactured	Total per 15+
1970	1024	4952	523.5	2530.2	3053.7
1971	965	5118	483.3	2563.6	3046.9
1972	934	5405	458.8	2651.8	3110.6
1973	853	5526	407.8	2644.0	3051.8
1974	782	5769	363.7	2686.1	3049.8
1975	749	6229	340.2	2828.3	3168.4
1976	702	6230	312.7	2779.3	3092.0
1977	666	6346	294.1	2800.8	3094.9
1978	610	6268	266.7	2739.1	3005.7
1979	575	6130	250.0	2661.6	2911.6
1980	548	5991	234.3	2565.5	2799.8
1981	553	6168	234.3	2613.6	2847.9
1982	539	6112	225.5	2551.8	2777.3
1983	546	6089	223.5	2491.0	2714.5
1984	534	6236	214.7	2509.7	2724.4
1985	493	5654	196.1	2247.9	2444.0
1986	501	5223	198.0	2060.7	2258.7
1987	511	5361	199.0	2083.2	2282.2
1988	552	5355	212.7	2059.7	2272.4
1989	554	4270	211.8	1629.3	1841.1
1990	602	4489	228.4	1703.8	1932.2
1991	652	4014	242.5	1,492.9	1735.4
1992	768	3466	282.5	1,275.1	1557.6
1993	810	3381	294.7	1,229.9	1524.6
1994	694	3396	249.1	1,219.0	1468.1
1995	808	3338	285.7	1,180.4	1466.1
1996	658	3660	229.0	1,273.5	1502.5
1997	733	3449	251.6	1,184.0	1435.7
1998	757	3263	257.5	1,109.9	1367.4
1999	736	3119	248.7	1,053.8	1302.4
2000	841	3152	282.1	1,057.2	1339.3
2001	780	2608	259.3	867.0	1126.3
2002	810	2817	264.6	920.2	1184.8
2003	795	2367	254.3	757.2	1011.5
2004	841	2320	264.6	730.1	994.7
2005	888	2436	275.7	756.3	1032.0

Sources: Tobacco Facts 2005, plus 2005 data.
But
- small error in 1970 data corrected
- 1970 to 1990 per capita numbers scaled down about 2 percent for change in population measure from 1991
- more up-to-date mean calendar years populations used for 1991 to 2005

Note: One tonne loose tobacco assumed 1 million cigarette equivalents

Table A.3 Smoking prevalence rates (15+). 1976 to 2005. Percentages.

Year	Total Males	Total Females	Total (15+ yrs)
1976	40	32	36
1981	35	29	32
1983	35	31	33
1984	34	31	32
1985	30	30	30
1986	29	31	30
1987	31	28	30
1988	29	29	29
1989	27	27	27
1990	28	27	28
1991	27	26	26
1992	27	27	27
1993	28	26	27
1994	28	26	27
1995	27	26	27
1996	26	26	26
1997	26	27	26
1998	26	24	25
1999	26	25	26
2000	25	25	25
2001	25	25	25
2002	25	24	25
2003	25	25	25
2004	24	22	23
2005	23.7	23.3	23.5

Source: AC Nielsen Surveys. *Tobacco Trends 2006.* Ministry of Health
Year 2003 - 18+ population

Note that the 1976 and 1981 prevalences are from the population census in those years, and may not be precisely comparable with the subsequent Nielsen survey data.

Note also that data were published to an extra decimal place in 2005.

Table F.1

Prevalence of cigarette smoking (%), 15+ years.
By ethnicity. 1990-2005

	Maori	Pacific peoples	European/ Other	Total
1990	51	32	25	28
1991	50	30	24	26
1992	52	33	24	27
1993	54	33	24	27
1994	52	34	24	27
1995	51	34	24	27
1996	49	32	23	26
1997	51	34	23	26
1998	49	33	22	25
1999	51	30	22	26
2000	49	34	22	25
2001	51	31	21	25
2002	49	35	21	25
2003	52	33	20	25
2004	47	29	20	23
2005	50.9	33.1	19.3	23.5

Source: ACNielsen (NZ) Ltd As given in *Tobacco Trends 2006* Table C2

Notes:

3 Smoking prevalence figures include the smoking of both manufactured and roll-your-own cigarettes

4 The classification of ethnicity information changed from 1997 onwards. Therefore, ethnic specific-data before and after 1997 may not be comparable.

Year 2003. For 18+ population

Table F.2

Prevalence of cigarette smoking (%), 15+ years, by age, gender and ethnicity, 2004

