The impact of tobacco advertising bans on consumption in developing countries

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Policy Paper Number 13

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The impact of tobacco advertising bans on consumption - a cross country approach including developing countries

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July 2008

Abstract

Tobacco advertising bans have become commonplace in developed nations but are less prevalent in developing countries. The importance of advertising bans as part of comprehensive tobacco control strategies has been emphasised by the Framework Convention on Tobacco Control which calls for comprehensive bans on tobacco advertising. The empirical literature suggests that comprehensive advertising bans have played a role in reducing consumption in developed countries but that limited policies have not. This paper extends this analysis to include 30 developing countries and finds that bans do play an important role in reducing tobacco consumption in these countries. It finds that both comprehensive as well as limited policies are effective in reducing consumption although comprehensive bans have a far greater impact than limited ones. Furthermore, it finds that advertising bans may be even more effective in the developing world than they are in the developed world.

JEL Classification: I18; L66; M37

Keywords: Tobacco advertising; Advertising bans; Tobacco consumption; Developing countries

1 Introduction

Possibly the single most important event in the history of tobacco control occurred in 1964 when the United States Surgeon General warned of the potential causal relationship between cigarette smoking and smoking related diseases, particularly lung cancer (United States Department of Health and Welfare, 1964, in Laugesen and Meads, 1991). This encouraged a wave of regulation and legislation in the developed world as governments began to restrict the advertising and promotion of cigarettes, place warnings of the dangers of smoking on packaging and increase prices using taxation (Laugesen and Meads, 1991). It is now generally accepted that smoking, as well as passive smoking is a significant cause of premature death (United States Department of Health and Human Services, 1989, in Laugesen and Meads, 1991). More and more governments are finding it necessary to strengthen the regulation of advertising and in many cases banning it altogether. This is in line with the obligations and commitments contained in the *Framework Convention on Tobacco Control* which recognizes that a "comprehensive ban on advertising, promotion and sponsorship would reduce the consumption of tobacco products" (World Health Organisation, 2003: 11). Furthermore it calls upon all ratifying nations to implement comprehensive bans on advertising. This has seen an increase in the number of developing countries taking steps to restrict and ban the advertising of tobacco products.

By 2030, tobacco is expected to be the single biggest cause of death worldwide. By 2020, 70 percent of those killed by smoking will be in low- and middle-income countries (Jha and Chaloupka, 1999). It is becoming important and necessary to understand which interventions succeed in reducing tobacco consumption, especially in the context of developing countries. Although the main driving force behind tobacco control is within the realm of public health it is economic interventions that have been found to be the most successful in reducing tobacco consumption. These interventions have tended to be related to increases in the price of cigarettes through taxation although a larger set of regulations including advertising bans, public smoking bans, restrictive sales practices, etc are now becoming increasingly popular. Thus it is important to assess the effectiveness of these policies to ensure that the best possible policies are put in place to reduce cigarette consumption in developing countries.

This paper attempts to consider the impact that advertising bans have on tobacco consumption, paying particular attention to developing countries. It does so by using a cross country analysis of fifty-one countries using static and dynamic specifications of demand. It makes use of fairly original data on advertising regulations in fifty-one countries. The first part considers the prior literature while the second section focuses on the methodology and data. This is followed by an analysis of the data and the estimation of the static and dynamic demand models.

2 Literature Review

The debate over whether or not advertising effects the consumption of tobacco has for a long time been controversial. Tobacco control advocates and practitioners argue that tobacco advertising has a positive impact on aggregate consumption and that restricting and even banning tobacco advertising altogether can reduce aggregate consumption. The tobacco industry have for a long period of time argued that advertising has no positive impact on aggregate consumption but rather that it influences the relative market shares of individual brands and is thus not a public health issue. Economists have added much value to this debate with many studies showing that advertising has had a positive impact on aggregate consumption while equally many studies have shown no significant impact. Table 1 details almost all of the studies that investigate the relationship between tobacco consumption and advertising expenditure. This literature has been heavily criticised on methodological grounds.

Saffer (2000) argues that the high level of aggregation of advertising expenditure data used in time series studies leaves very little variation to correlate with consumption data. Generally since the marginal product of advertising is very low (and possibly even zero) it is not likely that we would find any relationship between advertising expenditure and consumption. The marginal product of advertising is likely to be low since cigarettes are one of the most heavily advertised products (where permitted). Saffer (2000) quotes Advertising Age which reports that Philip Morris was the ninth largest advertiser in the world in 1996. Furthermore since the marginal product of advertising is likely to be high at low levels of advertising and fall progressively as advertising increases and it is likely to be non-linear. Few, if any, of the studies that investigate the relationship between tobacco consumption and advertising expenditure take this potential non-linear relationship into account.

Chapman (1989) also criticised the use of these techniques, and in particular noted the inability to examine all methods of promotion (including non-advertising) used by the tobacco industry. Econometric analysis only examines the effects of advertising on aggregate data, while advertising also has an influence on smoking related cognition and beliefs. In most cases they are unable to examine effects on specific population groups; eg. youth, women or the poor - some of whom may

be particularly vulnerable. He argued that it would be more relevant to analyse the consumers' use of marketing, deploying qualitative and quantitative techniques.

In more recent time economists have begun to focus less on advertising expenditure and more on studies that have attempted to quantify the impact of various advertising restrictions and bans on aggregate consumption. In the simplest context Smee (1992) and Perkurinen (1989) compared what happened before and after an advertising ban was put in place in Norway and Finland respectively and found that the ban has had a negative impact on per capita consumption. Laugesen and Meads (1991) used 22 OECD countries over the period 1960 to 1986 to examine the impact of increasing advertising restrictions on per capita consumption. They construct a demand model in which they specify per capita consumption as a function of price, income, a number of demographic factors and an advertising restrictions score. The advertising restriction score was bound by 0 and 10, 0 implying no restrictions whatsoever and 10 implied a total ban on all advertising and sponsorship and strong and varied warnings on cigarette packaging.[1] The model was pooled, with no fixed effects, and estimated using GLS. Laugesen and Meads found that increasing advertising restrictions had, since 1973, been associated with declining tobacco consumptions controlling for rising prices and incomes.

Laugesen and Meads (1991) was written as an improvement on the report of the New Zealand Toxic Substances Board (1989) which was used as evidence in various Canadian court cases and attempted to correct for the flaws in the data and some methodological errors (High 1999). Yet High (1999: 27) indicates that it still "suffers from basic flaws in methodology and data that renders it unintelligible and of no probative value" while Stewart's (1992) critique was described by High (1999: 37) as "devastating". Stewart's concerns included the quality of the data, the use of the estimation techniques (GLS) and the failure to control for country specific influences including different tastes, culture and attitudes. Furthermore, High (1999) raises a major concern with the use of the advertising restriction score since it implies that a ban in one particular media has the same impact as a ban in another media and a restriction half that of a ban. The method implies that a score of two has double the impact of a score of one and a score of three triple the impact.

Stewart [2](1993b) attempts to correct the data and methodological flaws of both the Report of the New Zealand Toxic Substance Board (1989) and Laugesen and Meads (1991) (High, 1999). High (1999) indicates that "Stewart has produced among the best studies of advertising and consumption" in the tobacco control literature. Yet High (1999) fails to take into account that Stewart's so called corrections to the flawed data and methodology are considered on data flaws that are in fact not necessarily so since Stewart's (1992) critique of the Laugesen and Meads (1991) dataset was in fact based on an incorrect dataset (Laugesen and Meads, 1992). Furthermore the criticism of Laugesen and Meads' (1991) pooling technique by High (1999) remains valid for Stewart (1993) since he does not specify a panel model either.

Stewart's (1993b) model uses annual data from 22 OECD countries for 27 years from 1964 to 1990. Per capita tobacco consumption is estimated as a function of the real price of tobacco, real

[1] A point was awarded each for bans on television, radio, cinema, outdoor posters, point of sale (shops), press, magazines and sponsorship while restrictions earned half a point. A further point was scored if package warnings were the same on all packets and a second if the warnings were varied.

[2] It is also important to note that Stewart is a private consultant who has worked for the Confederation of European Community Cigarette Manufacturers (CECCM) (Abbey Management Service, 1996). It is not known whether Stewart's part in this debate was funded by the CECCM but the result of his study would be consistent with other tobacco industry funded research (Scollo et al, 2003, show that studies funded by the tobacco industry that attempted to estimate the impact of clean air legislation on hospitality industries consistently found that regulation had negative effects while studies that did not receive tobacco industry funding did not contain such biases).

per capita private consumption expenditure, the age profile of the population, the unemployment rate, female workforce participation, advertising bans and a time trend. Stewart (1993b) indicates "a series of pooled cross-sectional time series regression models ... were estimated." Advertising bans were proxied by a dummy variable which indicates whether an advertising ban was in place although we have no indication of what type of ban it was, or what media were banned.

The coefficient of the advertising ban dummy was 3.8, which was significant at the 5% level of statistical significance. This indicates that the implementation of the ban in a country would result in a 3.8% increase in per capita tobacco consumption. Some variations of the regression were also presented and the dummy variable remained positive and significant although none of the restrictions are formally tested.

Duffy (1996: 15 in High, 1999) indicates that Stewart's result can be explained by the reduction in health warnings associated with reduced cigarette advertising and that it may result in increases in consumption that are associated with the imposition of advertising bans. This could only be based on the assumption that people are therefore less aware of the health implications of smoking as a result of less advertising. This argument is flawed since health warnings have become more prevalent on packaging and at points of sale since advertising bans have been imposed.

When High (1999) argues that Stewart's (1993b) study represented one of the best that investigated the relationship between tobacco consumption and advertising he was wrong. High argues that all those studies (including Laugesen and Meads, 1991) that found advertising bans to have a negative impact of consumption suffered from poor methodology and thus in his definition of flawed he should include Stewart's (1993b). It suffers from many of the same problems as Laugesen and Meads (1991) while many are even more severe.

High (1999) argues that Laugesen and Meads (1991) take an incorrect approach to estimate the effect of advertising bans on tobacco consumption. High (1999: 28) argues that by using an advertising restriction score the "model would embody the very assumptions about those effects that it was designed to test". This same criticism stands for Stewart (1993b) in that he uses a single dummy variable to indicate a ban, making no allowance for a partial ban in one media and a complete ban in another. Saffer and Chaloupka (2000) attempt to correct for this problem by replacing the advertising restriction score in Laugesen and Meads (1991) and the adverting ban dummy variable in Stewarts (1993b) with two dummy variables, one indicating if a limited ban was applicable in a particular country in a particular year and the second whether a comprehensive ban was applicable (the base case is for a weak policy regime). They indicate the importance of looking at the effect of specific bans since a greater number of countries have implemented more comprehensive bans and restrictions on tobacco advertising since the 1980s. This, to some extent, corrects for High's concerns about the different effects of different bans. Saffer and Chaloupka (2000) conclude that limited advertising bans have little or no effect on tobacco consumption while comprehensive bans can reduce tobacco consumption.

