Abstract
The study seeks to re-investigate the price elasticity of South African cigarette demand over the period 1996 to 2006. At first glance, rising cigarette prices seem to have played an important role in reducing cigarette consumption over the sample period, especially during the late nineties. But how dependent is the impact of price increases on general economic conditions and overall health awareness among smokers? Health awareness, in particular, has not received sufficient attention in the South African context, due to a lack of data. Furthermore, previous estimates of price and income elasticity of cigarette demand are based on long annual time series data, which do not allow for changes in underlying tastes and preferences. The paper attempts to disentangle the forces of price, income, health awareness and policy intervention using a quarterly dataset. In addition, the study also cautions against the upward bias in estimates derived from formal cigarette sales data – in the light of increasing illicit cigarette volumes in South Africa.

J.E.L. Classification: D12, H21, I18, C40
Keywords: price elasticity, tobacco control, cigarettes, illicit cigarettes, excise duties, health information

1. INTRODUCTION

The South African tobacco industry has seen extensive regulatory reforms in the nineties, including sharp increases in excise duties, limits on public smoking and strict control of tobacco advertising (Van Walbeek, 2004). These changes have encouraged research on the economics of tobacco control in South Africa – with particular emphasis on the price sensitivity of smokers (see Reekie (1994), Abedian and Dorrington (1994), Van Walbeek (1996), Van der Merwe and Annett (1998) and Van Walbeek (2000)).

Historically, only annual consumption and price data have been available. This frequency constraint has forced South African researchers to rely on longer sample periods commencing in the sixties or seventies. However, such a long-run perspective does not account for changes in consumer tastes and preferences – as data on health awareness or other preferences of South African smokers are not generally available. These data constraints may be particularly problematic for an analysis of cigarette demand over the past ten years, due to substantial tobacco policy intervention over this relatively short period of time. This study attempts to address these problems by using a new quarterly dataset for the period 1996 to 2006, including data on prices, disposable income and
policy intervention (in particular, health awareness).

The paper commences with a brief overview of South African research on the price sensitivity of smokers, followed by an extensive discussion of the dataset. The empirical results then follow, divided into two components. The first part involves a descriptive analysis of the relationship between cigarette consumption and prices. The goal is to illustrate that this relationship is conditional on the general state of consumer income and on the health awareness of smokers (which is driven by, \textit{inter alia}, changes in tobacco control policy). The second part is an attempt to disentangle the different forces shaping cigarette demand. To this end, a regression analysis is employed to obtain price, income and health awareness elasticity estimates. The paper concludes with a section on the impact of illicit cigarette trade and a subsequent summary of the arguments.

2. PREVIOUS RESEARCH ON PRICE ELASTICITY

Reekie (1994) is the first formal attempt to estimate the price elasticity of tobacco demand in South Africa. Using data from 1970 to 1989, Reekie (1994) estimates a price elasticity of -0.87. This is derived from a fairly basic econometric specification including only two independent variables: price and disposable income per capita. Abedian and Dorrington (1994) offers a critique of Reekie (1994), arguing that this specification results in too high an estimate as it fails to account for all demand-shift factors.

Van Walbeek (1996) notes that, while Abedian and Dorrington (1994) highlight theoretical and technical issues deserving attention, it is quite difficult to measure the qualitative variables that these authors emphasize. Using different data sets, Van Walbeek finds evidence of long-run price elasticities ranging from -0.53 to -1.52, based on data from 1970 to 1990. He ascribes the wide range of different estimates to the relatively low correlation between the tobacco consumption data in the different data sets (Van Walbeek, 1996: 29). Similarly, Van der Merwe and Annett (1998) and Van Walbeek (2000) focus on price and income elasticity, reporting long-run elasticities of around -0.69 and -0.6 respectively over the period 1970 to the mid-nineties. Table 1 summarises the results in the South African literature:

<table>
<thead>
<tr>
<th>Author</th>
<th>Elasticity estimate</th>
<th>Sample period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reekie (1994)</td>
<td>-0.87</td>
<td>1970-1989</td>
</tr>
<tr>
<td>Van Walbeek (1996)</td>
<td>-0.53 to -1.52</td>
<td>1970-1990</td>
</tr>
<tr>
<td>Van der Merwe &amp; Annett (1998)</td>
<td>-0.69</td>
<td>1970-1995</td>
</tr>
</tbody>
</table>

