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Original article

Advertising bans as a means of tobacco control policy: a systematic literature review of time-series analyses

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Summary

Objectives: This paper reviews the international literature that employed time-series analysis to evaluate the effects of advertising bans on aggregate consumption of cigarettes or tobacco.

Methods: A systematic search of the literature was conducted. Three groups of studies representing analyses of advertising bans in the USA, in other countries and in 22 OECD countries were defined. The estimated effects of advertising bans and their significance were analysed.

Results: 24 studies were identified. They used a wide array of explanatory variables, models, estimating methods and data sources. 18 studies found a negative effect of an advertising ban on aggregate consumption, but only ten of these studies found a significant effect. Two studies using data from 22 OECD countries suggested that partial bans would have little or no influence on aggregate consumption, whereas complete bans would significantly reduce consumption.

Conclusions: The results imply that advertising bans have a negative but sometimes only narrow impact on consumption. Complete bans let expect a higher effectiveness. Because of methodological restrictions of analysing advertising bans' effects by time series approaches, also different approaches should be used in the future.

Key words: **Cigarette advertising – Cigarette consumption – Tobacco – Advertising ban – Tobacco control policy.**

Health risks of cigarette smoking became public knowledge in the 1950s and 1960s (Jacobson et al. 1997). Governments across the world started curtailing tobacco consumption, taxing tobacco, prohibiting smoking in public, and banning tobacco product advertisements. Conflicts of interest make advertising bans very controversial. Therefore intensive controversies usually accompany the introduction of stricter regulations.

Advertising ban advocates come primarily from health lobby groups – physician, patient, or health promotion organisations (Hoek 1999). They assume tobacco advertisements increase consumption of tobacco products. Positive depictions of smoking would create in young people the desire to smoke. Likewise, constant advertising could keep smokers from quitting. Thus an advertising ban would reduce the number of consumers and the negative consequences of smoking for individuals and for society, which suffers from the economic damage of illness and absence from work (compare for Germany (Welte et al. 2000).

Juxtaposed to these are the interests of advertising agencies, the media, and the tobacco industry. According to these groups, advertising distributes market shares among competitors and does not increase aggregate consumption (Wilcox & Vacker 1992; Johnson 1986). Advertising, they contend, is important for informing consumers about market developments (new filters, light cigarettes) and helping potential competitors to enter the market. Thus advertising bans cannot decrease consumption. If the tobacco industry had to cancel several billion Dollars (Federal Trade Commission 2005) annually for advertising and promotion, jobs would be threatened, and the printed media, movie theatres, and international mass sports events would experience severe problems.

In various countries tobacco advertising restrictions have been in effect for years. The United States Congress passed the Cigarette Smoking Act of 1969 banning cigarette advertising from television and radio beginning in 1971 (Jacobson et al. 1997). In Europe, the United Kingdom was among the first countries to restrict tobacco advertising, banning it from the electronic media in 1965 (Witt & Pass 1983). Norway and Finland even enacted complete bans as early as 1975 and 1977, respectively (Rimpela et al. 1993). Today many countries in the European Union (EU) have already complete bans on tobacco advertising (World Health Organization Regional Office for Europe 2004). In May 2003 the EU directive 2003/33/EG mandated the compatibility of laws within the EU (European Parliament and Counsel 2003), requiring a member-wide introduction of comprehensive advertising bans by the summer of 2005.

In the past forty years studies have tried to determine if advertising bans influence aggregate tobacco or cigarette consumption in different countries. Most of these studies use econometric analyses. Their basic principle is the development of an economic model representing the relationship between a dependent variable (aggregate consumption of cigarettes, usually operationalised as purchased cigarettes) and different explanatory variables (per capita income, cigarette price, advertising expenses, and advertising bans). In the model, aggregate consumption within a period results from the explanatory variables plus a margin of error (error term). A regression analysis permits calculation of coefficients for the explanatory variables. These coefficients show direction (positive or negative) and magnitude of the variables' influence and can be tested for significance.

Our review provides a survey of the existing studies in the international literature which used econometric methods to examine the effect of a tobacco advertising ban on aggregate consumption of cigarettes or tobacco. Compared with existing overviews of the literature, our review is more recent and tried to avoid a number of problematic aspects found in earlier surveys. It only considered studies *directly* analysing the effects of *advertising bans*. Bauer et al. (1998) primarily examined studies considering the effects of *advertising*; the examined studies then usually commented on a ban's effect via inference. It will be discussed later on why this is thought to be problematic. Duffy's (1996) survey considered only 15 advertising ban studies. In contrast to Lancaster & Lancaster (2003a), our review did not examine the *number* of significant and not significant regression coefficients of advertising bans in the various studies. Examining the number of coefficients brings up problems: studies with several coefficients receive greater influence than those with one coefficient only. Sometimes coefficients which the original authors rejected were evaluated by Lancaster & Lancaster. Furthermore their survey was criticized for not taking into account that most results labelled *not significant* contained negative coefficients (Franke & Andrews 2003; Lancaster & Lancaster 2003b).