Saffer and Chaloupka (2000) also attempt to remove some of the controversy involved in the choice of datasets by using four different datasets, two of which use per capita tobacco consumption (in grams) and two of which measure per capita cigarette consumption (by number of cigarettes). The former were created by Health New Zealand [3](HNZ) and the United States Department of Agriculture (USDA) and the latter by HNZ and Stewart (1993b). The two alternatives of the HNZ datasets are both derived from the same source. The controversy over datasets used in cross-country studies was driven by Stewart's (1992 and 1993a) criticisms of Laugesen and Meads

[3]Health New Zealand is a consultancy group of which Murray Laugesen is the proprietor and this dataset represents an updated version of the Laugsen and Meads (1991) dataset.

(1991). Consequently Luik (1994 in Saffer and Chaloupka, 2000) indicated that in *RJR Macdonald v The Attorney General of Canada* the court concluded that the dataset used by Laugesen and Meads (1991) was unreliable. Yet Stewart's (1993b) and the HNZ datasets have a high correlation coefficient of 0.81 over the period 1970 to 1990 while the USDA and HNZ datasets have a correlation coefficient of 0.92 between 1970 and 1992 (Saffer and Chaloupka, 2000). Thus Saffer and Chaloupka (2000) indicate that given the correlation between the HNZ dataset and the other available datasets the court's findings are unsubstantiated. Thus either all the datasets should be considered unreliable or all should be considered usable since there remain few acceptable alternatives.

An initial set of regressions were conducted using all four different specifications of the dependent variable and including price, income, the unemployment rate and the percentage of filtered cigarettes as independent variables in addition to dummy variables for limited and comprehensive bans over the period 1970 to 1992. The regressions were conducted as a two-way fixed effects model including fixed effects for countries and time periods. The coefficient of the limited ban was found to be negative in both the HNZ datasets and positive in the Stewart and USDA datasets while the coefficient of the comprehensive ban was found to be positive in all four. All the coefficients are generally found to be insignificant. Saffer and Chaloupka (2000) indicate that the inconsistent results may reflect a lack of variation in the ban variables in the early years of the dataset prior to 1983. They altered the specification of their model to include only years from 1984 onwards and found that the coefficient of both the limited and comprehensive ban dummies were negative using all four dependent variables. The limited ban coefficients remain somewhat insignificant while the comprehensive ban coefficients are significant in all four models. Furthermore the magnitudes of the comprehensive ban coefficients were consistently greater than those of the limited bans. They also found that the results of both HNZ datasets and the USDA dataset were very similar while the Stewart (1993b) dataset was less so although showed both limited and comprehensive bans to have a negative effect with the comprehensive ban having a stronger effect.

Saffer and Chaloupka (2000) draw some important conclusions indicating that limited bans are not effective in reducing tobacco consumption since it ultimately will result in a substitution of advertising from the banned resources to those that are still allowed and that comprehensive bans are effective in reducing consumption. This study shows the importance of testing for the effect of specific bans as suggested by High (1999) and also the use of fixed effects to control for heterogeneous differences between countries and time periods.

Nelson (2003) points out that two specific problems exist in Laugesen and Meads (1991), Stewart (1993b) and Saffer and Chaloupka (2000). He indicates that the early cross country studies ignored the possibility that advertising bans are endogenously determined together with consumption. He also indicates the possibility of a structural break in the data noting that Saffer and Chaloupka (2000) find that comprehensive bans only become a significant determinant of tobacco consumption post 1984.

Nelson (2003) uses a dataset very similar to those used by both Laugesen and Meads (1991) and Saffer and Chaloupka (2000) by limiting his sample to 20 OECD countries over the time period 1970 to 1995. He defines consumption as per capita (aged 15 and older) total cigarette consumption, including both manufactured and hand-rolled cigarettes. The source of this data is *International Smoking Statistics* by Forey *et al* (2002). He also uses some variations of this definition as a dependent variable in regressions including per capita manufactured cigarette consumption, per capita cigarette consumption by weight and per capita (estimated smoking population) cigarette consumption. Data for prices are calculated by an expenditure method [4] similar to that used by

[4] Expenditure data was missing for some years from Japan and New Zealand and Nelson (2003) simply assumed

Laugesen and Meads (1991). He chooses not to use industry sources to develop a price series noting the criticism of Stewart's (1993b) choice of this data source by Laugesen and Meads (1991).

The first sets of regressions estimated by Nelson (2003) are estimated to replicate and improve the prior literature. Nelson (2003) estimates per capita consumption as a function of real per capita income, real price, the unemployment rate, the percentage of filtered cigarettes and a series of dummy variables. He includes dummy variables for i) requirements for warnings on packaging and advertising material, ii) television and radio advertising bans, iii) moderate bans (if three or four specific media[5] bans existed) and iv) strong bans (if five or more specific media were banned) as well as country and time dummies. The source of the regulatory information is the same HNZ database used by Saffer and Chaloupka (2000). Nelson (2003) diversifies his use of ban dummies to include some bans that he regards as important and is intentionally looking at the difference between broadcast bans and other media bans. Nelson's (2003) initial conclusions were that none of the bans play a role in the determination of cigarette consumption.

The use of the shortened sample from 1985 to 1995 was based on testing for a structural break, which was done by using a recursive technique successively estimating regressions with one less year. A structural break in 1985 was indicated graphically and confirmed formally by Wald and Chow tests. Nelson (2003) also tested the individual country autocorrelation in some of the regressions and found the majority of countries to have strong positive autocorrelation when considering the Durbin Watson statistics. He indicates that this may also account for a downward bias in standard errors and hence may have lead previous studies accepting that advertising bans had had a negative effect on consumption when in fact they had not. Nelson (2003) essentially rejects the previous attempts to measure the effectiveness of advertising bans on consumption in cross-country studies on the grounds of poor econometric techniques. He avoids the debate surrounding the data and methodological issues.

Although the model presented by Nelson (2003) shows nothing but an insignificant effect of advertising bans on consumption he is guilty of some errors. He has chosen to report models selectively not showing the results of inclusion of the ban count variable with the alternative specifications of the dependent variable. Furthermore he fails to include time fixed effects which could account for heterogeneous differences over time, such as the changes in attitudes and perceptions towards cigarettes and tobacco which may be causing the structural break he has found in 1985. It is impossible to estimate these models independently since the large parts of the dataset used by Nelson (2003) are proprietary.

Based on his conclusion that advertising bans do not play a role in determining consumption

real expenditure to be the same as those in earlier time periods. He may have been better advised to assume a constant proportion of total income rather than a constant real expenditure although this is unlikely to make a significant difference. Nominal values were converted to real values using the GDP Deflator in each country although the use of a consumer price index may have been better reflective of substitutes than a broad deflator. He then converts the real prices in local currency units to US dollars using a purchasing power parity conversion factor. This is problematic since this factor was only available on an ad hoc basis and was estimated for each of the missing years using inflation data in each country relative to the US. Nelson (2003) indicates that unrealistic prices were calculated for Greece and Iceland during the 1970s and early 1980s due to high inflation in those countries. As a solution he uses a single year's PPP factor to deflate for all previous years. These transformations are a cause for concern but even more important is the nature of the construction of the price series. The definition of the price series of the real price per packet of cigarettes and is inconsistent with the definition of consumption in the dependent variables. Furthermore the use of the PPP conversion factors is unnecessary and distorts the series since cigarettes are not an internationally tradable good (Laugesen and Meads, 1991). He does not indicate a suggestive source for this usage in the literature and does not justify the use of it. A simple real price converted to a common currency would suffice.

[5] Nelson (2003) considers a total of nine media, namely: television, radio, cinema, outdoor, newspapers, magazines, shop advertising, sponsorships, and indirect advertising such as brand names on non-tobacco products.

Nelson (2003) hypothesises a public choice model arguing that advertising restriction only get implemented once smoking prevalence has fallen such that smokers no longer constitute an "effective economic or political interest group"[6](Nelson 2003: 20). Nelson (2003) indicates that most comprehensive advertising bans were only legislated once large scale falls in consumption had been seen. To test this hypothesis that advertising bans are a result in a reduction in tobacco consumption Nelson (2003) estimates a two-stage model treating advertising restriction endogenously.

Nelson (2003) uses the fitted values for the advertising restriction score as an instrumental variable in estimating tobacco demand.[7] Nelson (2003) finds that income and prices are statistically significant in predicting demand, while warnings are only statistically significant in the first sample period[8] while the advertising restriction score is not statistically significant in any of the samples. Although not statistically significant the coefficients are negative in all samples, which are inconsistent with the results Nelson (2003) found in the single equation models. The t-statistic also fall over the three samples indicating that advertising restrictions have become less important in determining consumption. In order to test the endogeneity of the advertising bans, a Hausman test was performed which failed to reject the null hypothesis that advertising bans were exogenous, indicating that the two stage model is important in explaining the relationship between the political economy and advertising bans and their relationship with consumption. Nelson (2003) concludes that advertising bans and restrictions have had no effect on consumption although the final model he presents does suggest that this is not the case and that in fact, advertising bans and restrictions have had a very small, albeit insignificant, effect on consumption.

Yet, of this work, very little has been conducted with respect to developing countries. Since a large amount of the work relating to the impact of economic interventions (particularly taxation and price elasticities) on tobacco consumption have shown significantly different results in developing countries as opposed to developed nations there is no reason to suggest that the results of the literature with respect to advertising in developed nations can be generically fitted to developing counties. Thus the purpose of this study is to quantify, if any, the impact of advertising bans and restrictions on tobacco consumption in developed and developing countries. It is important to note that the aim of this paper is not to test the impact of advertising on aggregate consumption but rather the impact of advertising bans and restrictions, in essence the policy responses and interventions, on aggregate consumptions with respect to developing countries.

3 Methodology and Data

The study makes use of a cross country panel dataset to investigate the impact of advertising bans on tobacco consumption. It will specify a demand model where consumption is estimated as a function of price, income and advertising regulations.

Dynamic specification of demand will be used in order to control for the addictive nature of cigarettes. Dynamic specifications are particularly important when considering the demand for

[6] The rationale behind this hypothesis is that since the mid-1960s tobacco consumption has fallen due to the public's knowledge of the health risks associated with smoking and influenced by, amongst others, government reports, public education programs, health warnings and counter advertising campaign. Together with greater understanding of these risks, combined with higher taxation and direct measures such as age controls, tobacco consumption and prevalence fell resulting in the swing in public opinion that allowed advertising bans to be legislated without much political cost.

