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## Smoking in Germany: Stylized Facts, Behavioral Models, and Health Policy

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Silja Göhlmann and Christoph M. Schmidt

# Smoking in Germany: Stylized Facts, Behavioral Models, and Health Policy

#64



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**Silja Göhlmann and Christoph M. Schmidt\***

## **Smoking in Germany: Stylized Facts, Behavioral Models, and Health Policy**

### Abstract

It is well known that smoking causes severe adverse health effects, and it seems evident that governments are justified or even obliged to implement measures of tobacco control to mitigate these effects. Yet, as this paper argues with a distinct focus on Germany, the three most important and still largely open questions in the design and implementation of economic and health policy are, whether government action is justified at all, what behavioral patterns this policy should try to alter, and whether the policy measures chosen indeed exert any substantial effects on the targeted outcomes. We conclude that the case for control measures aiming at the prevention of smoking initiation among adolescents is indeed strong, but also that their proper design would benefit from a better understanding of behavioral issues and that their empirical evaluation requires (non-experimental) study designs that facilitate the identification of causal effects.

JEL Classification: I11, I12, I18

Keywords: Tobacco, tobacco control, rational addiction

August 2008

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# 1 The Problem

There is hardly any dispute today that tobacco consumption impairs health and well-being and tends to reduce life time. Based on this fundamental insight, many observers conclude that the authorities should actively try to reduce tobacco consumption by implementing health information campaigns and regulations (Deutsches Krebsforschungszentrum, 2002). Yet, it is far from obvious, whether the state should interfere with any self-destructive decisions of its citizens. As long as all costs of self-destructive activities are fully internalized and smoking behavior reflects a rational trade-off between individual benefits and costs, the justification for intervention is missing. Moreover, it is unclear whether such measures indeed have the potential to alter smoking behavior. Even well-justified and carefully implemented measures might fail. The answers to these questions depend on informational and behavioral aspects of take-up, habit formation and exit.

Before these behavioral questions could be addressed, though, the first step would necessarily be a thorough assessment of magnitude and structure of the phenomenon. Undoubtedly, the death toll linked to tobacco consumption is remarkable. Yet, even a high number of smoking-related deaths is not very informative regarding the associated health burden. This burden would be quite low if the observed fatalities had occurred in close proximity to the actual death anyway, but for another reason. Epidemiological studies suggest that around one half of all individuals having smoked for many years die earlier because of the consequences of tobacco consumption and that on average smokers lose about 10 life years (Doll et al., 2004). On the one hand, given the strong correlation between smoking and other adverse health-related behaviors, it is difficult to isolate the impact of smoking. Consequently, the burden associated with smoking might be smaller. On the other hand, since a comprehensive assessment would also account for the external effects of smoking on the health and well-being of others, the true burden might even be more substantial.

The way in which modern societies organize their health and old-age insurance generates an additional channel through which smokers might burden others with the health consequences of smoking. This additional burden arises, since the treatment of smoking-related health conditions typically leads to high health expenditures. It might well turn out, though, that the net lifetime balance of contributions and expenditures favors non-smokers, if - on the average - smokers die early enough

to miss out on long spells of pension payments. Similarly, through tobacco taxes smokers contribute disproportionately to state income. It is hardly straightforward to assess the net balance of all these taxes and transfers.

In addition, the phenomenon has an important industrial facet. The tobacco multinationals tend to act as strong antagonists of the supporters of a stronger tobacco control, arguing that epidemiological assessments of the disease burden associated with smoking are exaggerated and that excessive control measures threaten jobs and economic prosperity. Their strong political influence is not only reflecting the high persistence of demand for their major product cigarettes and the continuing appeal of smoking to younger cohorts. It is also the oligopolistic structure of the tobacco industry which is conducive to retaining a strong political influence. Hence, a thorough analysis of the political possibilities to reduce tobacco consumption will have to address the structure of the tobacco industry.

Before this background, this paper discusses the current state of knowledge regarding the three most important questions in the design and implementation of economic and health policy concerning smoking, (i) whether government action is justified at all, (ii) what behavioral patterns this policy should try to alter, and (iii) whether the policy measures chosen indeed exert any substantial effects on the targeted outcomes. We conclude that the case for control measures aiming at the prevention of smoking initiation among adolescents is indeed strong, but also that their proper design would benefit from a better understanding of behavioral issues and that, by contrast to current practice, their empirical evaluation would require (non-experimental) study designs that facilitate the identification of causal effects.