Methods

Literature research

A systematic literature search was performed in the databases MEDLINE (Pubmed), EconLit and Business Source Premier (EBSCO) to uncover relevant works in international literature (as of March 2005). A search in MEDLINE, the largest medical database, used the following terms: (Smoking [MeSH] OR Tobacco [MeSH]) AND (Advertising [MeSH]). For the economic databases EconLit and Business Source Premier the following search strategy was used: AB (advertis* or market* or promotion) AND AB (ban or restriction or regulation or poli*) AND AB (smok* or tobacco or cigarette) AND AB (consumption or demand or prevalence or effect); Limits: 1993–2004; AB = in Abstract. A long list of titles resulted (Pubmed approx. 1 200, EBESCO approx. 260). Excluded from consideration were studies whose titles or abstracts clearly indicated that they did not use econometric analyses to estimate the effects of advertising bans. 42 remaining articles were analysed and their bibliographies searched for relevant articles. 39 titles resulted from the bibliography search. Altogether 81 articles were identified and subjected to our selection criteria.

Selection criteria

Articles fulfilling the following criteria were included in our review: first, they used an econometric time-series analysis. Second, they examined an advertising *ban's* effect on aggregate cigarette or tobacco consumption in one or more countries. Third, they estimated a coefficient for the advertising ban's effect. Fourth, they were available in the German library system. Criteria one disqualified 42 studies which did not use an econometric analysis. Nine studies did not meet criteria number two because they did not analyse an advertising *ban's* effect on aggregate consumption in one ore more countries. Three studies were excluded from consideration due to criteria number three: not estimating a coefficient for the advertising ban. Two studies were not available in the German library system. One article was not considered individually because its data was analysed by the same author again in a later study using the identical model. A list of the excluded studies can be requested from the authors.

Time-series analyses of advertising bans have no generally accepted standards of quality (Hoek 1999). This review consi-

Int J Public Health 52 (2007) 295–307

dered all types of models or methods of evaluation, in an attempt to register *all* time-series analyses of advertising bans' effects. Therefore studies fulfilling the selection criteria were included even if their quality had been long discussed and criticized by other authors, like Laugesen & Meads (1991).

Evaluation criteria

24 articles were evaluated.[1] The country-specific nature of advertising bans delineated three groups. 15 studies examined the effects of a 1971 television and radio advertising ban in the USA. Six articles analysed the effects of advertising bans in other countries. Group three summarized three studies using data from 22 OECD countries.

The advertising ban's effect on aggregate consumption was the basic evaluation criteria for the studies. They were classified by algebraic signs (positive – negative) and significance (significant – not significant) of the regression coefficients of the variables used to capture the advertising ban's effect. If various econometric models were used by one study, the classification was based on the model which the authors considered to be most suitable. A negative regression coefficient means a negative effect of the advertising ban on aggregate consumption. In other words, aggregate consumption is lower than it would have been without the advertising ban. Due to the complexity of the models, most authors refrained from interpreting the numerical values of the estimated coefficients in terms of magnitude of consumption change resulting from the advertising ban. If reported by the authors, the magnitude of the ban's effect in terms of percentage change in aggregate consumption was considered in this review. Besides, the time frame, the explanatory and dependent variables, and some peculiarities of the calculations or of the results were itemized for comparison. The diversity of the selected studies made a meta-analytical evaluation impossible.

Results

Studies from the USA

In the United States the Surgeon General's 1964 report concluded cigarette smoke causes lung cancer. A 1966 law responding to this required warnings on cigarette packs (Blaine & Reed 1994). The Fairness Doctrine also resulted, requiring one anti-smoking announcement for every fifth tobacco industry advertisement on radio and television (Schneider et al. 1981). With the 1971 advertising ban for radio and television the Fairness Doctrine was rescinded. Many United States studies examined the influence of both, the advertising ban and other regulatory measures on aggregate consumption.

Five studies concluded that the advertising ban significantly decreased aggregate consumption (Blaine & Reed 1994; Doroodian & Seldon 1991; Gallet 1999; Goel & Morey 1995; Seldon & Boyd 1991). Seven studies found an insignificant reduction in aggregate consumption (Abernethy & Teel 1986; Bishop & Yoo 1985; Franke 1994; McAuliffe 1988; Porter 1986; Seldon & Doroodian 1989; Wilcox & Vacker 1992). One study with insignificant results did not indicate the direction of change in aggregate consumption (Fujii 1980), and two studies found an insignificant rise in aggregate consumption (Schneider et al. 1981; Kao & Tremblay 1988).

