# ISSUES IN TOBACCO TAXATION

The use of tobacco incurs a significant cost on society. The use of tobacco has been estimated to be responsible for at least 900,000 premature deaths in Australia since 1950. There is a wide range in the values of the social costs of smoking but these have been estimated at $31 billion in 2005[1]. As such, there is a need to evaluate policies designed to reduce the level of tobacco consumption. At the centre of any tobacco control policy is excise taxation, and the focus of this paper is an evaluation of the effectiveness of excise tax increases in achieving this end. The stimulus for much of this analysis is the 25% increase in tobacco excise of 30 April, 2010.

It is clear that any assessment of the effectiveness of tobacco excise taxation in raising revenue and inducing smokers to quit hinges on the elasticity of demand. As such, a second focus of this paper is to review and re-estimate the elasticity of demand for tobacco.

## TOBACCO EXCISE IN AUSTRALIA

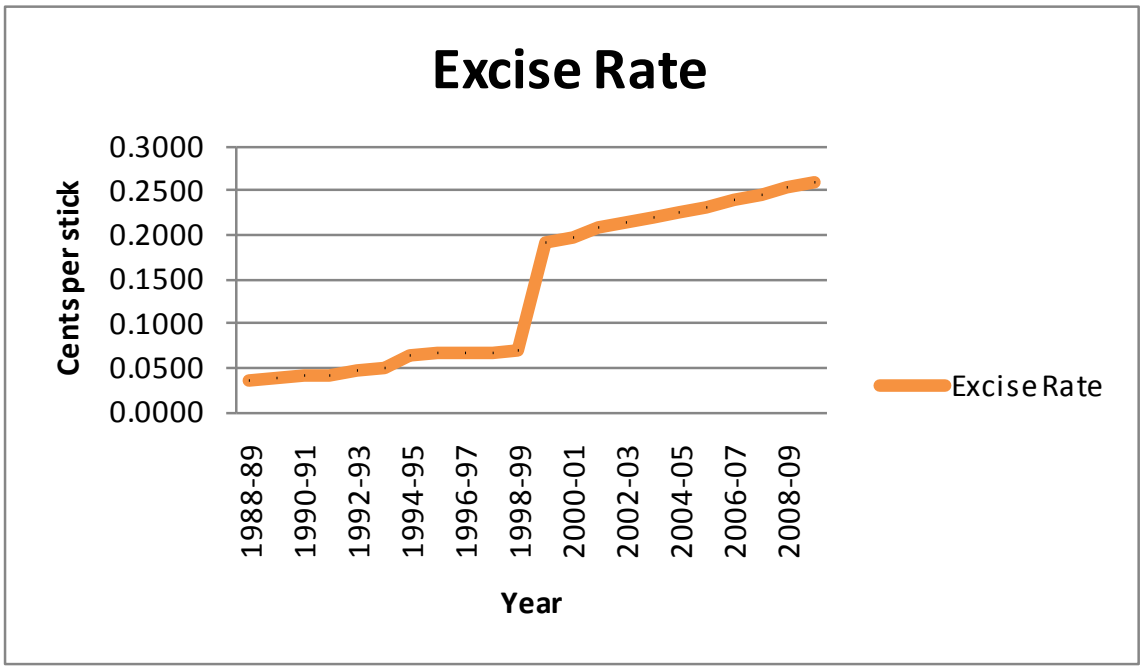
Tobacco excise is charged in Australia on a per-stick basis for cigarettes which contain up to 0.8 grams of tobacco. Heavier sticks and loose tobacco are taxed on a per kilogram basis. The rates of excise as at the 1st of July 2010 are $0.32775 per stick and $409.71 per kilogram.

Prior to this increase, rates of tobacco excise in Australia have been relatively stable in real terms. Only two sharp increases of note have occurred in the past 20 years. The first was the move from an ad valorem tax to the per stick system in November 1999. The second was the imposition of the GST in the following year.