The paper is structured as follows. The next section gives an overview of the demand for tobacco and also of the structure of the supply side as well as of regulations implemented in Germany. Section 3 reviews the existing literature concerning behavioral aspects of smoking. Section 4 summarizes the empirical evidence on the effectiveness of tobacco control measures. Finally, section 5 concludes.



## 2 Tobacco Consumption in Germany

### 2.1 The Demand Side

#### Smoking Prevalence

As in other developed economies, in Germany cigarettes are the most important variety of tobacco products. In 2005, €19.5 billion (81% of the total value of tobacco products sold) were spent on cigarettes, €3.7 billion (15.5%) on fine cut, €0.6 billion (3%) on cigars, and €0.1 billion (0.4%) on pipe tobacco (*Statistisches Jahrbuch für die Bundesrepublik Deutschland*, 2006). These numbers correspond to 95.8 billion cigarettes, 4 billion cigars, 33,200 tons of fine cut, and 804 tons of pipe tobacco. Figure 1 displays the development of per capita tobacco consumption in Germany from 1970 up to 2005 (*Statistisches Jahrbuch für die Bundesrepublik Deutschland, various editions, 1973-2005; Statistisches Jahrbuch der Deutschen Demokratischen Republik*, 1990). The number of cigarettes per capita in West Germany fluctuated around an almost constant trend of about 2000 cigarettes between 1970 and 1990, whereas per capita cigarette consumption in East Germany steadily increased from about 1,300 cigarettes in 1970 to about 1,850 cigarettes before German reunification in 1990.

In unified Germany, cigarette consumption underwent some remarkable changes. During the first years after reunification, per capita cigarette consumption sharply declined, but then fluctuated around a level of about 1,700 cigarettes up to 2003. Three subsequent tax increases of about 1 cent per cigarette, respectively, were enacted between 2002 and 2004. This obviously made cigarettes less attractive, as per capita cigarette consumption steeply declined to about 1,200 cigarettes in 2005. Since 1990, the consumption pattern of fine cut, whose tax is much lower than for cigarettes, has been exactly opposite to that of cigarettes.

Several surveys of individual consumers facilitate the analysis of the structure of tobacco consumption in Germany.<sup>1</sup> In our own analysis, we refer to the 1992, 1995,

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<sup>1</sup>The most important surveys are the Mikrozensus collected by the Federal Statistical Office of Germany, the National Health Survey compiled by the Robert-Koch Institute, the drug affinity studies carried out by the Federal Center for Health Education (BZgA), and the German Socio Economic Panel (GSOEP) provided by the DIW Berlin.

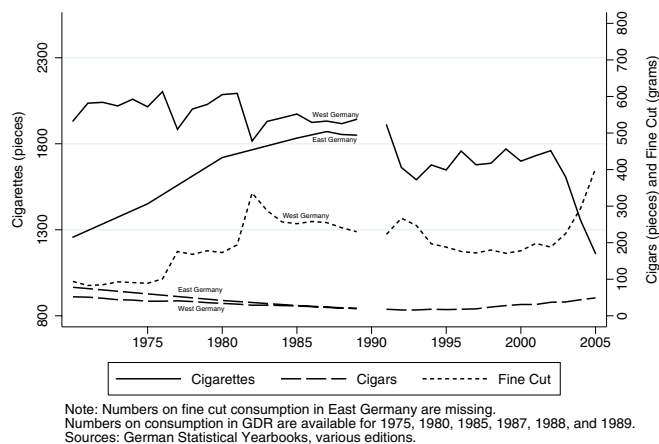


Figure 1: Per Capita Tobacco Consumption in Germany

1999 and 2003 cross-sections of the German Mikrozensus.<sup>2</sup> Overall, the percentage of female respondents who answered to smoke either occasionally or regularly remained almost constant between 1992 and 2003 at a level of about 22%. By contrast, smoking prevalence among males steadily decreased from about 37% to about 33%. Figures 2 (women) and 3 (men) document that there is a distinct age profile to smoking prevalence, with moderate (yet still disconcerting) smoking rates among adolescents, a peak at young adult age and a slow decline towards middle age, when smoking-related deaths are presumably already reducing the number of smokers faster than that of non-smokers. They are lowest in old-age, reflecting among other factors the relatively low life expectancy of smokers.<sup>3</sup>

<sup>2</sup>The Mikrozensus is a one percent random sample of all households in Germany with approximately 500,000 observations in each cross-section. For further information see German Social Science Infrastructure Services (n.d.). In all four waves there was a special voluntary questionnaire on health-related information administered to a sub-sample covering 0.5 percent of the population. Approximately 200,000 respondents answered these questionnaires in each wave.