Table 1 summarizes the individual studies. Unusual features of the econometric models and differences in the dependent and independent variables are presented. The explanatory variables show that almost all authors took into account the price of cigarettes, income (except Abernethy & Teel 1896), and advertising expenses (except Blaine & Reed 1994). In addition, many different variables were used: the share of filter and low tar cigarettes in actual cigarette consumption, tobacco content per cigarette, the previous year's consumption, the previous year's advertising expenses, introduction of warning labels, the population's age structure, the price of alcohol, and various other health relevant factors. Some authors estimated the magnitude of the advertising ban's effect, which varies considerably between these studies: Blaine & Reed (1994) estimated aggregate consumption in 1992 to be 3–4 % lower than it would have been without the advertising ban. On the other hand, Schneider et al. (1981) estimated the effect of the advertising ban to be an increase in consumption of 4.9 % (not significant).

Studies from other countries

Three studies from other countries examined the 1976 Australian television advertising ban for tobacco products (Bardsley & Olekans 1999; Johnson 1988; McLeod 1986). Two Australian studies found aggregate consumption narrowly decreased after the introduction of the advertising ban, but this was significant only in one study (Table 2).

Finland completely banned advertising in 1977. Pekurinen (1989) examined its effects in an econometric study. He found the advertising ban to have had a significant negative effect on aggregate consumption which he estimated to be 7 % lower than it would have been without the ban. However, this cannot be definitively attributed to the advertising ban because of other concurrently introduced tobacco regulations.

Great Britain banned tobacco advertising in 1965. This ban was found to insignificantly decrease aggregate consumption

[1] 6 of the 24 articles contained mention of financial support. Only public contributors and organizations were named. None of the studies considered contained an explicit reference to support from the tobacco industry.

Int J Public Health 52 (2007) 295–307

Table 1 Studies on the ban of tobacco advertising on television and radio in the USA in 1971

Study results	Authors	Time period researched	Dependent variables	Further results and comments	Size of influence of the ban (percentage change in aggregate consumption)	Explanatory variables
The advertising ban had a significant negative impact[a] on aggregate consumption	Blaine & Reed (1994)	1946–1992	Aggregate cigarette consumption	A dummy variable with increasing value was used. This should document an increasing effect of the advertising ban.	The influence of the variable connected with the advertising ban was estimated at 3–4% of aggregate consumption in 1992.	price, income[b], age structure, proportion of filter cigarettes, proportion of low tar cigarettes, aggregate consumption of previous year, health warning (1954), Surgeon General Report (1964), advertising ban
	Doroodian & Seldon (1991)	1952–1984	Aggregate cigarette consumption	Advertising caused an increase in aggregate consumption (until 1963). In the applied model, the advertising ban (and the other health relevant events) influenced aggregate consumption by decreasing the positive effect of advertising on consumption.	No indication	price, income, advertising expenditures of the current and previous year, aggregate consumption of previous year, Surgeon General Report (1964), Fairness Doctrine, 2nd Surgeon General Report (1979), advertising ban
	Gallet (1999)	1958–1991	Aggregate cigarette consumption	Effects of the advertising ban on supply and demand were examined. Aggregate cigarette consumption decreased after introduction of the ban, although advertising did not significantly influence consumption[c]	No indication	price, income, advertising expenditures, Surgeon General Report (1964), advertising ban, advertising ban multiplied by elasticity of advertising
	Goel & Morey (1995)	1959–1989	Aggregate cigarette consumption	A long-term positive influence of advertising on aggregate consumption was determined. The study also examined the connections between tobacco and alcohol consumption.	No indication	price, income, advertising expenditures, alcohol price, advertising expenditures and consumption of the previous year, Fairness doctrine, advertising ban
	Seldon & Boyd (1991)	1953–1984	Aggregate cigarette consumption	A special model (Cooley-Prescott model) was used.	No indication	price, income, advertising expenditures, consumption of the previous year, Surgeon General Report (1964), Fairness doctrine, 2. Surgeon General Report (1979), advertising ban
The ban had an insignificant negative impact on consumption[d]	Abernethy & Teel (1986)[e]	1949–1981	Aggregate tobacco consumption	The authors noted that total advertising expenditures decreased initially after the ban. But expenditures for printed advertising increased strongly.	No indication	price, advertising expenditures, aggregate consumption of previous year, Fairness Doctrine, cigarette pack warnings (1965–1969 und 1970–1985) , advertising ban