Chaloupka \textit{et al} (2000) and Abedian and Jacobs (2001) provide summaries of current international research on the demand for tobacco, distinguishing between estimates for developed and developing economies. These authors find that estimates of the price elasticity of tobacco demand in developing countries are generally higher than those in developed nations (Chaloupka \textit{et al}, 2000: 246). Warner (1990) argues that these higher estimates are feasible, given that lower absolute levels of income in poorer economies
may induce higher consumer sensitivity to price. The South African estimates discussed above are generally at the lower end of the range of estimates for other developing countries, but higher than for developed nations (apart from Turkey, where elasticity is also low), as shown in Table 2:

<table>
<thead>
<tr>
<th>Country</th>
<th>Elasticity estimate</th>
<th>Sample period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papua New Guinea</td>
<td>-0.71 (cigarettes)</td>
<td>1973-1986</td>
</tr>
<tr>
<td></td>
<td>-0.50 (non-cigarettes)</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>-0.37 (long-run)</td>
<td>1960-1988</td>
</tr>
<tr>
<td></td>
<td>-0.21 (short-run)</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>Range of -0.65 to -0.8</td>
<td>1981-1993</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Range of -0.5 to -0.7</td>
<td>1966-1995</td>
</tr>
<tr>
<td>China</td>
<td>-0.99</td>
<td>1978-1992</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>-0.85</td>
<td>1970-1996</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.80</td>
<td>1983-1994</td>
</tr>
</tbody>
</table>

Source: Adapted from Chaloupka et al (2000: 246-250)

The South African studies outlined above highlight two issues important to this study. Firstly, estimates by Van der Merwe and Annett (1998) and Van Walbeek (2000) that include data from the nineties appear to fall in a range of -0.6 to -0.7. This paper reconsiders the first issue, showing that average price elasticity may be slightly lower than this range, although the estimate appears to have increased in recent years. This is not a novel idea in the South African context: Van Walbeek (2000) argues that one should not overemphasise the average elasticity estimate, as this value may hide underlying changes in price sensitivity. Secondly, all South African studies emphasise the problems with modelling cigarette demand in the absence of data on preferences. This data constraint receives attention in the somewhat larger dataset employed in this paper, which is the subject of the following section.

3. DATA AND DESCRIPTIVE ANALYSIS

(a) Measuring the quantity of cigarettes demanded

A proper cigarette demand study requires the appropriate measurement of the quantity of cigarettes demanded. As cigarette demand studies are concerned with the consumer’s response to price and other demand-shift forces, retail cigarette sales are usually the preferred proxy for quantity demanded. However, such retail figures are difficult to obtain, mostly due to the absence of national bodies with data collection capabilities. This is true in some developed countries such as Canada (Gospodinov and Irvine, 2005) and also for developing countries, including South Africa (Van Walbeek, 1996). Even where data is available, the time frequency is usually annual – forcing economists to rely on fairly long sample periods. Unfortunately, while a long run view helps to overcome the econometric problems associated with small samples, it does not account for changes in the “deeper” parameters, such as consumer tastes. Consequently, a shorter sample period of higher frequency (quarterly or monthly) may be more appropriate. The current study uses a quarterly dataset obtained from a prominent South African cigarette
manufacturer. However, this gain also entails a trade-off, as only wholesale cigarette shipments (and not retail sales) are available at a quarterly frequency.

There are two particular problems associated with cigarette shipments from manufacturers to wholesalers as a proxy for quantity demanded. Firstly, cigarette shipments are influenced by marketing activities. Wilkins, Yurekli and Hu (2007: 28) note that manufacturers tend to increase sales towards the end of a financial year to meet predetermined targets. In the South African context, a more plausible explanation may be that retailers and wholesalers will increase their cigarette purchases prior to the annual increase in excise duties. This behaviour is clearly evident if one considers Figure 1, illustrating such a pattern for monthly cigarette sales for the period 2003-2005.

![Figure 1. Monthly cigarette shipments (in millions) for 2003-2005](image)

Clearly, March sales tend to be uncharacteristically lower than other months, with February sales usually higher. This study uses average quarterly figures, calculated as the simple average of the three months in any quarter, which partially addresses the above-mentioned problems. Of course, monthly data based on a three-month moving average could also be used, but the frequency of the income variable (this paper uses personal disposable income) constrains the study to a quarterly frequency.