[7] The first stage is estimated by a Poisson regression with country fixed effects. This technique is used since the advertising restriction score is a discrete variable and bounded by a minimum and maximum value.

[8] Three difference samples are used: 1971-1995, 1977-1995 and 1985-1995.

tobacco since it is unlikely that consumption in one period is determined by factors only in that period. Furthermore one needs to consider both the short run and long run dynamics of smoking. These specifications are well described in the literature as the partial addiction model, attributed by Baltagi *et al* (2000) to Houthakker and Taylor (1970) and McGuiness and Cowling (1975), and the rational addiction model of Becker and Murphy (1988).

The literature does provide a number of pooled data studies which have considered the demand for cigarettes. Baltagi and Levin (1986), Laugesen and Meads (1991), Stewart (1993b), Sung *et al* (1994), Baltagi *et al* (2000), Saffer and Chaloupka (2000), Nelson (2003) and Huang *et al* (2004) have all consider the demand for cigarettes using pooled data although only Baltagi and Levin (1986), Baltagi *et al* (2000) and Huang *et al* (2004) consider dynamics in their specification of demand. Laugesen and Meads (1991), Stewart (1993b), Saffer and Chaloupka (2000) and Nelson (2003) have also consider the impact of advertising in their specifications. Importantly none of these studies consider any developing countries mostly they concentrate on US states and *OECD* countries.

The dataset has been drawn from a number of sources. Price data is sourced from the *Economist Intelligence Unit's World Cost of Living Survey.* This dataset is the largest dataset which includes a significant number of developing countries which collects annual data consistently on the retail prices of cigarettes. Data is collected on a city wide basis for two different brands, an international or imported brand (usually Marlboro) and a locally produced popular brand, in two different types of retail stores. In order to choose one price form the four available the cheapest is selected in each year and city. This suggestion was made by Blecher and Van Walbeek (2004) when using the same dataset since they suggest that they cheaper brand would in fact be, in most countries, the most popular brand. In many developed nations there is little difference between the two prices. Where a number of cities are surveyed in a particular country the average price is used. Prices are captured in a common currency, United State Dollars and converted into real term (constant 2000 prices) using the *United States Consumer Price Index City Average for All Items* (United States Department of Labour).

Consumption data is sourced from the *Tobacco Control Country Profiles*[9] (Shafey *et al*, 2003) dataset and is defined as per capita consumption per adult (aged 15 and older) while income data is sourced from the *World Bank's World Development Indicators* dataset. Per capita Gross Domestic Product in constant 2000 US dollars is used as a proxy of income since it places a value on free state services and transfers (Laugsesen and Meads, 1993).

Data on regulations in each individual country are captured from a number of sources. For European nations, the regional office of the World Health Organisation provides an online *Tobacco Control Database* which includes detailed information on each member country. A similar situation exists for some members of the Pan American Health Organisation which provides the *Pan American Tobacco Information Online System (PATIOS).* This provided data for a small number of countries although this was also supplemented by the *Tobacco Control Country Profiles* (Shafey *et al*, 2003) since only the current status is indicated in PATIOS, not the historical status which was found in Shafey *et al* (2003). All countries that were not included in either of the aforementioned databases were surveyed using an online survey of eminent persons in each country. In a small number of countries which were not surveyed due to language barriers or other logistical problems a search of *Tobacco Control Country Profiles* (Shafey *et al*, 2003), the Centre for Disease Control's *National Tobacco Information Online System (NATIONS)* and source documents was employed. A detailed

[9] Data from 1990 to 2000 is taken from the indicated source while data from 2001 and after were sourced directly from the author of the indicated source.

appendix of all sources in each country in included.

A number of alternatives are available for including advertising bans and restrictions in the model. The first would simply be to create a discrete and bounded score where 10 might represent a total ban on all advertising in all media and zero a free market. This method used by Laugsesen and Meads (1991) has a distinct disadvantage in that it implies that a point scored for any reason implies the same generalised impact as any other. A second method is to create dummy variables for weak, limited and comprehensive bans as used by Saffer and Chaloupka (2000). The weakness of this methodology would be the subjective nature of the application of a weak, limited or comprehensive ban to a particular country in a particular year. A third method would be to include dummy variables for bans and restrictions in different categories or media (e.g. television, radio, outdoor, cinema, print, etc) as suggested by High (1999). The inclusion of so many dummy variables would require large dimensions of the panel to ensure sufficient degrees of freedom. Furthermore, the use of individual dummies for each particular media also removes the ability to examine the interaction between bans in different media which the Saffer and Chaoupka method allows by measuring the overall impact. The Saffer and Chaloupka method is used here since it is relatively easy to use and understand.

4 Data Analysis

The level of regulation in each country and year were measured according to the methodology designed by Saffer and Chaloupka (2000) by classifying the level of regulation in each country in each particular year as being weak, limited or comprehensive. The Saffer and Chaloupka method considers the regulation in seven types of media: television, radio, outdoor (including billboards), print (including magazines, books, newspapers), cinema, point of sale and sponsorships. If bans exist in none, one or two media the regulation is considered weak, three or four bans as limited and five or more being comprehensive.

Data on advertising regulations was collected for 51 countries, of which 21 are considered as high income countries according the World Bank's list of economies as of July 2006 (World Bank, 2006) while the remaining 30 are considered as upper-middle, lower-middle or low income countries or collectively as developing countries. The analysis of advertising regulations covers the period 1990 to 2005. During this period there has been a remarkable trend towards the strengthening of advertising regulations with many countries moving from weak, to limited and comprehensive regulations. The trend has been consistent over the entire period in the high incomes countries although it has been more recent in the developed world.

In 1990, 71 percent of high income countries and 93 percent of developing countries had weak policies in place and this number has declined to 14 and 63 percent respectively by the 2005. Limited policies are generally not popular and could be found in 10 percent of high incomes countries in 1990 and in only 3 percent of developing countries. Countries with limited bans tend to be scarce since they are usually countries in transition from weak to comprehensive policy. By 2005, this number has grown to 24 percent in high income countries and was non-existent in the developing world. Comprehensive bans occurred in 19 percent of high income countries in 1990 and in only 3 percent of developing countries. The number of countries implementing comprehensive advertising bans grew considerably to 62 percent of high income countries and 37 percent of developing countries by 2005. Figures 1 and 2 indicate the number of countries choosing weak, limited and comprehensive advertising ban policies in high income and developing countries respectively while Figure 3 represents the same for all countries included in the analysis.

Developing countries have certainly been slower on taking up more rigorous policies. The majority of developing countries still have little or even no regulation of advertising while, since 2002, the majority of high income countries have had comprehensive policies in place banning advertising.

Consumption is varied across countries. Developed countries tend to have higher levels of per capita consumption than developing countries and countries with comprehensive and limited bans higher per capita consumption than countries with weak bans although it has already been shown that developing countries are more likely to have weak policy regimes in the first place. Figure 4 shows the average annual per capita consumption between the years 1990 and 2002.[10] Of interest is the sharp decline in the consumption in countries with a limited ban in place although this is somewhat misleading since only 3 counties had such a policy in place in 1990 and this grew to 5 countries in 1994, and reached 7 by 2002. More importantly is the apparent decline in consumption in countries with comprehensive bans. Countries with weak bans saw consumption vary with a slight negative trend although the trend seems neutral if the final observation is excluded. It seems that countries which implemented limited and comprehensive bans found greater reductions in consumption than those with limited bans.

Of concern here is what happens to consumption when a country implements a stricter policy and as such we can examine how consumption patterns changed for countries that had weak policies and implemented stricter policies. Figure 5 shows the average annual per capita consumption for countries that had weak policies in place in 1990. It indicates three different series, for those countries that by 2002 had implemented limited bans and for those that had implemented comprehensive bans. It also includes those that kept weak policies in place as a baseline. What is immediately noticeable is how countries that changed to limited and comprehensive bans had higher consumption, to begin with, than those who did not – again since most countries who implemented limited and comprehensive strategies were more than likely high income countries and those that kept weak policies in place developing countries. Furthermore, countries that implemented limited and comprehensive bans found consistently declining consumption over the period while countries that kept weak bans in place found that consumption consistently rose.

The above analysis is suggestive of a link between advertising bans and tobacco consumption in that countries that have implemented limited and comprehensive bans have seen tobacco consumption falling while countries that have maintained weak policies have seen consumption not decline and in some cases increase. Yet we have also seen evidence that developing countries are less likely to implement limited and comprehensive bans. Figure 6 describes the trends in consumption in developing and developed countries and shows that there has been a consistent decline in consumption in high income countries between 1990 and 2002. In the same period there has been a modest increase in consumption in developing countries although this has occurred since 1995. Prior to 1995 the graph indicates declining consumption in the developing world.

Figure 7 breaks down developing countries into three groups based on the status of their policies in the last year of the analysis, 2002. The data indicates robust declines in consumption in those countries that chose to implement limited and comprehensive bans between 1990 and 2002. At the same time it shows that consumption in countries who maintained weak policies rose substantially, particularly since 1995. This indicates that although most developing countries maintained weak policy regimes that limited and comprehensive bans may be as influential in reducing consumption in the developing world as they are in high income countries.

The figures presented here are very interesting. They show that high income countries are more likely to implement comprehensive strategies than developing countries. Furthermore, we have

[10] The time period under analysis is restricted by the availability of consumption data.

shown that per capita consumption is declining in high income countries and that this trend has not been shared in the developing world. We have also seen that it is easy to mistake the trend of declining consumption in the developed world with increasing advertising bans. Yet at the same time there is some evidence to suggest that increasing advertising bans occur in countries with declining consumption. A more rigorous analysis will now be undertaken.

5 Econometric Model

The model is first estimated in a static form after which dynamic specifications are estimated. The static model is estimated using fixed and random effects estimators using country effects only and then using both country and time effects. The country specific fixed effects only controls for country specific differences and is called a one-way model. The two-way model including both country and time effects controls for differences across countries as well as differences between time periods. Fifty-one countries are included in the model over 14 years (1990 to 2003). The panel is not balanced since observations are missing for some countries in some years due to unavailable data. The static model is estimated in natural logarithms to allow for interpretation of the coefficients as elasticites and is formalised by equation [1] below:

$$\ln C_{it} = \alpha_0 + \alpha_1 \ln P_{it} + \alpha_2 \ln Y_{it} + \alpha_3 D\left(Lim\right)_{it} + \alpha_4 D\left(Comp\right)_{it} + \mu_{it} \tag{1}$$

Where C represents per capita consumption, P real prices, Y per capita real income, *D(Lim)* and *D(Comp)* the dummy variables for limited and comprehensive bans. The subscript it refers to country i and time period t. The results of the estimations of the static model includes 617 observations are shown in Table 4.