The course of tobacco excise is shown in figure 1

**FIGURE 1: TOBACCO EXCISE IN AUSTRALIA**

[1] Public Health (Tobacco) Act 2008 (NSW). Availablefrom: http://www.legislation.nsw.gov.au/




The shift to a specific taxation regime for tobacco in 1999 from an ad valorem system ensures a more stable revenue stream. Townsend (1998), for example notes that in the presence of monopoly power, that an ad valorem tax is more readily manipulated by producers. A complication from the former regime, when excise was calculated on a per-kilogram basis, was that producers would attempt to subvert this through the production of lightweight "budget" cigarettes. This led to the market dominance of large packets of budget tobacco which rapidly lost favour under the newper stick system, where these lightweight "budget" cigarettes would be subject to the full per-stick excise rate.

As shown above, tobacco excise taxation of 0.32775 per stick, means that an average 30 pack of cigarettes contains $9.83 in excise. Using an average price of $15.50 per pack of thirty, excise accounts for approximately 63% of the price of a packet of cigarettes. Cigarettes are also subject to GST, as such we find that approximately 72% of the price of a cigarette is made up of tax.

Figure 2 shows that the proportion of the price of tobacco accounted for by taxation is relatively low in comparison to other OECD countries[2]. Further, this proportion has been seized in recent times as a rationale for increasing the rate of tobacco excise in Australia. However, it should be noted that this figure is somewhat misleading. Much of the basis for this relatively outcome is Australia's comparatively low consumption taxation rates. As an example, the consumption tax rate in France, Ireland and the UK are 19.6%, 21% and 17.5%, respectively. And it should be noted that only the rate of excise is important when comparing tobacco control policies, as the consumption tax rate will not skew preferences between goods[3]. Further, it should be noted that the proportions have increased to the point where taxation on tobacco in Australia would rank considerably higher as shown above.

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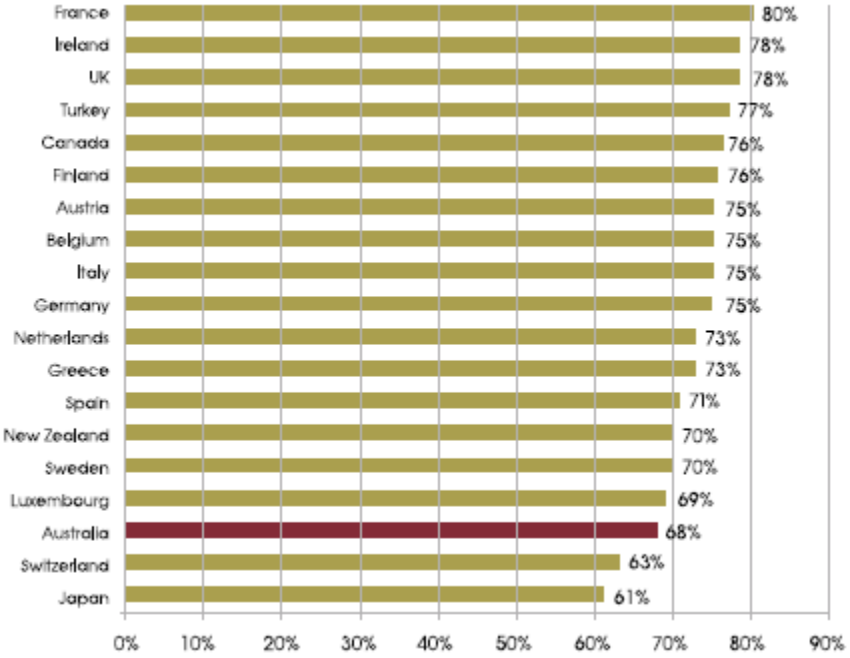
[2] This figure is based on data prior to the excise increase