<sup>3</sup>Ideally, this information on smoking prevalence should be supplemented by data on smoking intensity. The Mikrozensus does not comprise information on the exact number of cigarettes smoked. According to the National Health Surveys of 1990/1992 and 1998 the number of cigarettes smoked decreased for West-German smokers in almost all age groups (except those 60 to 69 years old) (Junge and Nagel, 1999), while no clear pattern emerges for East Germany.

For both men and women, in 2003, the observed smoking rate was the highest among individuals aged 20 to 24 (about 46% and 35%, respectively). A decade earlier smoking rates peaked in the 30 to 34 age bracket, though. One explanation for this phenomenon might be a different starting behavior: a comparison of the 1992 participation rates with the rates in 2003 reveals that smoking participation increased for youngsters in the age group 15 to 24 years<sup>4</sup> and decreased for all men and women aged 25 to 39. Moreover, while there was only little movement for men between 40 and 59, smoking rates for women in this age group increased, particularly among women between 45 and 59. This increase was particularly remarkable among East German women.<sup>5</sup>

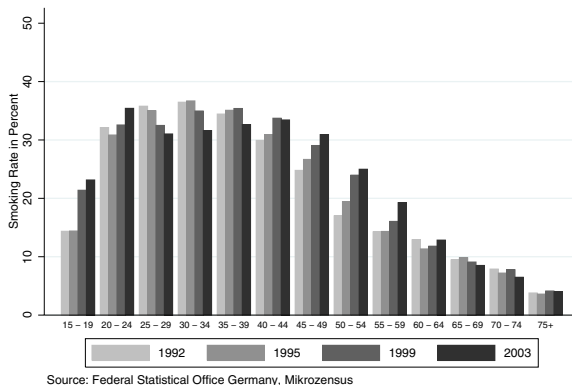


Figure 2: Smoking Rates by Age Group - Women

Quite obviously, three different factors interact in shaping these cross-sectional profiles. First, and perhaps most important, for all birth cohorts, there seems to be a

<sup>4</sup>A youth study of the BZgA concludes that smoking rates among the 16-19 years old individuals slightly increased between 1993 and 1997 from 43% to 47%, but decreased afterwards until it reached in 2003 again the level of 43%. It is unclear why the numbers of the BZgA are that much higher. Partly this might be due to the possibility of proxy interviews within the Mikrozensus given by parents for their children. However, it is unlikely that the bias from proxy interviews differed from wave to wave. The BZgA further concludes that among the 12-15 years old individuals the smoking participation rate increased from 11% in 1993 to 19% in 2001 and then decreased to 14% in 2003 (Christiansen and Töppich, 2006).

<sup>5</sup>As the 1992 Mikrozensus is not available as a scientific use file, a separate analysis of smoking rates for East and West Germans could be carried out only for 1995, 1999, and 2003.

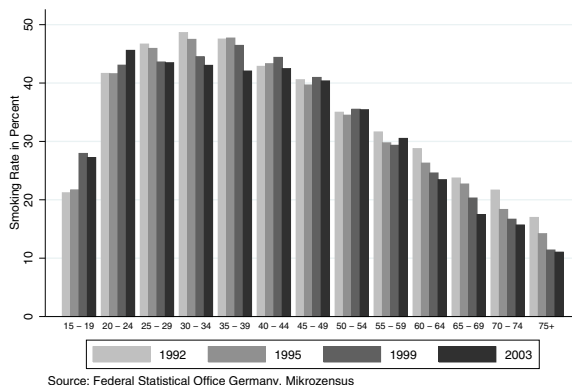


Figure 3: Smoking Rates by Age Group - Men

distinct profile of smoking prevalence across the life cycle. Children do not smoke, and therefore the number of smokers who recently started smoking dominate prevalence rates among adolescents and young adults. Not many people start smoking after their early twenties (see below), but some smokers give up on smoking as they become older. These patterns of initiation and cessation are likely to produce a single-peaked lifetime profile of smoking prevalence. Second, there seem to be general shifts to these patterns, due to variations in health consciousness, wealth, and perhaps tobacco control policies. Some shifts might persistently influence the behavior of a generation over their complete life cycle, presumably most importantly through a reduction of take-up rates in adolescence (cohort effects). Other factors might affect the take-up and exit behavior of (potential) smokers across all age groups simultaneously (period effects). These different effects are difficult to isolate empirically from one another, though.