The pooled model including no fixed effects is estimated with a negative price elasticity of demand and a positive income elasticity of demand. Both are significantly different from zero. The limited and comprehensive ban dummies are both negative although neither are statistically significant. A one-way fixed effects model is then estimated with negative and statistically significant price elasticity although a negative and statistically significant income elasticity is found. Only the comprehensive ban dummy is statistically significant although both ban dummies are negative. The one-way fixed effects model preferred to the pooled model since the model selection test is distributed $\chi^2(49)$=1608.04 (P=0.000).

A two-way fixed effects model is then estimated which is preferred to both the pooled model since $\chi^2(63)$=1644.78 (P=0.000) and the one-way fixed effects model since $\chi^2(13)$=36.75 (P=0.001). The price elasticity is again negative and significant while the income elasticity is positive and significant. Again both ban dummies are negative although only the comprehensive ban dummy is significantly different from zero.

In both cases the one and two-way fixed effects models are preferred to a random effects model since H(4) =54.13 (P=0.000) and H (4)=49.14 (P=0.000) for the one and two-way models respectively. The results for the static models are unsurprising and consistent with the literature. Tobacco is found to be price inelastic and a normal good while limited bans seem to play no role in the determination of consumption but comprehensive bans have a significant and negative impact as suggested by Saffer and Chaloupka (2000).

The model is then estimated again, this time including only developing countries. Twenty-nine countries are included in the model over 14 years (1990 to 2003). The panel is not balanced since

observations are missing for some countries in some years due to unavailable data. The results of the static model includes 331 observations are shown in Table 5.

Again a pooled model including no fixed effects is estimated with a negative price elasticity and a positive income elasticity. Only the income elasticity is statistically significant while both the limited and comprehensive ban dummies are positive and statistically significant. A one-way fixed effects model is then estimated with negative and statistically significant price elasticity and a positive income elasticity is found although it is not significantly different from zero. Both the limited and comprehensive ban dummies are negative and statistically significant. The one-way fixed effects model is preferred to the pooled model since $\chi^2(28)$=977.82 (P=0.000).

A two-way fixed effects model is then estimated which is preferred to the pooled model since $\chi^2(13)$=995.17 (P=0.000) but not to the one-way fixed effects model since $\chi^2(13)$=17.35 (P=0.184). The price elasticity is again negative and significant while the income elasticity is positive and significant. Again both ban dummies are negative and significantly different from zero.

In both cases the one and two-way fixed effects models are preferred to a random effects model since H(4)=14.66 (P=0.006) and H (4)=24.50 (P=0.000) since the results are not significantly different from those of the fixed effects models. The preferred model is this the one-way fixed effects model

The results from these model are interesting. In the full model, the preferred two-way fixed effects model indicates the important influence of price and income on tobacco consumption. It indicates that tobacco is inelastic and normal albeit with small magnitudes. Furthermore it indicates that comprehensive bans have a negative impact on consumption although limited bans have a very small negative, if any, impact on consumption. Yet when we move into a model including only developing countries the results change somewhat. In the preferred one-way fixed effects model prices still have an important influence indicating the inelastic nature of tobacco but income seems to have a less important influence and although it is a normal good the magnitude is small and not significantly different from zero. The ban dummies indicate that both limited and comprehensive advertising bans have a negative impact on consumption and that the comprehensive bans have a far greater impact on consumption than limited bans. Thus one can conclude that advertising bans have a greater impact on consumption in the developing world than high income countries and that they could indeed be a very useful demand side tool in curbing tobacco consumption in the aggregate.

A number of different dynamic specifications of demand can be found in the literature. We employ the simplest of those, the partial addition model which specifies current consumption as a function of prior consumption in addition to price, income and other factors. In order to estimate a dynamic model to take into account the addictive nature of cigarette smoking a balanced panel is required. In order to make a balanced panel the period 1990 to 2002 is considered since consumption data is missing for many nations in 2003. Furthermore, 14 countries are excluded[11] due to missing consumption or price data in individual years, leaving 36 countries for analysis in the dynamic specification, of which 16 are developing countries and 20 developed. The partial addiction model is formalised by equation [2] below:

$$\ln C_{it} = \beta_0 + \beta_1 \ln C_{it-1} + \beta_2 \ln P_{it} + \beta_3 \ln Y_{it} + \beta_4 D(Lim)_{it} + \beta_5 D(Comp)_{it} + \sigma_{it} \qquad (2)$$

Dynamic panel models cannot be estimated using the same fixed and random effects techniques

[11] The excluded countries are: Czech Republic, Ecuador, Gabon, Greece, Guatemala, Iran, Kenya, Nigeria, Paraguay, Peru, Russia, Senegal, Turkey and Uruguay.

that were used for estimating the static specifications. In order to present consistent estimates, an *IV* technique is employed. The Arellano and Bond (1991)[12] technique is a generalized method of moments (GMM) technique which uses lags of the endogenous variables as instruments to provide unbiased and consistent estimates of the coefficients. This requires that the differenced equation does not exhibit second and higher order serial correlation.

The Arellano and Bond (1991) method is estimated in two-stages, the second stage providing the coefficients and the tests for serial correlation and over-identifying restrictions. The first stage only provides results for inference on the second stage coefficients since the second step estimates of the standard error tend to be biased in relatively small samples (Dunne and Perlo-Freeman, 2003).

Only the coefficient of the lagged dependent variable is significantly different from zero. Although the price elasticity is negative and the income elasticity positive as expected neither is significantly different from zero. Furthermore neither of the ban dummies are significantly different from zero although the comprehensive ban dummy is negative. The Sargan statistic tests the validity of the instruments based on the correlation between the instruments and the residuals. In this case it is not possible to reject the null hypothesis that the over-identifying restrictions are valid. Although the results indicate the presence of first order serial correlation this should be expected in differenced equations of this form. Evidence of second order serial correlation would be indicative of dynamic mis-specification (Greenaway *et al*, 1995) yet the results indicate that it is not possible to reject the null hypothesis of no second-order autocorrelation.

Interestingly enough, as we add further lagged dependent variables the importance of the price elasticity becomes apparent (since it grows in absolute magnitude and statistical significance). Yet at the same time income and the ban dummies become less important in determining consumption. The long run coefficients of price and income are -0.076 and 0.008 respectively.

A sub-sample of only developing countries is then estimated. The results in the sub sample is equally disappointing, with only the lagged dependent variable being significantly different from zero. Interestingly though is that the magnitude of the lagged dependent variable is high and near one in developing countries. This indicates that consumption is highly dependent on past consumption in poorer countries. Limited bans are an insignificant determinant of consumption but comprehensive bans seem to have an important role in developing countries since the coefficient is negative and significantly different from zero, albeit only at the 10% level. The price elasticise is negative although not significantly different from zero as is the income elasticity which is positive.

6 Discussion and Conclusion

The principle question asked in this paper is what impact do advertising bans have on tobacco consumption. Secondary to that is what impact they have specifically in the context of developing countries. This paper has attempted to use both static and dynamic specifications to estimate cross country demand models to quantify the impact of limited and comprehensive advertising bans on consumption controlling for changing prices and incomes. The static models show that comprehensive bans have a significant negative impact on consumption in that the imposition of a comprehensive ban results in a 6.7 percent decline in per capita consumption. It also indicates

[12] The Arellano and Bond (1991) technique provides an efficient estimate of the dynamic model since it takes the estimation equation and differences it to transform out the country specific effects and then allows a dynamic specification in differences, with a lagged dependent variable. As the differencing induces a bias in the coefficient on the lagged dependent variable, because of the correlation between it and the unobserved fixed effects in the residual, an instrumental variable method must be adopted.

that limited bans have no significant impact on consumption. This is consistent with Saffer and Chaloupka's (2000) conclusion that only comprehensive bans have an impact on consumption since the imposition of limited bans only causes a substitution of advertising away from those media which have been banned towards those media that are still allowed. When considering only the sub sample of developing countries we find that the comprehensive bans have a significant negative influence on consumption but we also find that limited bans now have a significant negative impact too. Limited bans reduce per capita consumption by 13.6 percent while comprehensive bans result in a larger 23.5 percent reduction in per capita consumption (relative to the base case of a weak policy regime).

An interesting question arises, why should advertising bans have such a large impact on consumption in the developing world relative to the entire sample? For one the literature indicates that the impact of price changes have a larger impact on consumption in developing countries vis-à-vis developed countries. Van Walbeek (2005: 80) indicates that "the consensus view is that the price elasticity of demand is around -0.4 for developed countries and between -0.4 and -0.8 for developing countries". Furthermore, changes in income also have a greater impact on consumption in the developing world than the developed world. Thus it can be said that tobacco demand is more sensitive to its determinants in the developing world relative to the developed world. Consumers are more sensitive to demand sided interventions, whether it be price increases as a result of tax increases or non-price measures including advertising bans, public smoking bans and social factors. There are a number of reasons for this greater sensitivity, firstly the price of cigarettes takes up a greater portion of a consumer's income in the developing world than in a rich country (Blecher and Van Walbeek 2004). Thus as a result an increase in price has a relatively greater impact on a person's relative budget. Furthermore, consumers in poorer countries are likely to have lower education levels and thus have a poorer understanding of the health consequences of smoking. Thus the impact of advertising is weaker in high income countries since a fewer number of smokers are enticed by advertising due to the better understanding of the health consequences.

Yet the results of the dynamic specification of demand using a partial addiction model shows that advertising bans are not an important determinant of demand. Past consumption is the most important determinant of consumption and even prices and incomes are not significant determinants even though they are signed correctly. This is consistent when looking only at the sub sample of developing countries although in such a case comprehensive bans are found to have a very small negative impact in determining consumption. An interesting question is how the prior literature would react to the use of dynamic specifications of demand, ie. would Laugesen and Meads (1991), Stewart (1993b), Saffer and Chaloupka (2000) and Nelson (2003) all provide the same or similar conclusions if dynamic specifications of demand were employed? The results are quite interesting; Blecher (2005) considers this question for Laugesen and Meads (1991) and Stewart (1993b) and found that advertising restrictions were not significant in determining demand in a dynamic specification. The Saffer and Chaloupka (2000) and Nelson (2003) used proprietary datasets and were thus not considered. Thus there is some evidence that suggests that the specification of demand is very important in that studies that used static specifications of demand found that advertising bans had played a role in determining consumption while those that use dynamic specifications tend to find otherwise.