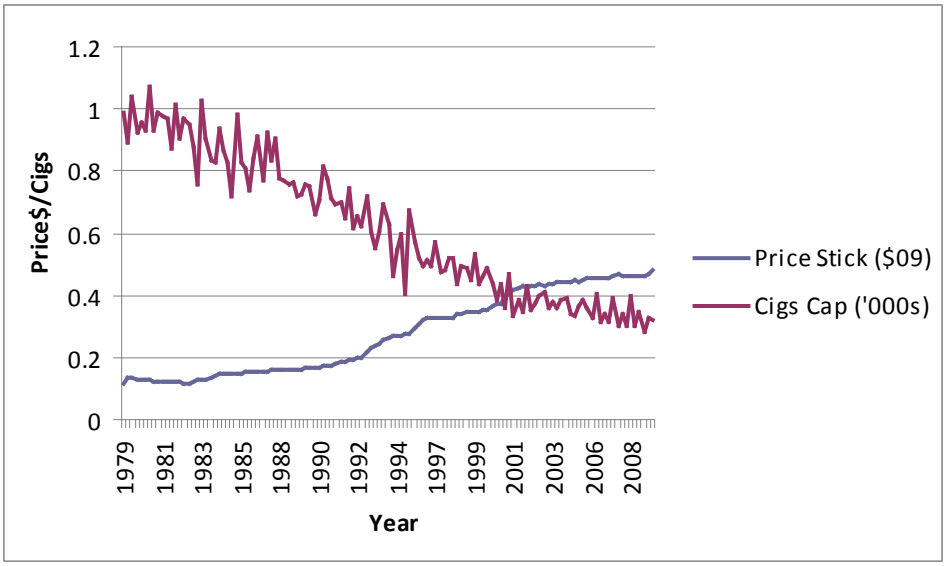
[3] Apart from the consumption tax that is charged on excise….

**FIGURE 2: COMPARATIVE OECD TOBACCO TAXATION RATES[4]:**




Tobacco excise is a relatively stable source of revenue. Due to its relatively addictive nature, price changes have a relatively limited impact tobacco consumption. This is predominantly a function of its relatively inelastic demand, which will be discussed below. However, there is strong evidence of a decline in per capita consumption of tobacco over time, and the source of this effect – whether price related or otherwise – is of importance to this study.

**FIGURE 3: PER CAPITA CONSUMPTION OF TOBACCO AND THE PRICE OF A "STICK" OF TOBACCO**
**Prices are in constant price with 2009 as the base.**




As mentioned above, in spite of this decline in per capita smoking rates, the excise revenue collected from tobacco is relatively stable. This is due to the effect of this per capita decline being largely balanced by the rate of population growth and the indexation on tobacco excise. Figure 4, below shows this relatively stable path of nominal excise collections over the past decade (top line). However, in real terms, tobacco excise can be seen to be in decline. Finally, tobacco excise as a proportion of government revenue is also declining, from a high of 2.7% to 1.6% in 2008/09.

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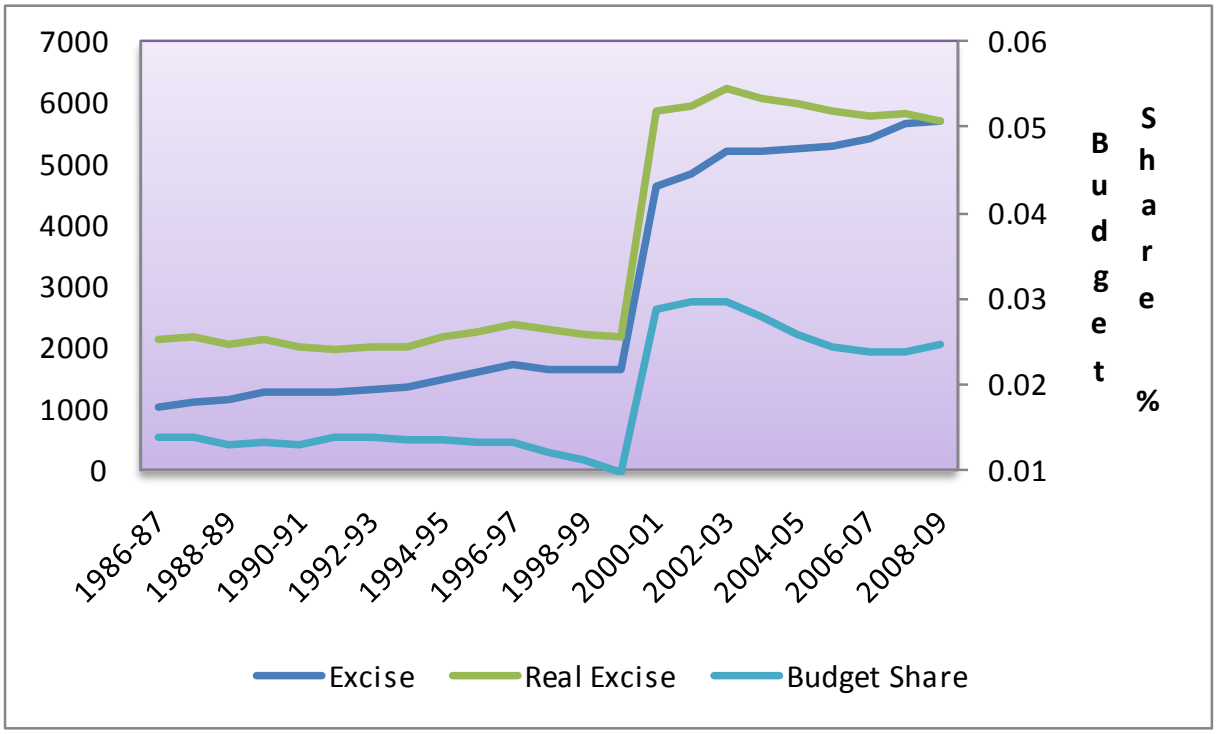
[4] All Taxes as a percentage of price