The second problem that could plague both retail sales and manufacturer shipments is their aggregate nature. National cigarette sales or shipments are aggregate figures that include various cigarette flavours. A regression of these figures on an average price series may lead to biased results, as higher-priced cigarettes may react differently from lower-priced cigarettes to price increases. On the other hand, disaggregate figures are not without their own problems. Price elasticity estimates for different flavours may be biased upward, as they do not account for the fact that, following a price increase, consumers may not stop smoking, but rather switch to another brand. Therefore, if the goal is to assess the overall sensitivity of consumers to price and other demand-shifting factors, aggregate figures may yet be useful.

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1 The shipment data excludes non-cigarette tobacco products.
Figure 2 shows the trend in the quantity of cigarettes sold in South Africa since 1990. The early nineties is characterised by a moderate decline in cigarette consumption, which accelerates from 1995 through 2000. These declines then appear to be followed by a period of relative stability in cigarette sales.

The aim of this study is to study the underlying sources of the rapid decline in cigarette consumption in the late nineties and the subsequent stabilisation period. In general, demand studies focus on the roles of price and income in the cigarette demand function.

(b) Price and income as demand-shift factors

Wilkins, Yurekli and Hu (2007: 17) note that a weighted price is to be preferred as this accounts for different types of cigarettes bought under different circumstances (e.g. a single pack, a vending machine, etc.), thereby providing a better representation of the average price facing different consumers. In particular, this study is based primarily on a recommended retail selling price for a pack of twenty, provided by a South African tobacco manufacturer.

Figure 3 shows the evolution of this price series, with cigarette prices rising substantially from 1994 onwards, among others, driven by excise tax increases (Van Walbeek, 2004). A visual comparison of Figure 2 and 3 suggests a generally negative relationship between prices and quantity until 2001. Thereafter, changes in cigarette consumption appear to become less correlated with changes in the real price. Arguably, part of the answer is found by considering the behaviour of the year-on-year growth rate in the real cigarette price, as shown in Figure 4.
The average growth rate of the real price is about 11% for the period 1995 to 2000 – significantly higher than the average of about 5% price growth achieved from 2001 onwards. Hence, it may be more accurate to consider a generally negative relationship between quantity and the intensity of price increases: larger price increases appear to result in significant reductions in quantity, while smaller price rises do not necessarily affect consumption negatively. These visual impressions can be given formal content by measuring the responsiveness of cigarette sales to price.

Table 3 presents a comparison of the percentage change in annual cigarette sales and that of cigarette prices over the sample period, together with “elasticity” estimates calculated using the mid-point formula. Note that these values are not elasticity estimates in the econometric sense of the word, as the calculation does not control for the impact of other factors. Consequently, these values will be termed conditional elasticity estimates.
<table>
<thead>
<tr>
<th>Year</th>
<th>Price change (%)</th>
<th>Quantity change (%)</th>
<th>Elasticity estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>8.9</td>
<td>-7.8</td>
<td>-0.88</td>
</tr>
<tr>
<td>1997</td>
<td>17.3</td>
<td>-4.1</td>
<td>-0.24</td>
</tr>
<tr>
<td>1998</td>
<td>13.0</td>
<td>-7.0</td>
<td>-0.54</td>
</tr>
<tr>
<td>1999</td>
<td>13.4</td>
<td>-9.3</td>
<td>-0.69</td>
</tr>
<tr>
<td>2000</td>
<td>3.9</td>
<td>-3.3</td>
<td>-0.85</td>
</tr>
<tr>
<td>2001</td>
<td>5.7</td>
<td>-3.8</td>
<td>-0.66</td>
</tr>
<tr>
<td>2002</td>
<td>-1.0</td>
<td>0.6</td>
<td>-0.57</td>
</tr>
<tr>
<td>2003</td>
<td>9.2</td>
<td>-3.0</td>
<td>-0.33</td>
</tr>
<tr>
<td>2004</td>
<td>6.0</td>
<td>-1.6</td>
<td>-0.26</td>
</tr>
<tr>
<td>2005</td>
<td>4.1</td>
<td>-0.6</td>
<td>-0.14</td>
</tr>
<tr>
<td>2006</td>
<td>3.0</td>
<td>2.2</td>
<td>0.72</td>
</tr>
</tbody>
</table>

The estimates presented in Table 3 varies from -0.09 to -0.88. Also, the estimate for 2006 indicates, somewhat counter-intuitively, a positive conditional correlation. Arguably, this wide range of estimates can be ascribed to the over-powering impact of other benign forces on cigarette demand. The literature (including South African studies) emphasise the importance of consumer income as a positive demand-shift factor.