Does this mean that advertising bans are not useful in curbing tobacco consumption, particularly in the developing world? Most certainly not! Restrictions and bans on tobacco advertising are part and parcel of comprehensive tobacco control strategies, it is unlikely that a government could or would implement restrictive policies on tobacco advertising in a vacuum. It is likely that these

policies are to be implemented within the context of public smoking bans, restrictions of sales to minors and warning labels on packaging (and advertising material if applicable). Furthermore, it is likely that the implementation of these policies will coincide with increases in taxation to increase the price of cigarettes and directly reduce consumption. Even if advertising bans were not to decrease consumption directly, they can still play an important role, together with many other factors, in influencing the social acceptance of smoking.

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Appendix

Table A1: Sources of information on advertising bans in individual countries

Argentina	Survey
Australia	TCCP; Acts of parliament
Austria	WHO Regional Office for Europe Tobacco Control Database
Bangladesh	Survey
Belgium	WHO Regional Office for Europe Tobacco Control Database
Canada	Survey
Chile	Pan American Health Organisation PATIOS Database; TCCP
China	Survey
Colombia	Pan American Health Organisation PATIOS Database; TCCP
Czech Republic	WHO Regional Office for Europe Tobacco Control Database
Denmark	WHO Regional Office for Europe Tobacco Control Database
Ecuador	Pan American Health Organisation PATIOS Database; TCCP
Eqypt	Survey
Finland	WHO Regional Office for Europe Tobacco Control Database
France	WHO Regional Office for Europe Tobacco Control Database
Gabon	TCCP; NATIONS
Germany	WHO Regional Office for Europe Tobacco Control Database
Greece	WHO Regional Office for Europe Tobacco Control Database
Guatemala	Pan American Health Organisation PATIOS Database; TCCP
Holland	WHO Regional Office for Europe Tobacco Control Database
Hungary	WHO Regional Office for Europe Tobacco Control Database
India	Survey
Indonesia	TCCP; NATIONS
Iran	TCCP; NATIONS; World Health Organisation (Undated)
Ireland	WHO Regional Office for Europe Tobacco Control Database
Israel	WHO Regional Office for Europe Tobacco Control Database
Italy	WHO Regional Office for Europe Tobacco Control Database
Kenya	TCCP; Acts of parliament
Malaysia	Survey
Mexico	Survey
New Zealand	Survey
Nigeria	TCCP; NATIONS
Norway	WHO Regional Office for Europe Tobacco Control Database
Pakistan	TCCP; NATIONS
Panama	Pan American Health Organisation PATIOS Database; TCCP
Paraguay	TCCP; Acts of parliament
Peru	Pan American Health Organisation PATIOS Database; TCCP
Poland	WHO Regional Office for Europe Tobacco Control Database
Portugal	WHO Regional Office for Europe Tobacco Control Database
Russia	WHO Regional Office for Europe Tobacco Control Database
Senegal	TCCP; NATIONS; Acts of parliament
South Africa	Survey
Spain	WHO Regional Office for Europe Tobacco Control Database
Sweden	WHO Regional Office for Europe Tobacco Control Database
Switzerland	WHO Regional Office for Europe Tobacco Control Database
Thailand	Survey
Tunisia	TCCP; Survey
Turkey	WHO Regional Office for Europe Tobacco Control Database
United Kingdom	WHO Regional Office for Europe Tobacco Control Database
United States	TCCP; NATIONS; Nelson (2003)
Uruguay	Survey

Note: The names and details of the persons surveyed are available on request from the author.

Tables and Figures

Table 1: Studies investigating the impact of advertising expenditure on tobacco consumption

Study	Country	Time Period
No significant effect of advertising		
Grabowski (1976)	United States	1956-1972
Schneider *et al* (1981)	United States	1930-1978
Yuclet and Kaynak (1984)	United States	1955-1979
Baltagi and Levin (1986)	United States	1963-1980
Johnson (1986)	Australia	1961-1986
Godfrey (1986)	United Kingdom	1956-1984
Hoffman (1987)	West Germany	1969-1979
McAuliffe (1988)	United States	1957-1985
Baltagi and Levin (1992)	United States	1963-1988
Wilcox and Vacker (1992)	United States	1991-1990
Duffy (1991)	United Kingdom	1971-1987
Franke (1994)	United States	1961-1990
Wilcox *et al* (1994)	South Korea	1988-1992
Duffy (1995)	United Kingdom	1963-1988
Goel and Morey (1995)	United States	1959-1982
Duffy (1996)	United Kingdom	1963-1992
Gallet (1999)	United States	1958-1971
Duffy (2003)	United Kingdom	1963-1996
Significant positive effect of advertising		
Fujii (1980)	United States	1929-1973
Witt and Pass (1981)	United Kingdom	1955-1975
Young (1983)	United States	1929-1973
Bishop and Yoo (1985)	United States	1954-1980
Radfar (1985)	United Kingdom	1965-1980
Leefland and Reuijl (1985)	West Germany	1960-1975
Abernethy and Teel (1986)	United States	1949-1981
Porter (1986)	United States	1947-1982
Chetwynd *et al* (1988)	New Zealand	1973-1985
Kao and Tremblay (1988)	United States	1953-1980
Harrison *et al* (1989)	New Zealand	1973-1985
Seldon and Doroodian (1989)	United States	1952-1984
Tegene (1991)	United States	1953-1985
Smee (1992)	United Kingdom	1960-1987
Valdes (1993)	Spain	1964-1988
Tremblay and Tremblay (1995)	United States	1955-1990
Bardsley and Olekalns (1999)	Australia	1963-1996

Source: Smee (1992), Saffer and Chaloupka (2000) and Nelson (2006).

Figure 1: High income countries (n=21)

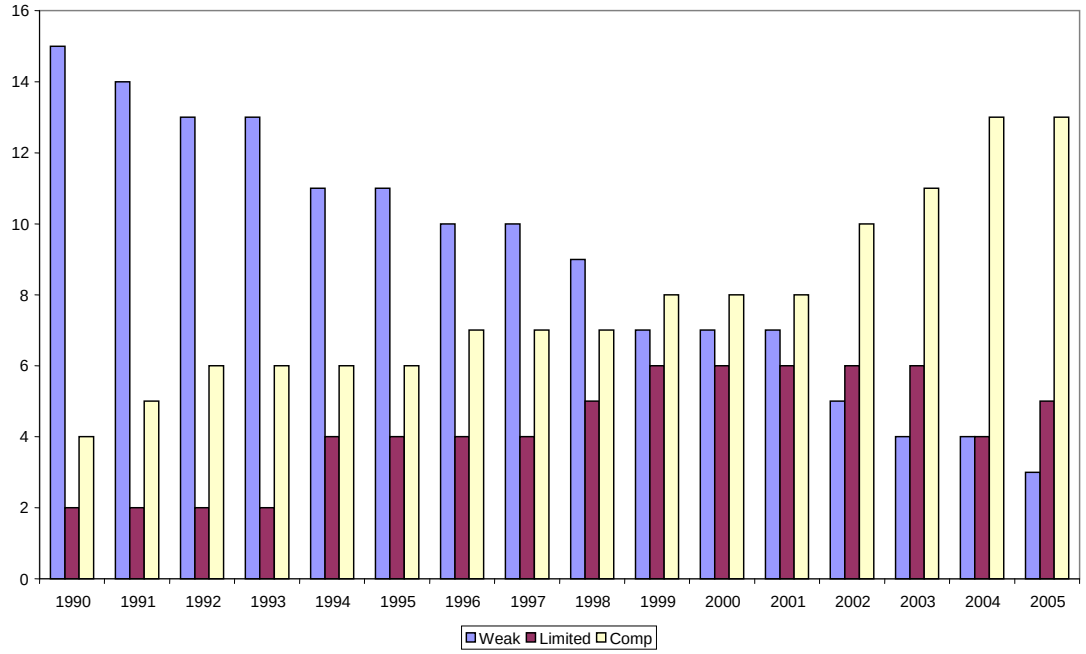

Figure 2: Developing countries (n=30)

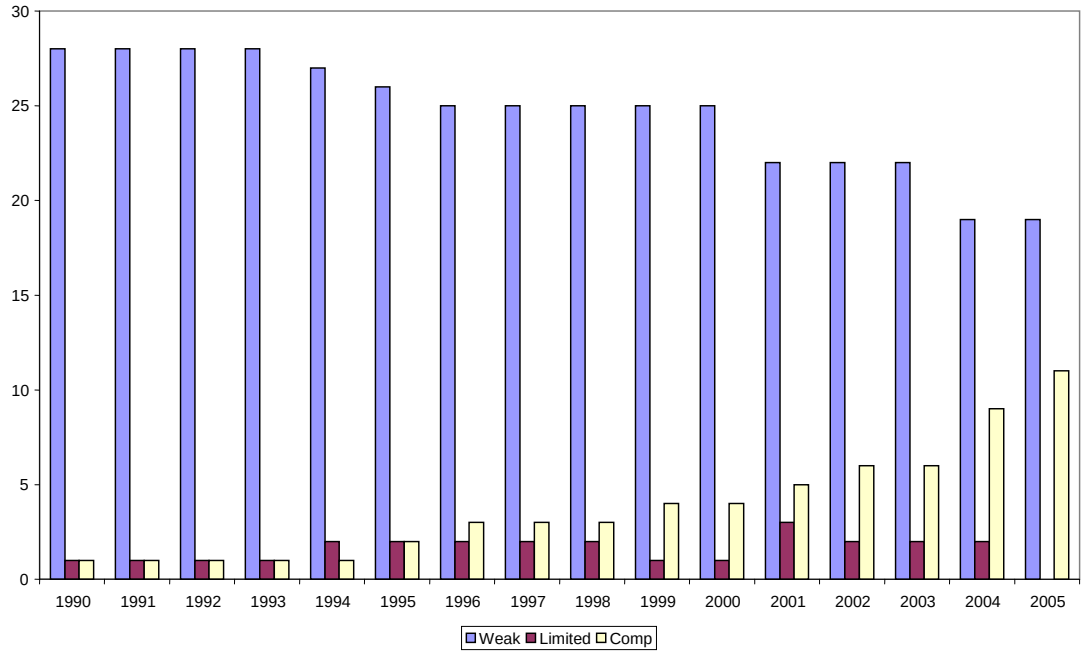

Figure 3: All countries (n=51)