**FIGURE 4: NOMINAL REAL AND PROPORTIONATE EXCISE COLLECTIONS**




## PROPERTIES OF TOBACCO TAXATION

In the following section, we consider the theoretical underpinnings of two key goals of tobacco excise policy: its effects on cessation and the raising of revenue. Further, we consider the performance of tobacco excise tax in terms of its efficiency and equity effects. Much of this analysis hinges on the price elasticity of demand and this will be a focus of this paper.

### Efficiency and Equity

When considering the efficiency of a tax, we consider two criteria. First, an efficient tax is one that has a minimal impact on consumer preferences. Second, a tax that is efficient relates the price of a good to reflect its social cost. We shall see in the following section that an excise on tobacco satisfies both of these efficiency criteria.

Tobacco is a relatively inelastic good and as such based upon the Ramsey Rule an appropriate item to tax at a relatively high rate. The inverse elasticity rule - an extreme version of this rule described in Myles (1995) - implies that commodity taxation should be applied inversely to the price elasticity of demand. That is, where demand is relatively inelastic, commodity taxation should be relatively high. Applying higher taxes on goods which have relatively low price elasticities is optimal as these taxes are less distortionary as their effects on consumer preferences are relatively minor.

In many cases, taxation of goods of this nature: that is goods with extremely inelastic demands are inappropriate, for example via a tax on rental accommodation or basic foods. However in the case of tobacco – a good which is seen neither as a necessity, nor even as a desirable good - an application of the Ramsey criteria is considered more appropriate.

The second criterion for an efficient tax is that it should tax a commodity such that its price reflects more accurately its social cost. The social cost of smoking is not reflected by the market price of tobacco. An individual's consumption of tobacco creates externalities through increased healthcare costs – which are often borne by society, and the effects of passive smoking. Consequently, taxation increases the price of tobacco to better reflect its social cost.

It is clear that the impact of an excise tax on tobacco is efficient. However it does not meet the equity criterion quite as successfully. Equity in terms of tobacco taxation is a loaded issue. Two equity issues exist here: the benefit principle and the ability to pay principle.

Under the benefit principle, smokers are charged a user fee of sorts for the publicly supplied benefits they access through their decision to smoke. Smokers are likely to cause a greater burden on the public health system than non-smokers and as such, under the benefit principle, should pay for this through the instrument of tobacco taxation. Under this principle, tobacco taxation is equity enhancing.

Under the ability to pay principle, tobacco excise is not generally equity enhancing. The ability to pay principle has two components: horizontal and vertical equity. Horizontal equity suggests that those with equal ability to pay should pay an equal share of the total tax burden. This is clearly violated by tobacco taxation. Individuals with equal abilities to pay, pay largely different shares of the tax burden based only on the decision to consume a given item. A pack-a-day smoker[5] pays approximately $3,589 more tax than his non-smoking counterpart all other factors held constant.