Table 1 Continued

Study results	Authors	Time period researched	Dependent variables	Further results and comments	Size of influence of the ban (percentage change in aggregate consumption)	Explanatory variables
	Bishop & Yoo (1985)[f]	1954–1980	Aggregate tobacco consumption	Supply and demand were examined. The advertising ban was figured into the supply side of calculations. Advertising expenditures between 1970 and 1980 increased by 200 %.	The advertising ban could have led to a very narrow decrease in aggregate consumption.	Supply equation: retail price, production price, tax per cigarette, advertising ban Demand equation: price, income, advertising expenses, Surgeon General Report (1964)
	Franke (1994)	1961–1990	Aggregate cigarette consumption	Quarterly figures were used to find temporary changes. Advertising brought no increase in aggregate consumption. Non-smoking messages had a negative effect on aggregate consumption.	No indication	price, income, advertising expenses, consumption of the previous year, Surgeon General Report (1964), Fairness Doctrine, Time of the year, advertising ban.
	McAuliffe (1988)	1957–1985	Aggregate cigarette consumption, but inclusion of change in tobacco amount per cigarette.	As in many other studies, it was also pointed out here that advertising bans make it difficult for new competitors to enter the US market.	No indication	price, income, advertising expenses, tobacco per cigarette, Surgeon General Report (1964), Fairness Doctrine, advertising ban
	Porter (1986)	1947–1982	Aggregate cigarette and tobacco consumption	No direct negative effect of the advertising ban was found. The study also considered additional indirect consequences, e.g. for the effectiveness of advertising, the amount of advertising expenses, the price of cigarettes and additional consequences for consumption.	The advertising ban was estimated to have led to a net decrease in aggregate consumption of 3 %. (Resulting from the decrease in advertising expenses after the 1971 ban, removing the effect of the discontinuation of the Fairness Doctrine.)	price, income, advertising expenses, cigarette tax, tobacco per cigarette, proportion of filter cigarettes, proportion of low tar cigarettes, health risk warning (1953), Surgeon General Report (1964), Fairness Doctrine, advertising ban
	Seldon & Doroodian (1989)	1952–1984	Aggregate cigarette consumption	Advertising increases aggregate consumption, and an advertising ban causes a decrease in advertising expenses of companies.	No indication	price, income, advertising expenses, consumption of previous year, Surgeon General Report (1964), Fairness Doctrine, 2. Surgeon General Report (1979), advertising ban
	Wilcox & Vacker (1992)	1961–1990	Aggregate cigarette consumption	Quarterly figures were used. Only cigarette price and per capita income had a significant influence on aggregate consumption.	No indication	price, income, advertising expenses, age structure, seasonal variables, three variables for different health risk warnings, Surgeon General Report (1964), Fairness Doctrine, advertising ban

Int J Public Health 52 (2007) 295–307

Table 1 Continued

Study results	Authors	Time period researched	Dependent variables	Further results and comments	Size of influence of the ban (percentage change in aggregate consumption)	Explanatory variables
The ban had no significant impact on consumption. No indication of signs.	Fujii (1980)	1929–1973	Aggregate cigarette consumption	The consequences of the advertising ban were not described in depth. It was only mentioned that the ban variable was not significant and thus removed from the equation	No indication	price, income, advertising expenses, consumption of previous year, health risk warning (1954), Surgeon General Report (1964), Fairness Doctrine, advertising ban
The ban had an insignificant positive impact on consumption.	Schneider et al. (1981)	1930–1978	Aggregate tobacco and cigarette consumption	Several model calculations were executed[g]. Possible consequences of an advertising ban for the effectiveness of advertising and the price of cigarettes were analysed. The ban did not significantly change the effectiveness of advertising. The observed increase in consumption was ascribed to the discontinuation of the Fairness Doctrine.	An increase in aggregate tobacco consumption of 4.9 % was considered a consequence of the abrogation of the anti-smoking Fairness Doctrine. An additional increase could also come from a lower cigarette price after the ban.	price, income, advertising expenses, advertising from previous year, proportion of low tar cigarettes, proportion of filter cigarettes, tobacco per cigarette, health risk warning (1954), Surgeon General Report (1964), Fairness Doctrine, advertising ban
	Kao & Tremblay (1988)[h]	1954–1980	Aggregate cigarette consumption and tobacco consumed as cigarettes	The authors pointed out that the cigarette market is highly concentrated. Thus they considered cigarette companies to be price fixers and criticized Bishop & Yoo's study. Supply functions cannot be defined unambiguously for such a market.	No indication	price, income, advertising expenses, consumption of previous year, Surgeon General Report (1964), Fairness Doctrine, advertising ban

[a]Significance according to the author ($p < 0.001$, $p < 0.05$ or $p < 0.1$).

[b]Income, price and advertising expenses were converted into real values by different methods; Income was always measured per capita; advertising expenses were also often measured per capita.

[c]The author explains this surprising conclusion with the claim that the advertising ban could have led to a stronger public awareness of the consequences of smoking.

[d]Not significant according to the author ($p > 0.1$).

[e]The results of the linear model and the conclusions of the author lead to classifying the study in this group. In a similarly estimated logarithmically transformed model a non-significant positive coefficient of the advertising ban was found.

[f]The authors estimated several models in which they found a negative but usually insignificant influence.

[g]A more simple model forecasting a significant negative influence of the advertising ban on aggregate consumption was rejected by the authors as falsely specified.

[h]The authors estimated four models; in all four models a positive influence of the ban was determined, being significant only once though.