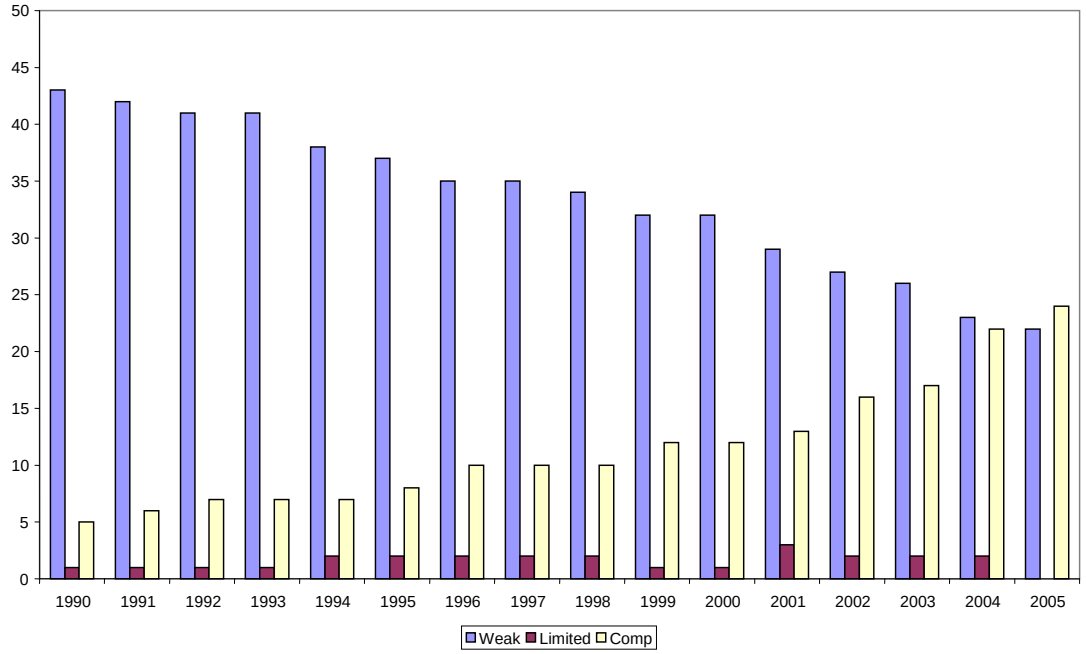

Figure 4: Average annual per capita consumption for developing and developed countries

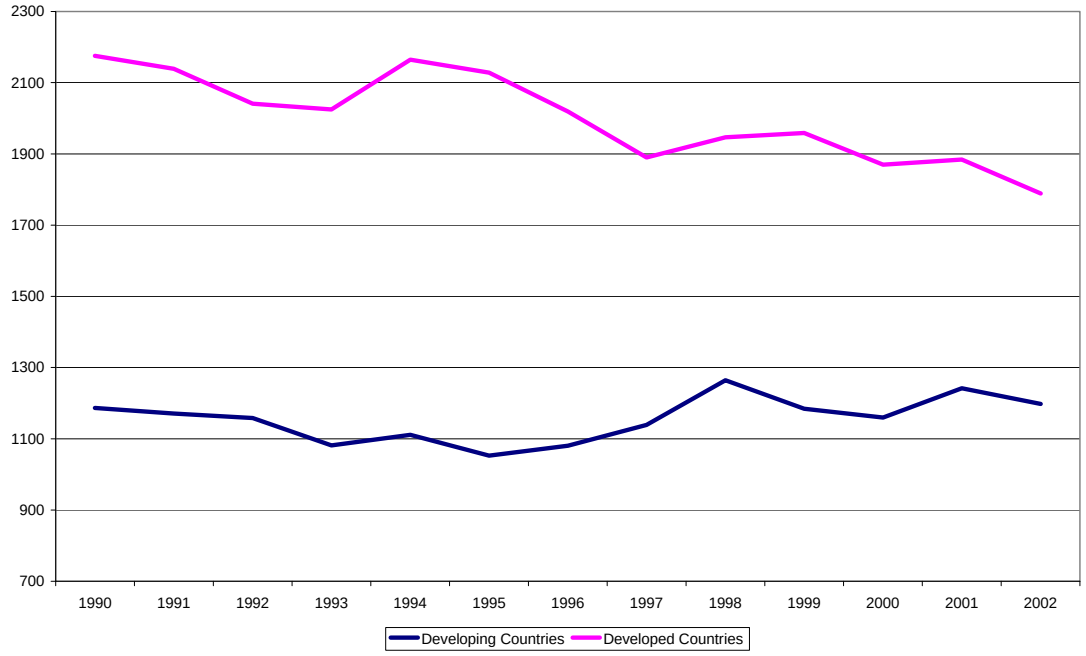

Figure 5: Average annual per capita consumption for countries which in 1990 had weak policies

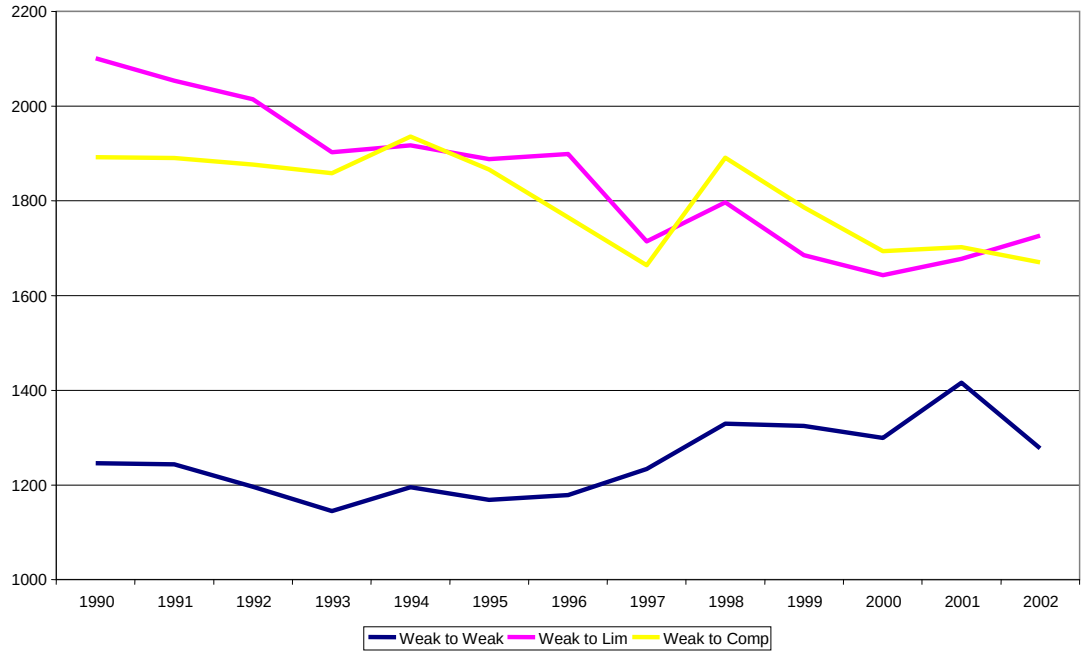

Figure 6: Average annual per capita consumption for developing countries with weak, limited and comprehensive policies in 2002

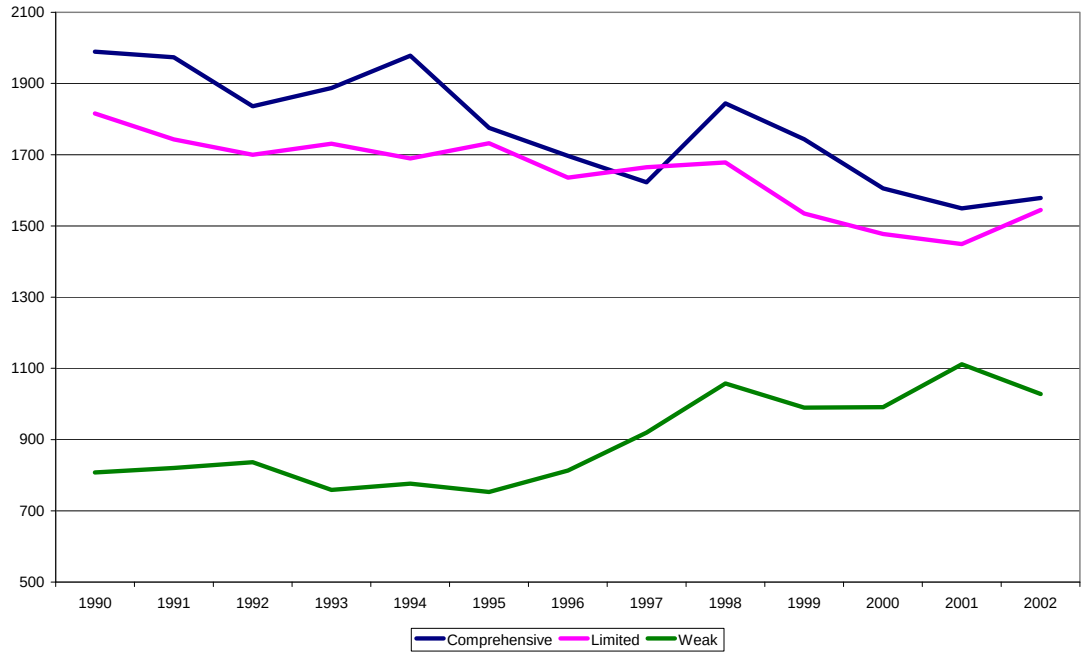

Table 2: Results of the econometric models

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.123	0.192	-0.026	-0.067	5.543	0.96
	(-4.512)***	(1.999)**	(-0.709)	(-1.830)*	(6.745)***	
Developing countries						
OLS Di	-0.099	0.086	-0.136	-0.235		0.97
	(-2.928)***	(1.040)	(-2.199)**	(-4.434)***		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%

Table 3: Summary of advertising ban dummies

	Weak	Limited	Comprehensive
Restricted alternative	0, 1, 2, 3	4, 5	6, 7
Saffer and Chaloupka (2000)	0, 1, 2	3, 4	5, 6, 7
Relaxed alternative	0, 1	2, 3	4, 5, 6, 7

Table 4: Sensitivity tests on advertising ban dummy variables: alternative 1

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.120	0.197	0.083	0.032	5.398	0.96
	(-4.419)***	(2.089)**	(2.181)**	(0.753)	(6.622)***	
Developing countries						
OLS Di	-0.091	0.069	0.203	0.029		0.96
	(-2.757)***	(0.842)	(3.430)***	(0.405)		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%