### The Socioeconomic Gradient

The epidemiological analysis of smoking participation emphasizes a strong socioeconomic gradient to smoking behavior. Smokers are typically less educated, have lower income and are more often unemployed or on social security. For Germany see, e.g., Helmert et al. (1997), Helmert and Maschewsky-Schneider (1998), Helmert and Borgers (1998), Helmert (1999), Knopf et al. (1999), Helmert et al. (2001), Lampert

and Kroll (2005), or for multivariate analyses Lampert and Thamm (2004) and Göhlmann (2007b). The most obvious factor to look for is education. Göhlmann (2007b) concludes that the likelihood of being a smoker is 5 to 9 percentage points higher for women with only a basic school degree compared to women with a high school degree. Among men, this difference is even larger and amounts to about 10 to 15 percentage points.

In addition to education, other factors are strongly correlated with smoking rates. Specifically, the probability to smoke is 6 to 10 percentage points higher for unemployed women compared to women not participating in the labor market, whereas unemployed men exhibit a 9 to 17 percentage points higher probability. Comparing individuals with a monthly equivalent income of less than €1,000 with individuals having an income of more than €1,500 results indicate a difference in the probability of smoking of 3 to 9 percentage points among the less affluent. Finally, the probability to smoke is also substantially higher for divorced or widowed individuals, with a difference of 11 to 18 percentage points compared to married individuals. Göhlmann (2007b) also demonstrates that the demand for cigarettes conditional on being a smoker is larger among less educated, unemployed, and divorced respondents.

Although in the literature these factors are often called "social determinants" of smoking behavior, it is quite obvious that these correlations do not support a causal interpretation. It is certainly possible to tell a story illustrating a causal link from certain lifetime events to smoking initiation or cessation. It might well be, for instance, that the stressful event of a job loss leads some workers to take up smoking. Yet, both labor market success and smoking behavior are outcomes of complex behavioral processes at the individual level. Thus, they reflect other factors, such as patience, motivation, and self-restraint, which are not (easily) observable to the researcher.

Consequently, pinning down the causal effect of one outcome (e.g. unemployment) on the other (smoking) empirically is extremely difficult. These correlations are therefore hardly a reliable guide to policy recommendations. Nevertheless, they offer useful descriptive information, most interestingly on the strong correlation between education and smoking behavior. The crucial research question to be addressed by future research is, whether providing better education is a promising channel to

reduce the number of youngsters (or adults) who start smoking. This is far from obvious.

### **Smoking Initiation and Cessation**

Because of the the high persistence of tobacco consumption - individuals who seriously start smoking typically stay smokers for a long time - changes in the smoking rates of the total population over time reflect any substantial alteration in the starting behavior of successive cohorts. In Germany, the average starting age among ever-smokers decreased from cohort to cohort: among men the average declined from 17.6 for males born between 1950-1954 to 16.6 for males born between 1975-1979; among women it declined from 18.8 for females born between 1950-1954 to 16.5 for females born between 1975-1979 (Göhlmann, 2007a). Young adults (up to their early twenties) who did not start smoking before, typically do not take up smoking in later years. Less is known about the age structure of cessation rates.

Reflecting its high relevance for health policy, a growing literature investigates the correlates of individuals' take-up behavior. A sizeable number of these empirical analyses of starting behavior applies discrete choice models to micro-level data, where the dependent variable is a binary indicator for recent smoking participation among youths (see, e.g., Chaloupka and Grossman, 1996; Chaloupka and Wechsler, 1997; Tauras and Chaloupka, 1999b; Chaloupka and Pacula, 1999; Gruber and Zinman, 2000; DeCicca et al., 2002; Bantle and Haisken-DeNew, 2002). Typically, these studies only use characteristics (most importantly prices) as of survey time, while ideally, these determinants would be observed when the respondents were exposed to the temptation.

The second strand of this literature estimates duration models, where duration is defined as the time until an individual starts smoking (see, e.g., Douglas and Har-iharan, 1994; Jones, 1995; Douglas, 1998; Forster and Jones, 2001; Lopez-Nicolas, 2002; DeCicca et al., 2002; Madden, 2007). Typically, these studies do not control for socio-demographic characteristics at the time of take-up, and focus on the role of prices on the decision to start smoking. Based on data from the GSOEP, the results of Göhlmann (2007a) indicate that among adolescents those with higher education are less likely to start. Parental variables are highly correlated with take-up rates. Specifically, when parents smoke throughout the whole childhood, this significantly

increases their children's probability to start and tends to shorten time until starting smoking. The hazard of starting further decreases with income, whereas no robust effects are found regarding parental education and labor market status.