Vertical equity is also not satisfied by tobacco excise. Tobacco excise is generally considered to be a regressive tax. The effect of excise changes will be felt most heavily by those earning low and fixed incomes. For example, a 30 cigarette per day smoker earning the minimum wage of $483.78 per week spent approximately 19.2% of their income on cigarettes prior to the excise increase[6]. An increase in the price of cigarettes to $15.5 following the excise increase would increase this proportion to approximately 22.4%, representing an erosion of 3.2 per cent of income in the absence of some form of behavioural change. When this analysis is performed at using the average weekly earnings of $960.50[7], the proportions drop to 9.7 per cent before the increase and 11.3 per cent after the increase, meaning that the price increase would account for 1.6 per cent of income without any behavioural change. So what can be seen here, is that a tax that is already considered regressive becomes more so as the rate of taxation is increased.

Even if tobacco consumption was assumed to be homogenous across income strata, vertical equity would be violated by tobacco excise taxation. However, the equity effects are even more significant when viewed in light of Townsend et al (1994) who show that tobacco consumption is higher amongst lower income groups. One possible offsetting fact is that, Tobacco elasticities are higher amongst lower income earners (Harris and Chan, 1998). As such, tobacco excise increases should reduce tobacco consumption amongst lower income earners at a higher rate and as such may not be strictly regressive.

Related to vertical equity and the impact of tobacco excise on lower income earners is the perverse outcome that tobacco excise taxation reduces health outcomes. This argument suggests that following an appreciation in the price of tobacco, lower income earners will smoke to a similar degree, but compensate for their reduced effective income by substituting into unhealthy lower cost behaviors. An example is purchasing less nutritious foods for themselves and their families or substituting out of legally regulated alcohol and tobacco products into unregulated black-market

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[5] Cigarette tax per stick = $0.32775, 30 cigarettes per day.
[6] Assuming a price of $13.30 per 30 pack
[7] ABS catalogue 6302.0 February 2009 (after tax)

versions. Wilson et al (2004) estimate that this argument is overstated, positing that whilst there is slight evidence that this behavior exists, that the reduction in life expectancy attributable to these behaviors is between 42 and 257 times less than that due to smoking. However, it should be noted that this is a real issue that should be considered in the framing of an overall tobacco control policy.

## THE PRICE ELASTICITY OF DEMAND FOR TOBACCO

Tobacco excise policies are focused to serve the dual purpose of raising revenue and controlling a socially undesirable behaviour. These dual aims of tobacco excise are both critically linked to the price elasticity of demand for tobacco. When the price elasticity of demand is relatively high, cessation rates will be higher for a given increase in excise. However, the change in revenue will be relatively less significant. As such, an understanding of the issues in the estimation of the price elasticity of demand and a sensible estimate of this are critical.

The elasticity of demand should be variable dependent upon an individuals' demographic background. For example, a feature of most studies is that younger people, particularly teenagers are more sensitive to price than adults. An example of this is Harris and Chan (1998) who found that the Price Elasticity of Demand ranged from -0.831 in teenagers to -0.095 in Adults.

The effect of the long-run price elasticity of demand also needs to be considered. In the long-run, consumers adjust to a price increase and change their consumption habits more readily over time. For example, in the short-term, a smoker could respond to a price increase through a reduction in their daily cigarette consumption. In the longer-term, the smoker may actually cease smoking. As such, it is important to distinguish between these concepts in this study. Estimates of the long-run elasticity in the literature are wide, reflecting the absence of a dominant methodology to estimate this. Sung, Hu and Keeler (1994) provide an estimate of the long-run price elasticity of demand for cigarettes (-0.48) that is relatively close to their short-run estimate (-0.40). Becker, Grossman and Murphy (1994) provide a range of long-run elasticities which vary between 0.515 and 0.799.

Whilst Wasserman et al (1991), provides an estimate of the price elasticity of demand that is on the lower end of the range, an interesting result from that study, is that the Price elasticity of demand is increasing over time. This may be a function of the interaction of price effects with other policy mechanisms and community awareness of the dangers of smoking.