Table 5: Sensitivity tests on advertising ban dummy variables: alternative 2

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.127	0.209	0.017	-0.069	5.375	0.96
	(-4.598)***	(2.205)**	(0.526)	(-1.866)*	(6.611)***	
Developing countries						
OLS Di	0.097	0.107	-0.017	-0.208		0.97
	(-2.987)***	(1.257)	(-0.289)	(-3.805)***		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%

Appendix

Table A1: Sources of information on advertising bans in individual countries

Argentina	Survey
Australia	TCCP; Acts of parliament
Austria	WHO Regional Office for Europe Tobacco Control Database
Bangladesh	Survey
Belgium	WHO Regional Office for Europe Tobacco Control Database
Canada	Survey
Chile	Pan American Health Organisation PATIOS Database; TCCP
China	Survey
Colombia	Pan American Health Organisation PATIOS Database; TCCP
Czech Republic	WHO Regional Office for Europe Tobacco Control Database
Denmark	WHO Regional Office for Europe Tobacco Control Database
Ecuador	Pan American Health Organisation PATIOS Database; TCCP
Eqypt	Survey
Finland	WHO Regional Office for Europe Tobacco Control Database
France	WHO Regional Office for Europe Tobacco Control Database
Gabon	TCCP; NATIONS
Germany	WHO Regional Office for Europe Tobacco Control Database
Greece	WHO Regional Office for Europe Tobacco Control Database
Guatemala	Pan American Health Organisation PATIOS Database; TCCP
Holland	WHO Regional Office for Europe Tobacco Control Database
Hungary	WHO Regional Office for Europe Tobacco Control Database
India	Survey
Indonesia	TCCP; NATIONS
Iran	TCCP; NATIONS; World Health Organisation (Undated)
Ireland	WHO Regional Office for Europe Tobacco Control Database
Israel	WHO Regional Office for Europe Tobacco Control Database
Italy	WHO Regional Office for Europe Tobacco Control Database
Kenya	TCCP; Acts of parliament
Malaysia	Survey
Mexico	Survey
New Zealand	Survey
Nigeria	TCCP; NATIONS
Norway	WHO Regional Office for Europe Tobacco Control Database
Pakistan	TCCP; NATIONS
Panama	Pan American Health Organisation PATIOS Database; TCCP
Paraguay	TCCP; Acts of parliament
Peru	Pan American Health Organisation PATIOS Database; TCCP
Poland	WHO Regional Office for Europe Tobacco Control Database
Portugal	WHO Regional Office for Europe Tobacco Control Database
Russia	WHO Regional Office for Europe Tobacco Control Database
Senegal	TCCP; NATIONS; Acts of parliament
South Africa	Survey
Spain	WHO Regional Office for Europe Tobacco Control Database
Sweden	WHO Regional Office for Europe Tobacco Control Database
Switzerland	WHO Regional Office for Europe Tobacco Control Database
Thailand	Survey
Tunisia	TCCP; Survey
Turkey	WHO Regional Office for Europe Tobacco Control Database
United Kingdom	WHO Regional Office for Europe Tobacco Control Database
United States	TCCP; NATIONS; Nelson (2003)
Uruguay	Survey

Note: The names and details of the persons surveyed are available on request from the author.

Tables and Figures

Table 1: Studies investigating the impact of advertising expenditure on tobacco consumption

Study	Country	Time Period
No significant effect of advertising		
Grabowski (1976)	United States	1956-1972
Schneider *et al* (1981)	United States	1930-1978
Yuclet and Kaynak (1984)	United States	1955-1979
Baltagi and Levin (1986)	United States	1963-1980
Johnson (1986)	Australia	1961-1986
Godfrey (1986)	United Kingdom	1956-1984
Hoffman (1987)	West Germany	1969-1979
McAuliffe (1988)	United States	1957-1985
Baltagi and Levin (1992)	United States	1963-1988
Wilcox and Vacker (1992)	United States	1991-1990
Duffy (1991)	United Kingdom	1971-1987
Franke (1994)	United States	1961-1990
Wilcox *et al* (1994)	South Korea	1988-1992
Duffy (1995)	United Kingdom	1963-1988
Goel and Morey (1995)	United States	1959-1982
Duffy (1996)	United Kingdom	1963-1992
Gallet (1999)	United States	1958-1971
Duffy (2003)	United Kingdom	1963-1996
Significant positive effect of advertising		
Fujii (1980)	United States	1929-1973
Witt and Pass (1981)	United Kingdom	1955-1975
Young (1983)	United States	1929-1973
Bishop and Yoo (1985)	United States	1954-1980
Radfar (1985)	United Kingdom	1965-1980
Leefland and Reuijl (1985)	West Germany	1960-1975
Abernethy and Teel (1986)	United States	1949-1981
Porter (1986)	United States	1947-1982
Chetwynd *et al* (1988)	New Zealand	1973-1985
Kao and Tremblay (1988)	United States	1953-1980
Harrison *et al* (1989)	New Zealand	1973-1985
Seldon and Doroodian (1989)	United States	1952-1984
Tegene (1991)	United States	1953-1985
Smee (1992)	United Kingdom	1960-1987
Valdes (1993)	Spain	1964-1988
Tremblay and Tremblay (1995)	United States	1955-1990
Bardsley and Olekalns (1999)	Australia	1963-1996

Source: Smee (1992), Saffer and Chaloupka (2000) and Nelson (2006).

Figure 1: High income countries (n=21)

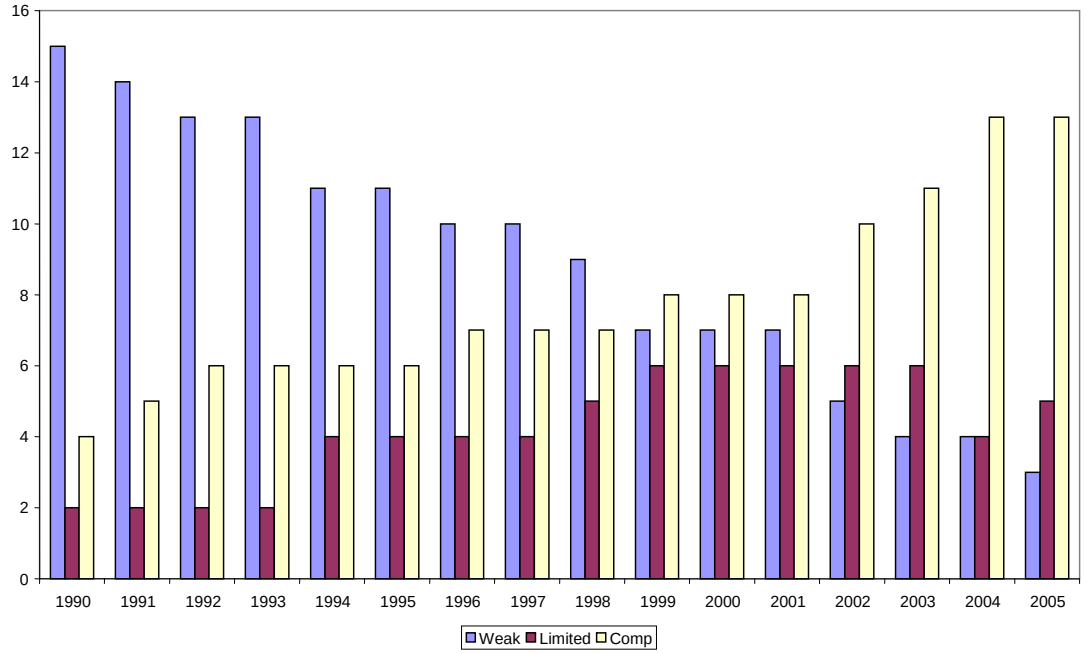

Figure 2: Developing countries (n=30)

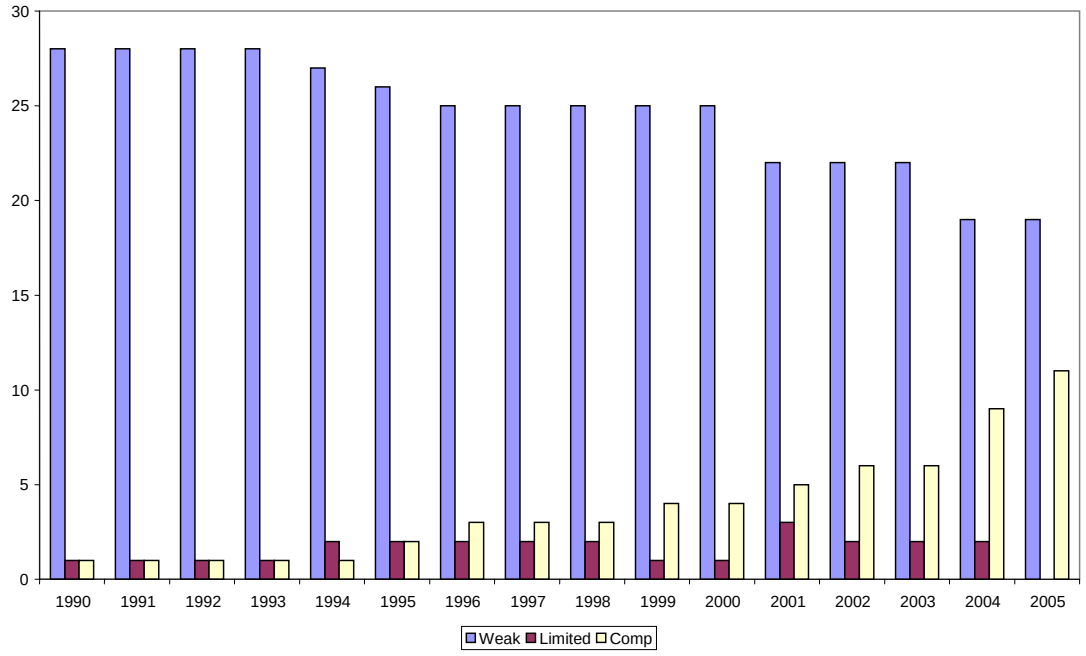

Figure 3: All countries (n=51)