Table 2 Studies from other countries on tobacco asvertising bans

Country, advertising ban considered, date of introduction	Author	Time period studied	Dependent	Results and comments[a]	Explanatory variables
Australia, advertising ban for television and radio, 1976	Bardsley & Olekans (1999)	1962/63–1995/96	Aggregate tobacco consumption	The advertising ban had a negative but not significant influence on consumption. Advertising had a narrow consumption boosting effect (until the complete ban in 1993).	price, income, advertising expenses, consumption of previous year, advertising of competitors, age structure of the population, smoking ban at work, warnings, advertising ban
	Johnson (1988)[b]	1961–1986	Aggregate cigarette consumption	The advertising ban did not significantly change consumption (no indication of a sign). Advertising in itself did not significantly influence consumption.	price, income, consumption of previous year, Variables for each year after introduction of the advertising ban
	McLeod (1986)	1953–1983	Aggregate tobacco and cigarette consumption	Tobacco consumption was significantly negatively influenced (from –1 % to –5 %) in most of the years after introduction of the ban. Cigarette consumption was significantly reduced (–5 % to –6 %) in the year after introducing the ban.[c]	As with Johnson (1988)
Finland, advertising ban for all media, 1977	Pekurinen (1989)	1960–1987	Aggregate tobacco and cigarette consumption	The advertising ban was not considered alone. The tobacco control measures influenced consumption after 1977 significantly and negatively (–7 %).[d]	price, income, consumption of previous year, price of the previous year, income of previous year, advertising of competitors (1964), smoking ban, sale limits (1976), advertising ban (1977)
Great Britain, advertising ban for television, 1965	Witt & Pass (1983)	1955–1975	Aggregate cigarette consumption	The advertising ban did not significantly influence consumption.[e] There were no restrictions keeping tobacco companies from moving their advertising to other media.	price, income, advertising expenses, three health risk warnings (1962, 1964 and 1971), advertising ban
Spain, advertising ban for television and radio (until 9:30 p.m.), 1978	Valdés (1993)	1964–1988	Aggregate cigarette consumption	The advertising ban had a significant negative influence. On the other hand, the author indicated that (based on the very low elasticity of advertising) the influence was only very narrow. During the time frame of the study Spain had a state-controlled cigarette monopoly.	price, income, advertising expenses, consumption of previous year, changes in product quality following the advertising ban (1979), two further tobacco monitoring measures (1982 and 1988), advertising ban

[a]Significance according to the author.

[b]There is a further study by Johnson (1986; Dates from 1961–1983), which also found no significant influence of the advertising ban on consumption (Johnson 1988).

[c]The author explains this with the decreasing tobacco content per cigarette over the course of time.

[d]Due to the non-isolated examination, the significance for the effectiveness of advertising bans in general is only narrow.

[e]The evaluated coefficients are positive or negative, depending on the model.

Int J Public Health 52 (2007) 295–307

Table 3 Studies with data from 22 OECD countries[a] on tobacco advertising bans

Author	Time period	Dependent variables	Measuring the intensity of the bans	Results and comments[b]	Explanatory variables
Laugesen & Meads (1991)	1960–1986	Sold tobacco products	The intensity of the bans in the individual countries was measured on a point scale of 0–10. Health risk warnings also counted as points.	For the time period from 1960 to 1971 aggregate consumption experienced either positive or no influence from the amount of advertising limitations. In this time period international advertising limitations were still narrow. Increasing intensity of restrictions produced a negative influence on consumption. From 1973 on there was already a significantly negative elasticity of advertising bans which continued to increase. If all countries not having a comprehensive advertising ban had introduced one in 1986, aggregate consumption would have decreased by 6.8%.	price, income, age structure, proportion of female in working population, proportion of mass-produced cigarettes, intensity of the advertising ban
Stewart (1993)	1964–1990	Aggregate tobacco consumption	A distinction was made only between an existing ban and no ban.	For a given year in a given country with an advertising ban, consumption was estimated to be not significantly higher (3.8%) than in a country with no ban. The author explained this surprising result by pointing out that advertising bans always cause the disappearance of health risk warnings which – prior to a ban – appear together with the advertising.	price, income, age structure, unemployment rate, proportion of females in the working population, one country variable, one variable for each country's different time variable, advertising ban
Saffer & Chaloupka (2000)	1970–1992	Aggregate tobacco and cigarette consumption	Distinctions were made between a weak ban (also including no ban at all), a limited ban, and a comprehensive ban.	The authors determined that limited advertising bans not avoiding a compensatory increase of advertising in other media only have a narrow impact on consumption. Comprehensive advertising bans, however, which limit the possibilities of compensation for the tobacco industry, have a significant negative influence on consumption. If all OECD countries would introduce comprehensive advertising bans, decreases in consumption of 5.4% for tobacco and 7.4% for cigarettes might result. The authors came to these results only when limiting their analysis to the years 1984–1992. During this time period, in which several countries had comprehensive bans, advertising bans always had negative coefficients. While coefficients were always significant with comprehensive advertising bans, they were always not significant with limited advertising bans.	Price, income, proportion of filter cigarettes, unemployment rate, time variable, country variable, intensity of the advertising ban

[a]The available data for each country and for each year were summarized in all three studies with one regression model per study.

[b]Significance according to the author.