This study employs real national disposable income as the proxy for income of smokers. Of course, one might argue that, given the skewed income distribution of South Africa, it may be prudent to account for different income groups – or even estimate separate demand functions for each income group (Ground and Koch (2007), Black and Mohamed (2006) and Berg and Kaempfer (2001)). However, apart from the problem of obtaining such information in the correct frequency and form, the aim of this study is to provide an assessment of overall sensitivity to price and other factors among South African smokers.

Consider the behaviour of the estimates in Table 3 from 1999 onwards. The year 1999 marks the start of the South African economy’s longest (and continuing) post-War expansion. The first years of the upswing were quite mild and conditional price elasticity estimates range between -0.57 and -0.85. However, from 2003 onwards economic growth accelerates substantially, resulting in 5%+ annual growth in real disposable income. For this period (excluding 2006), conditional price elasticity estimates appear to be much lower: in the range of -0.14 to -0.33. Hence, Table 3 suggests that changes in disposable income (as driven by the economic growth cycle) could offer an important additional explanation for changes in cigarette sales.

**Other demand-shift variables**

Apart from price and income, changes in advertising, regulation and consumer preferences may influence cigarette consumption (Wilkins, Yurekli and Hu (2007); Keeler et al (2001); Gallet (2003)). Nonetheless, accounting for changes in the institutional environment and for changes in the underlying tastes and preferences of tobacco consumers is a difficult task (Van Walbeeck (1996, 2000)). This study faces similar difficulties with tobacco advertising expenditure, as advertising data is not available at the
quarterly frequency, although the data picture is more promising for regulation and consumer preferences.

The tastes and preferences of smokers represent deep parameters in the demand for cigarettes. Arguably, misspecification in cigarette demand models derives from an inability to accurately capture tastes and preferences. The tobacco policy literature emphasise the role of health information as an additional factor that may decrease cigarette consumption. Schneider et al (1981) argue that US smokers gradually switched to low-tar cigarettes as information on the health hazards of smoking spread. Hsieh et al (1999) use a similar approach to consider the impact of informational campaigns on cigarette consumption in Korea. Arguably, health awareness among South African smokers increased since 1995, given that the elaborate policy interventions of the nineties were aimed at increasing awareness of the health consequences of smoking. Hsieh et al (1999) note that the market share of light cigarettes – cigarettes delivering lower levels of nicotine and tar – could be used to gauge the health awareness among smokers. This study defines light cigarettes as cigarettes with a tar content of lower than nine milligram, based on the classification of a South African tobacco manufacturer. Figure 5 presents light cigarettes as a proportion of total cigarette sales in South Africa.

![Figure 5. Market share of light cigarettes](image)

Light cigarettes have grown substantially since 1994 – in a period during which aggregate cigarette sales have been falling. In particular, light cigarettes increased their market share from about 16.4% in 1995 to 29% in 2003. Since 2003, the trend tapers off and stabilises around 30%. Arguably, the increase in this proxy of health awareness offers an additional explanation for the behaviour of the conditional price elasticity estimates. The conditional elasticity estimates from Table 3 are lower since 2003 – the same period during which light cigarette sales are stabilising. Hence, health awareness may also offer a partial explanation for changes in South African cigarette consumption.