	Maori	European/Other	Pacific peoples	Total
Males				
15-24	39.4 (32.3-46.4)	22.4 (19.8-25)	27.0 (16.2-37.8)	25.4 (22.9-27.8)
25-34	49.8 (42.6-57)	30 (27.1-32.8)	39.3 (27.3-51.2)	33.6 (30.9-36.2)
35-54	47.6 (41.6-53.7)	24.3 (22.5-26.1)	34.9 (24.8-45)	27.5 (25.7-29.3)
55+	19.0 (12.3-25.8)	13.0 (11.7-14.2)	26.8 (14.4-39.2)	13.6 (12.3-14.9)
Total males	42.6 (39-46.1)	21.6 (20.5-22.7)	32.6 (27-38.1)	24.5 (23.4-25.6)
Females				
15-24	51.1 (45.3-56.8)	22.8 (20.3-25.3)	26.1 (17.9-34.4)	28.6 (26.3-31)
25-34	56.0 (50.5-61.6)	23.7 (21.6-25.8)	31.6 (23.8-39.4)	30.2 (28.1-32.3)
35-54	51.4 (46.7-56.1)	19.4 (18-20.8)	24.8 (18.3-31.2)	23.6 (22.2-25.1)
55+	34.4 (27.4-41.4)	11.3 (10.3-12.2)	13.1 (1.2-25.1)	12.6 (11.6-13.7)
Total females	50.2 (47.3-53)	17.9 (17.1-18.7)	26.2 (22.4-30)	22.4 (21.5-23.3)
All				
15-24	45.8 (41.4-50.3)	22.6 (20.7-24.5)	26.5 (19.7-33.4)	27.0 (25.2-28.7)
25-34	53.2 (48.8-57.7)	26.8 (25.1-28.6)	34.5 (27.8-41.2)	31.8 (30.1-33.5)
35-54	49.6 (45.7-53.5)	21.8 (20.6-23)	29.3 (23.4-35.1)	25.5 (24.3-26.8)
55+	27.7 (22.5-32.8)	12.0 (11.2-12.8)	20.7 (11.8-29.7)	13.1 (12.2-13.9)
Total All 15+	46.7 (44.3-49.1)	19.7 (19-20.4)	29.0 (25.8-32.3)	23.4 (22.6-24.2)

Source: ACNielsen (NZ) I As given in *Tobacco Facts 2005* Table A.1, Appendix I

Notes: 1. 95% confidence intervals are given in parentheses.
2. Totals are not age-standardised.

Table F.3

Age-standardised cigarette smoking prevalence (%), 15+ years, by gender and ethnicity. 2004

	Maori	European/Other	Pacific peoples	Total
Males	39.5	22.6	32.0	25.2
Females	47.6	19.5	22.4	23.8
Total	44.0	21.0	26.9	24.5

Source: ACNielsen (NZ) Ltd
Note: Rates are age-standardised using the WHO population

The WHO's standardised world population distribution is given in WHO 1998.

Table F.4

Prevalence of cigarette smoking (%), 15+ years, by labour force status and gender, 2004

	Males	(95% CI)	**Females**	(95% CI)
White collar	18.9	(17.4-20.5)	20.2	(19.0-21.4)
Blue collar	32.9	(30.9-34.9)	33	(30.6-35.4)
Home maker	36.8	(25.7-47.8)	22.9	(20.6-25.3)
Student	18.1	(15.0-21.2)	16	(13.4-18.5)
Beneficiary	46.3	(41.9-50.6)	47	(43.6-50.3)

Source: ACNielsen (NZ) Ltd *Tobacco Facts 2005.* Table 3.
Note: 95% confidence intervals are given in parentheses.

Table F.5

Prevalence of cigarette smoking (%), 15+ years, by household income and gender, 2004

Household income	**Males**	**Females**
< $20,000	29.7 (26.8-32.6)	24.6 (22.8-26.4)
$20,000-$29,999	23.6 (20.6-26.7)	26.6 (24.1-29.1)
$30,000-$39,999	29.2 (25.8-32.6)	26.2 (23.5-28.8)
$40,000-$59,999	27.4 (24.8-29.9)	26.0 (23.7-28.3)
$60,000-$79,999	25.1 (22.2-28)	21.0 (18.5-23.5)
$80,000-$99,999	23.1 (19.9-26.4)	17.6 (14.7-20.4)
$100,000-$119,999	16.9 (13.2-20.5)	17.1 (13.5-20.8)
$120,000-$249,999	18.9 (15.1-22.7)	15.4 (12.1-18.8)
> $250,0000	12.2 (5.7-18.6)	11.1 (5.2-17)
Do not know	23.5 (21.3-25.7)	20.6 (18.8-22.3)

Source: ACNielsen (NZ) Ltd *Tobacco Facts 2005.* Table A.6.
Note: 95% confidence intervals are given in parentheses.

Table F.6

Life Expectancy at Birth - 1995-97 Abridged Life tables
All Deprivation Groups

	e_x All Smoking Statuses	e_x Smoking Deleted
	Years	Years
Total Population		
Males	74.4	76.2
Females	79.6	80.4
European Population		
Males	75.6	77.2
Females	80.9	81.6
Maori Population		
Males	67.2	70.7
Females	71.6	74.0
Pacific Island Population		
Males	69.8	73.4
Females	75.6	76.5

Source: Abridged Life tables prepared for Ministry of Health publication *Inhaling Inequality* Oct. 2001

Table F.7

Maori Life Expectancy at Birth - 1995-97 Abridged Life Tables. By Deprivation Group

	e_x All Smoking Statuses	e_x Smoking Deleted
	Years	Years
All Deprivation Groups		
Males	67.2	70.7
Females	71.6	74.0
Deprivation Groups 1 to 7		
Males	70.7	73.7
Females	76.1	78.0
Deprivation Groups 8 & 9		
Males	66.1	70.4
Females	70.9	73.5
Deprivation Group 10		
Males	63.3	67.9
Females	68.1	71.3

Source: Abridged Life tables prepared for Ministry of Health publication *Inhaling Inequality* Oct. 2001

Table F.8

Approximate effect of smoking on Life Expectancy at Birth
1995-97 By Ethnicity All Deprivation Groups

	Assumed smoking prevalence	Reduction in Life Expectancy of Smokers
		Years
Total Population		
Males	0.25	-7.2
Females	0.225	-3.7
European Population		
Males	0.2	-7.9
Females	0.2	-3.4
Maori Population		
Males	0.425	-8.1
Females	0.5	-4.8
Pacific Island Population		
Males	0.3	-11.9
Females	0.3	-3.0

Source: Life Expectancies from *Inhaling Inequality* plus assumed prevalences from visual examination of Figure 6, Page 9, of that publication