Int J Public Health 52 (2007) 295–307

(Witt & Pass 1983). A study analysing the 1979 Spanish ban for television advertising (Valdés 1993) could find a significant yet narrow negative influence on aggregate consumption.

Studies with data from 22 OECD countries

The studies in Table 3 examined advertising ban effects in several countries. Their regression models included data from 22 OECD countries evaluating influences on aggregate consumption internationally in the course of time. Two studies distinguished between the intensity of advertising bans in individual countries, concluding that comprehensive advertising bans usually significantly decreased aggregate consumption, while limited bans did not significantly influence aggregate consumption (Laugesen & Meads 1991; Saffer & Chaloupka 2000). Laugesen & Meads placed the influence of comprehensive bans on aggregate consumption at –6.8 %, and Saffer & Chaloupka at –5.4 % and –7.4 % for tobacco and cigarette consumption, respectively.

The third study did not consider the advertising ban's intensity as an explanatory variable, and found aggregate consumption in countries with bans to be 3.8 % (insignificant) higher than in countries without bans (Stewart 1993).

In summary: Ten of the 24 studies evaluated found an advertising ban significantly and negatively influencing aggregate consumption. Eight further studies found an insignificant and in some cases rather negligible negative effect of an advertising ban. Three studies either did not comment on the direction of the influence or were undetermined. Only three studies reported an insignificant positive effect of an advertising ban on aggregate consumption. The individual studies' authors usually considered an insignificant effect of an advertising ban to be no effect.

Discussion

Similar to previous surveys of the international literature, our review included studies that reported contradictory results, although many of the evaluated studies found significantly negative effects of advertising bans on aggregate consumption of tobacco or cigarettes. An interpretation of the variation in results requires critical evaluation of the methods of econometric analysis in general as well as discussion of specific problems of individual studies.

Methodical problems of econometric analysis

Econometric analyses reach their limits when they try to assign quantitative values to qualitative variables, such as recording the intensity of advertising bans on a point-scale or measuring advertising through advertising expenditures (Chapman 1989). Measuring the influence of advertising via aggregate advertising expenditures is problematic because the varying effectiveness of individual advertising events (television or print media) is ignored. Furthermore, expenditures for cigarette advertising do not capture the effect of indirect advertising by spreading the brand through non-tobacco product lines, for example, by fashion items such as "Camel boots," or "Marlboro Classics casual clothing". The difficulty of quantifying qualitative factors also arises when trying to operationalise cultural factors or attitudes towards smoking (Chapman 1989). Some of the evaluated studies tried to control for such factors by using time trend or country variables in their econometric models.

Analysis of advertising bans is further complicated since the tobacco industry usually does not publish its figures for advertising expenditures, explaining the nature of discussions on data used in studies (see Stewart's (1992) critique of Laugesen & Meads 1991). Saffer & Chaloupka (2000) attempted to avoid this by using several data pools for their analysis.

The explanatory power of econometric analyses can be limited when examining the effects of advertising bans in a complex environment. Most models incorporated their advertising ban as dummy variables valued "0" during the time period without an advertising ban and "1" during the years with ban. Thus the variables of advertising bans simultaneously measured various changes influencing aggregate consumption from the first year of the ban, like changes in advertising budget structures, anticipatory and delayed effects in the reactions on supply and demand sides and other newly introduced tobacco control measures. The neglect of such confounders could cause the effects of advertising bans to be over- or underestimated.

Looking at the way advertising bans take effect and the time frame this effect needs, Hoek (1999) categorically questioned whether it is possible at all to analyse advertising bans using econometric analyses. Econometric analyses assume an existing correlation between smoking and advertising that should result in sudden changes of consumption habits. Hoek argued that advertising cannot be viewed as the catalyst for consumption, according to theories of advertising and psychology. Behaviour theory would view advertising as a booster whose removal can only affect consumption in the long run, possibly after a change of the cultural attitude towards smoking. Only a few studies included in this review consider such time-delayed effects (Blaine & Reed 1994; Johnson 1988). These methodological problems underscore the difficulty of a comparative interpretation of contradictory results from a wide array of studies.

Problems of studies from the USA

The 15 studies examining the US radio and television advertising ban came to different conclusions. They used differing methods, explanatory variables, linear, logarithmic or double logarithmic models, varying estimating methods (ordinary least squares, two stage least squares, three stage least squares), and different data material. These variations may explain the differing results. Here, only two different approaches to the inclusion of explanatory variables will be discussed to illustrate the complexity.

Discrepancies in results may be due to the way the advertising ban was included. Some studies evaluated the partial ban's effect via the ban's influence on advertising effectiveness (Doroodian & Seldon 1991; Schneider et al. 1981). Others (Porter 1986) even considered a decrease in advertising expenditures to be an effect of the ban. Most studies included advertising bans as simple dummy variables. However, these differences in dealing with advertising bans are not sufficient to explain the variety of results. For example, of the two studies measuring the impact of the ban via advertising effectiveness, one demonstrated a significant negative effect of the advertising ban (Doroodian & Seldon 1991), and the other found a positive effect, but here in the context of a substantially different time frame for the study (Schneider et al. 1981).