While smoker health awareness can be considered a proximate variable for tobacco policy intervention, it is also possible to consider the relationship between the actual regulatory variables and cigarette consumption. Two types of tobacco control policy are important:
compulsory health warnings and smoking restrictions (Keeler et al, 1993). This paper does not consider the impact of the former, given that the sample period commences after the introduction of the 1995 tobacco legislation requiring health warning labels on South African cigarette packs. However, it is possible to study the impact of government-imposed smoking restrictions by comparing cigarette sales before and after 2001, when these restriction were implemented. Unfortunately, the informal analysis employed in this section does not allow the isolation of this effect – as it is likely that other forces discussed previously may be overshadowing the negative effect of smoking restrictions. The statistical analysis pursued in the following section will assist in disentangling the different effects. In that section, a dummy variable is constructed from the chronology of tobacco legislation in Van Walbeek (2004). In particular, the series takes the value of 0 up to the last quarter of 2000, as smoking restrictions were virtually absent, except for a smoking restriction on public flights (Van Walbeek, 2004: 111). Amendments to the Tobacco Products Control Bill came into effect in January 2001 and contained substantial smoking restrictions in public places, including restaurants. Consequently, the dummy variable takes the value of 1 from the first quarter of 2001 onwards.

(e) Summary

The conditional estimates of price elasticity suggest that changes in cigarette consumption are strongly correlated with changes in cigarette consumption. However, awareness of the health risks associated with smoking and the general state of the economy appear to either complement or counteract the impact of increased cigarette prices over the sample period. It is difficult to distinguish the relative strengths of these effects using descriptive analysis. The regression analysis attempted in the following section helps to separate the different influences, providing specific information on the impact of each demand-shift factor ceteris paribus.

4. REGRESSION ANALYSIS

The goal of the regression analysis is to separate the influences of different demand-shift factors on cigarette sales, by estimating the price, income and health awareness elasticity of cigarette demand. However, due to the precarious nature of cigarette consumption data (as discussed later), these estimates merely indicate orders of magnitude and are not necessarily useful for calculating optimal excise tax levels. Nevertheless, the estimates obtained offer preliminary support for alternative explanations of the sharp reduction in South African cigarette consumption in the late nineties and of the subsequent period of stabilisation.

(a) Methodology

The statistical analysis follows a data-driven approach and is based on an unrestricted vector autoregression (VAR), which allows the economist to treat all variables as endogenous. Specifically, the VAR consists of four equations, with cigarette consumption, price, disposable income and health awareness as dependent variables, where each dependent variable is modelled as a function of past values of itself and of the
other variables. Note that this study does not employ more sophisticated techniques, such as error-correction modelling, given the high probability that the consumption data may be less reliable than previously thought. The aim here is to obtain approximate orders of magnitude from a simplified model of cigarette demand.

The VAR is based on the natural logarithms of the variables, which implies that the price elasticity is assumed constant along the demand curve. This assumption may not be appropriate for policy modelling and it has been heavily criticised by Abedian and Dorrington (1994) in the South African context. However, Wilkins, Yurekli and Hu (2007) note that it is acceptable where the goal is constrained to an analysis of relationships, as is the case for the current study.

The Akaike information criterion suggests an optimal lag length of three quarters, while the Schwarz information criterion suggests two. Consequently, the VAR is estimated for a lag order of three quarters. This choice is supported by employees of a South African cigarette manufacturer, who note that, for strategic purposes, excise tax increases are assumed to have their full effect after three quarters.

This study is focused on the equation for cigarette consumption, which can be interpreted as a cigarette demand equation showing the impact of different factors on cigarette sales. Algebraically, this particular equation in the VAR can be represented as:

\[
Q_t = \mu + \sum_{k=1}^{3} \beta_k Q_{t-k} + \sum_{k=1}^{3} \gamma_k P_{t-k} + \sum_{k=1}^{3} \theta_k Y_{t-k} + \sum_{k=1}^{3} \phi_k H_{t-k} + \lambda_t + \epsilon_t
\]

(1)

where

- \(Q_t\) log of cigarette consumption
- \(P_t\) log of real cigarette price
- \(Y_t\) log of real disposable income
- \(H_t\) log of market share for light cigarettes
- \(\lambda_t\) smoking restrictions dummy variable

The output from this equation can be used to estimate long-run elasticities. For example, the price elasticity of cigarette demand \((E_d)\) can be calculated, from an estimated version of (1), as follows:

\[
E_d = \frac{\partial Q_t}{\partial P_t} \frac{P_t}{Q_t}
\]

Van Walbeek (2000) notes that such an approach entails, \textit{inter alia}, the assumption that disposable income is dependent on cigarette consumption, which is not economically intuitive. Nevertheless, the focus falls here on the consumption (and not the income) equation in the VAR.

\[3\] These information criteria are based on a VAR with sample period 1996 to 2006.
\[
\hat{E}_d = \frac{\sum_{k=1}^{3} \hat{y}_k}{1 - \sum_{k=1}^{3} \hat{\beta}_k} \quad (2)
\]

Similar formulae can be used to estimate the income and the health awareness elasticity of cigarette demand.