The impact of non-price regulation is somewhat harder to estimate though more heavily utilized in public policy. As discussed above, there have been only two significant increases in the rate of tobacco excise since 1988. This was when tobacco excise changed to a per-stick excise from a weight based excise in 1999 and the imposition of the GST in 2000. On the other hand, there has been a steady increase in the use of non-price instruments over that period. Examples of these at the Federal level include the ban on advertising of tobacco products, and labeling regulations. At the state level, the range of restrictions on smoking in restaurants, workplaces and licensed venues has grown rapidly in the past decade.

The effect of this non-price regulation is somewhat harder to estimate. Tobacco advertising is a prime example of this. Tobacco advertising was most evident through the sponsorship of elite sport. For the most part, studies of the effect of advertising tobacco showed that tobacco advertising had little or no effect on total consumption (see for example Duffy (1995), Stewart (1993)). The main effect of tobacco advertising was to encourage loyalty to individual brands, rather than to encourage an increase in smoking rates generally. However, more recently there has been a shift in thinking as to the effects of advertising on smoking. Saffer and Chaloupka (2000), for example through using a more disaggregated data set determine that there is indeed a significant positive effect on tobacco consumption through advertising. Moreover, they determine that when comprehensive tobacco advertising bans are put in place, that there is a strong reduction in consumption. Other regulations

have been estimated in the literature, interestingly by Wasserman et al (1991) who create an index based on the time a representative individual would spend in regulated smoke free zones.

**MODEL**

Price and quantity data was obtained on a monthly basis. Quantity data was obtained from excise collection data. The ABS price index for tobacco, published as a component of the CPI tables was used as a price series. This restricts the scope of the analysis to some extent. Additional richness in the model could be gained from the addition of data such as age distribution of smokers and rates of cessation.

Initially, the study mirrored the bulk of the tobacco excise literature on the price elasticity of demand and estimated the price elasticity of demand equation in log-linear form. The benefit of estimating the equation in this form is that the coefficients output are naturally interpreted as elasticities. The drawback of such an estimation is that the elasticity is assumed constant along the demand curve. As tobacco prices increase and tobacco takes an increasing component of an individuals consumption basket, there may be a more pronounced demand response, that is the response of demand to a 1% change in price should vary along the length of the demand curve. The use of a log-linear demand specification yields apparently nonsensical values for optimal excise rates[8]. As such, a linear estimation may be more appropriate, particularly when considering revenue impacts as will be demonstrated in the subsequent sections.

The following demand system is modeled in the following analysis.

$$y_t = \beta_1 p_t + \beta_2 i_t + \beta_3 \varpi_t + \beta_4 t + \varepsilon_t$$

Where $y_t$ represents the per capita consumption of cigarettes in time t. Further, $p_t$ and $i_t$ respectively represent the contemporaneous levels of real price and real income and $\varpi_t$ represents an index of the level of regulation. Real tobacco price, is the CPI deflated tobacco index with a base of 1978-79. Likewise, real income is based in 1978-79. The vector of variables $\varpi_t$ is limited by data, however this paper attempts to construct a regulation index of sorts based on the Wasserman et al (1991) study. More than the above variables should influence the demand for cigarettes. This is present in a consistent declining trend in per capita cigarette consumption. Consequently, a time variable $t$ is included to attempt to de-trend the series.

The model was initially estimated using ordinary least squares. However, the residual plot demonstrated some evidence of autocorrelation. The appropriate model specification to deal with this autocorrelation was determined to be an autoregressive procedure of order 1 (AR(1)). The AR(1) process was estimated with lags of varying length and estimated using a maximum likelihood estimation process. The results are given in table 1, below.