Another possible reason for contradictory results may be attributed to the way of considering the amount of tobacco consumed. Some studies processed the amount of tobacco consumed as a dependent variable, and others as an explanatory variable (tobacco content per cigarette), while others ignored amounts of tobacco. Schneider et al. (1981) and Porter (1986) have shown tobacco content per cigarette sharply decreasing since the mid 1950s. Yet, a strong increase in aggregate cigarette consumption accompanied this trend, possibly a compensatory reaction of smokers. During this time period smokers also changed from other forms of tobacco use to cigarette smoking. Both factors increased cigarette demand before 1970. Thus, a smaller rate of increase in aggregate cigarette consumption after 1972 could suggest that advertising bans negatively influenced aggregate consumption. The real reason would have been the previous increase in aggregate cigarette consumption (Schneider et al. 1981). Studies only considering cigarette demand without adjusting for the influence of tobacco content per cigarette could have overestimated the advertising ban's effect. Even though this – as Table 1 shows – might not be the main cause of variation in results, it still indicates the problems with using a simple dummy variable to catch an advertising ban's effect: many factors which may not seem to be important at first sight may influence aggregate cigarette consumption, thus leading to an incorrect conclusion of an advertising ban's effect.

Problems of studies from other countries

Most advertising bans in other countries were considered in only one study per country. One could think that different results come from different country-specific advertising bans. This is improbable, though, since all authors except Pekurinen (1989) (who examined a complete advertising ban) looked only at radio and television advertising bans. The authors used the same variety of models, estimating methods and explanatory variables as those from the USA. A direct comparison of results is likewise difficult. Studies from different countries also contain many additional influencing factors (cultural, political, social) which the authors did not include in their models (e. g. the transition from a dictatorship to a democracy occurred during the analysed time period of the Spanish study). Nevertheless, most authors, except Witt & Pass (1983) and Johnson (1988), found a negative influence of advertising bans on aggregate consumption. Only two studies found this influence to be significant. Of these only Pekurinen (1989), examining a complete advertising ban, found a relatively large influence on aggregate consumption (–7 %). This result from Finland needs a critical viewing, though, since the authors examined the advertising ban in a regression model with a dummy variable, making no distinction between the effect of the advertising ban and other concurrently introduced tobacco control policies.

In summary, the vast majority of studies examining radio and television advertising bans in the USA and other countries estimated negative effects of bans on aggregate consumption. But they were often insignificant or narrow. For a long time the literature has been discussing whether comprehensive advertising bans have a greater effect than limited bans (Laugesen & Meads 1991; Saffer & Chaloupka 2000). Two studies using data from several countries attempted an answer to this question.

Studies with data from several countries

Laugesen & Meads (1991) and Saffer & Chaloupka (2000) contended that limited advertising bans (on television and radio) have only narrow or no effect on aggregate consumption, while comprehensive advertising bans can decrease aggregate consumption considerably. They based their claims on diminishing marginal product, an economic phenomenon also valid in advertising. According to this line of reasoning, when advertising reaches a certain magnitude, each additional advertisement only marginally increases aggregate consumption. Thus, if advertising is reduced at this high level, only narrow decreases in aggregate consumption will result. A ban on television and radio, only touching a portion of tobacco advertising and preventing no compensatory increase in advertising in other media, would only narrowly affect aggregate consumption. However, a complete advertising ban would significantly

Int J Public Health 52 (2007) 295–307

reduce aggregate consumption. Their research with data from 22 OECD countries distinguishing between limited and comprehensive bans appeared to confirm this assertion. Yet Laugesen & Meads' study has been criticized strongly by Stewart (1992), above all. He questioned whether Laugesen & Meads gathered all relevant explanatory variables for aggregate consumption in 22 OECD countries and came to a correct result. Their model only considered price, income, age structure, and percentage of females in the work force, percentage of mass-produced cigarettes, and the intensity of the advertising ban. Saffer & Chaloupka (2000) tried to avoid the problem of missing explanatory variables by introducing additional country and time variables; thus controlling for cultural or chronological effects. However, also Saffer & Chaloupka ran into a point of criticism that was originally raised by Duffy (1996) on Laugesen & Meads' study. Saffer & Chaloupka and Laugesen & Meads could prove the expected larger effects of complete bans only when limiting their analysis to a later segment of the time-series they considered. Saffer & Chaloupka (2000) tried to explain this phenomenon by pointing out that the number of complete advertising bans was too small in the first years. However, since the intensity of the advertising bans figured into the calculations as an independent variable, the number of comprehensive advertising bans should have had no influence on the result of their evaluations, according to Duffy's line of reasoning. Unfortunately, neither Saffer & Chaloupka nor Duffy thought of Hoek's (1999) alleged long-term cultural mechanisms which would have been a possible explanation for time-delayed effects of advertising bans.