(b) Results

The VAR model will be estimated for different sample periods. The first sample period is 2001-2006 and subsequent sample periods are expanded by including earlier years: 2000-2006, 1999-2006, etc. Prior to considering the results, the VAR models’ congruency with the relevant dataset can be assessed by a set of misspecification tests on the residuals. Both the individual equations and the system pass the heteroscedasticity, normality and autocorrelation tests.

Table 4 reports the long-run elasticity estimates for price, income and health awareness. The first column reports the results based on the sample period 2001-2006, which provides a general idea of the size of elasticity coefficients after the introduction of the smoking regulations in 2001. However, care should be taken when interpreting the coefficients, given the very short sample period (only 21 observations). Consequently, the subsequent columns report the results if the VAR is estimated over ever-longer sample periods that include the years preceding 2001.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.53</td>
<td>-0.57</td>
<td>-0.62</td>
<td>-0.38</td>
<td>-0.22</td>
<td>-0.16</td>
</tr>
<tr>
<td>Income</td>
<td>0.64</td>
<td>0.71</td>
<td>0.70</td>
<td>0.53</td>
<td>0.44</td>
<td>0.37</td>
</tr>
<tr>
<td>Health awareness</td>
<td>-0.34</td>
<td>-0.53</td>
<td>-0.53</td>
<td>-0.54</td>
<td>-0.59</td>
<td>-0.61</td>
</tr>
</tbody>
</table>

It is important to note that the estimates based on sample periods that include the first two to three years (1996-1998) seem to diverge from the results obtained for sample periods excluding these earlier years. Generally, based on the eight years (from 1999 to 2006), the price elasticity estimates are in the range -0.5 to -0.6, while they are in the range -0.2 to -0.4 if earlier years are included. Arguably, this indicates that consumers were less responsive to price increases in the earlier years and that elasticity increased as prices rose: elasticity tends to increase along the demand curve. The suggested income elasticity is in the range 0.5 to 0.7 for sample periods excluding 1996 and 1997; estimates are lower (around 0.4) if these years are included. Estimates for health awareness elasticity are in the range -0.5 to -0.6 for all but the shortest sample period.

The estimates above suggest that other factors, apart from price, may have played important roles in decreasing the consumption of cigarettes in the late nineties. In
particular, the size of the income and health awareness elasticity estimates coupled with the substantial increase in health awareness and the generally lacklustre economic growth of the late nineties may explain a significant part of the reduction in consumption over that period. This argument does not downplay the adverse effect of price increases, but provides a more nuanced picture of the forces shaping cigarette consumption. This interpretation is also consistent with fairly stable cigarette sales since 2003. In this time, favourable economic conditions and a slowdown in the growth of health awareness counteracted the mild adverse effect of relatively slower increases in the real price of cigarettes.

The above findings are based on a VAR that does not include a dummy variable to control for the impact of increased smoking regulations. As noted in the descriptive analysis, it may be useful to consider whether the smoking restrictions resulted in generally lower consumption after 2001. Consequently, a dummy variable measuring the introduction of smoking restrictions is added to each equation as an exogenous variable.

Table 5 presents the results. Barring sample periods including 1996 and 1997, it appears that consumption post-2001 is approximately 3% lower than the preceding years. It should be noted, however, that this variable may include the impact of other factors. The inclusion of this variable also does not significantly alter the estimates for price, income or health awareness, with price elasticity estimates in the range -0.5 to -0.7, income elasticity estimates in the range 0.5 to 0.7 and health awareness in a slightly lower range of -0.35 to -0.5. The general conclusion is maintained: income changes and increased health awareness may have complemented price increases in reducing cigarette consumption.