Early studies of smoking cessation estimated the probability to quit as a function of socio-demographic characteristics (see, e.g., Jones, 1994; Harris and Harris, 1996; Helmert et al., 1999). However, similar to studies regarding smoking initiation, these analyses also tend to suffer from the fact that socio-demographic characteristics are observed at the time of the survey and not at the time individuals decide to quit. More recent contributions usually employ duration models. Breslau and Peterson (1996) and Tauras and Chaloupka (1999a) estimate Cox hazard models, whereas van Ours (2006) estimates mixed proportional hazard models and Douglas (1998), Forster and Jones (2001), Lopez-Nicolas (2002), and Madden (2007) specify a range of parametric models like the Weibull and generalized gamma. Except the analysis of Tauras and Chaloupka (1999a), all of these contributions are based on a cross-section survey including retrospective information.

In a recent contribution, van Ours (2006) concludes that the earlier individuals start consuming a drug, the less likely they are to quit. Tauras and Chaloupka (1999a) find real prices to have a significantly positive effect on the hazard of quitting. While smoking bans have no significant effect on this hazard among males, there is a significant effect of a private workplace smoking ban on employed females. Furthermore, accounting for other correlates, among males the hazard decreases with age and it is higher among single males compared to males who are engaged or separated/divorced.

## 2.2 The Supply Side

With worldwide about 1.5 million employed workers and more than five trillion cigarettes produced per year the tobacco industry is an important economic and political force (Mackay et al., 2006). Approximately a third of the world market is held by China National Tobacco Corporation (CNTC), China's state monopolist. The world's next largest tobacco company is Altria, the parent company of Philip

Morris USA and Philip Morris International.<sup>6</sup> Its world market share was about 18% in 2003, followed by British American Tobacco (BAT) with 15%, Japan Tobacco Inc. (JTI) with 6%, Imperial Tobacco Group Limited (ITL) with 4% and, finally, Gallaher Group Plc with 3% market share. Over time, the industry is characterized by an increasing concentration process. In 2006, these companies generated profits of between 1 and 13 billion US dollars. These profits reflected return on sales between 7 and 42 percent (see Table 1).

Table 1: **Profit Numbers of Tobacco Companies in 2006**

	Profit from operations in billion US dollars	Return on sales*** in percent
Altria*	13.27	19.9
BAT	5.14**	26.9
Gallaher	1.29**	24.1
ITL	2.57**	41.5
JTI*	2.47**	6.8

Notes: \* Numbers for profit from operations and return on sales belong to the tobacco segment. \*\* Based on exchange rate at 03/21/2007. \*\*\* Calculated as 'profit from operations / revenues excluding excise taxes'.  
Sources: Annual reports.

In 2005 the German tobacco industry, comprising 23 tobacco (not only cigarette) manufacturing companies, employed about 12,000 workers and generated a revenue (excluding sales tax) of about €19.4 billion (2004: €22.2 billion). In total, the value of tobacco products sold amounted to €24 billion leading to tax revenues of about €14.4 billion, about 3.3% of all tax revenues of the Federal Government, the Länder, and municipalities (*Statistisches Jahrbuch für die Bundesrepublik Deutschland*, 2006). The amount the tobacco industry spent on advertising alone totaled about €180 million in 2005 (*Drogen- und Suchtbericht* 2007).

In 2005, Philip Morris GmbH, British American Tobacco Germany GmbH, Reemtsma Cigarettenfabriken GmbH, Gallaher Deutschland GmbH, and JT International Germany GmbH produced together 92% of all cigarettes sold in Germany (Table 2). Market leader was the Philip Morris GmbH, followed by BAT and Reemtsma (a company of the ITL). The high concentration of this industry is also reflected by the Herfindahl-Index. This index, defined as  $H = \sum_{i=1}^N p_i^2$ , where  $p_i$  is the market share of company  $i$  ( $i = 1, \dots, N$ ), amounts for the German tobacco

<sup>6</sup>In December 2005, Altria and CNTC reached an agreement that Altria is allowed to produce and sell their brand Marlboro in China.



industry to about 0.26. According to the US Antitrust Division of the US Department of Justice an index larger than 0.18 indicates a concentrated industry (US Department of Justice, n.d.). Up to 2007 the tobacco industry was represented by the "Verband der Cigarettenindustrie e.V." (VDC), a lobby group that represented the interests of all seven German cigarette manufacturers. However, after Philip Morris had announced in May 2007 to leave the association at the end of the year, in June 2007 the association decided its termination.