**RESULTS**

| Variable | Coefficient | t-value | P value |
|---|---|---|---|
| Constant | 0.002233 | 4.81 | 0.0001 |

[8] See for example Van Walbeek (2000).

| | | | |
|---|---|---|---|
| Price Stick | -0.001717 | -2.35 | 0.0274 |
| Time | -0.000089 | -10.84 | 0.0001 |
| Income | 0.000007869 | 3.53 | 0.0017 |
| Regulation | -0.000155 | -1.99 | 0.058 |

The results presented above detail the coefficient estimates from the AR (1) estimatation. Generally the model is well specified with the coefficients all significant at the 5% level with the exception of Regulation which is significant at the 10% level. The regulation dummy variable indicates that the rate of smoking per capita has been reduced by the steadily more severe regulatory regime. The coefficient on time indicates that there is a statisitically significant time trend.

As discussed, the model was estimated using a linear model. This means that the elasticity will vary over the length of the demand curve. We can translate the coefficients on income and price stick into elasticities at equilibrium by multiplying them by price over quantity using the identity: $\varepsilon = \partial Q / \partial P \times P / Q$.

The elasticities at equilibrium are thus estimated at -0.53 for the Price Elasticity and 1.5 for the Income Elasticity. These elasticities are reasonably placed albeit on the higher side of the literature. Demand is relatively inelastic in terms of its response to price and relatively income elastic.

**IMPLICATIONS**

Tobacco excise taxation is an important component of a government's cessation or deterrence strategy. The range of elasticity estimates provided above (-0.3 ~ -0.6) suggest that the impact of a price increase of 10% is a reduction in tobacco consumption of between 3 and 6%. Even at this inelastic level, there is a clear deterrence incentive for governments in increasing the rate of tobacco excise.

Following the above example, an important consideration in measuring the effectiveness of an excise change on the prevalence of smoking in the community is that a decline in tobacco consumption of 3% does not imply that 3% of individuals cease smoking. Rather, it is clear that some of this reduction will be the result of cessation and some the result of continuing smokers cutting back. Studies by Evans and Farrelly (1998) and the Centers for Disease Control (1998) for example suggest that this breakdown is close to a 50-50 split between these groups. And it should be noted that for the group that cut back, the health benefits are at best limited. Mayo Clinic (2001) suggests that price-based cutting-back of tobacco consumption has limited benefits, primarily based on smokers taking longer deeper drags on their remaining cigarettes.

The rate of reduction should be variant amongst groups. For example, our age based elasticities above suggest that due to the increased proportion of income accounted for by tobacco in lower income earners budget, that cessation/deterrence effects should be stronger in these groups.

Most critically, the effects on youth smoking uptake and cessation should not be understated. The significantly higher elasticities associated with youth/teenage smoking implies that excise increases are most strongly felt in this younger age group. A younger cohort featuring low smoking rates should continue to smoke at a lower rate as they age.

Of course, the effectiveness of a smoking excise tax in repressing rates of cigarette consumption hinges critically upon the ability of the state to control the supply and distribution of the product.

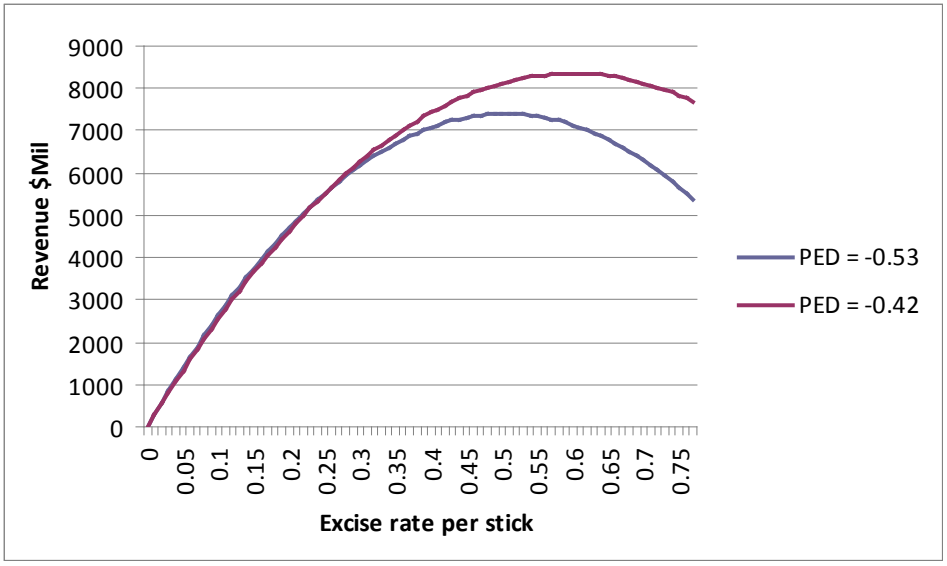
The existence of a lively black-market should have two main effects. By steering individuals away from legal tobacco, it should dampen revenue. This should be exacerbated by increases in the rate of tobacco excise. Increasing the tobacco excise increases the cost of legal cigarettes relative to their black-market counterparts and should increase revenue leakage in this way. The second important effect is the effect of a flourishing black-market on smoking cessation. Evidently, tobacco excise increases will not have the desired effect on cessation rates if smokers can readily substitute into cheaper illegal tobacco.