<table>
<thead>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking restrictions</td>
<td>n.a.</td>
<td>-0.04</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Price</td>
<td>-0.53</td>
<td>-0.64</td>
<td>-0.66</td>
<td>-0.50</td>
<td>-0.25</td>
<td>-0.18</td>
</tr>
<tr>
<td>Income</td>
<td>0.64</td>
<td>0.73</td>
<td>0.70</td>
<td>0.59</td>
<td>0.46</td>
<td>0.38</td>
</tr>
<tr>
<td>Health awareness</td>
<td>-0.34</td>
<td>-0.35</td>
<td>-0.40</td>
<td>-0.40</td>
<td>-0.55</td>
<td>-0.59</td>
</tr>
</tbody>
</table>

(c) Comparison with previous findings

The long-run price elasticity estimates, especially those based on sample periods including 1996-1998, are lower than previous studies suggest. Nonetheless, they do support the general notion that price sensitivity has increased in recent years. Income elasticity estimates correspond with the lower estimates provided in Van Walbeek (2000). In general, this study has attempted to address the criticism by Abedian and Dorrington (1994) concerning the absence of preferences in econometric models of cigarette demand. The results show that a smoker’s decision function is not satisfactorily described by the price and income sensitivity of the smoker alone. Preferences are quite important and it may be that changes in preferences during the nineties have been more important in reducing consumption than price intervention strategies have been. Also,
although smoking restrictions had significant health benefits, they did not necessarily reduce the consumption of cigarettes to a significant extent.

5. ILLEGAL CIGARETTES

This paper is based on cigarette shipment data that represent the sales of legal cigarettes in South Africa. Arguably, the shipment data is becoming less useful in the light of the growing consumption of illegal cigarettes. Mohamed (2002) is one of the rare papers to have noted the potential impact of illicit trade, but does not provide empirical evidence. Very little data exist on this phenomenon, but the tobacco industry has argued that sales of illegal cigarettes has increased from about 8 million in 2005 to about 10 million in 2006 (TISA, 2006). A large South African cigarette manufacturer has recently started to estimate illicit cigarette volumes. Figure 6 plots legal and total (that is, including illicit) cigarettes sold from the second quarter of 2005 to the last quarter of 2006.

While these figures are for a short period and have not been verified independently, it is clear that illicit cigarette volumes may represent approximately 20% of total cigarette consumption in South Africa. Also, the impact of illicit cigarettes may not be limited to a parallel upward shift in cigarette volumes – the preliminary figures suggest that their inclusion may also alter the \textit{behaviour} of the time series (see how the stronger upward movement in legal volumes for the first three quarters on the graph is reduced in the case of total volumes).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{Legal and illegal cigarette volumes from third quarter 2005 to end 2006}
\end{figure}

The above figure implies that elasticity estimates may be biased upward, especially when based on recent sample periods. Consumption may be much more stable in the face of
increasing prices and other demand-shift factors than previously thought. Therefore, the price elasticity estimates presented earlier may be too large: data on legal cigarette volumes is probably overestimating the reduction in the number of smokers – as some smokers have substituted legal for illicit cigarettes. This upward bias may be particularly large for the later years of the sample, if we assume that illegal cigarettes have become more pervasive.

6. CONCLUSIONS

This paper reconsiders the impact of cigarette price increases on the quantity of cigarettes demanded in South Africa. The evidence presented show that the reaction of smokers to price increases is dependent on the business cycle as well as their overall health awareness. The nineties saw a substantial decline in cigarette consumption due to higher prices. However, these were supported by slow economic growth and rising awareness about the health risks of smoking. In recent years, the booming economy has boosted disposable income, while health awareness appears to have hit a plateau – offsetting the negative effect of real price increases. Therefore, a narrow policy aimed at repeatedly exploiting the price elasticity of smokers may be misguided if it ignores other factors that also contribute to the evolution of cigarette consumption (see pro-excite tax arguments by Abedian and Jacobs (2001)). It is mistaken to argue that a 10% increase in cigarette prices today will reduce consumption by an amount similar to the reduction achieved by a hypothetical 10% increase in the 1990s, as preferences and economic conditions are quite different. Furthermore, there is not convincing evidence that the price elasticity of cigarette demand exceeds the range -0.5 to -0.7. Although the regression results suggest an increase in price elasticity over recent years, the lack of data on illicit trade in cigarettes is likely to generate an upward bias in these estimates.

REFERENCES