Table 2: **Overview of Tobacco Companies in Germany 2006**

Domestic Sales	Factories	Employment	Main Brands
<b>Philip Morris GmbH</b> 34,3Billions	Berlin, Munich, Dresden	2827	Marlboro, Philip Morris, L&M, f6, Next
<b>British American Tobacco Germany GmbH</b> 22,9Billions	Bayreuth	2067	Lucky Strike, Pall Mall, HB, Lord, Prince, Winfield, Gauloises Blondes, Dunhill
<b>Reemtsma Cigarettenfabriken GmbH</b> 19,5Billions	Berlin, Langenhagen	1853	West, Davidoff, John Player Special, Peter Stuyvesant, R1, Cabinet
<b>Gallaher Deutschland GmbH</b> 6,9Billions	-	36	Benson & Hedges, Nil, Ronson, Silk Cut
<b>JT International Germany GmbH</b> 2,9Billions	Trier	1470	Camel, Winston, Reyno, Club
<b>Tabak- und Cigarettenfabrik Heintz von Landewyck GmbH</b> 0,5Billions	Trier	279	Ducal, Afri-Filter, Elixyr, Tolerance
<b>Joh. Wilh. von Eicken GmbH</b> 0,4Billions	Lübeck, Dingelstädt	414	Burton, Manitou, Excite, Springwater

Source: Verband der Cigarettenindustrie (n.d.a)

## 2.3 Prices, Taxes and Regulations

### Prices and Taxes

Taxes are a major factor in the cigarette price paid by German smokers. Since the first oil crisis in 1973 the nominal price of cigarettes has steadily increased (Figure 4). However, the real price of cigarettes remained almost constant at its 1973 level up to 2001. From 1973 to 2005 the ratio of tax to retail price (i.e. gross price minus sales tax) fluctuated between 62% and 70%, with sharp increases in 1982 and 2002 (Figure 4).<sup>7</sup> Including sales tax, the total tax burden on a cigarette amounted to

<sup>7</sup>Sources: *Statistisches Jahrbuch für die Bundesrepublik Deutschland, various editions (1973-*

about 78% at the end of the year 2005. In addition to sales taxes, tobacco taxes comprise a quantity and a price component.<sup>8</sup>



Figure 4: Development of Cigarette Prices and Taxes in Germany

As with any other heavily taxed product, illegal activities are an important issue. Naturally, the current extent of cigarette smuggling can only be estimated. For 2006, the VDC estimates the percentage of cigarettes not taxed in Germany, compared to the total number of cigarettes consumed, to approximately 33.6% for East Germany (in 2005: 30.6%) and roughly 15.7% in West Germany (in 2005: 11.3%) (Verband der Cigarettenindustrie, n.d.b). The study of the VDC is based on the examination of about 12,000 disposed cigarette packs that were collected and analyzed with regard to their revenue stamps.

### Regulations - Advertising, Warnings, and Information

Reflecting the contrast between the information content of ads and public health concerns, the rigidity of advertising regulations has changed over time. In 1966 the tobacco industry has voluntarily committed itself to limit the size and density of posters and advertisements in newspapers and magazines.<sup>9</sup> Moreover, the industry

2005); *Fachserie 14, Reihe 9.1.1 and 9.1.2, Fachserie L, Reihe 8, various editions (1973-2006)* and German Tobacco Duty Law.

<sup>8</sup>Since September 2005 this tax for cigarettes has amounted to 8.27 Cent per piece and 25.29% of the retail price.

<sup>9</sup>Published in the 'Bundesanzeiger', no. 229, 12/07/1972. See also Verband der Cigarettenin-

agreed to different qualitative restrictions, in particular not to focus on youths, not to place advertisements in youth magazines, sporting venues, and in public transfer, and to display warnings and information on nicotine and tar values in press advertisements and posters. Since 1974 advertising in radio and tv has been forbidden by law.<sup>10</sup> Moreover, advertisements must not give the impression that the consumption of tobacco products positively affects health or that tobacco products are natural or pure.