The third study using data from other countries did not differentiate according to the intensity of the advertising ban: Stewart's study (1993) even determined an insignificant positive influence of advertising bans on aggregate consumption. Stewart (1993) supposed that this surprising result was due to the discontinuation of obligatory health warnings in tobacco advertising, which had contributed to a smaller aggregate consumption before the introduction of the advertising ban. Still, since this study did not differentiate the intensity of the advertising bans, the result did not contradict the conjectured mechanism of Laugesen & Meads and Saffer & Chaloupka.

Alternative methodical approaches

The previously mentioned difficulties in analysing advertising bans' effects on aggregate consumption bring up the question of alternative methodical approaches.

The literature contains many studies analysing the effects of tobacco *advertising* (usually operationalised as advertising expenditures) on aggregate consumption. These studies then comment on the effectiveness of a ban via inference. Lancaster & Lancaster (2003a) summarized the studies following this approach. It is disputable, whether such an approach has advantages compared with a direct consideration of a ban's effects (Warner et al. 1986). Pollay et al. (1996) and Warner et al. (1986) indicated that such studies only examine the influence of changes in advertising expenditures on the current almost optimal level. Increased expenditures on this high level would not affect aggregate consumption significantly – the tobacco companies would otherwise increase their expenditures for advertising. Pollay therefore concluded that if these studies showed no large advertising elasticity in aggregate consumption, these results could not serve as evidence for ineffectiveness of comprehensive advertising bans.

Analyses of individuals present a very different methodical approach. For example, results of surveys of young people before and after introducing an advertising ban can be analysed (Fielding et al. 2004). This approach has the advantage of more directly examining the causal connection between advertising and smoking. It also bears the advantage of analysing the influence of advertising on individual subpopulations (young people or non-smokers) (Rigotti et al. 2005), which is especially relevant for the political assessment of an advertising ban. Future research on advertising bans' effectiveness could use such methods more often. Similarly, it would help to see more research in nations with comprehensive advertising bans. Only then more accurate knowledge on the short- and long-term effects of such comprehensive bans would be attained.

Conclusion

The results of advertising ban studies tend to show a negative but sometimes only narrow impact of bans on aggregate consumption of tobacco products; comprehensive bans should be able to reduce aggregate consumption more effectively. The problems discussed concerning time-series analysis on the advertising bans' effects must be considered when interpreting results. Future studies should also incorporate further analytical approaches such as surveys of important target groups.

Conflict of Interest

The authors declare that there is no conflict of interest according to the regulations of the International Committee of Medical journal Editors.

Zusammenfassung

Werbeverbote als Tabakkontrollmaßnahme:
Ein systematischer Literaturüberblick über Zeitreihenanalysen
Fragestellung: Werbeverbote für Tabakwaren sind eine häufig verwendete Tabakkontrollmaßnahme. Die vorliegende Arbeit gibt einen Überblick über die in der internationalen Literatur vorhandenen Zeitreihenanalysen zu den Auswirkungen von Werbeverboten auf den Zigaretten-/Tabakkonsum.
Methodik: In einer systematischen Literaturrecherche wurden Studien identifiziert, die mithilfe einer ökonometrischen Zeitreihenanalyse die Auswirkungen von Werbeverboten in einem oder mehreren Ländern auf den Gesamtkonsum von Zigaretten oder Tabak untersuchten. Die Studien wurden nach dem untersuchten Werbeverbot sowie der Art und der Signifikanz des Ergebnisses klassifiziert.
Ergebnisse: 24 Studien wurden identifiziert. Die Studien verwendeten unterschiedliche erklärende Variablen, Modelle, Schätzmethoden und unterschiedliches Datenmaterial. 15 Studien untersuchten die Auswirkungen eines Werbeverbots in den USA, sechs in anderen Ländern. Drei Studien analysierten Werbeverbote in 22 OECD Ländern. 18 Studien fanden einen negativen Einfluss von Werbeverboten auf den Zigaretten-/Tabakkonsum, der aber nur bei zehn Studien signifikant war. Der durch ein Werbeverbot bewirkte Rückgang des Zigarettenkonsums wurde auf bis zu 7 % geschätzt, meist aber geringer. Zwei Studien mit Daten aus 22 OECD Ländern kamen zu der Schlussfolgerung, dass umfassende Werbeverbote einen negativen Einfluss auf den Konsum haben, während eingeschränkte Werbeverbote den Konsum nicht wesentlich beeinflussen können.
Schlussfolgerungen: Die Ergebnisse der Zeitreihenanalysen weisen auf eine negative – wenn auch teilweise geringe – Auswirkung von Werbeverboten auf den Konsum von Tabakwaren hin. Umfassende Werbeverboten lassen eine stärkere Reduktion des Konsums erwarten. Wegen der methodischen Einschränkung der Analyse von Werbeverboten durch Zeitreihenuntersuchungen sollten künftig auch andere Analyseansätze herangezogen werden.

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