Smuggling of black-market tobacco, or "chop-chop" is covered in some detail in the highly detailed history of Australian tobacco smuggling by Geis (2003). To some extent, large-scale black-market tobacco in Australia was dependent upon the existence of a domestic growing industry. According to Geis (2003) in 2002, manufacturers paid growers on average $600 per bale for their product. At that time the same bale would attract tax in the vicinity of $26,000. The existence of such a significant wedge between the prices paid to growers for tobacco and the price that could be offered by illegal manufacturers created strong incentives to sell to the black-market.

With a low elasticity of demand and significant levels of consumption, tobacco is a sound vehicle through which to raise a large and consistent revenue stream. Australian Excise collections from tobacco totalled approximately $5.5 Billion in 2008-09. The stability of this revenue stream is thus of significant interest in policy making. Further, it is important to understand the importance of this revenue stream to excise increases.

The elasticity estimate presented above of (-0.53) is as discussed in section 1.2 estimated under the assumption of a linear demand curve. This assumption is critical in the construction of the product-specific rate-revenue curve, below. The rate-revenue curve provides a representation of the optimal rate of taxation in terms of revenue maximisation. This curve is presented as figure 1, below.

**FIGURE 5: RATE-REVENUE CURVES FOR TOBACCO EXCISE**




As shown above, with an elasticity at equilibrium of -0.53, revenue would be maximised with an excise rate of 51 cents per stick, and resulting price of 74 cents per stick. At this price, revenue collections would increase by approximately 2 billion to $7.4 billion. The price of a packet of 30 cigarettes would increase to $22.20. Using the widely used -0.42 as the elasticity, the optimal excise is approximately 0.61 cents. This yields 8.3 Billion in excise.

## CONCLUSION

As shown above, whilst an efficient and stable source of revenue – tobacco collections are in long term real decline. Due to the declining per-capita consumption of tobacco, this decline can only be arrested by increases in the rate of excise above and beyond standard CPI indexation.

It is clear that any assessment of the effectiveness of tobacco excise taxation in raising revenue and inducing smokers to quit hinges on the elasticity of demand. This is relevant both in terms of its impact on cessation and the revenue raising potential of tobacco. New estimates provided in this paper indicate that the elasticity may be marginally higher than the "consensus" estimate of -0.42. This has important ramifications. First, the impact of excise increases should be higher. Second, the government's ability to increase tobacco excise as a revenue raising tool becomes slightly limited. This is evident in the rate-revenue curve shown above.

## EFFECT OF 25% INCREASE IN EXCISE RATE

The 25% increase in tobacco excise on 30 April presents a natural experiment in which we can test our estimates of the price elasticity of demand. A 25% increase in the level of excise should have an impact on an average price of cigarettes of approximately 15%, given that excise and the GST on excise accounts for 60% of the price of a packet of cigarettes.

From this, the impact projected impact on consumption could be determined using the elasticities discussed above. The estimate of -0.42 from the literature would mean that we would anticipate a decline in consumption of approximately 6.3%, and an increase in revenue of approximately 17%.

The higher elasticity estimated by the authors of -0.53 predicts a decline in consumption of approximately 8% and an increase of 15% in revenue.

Table (), below presents the results obtained when the period from May – October 2009 is compared with the period May to October 2010.