In 1993 the tobacco industry extended its commitments, for instance not to distribute free samples in public.<sup>11</sup> In 2002 commercials for tobacco products in cinemas have become more restricted (§ 11V, JuSchG). In 2003 the European Parliament and the Council of Ministers passed a directive that prohibits advertisements in press media, other print media and information society services – with a few exceptions – as well as the sponsoring of broadcasting programmes and many events (directive 2003/33/EG). Finally, the "Verordnung über Tabakerzeugnisse" from 1977, that was amended in 1982 and 2002, stipulates that a particular health warning has to be added to tobacco products and that the nicotine and tar content has to be displayed on packs.

### **Regulations - Youth Access and Smoking Bans**

The purchase and consumption of tobacco products by youths is heavily restricted. German law<sup>12</sup> stipulates that children and youths under the age of 16 are not allowed to smoke in public. In addition, the "Jugendschutzgesetz (JuSchG)" from 2002 further stipulates that neither restaurants nor retail shops are permitted to give tobacco products to children or youths younger than 16 (§ 10). Moreover, cigarette vending machines may be installed only if they are inaccessible to individuals younger than 16. Since January 2007 vending machines have been adapted to request age proof by the buyer using her or his eurocheque card. It is obvious that young smokers will have an easy time circumventing these hurdles.

An increasing number of regulations bans smoking from public places and institutions. An overall smoking ban at schools was firstly implemented by the federal state Berlin in 2004 followed by Hessen half a year later. In 2004 the German

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dustrie (n.d.c).

<sup>10</sup>§ 22, Lebensmittel- und Bedarfsgegenständegesetz (LMBG).

<sup>11</sup>Published in 'Pressemitteilung Nr. 41, Bundesministerium für Gesundheit, 04/29/1993.

<sup>12</sup>§ 9 of the "Gesetz zum Schutz der Jugend in der Öffentlichkeit (JÖSchG)" from 1985.

government passed a law ("Verordnung über Arbeitsstätten") that places an obligation on employers to taking the necessary steps in order to protect non-smoking employees at their place of work against the health risk of tobacco smoke (§51). In addition, another law bans smoking in all public sector buildings of the Federal Government, in public transport (also taxis), and at train stations of the public railway ("Bundesnichtraucherschutzgesetz"). This law further stipulates that from September 2007 onwards the minimum age to smoke in public and to get tobacco products will be increased from 16 to 18 years. The states agreed in March 2007 to ban smoking without exception in public offices, in educational, cultural, and health institutions, public transport as well as discotheques. The majority of Land ministers agreed to allow smoking in restaurants only in separated rooms.

### 3 Behavioral Aspects

While it is advisable to accept the evidence that smoking causes severe adverse health effects, it is far from obvious that governments are justified or even obliged to implement measures of tobacco control to mitigate these effects. The economics literature has debated this issue heavily, with the main aspects being those of rationality and regret. There seems to be a particularly strong case for control measures aiming at the prevention smoking initiation among adolescents. Furthermore, it is unclear how to aggregate benefits and costs of smoking and of measures of tobacco control, as even the individual-level consequences of both seem difficult to capture. In addition, one needs to reflect on the issue of external effects on non-smokers. Finally, the proper design of policy measures requires a deep understanding of behavioral issues, such as the role of peer group effects. These are the issues addressed in this section of the paper.

#### 3.1 Information Processing and Addiction

Chaloupka and Warner (1999) point out that models explaining consumer decisions regarding addictive goods have only been developed quite recently. These models motivate individual addictive behavior through one of three routes: (i) imperfectly rational models, (ii) models of myopic addictive behavior (habit persistence), and (iii) models of rational addictive behavior. The idea of imperfectly rational models

is that individuals have stable but inconsistent short-run and long-run preferences (Chaloupka and Warner, 1999) or according to Thaler and Shefrin (1981) that individuals are at any time both "farsighted planner and myopic doer". In contrast, myopic models assume that individuals know about the dependence between past and current consumption of addictive goods, but do not consider the effect of past and current on future consumption when making decisions on current consumption (Pollak, 1975). Empirical studies estimating the effect of past consumption or prices on current consumption conclude that past and current consumption are complements, i.e. that smoking is an addictive behavior. For an overview of analyses regarding myopic models see, e.g., Chaloupka and Warner (1999).