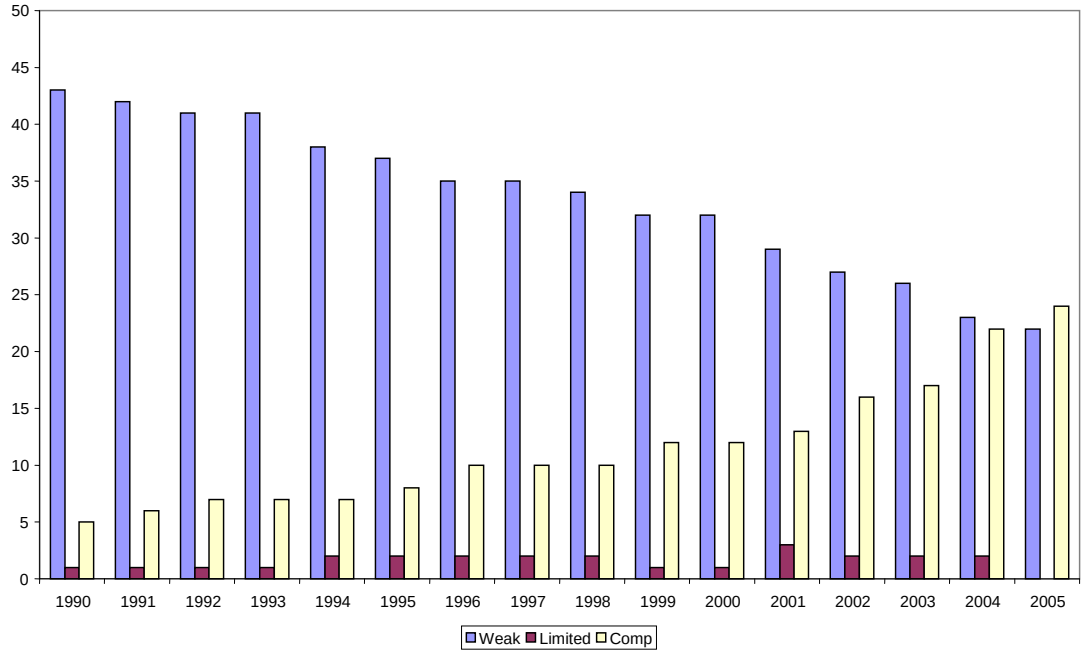

Figure 4: Average annual per capita consumption for developing and developed countries

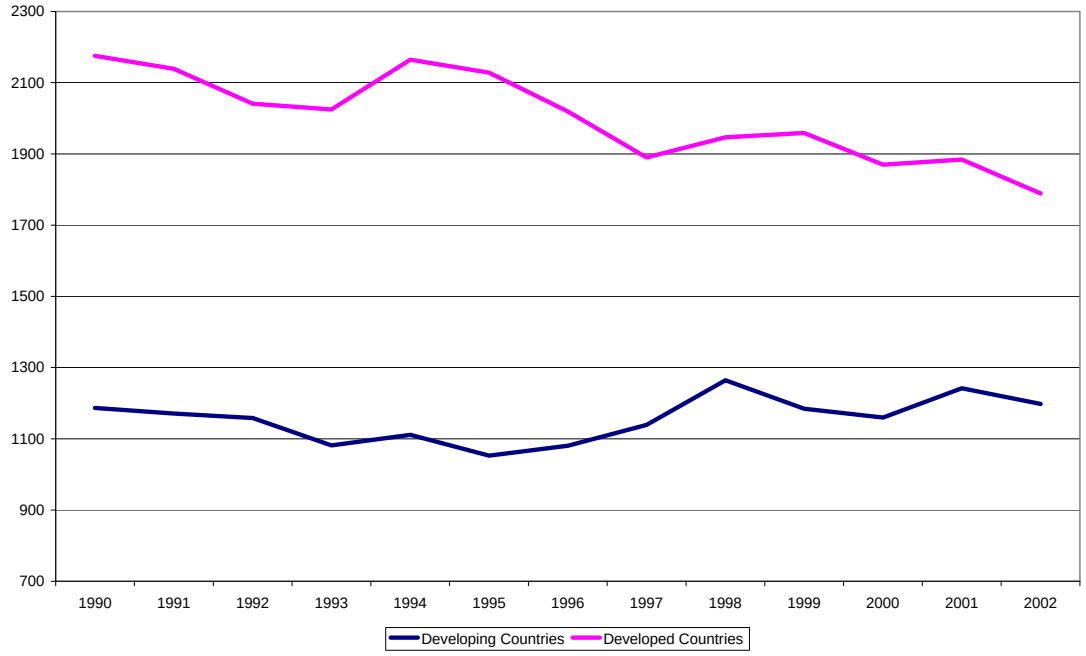

Figure 5: Average annual per capita consumption for countries which in 1990 had weak policies

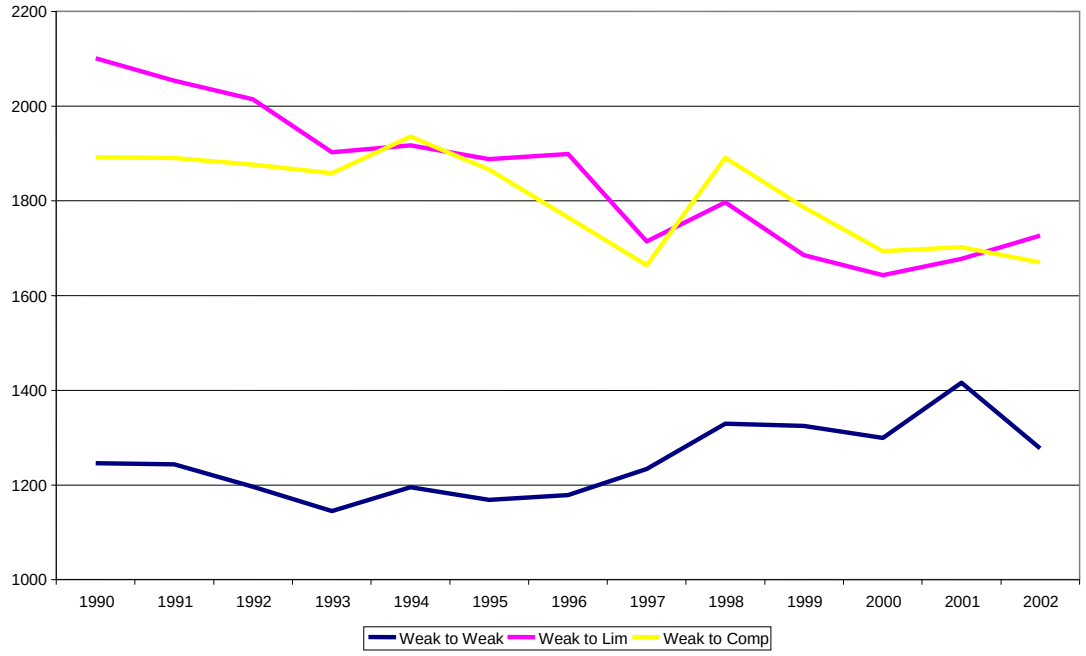

Figure 6: Average annual per capita consumption for developing countries with weak, limited and comprehensive policies in 2002

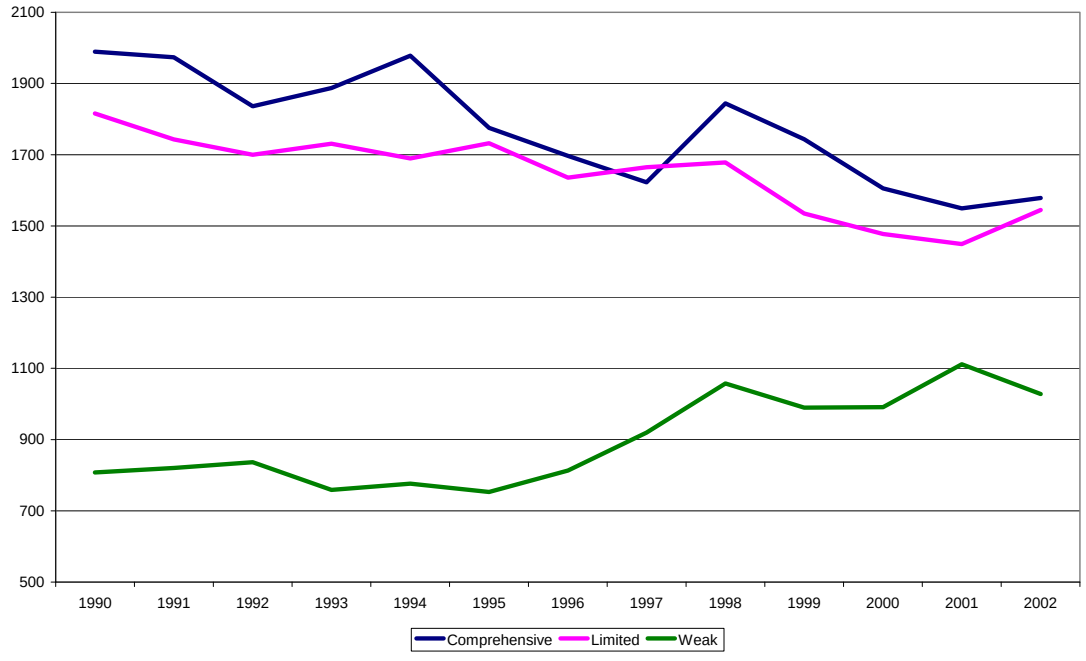

Table 2: Results of the econometric models

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.123	0.192	-0.026	-0.067	5.543	0.96
	(-4.512)***	(1.999)**	(-0.709)	(-1.830)*	(6.745)***	
Developing countries						
OLS Di	-0.099	0.086	-0.136	-0.235		0.97
	(-2.928)***	(1.040)	(-2.199)**	(-4.434)***		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%

Table 3: Summary of advertising ban dummies

	Weak	Limited	Comprehensive
Restricted alternative	0, 1, 2, 3	4, 5	6, 7
Saffer and Chaloupka (2000)	0, 1, 2	3, 4	5, 6, 7
Relaxed alternative	0, 1	2, 3	4, 5, 6, 7

Table 4: Sensitivity tests on advertising ban dummy variables: alternative 1

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.120	0.197	0.083	0.032	5.398	0.96
	(-4.419)***	(2.089)**	(2.181)**	(0.753)	(6.622)***	
Developing countries						
OLS Di	-0.091	0.069	0.203	0.029		0.96
	(-2.757)***	(0.842)	(3.430)***	(0.405)		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%

Table 5: Sensitivity tests on advertising ban dummy variables: alternative 2

Model	Ln *P*	Ln *Y*	*D(Lim)*	*D(Comp)*	Constant	R^2
All countries						
OLS Di & Dt	-0.127	0.209	0.017	-0.069	5.375	0.96
	(-4.598)***	(2.205)**	(0.526)	(-1.866)*	(6.611)***	
Developing countries						
OLS Di	0.097	0.107	-0.017	-0.208		0.97
	(-2.987)***	(1.257)	(-0.289)	(-3.805)***		

Notes: Asymptotic t-statistics in parenthesis. D_i and D_t represent country and time effects included in the model. Dependent variable is Ln *C*. *** significant at 1% ** significant at 5% * significant at 10%