The third category comprises models of rational addiction. The main idea is that individuals do not only consider the effect of past consumption but also of future consumption on current consumption. Nonetheless, rational addiction models also allow for a high discount rate of the considered effect of future consumption (Chaloupka and Warner, 1999). The key model within this category is the model of rational addiction suggested by Becker and Murphy (1988). In this model, every individual maximizes her or his utility consistently over time taking into account also future harmful consequences of their current decisions. Notwithstanding methodological differences in their study design, almost all studies testing the implications of the model of rational addiction empirically (see, e.g., Chaloupka, 1990, 1991, 1992; Keeler et al., 1993; Becker et al., 1994; Sung et al., 1994; Duffy, 1996; Labeaga, 1999; Baltagi and Griffin, 2001) support the rational addiction model. This would suggest that the fact that smokers impose enormous costs on themselves does not give a mandate for government action (Gruber, 2001).

Yet, the theory of rational addiction has been criticized because most smokers apparently regret having started smoking instead of being "happy addicts" (Orphanides and Zervos, 1995). As a consequence, several authors modified the rational addiction approach by (i) relaxing the assumption of perfect foresight (Orphanides and Zervos, 1995), (ii) implementing quitting costs, considering the fact that adverse health effects of smoking usually occur late in life and assuming bounded rationality of individuals (Suranovic et al., 1999), and (iii) allowing for endogenous time preferences (Becker and Mulligan, 1997) or time-inconsistent preferences (Gruber and Köszegi, 2001).

Orphanides and Zervos (1995) try to explain the phenomenon of regret by introducing uncertainty about the adverse effects of smoking. The main idea is that rational individuals start experimenting with smoking because they face uncertainty whether they will actually suffer from harmful effects of smoking or not. Some of those with a predisposition for addiction will learn about their addictive potential before they become addicted, but others will be "hooked" into addiction before they realize their addictive potential. The latter, thus, will regret their decision to have started smoking and their initial assessment of the potential harm of tobacco consumption. Within this model, addiction is indeed voluntary, but not intentional. In this context, Hammar and Johansson-Stenman (2004) conclude that smokers seem to underestimate the health risk of smoking.

In the model of Suranovic et al. (1999) regret arises because smokers are assumed to make choices only for the current moment. Thus, the individual is "boundedly rational" in the sense that she or he takes into account future consequences of her or his consumption decision, but heavily discounts future losses. After a while addiction emerges, leading to withdrawal costs, if smokers try to quit. Because of these adjustment costs, it might be optimal for a utility maximizing individual not to quit despite any regret about having started smoking, making him an unhappy addict. In that case, a government which succeeds in preventing young individuals from starting smoking will help them avoid a behavioral trap. Supporting this view, Yen and Jones (1996) find empirical evidence that withdrawal costs affect the decision of heavy smokers whether or not to quit.

Objecting to these approaches, Becker and Mulligan (1997) argue that time preference might itself be affected by addiction, i.e. individuals who became addicted might weight the future less because of their addiction. Similarly, Gruber and Köszegi (2001) argue that forward-looking individuals do not necessarily have time-consistent preferences. Their theoretical model extends the rational addiction model to time-inconsistent preferences. Time-inconsistent agents tend to use self-control devices to overcome their time-inconsistent tendencies. Whether individuals have time-consistent or time-inconsistent preferences has very different implications for governmental policy. Time-inconsistent individuals might even appreciate tax increases, because those could act as a self-control device helping them to quit smoking. Thus, there might be an argument for governmental interventions, in contrast to the standard rational addiction model. In support of this view Gruber and Mullainathan

(2002) conclude that both laboratory experiments and their own analysis indicate that consumers are indeed time-inconsistent.

### 3.2 Welfare Reflections

The question whether welfare considerations should include the "benefits" of smoking arising from reduced pension payments or reduced health care utilization at older ages because of premature death is a controversial issue. Manning et al. (1989) and Viscusi (1995), for example, conclude that the inclusion of these benefits make "smokers pay their way", i.e. they bear the external costs caused by their smoking behavior. However, this argument neither covers the health costs that arise because pregnant women harm their embryo nor may it adequately consider costs caused by second-hand smoking(Gruber, 2001). Available studies estimating the costs of smoking for Germany are based on the "prevalence approach", i.e. the costs comprise the present value associated with all existing cases of smoking-produced illness including future lost earnings because of premature death attributable to current deaths (Chaloupka and Warner, 1999). Welte et al. (2000) estimate the costs attributable to smoking in 1993 to about €17.3 billion, Ruff et al. (2000) to about €16.6 billion in 1996, and Neubauer et al. (2006) report an estimate of about €21.0 billion in 2003. For an overview of estimates for other countries see, e.g., Chaloupka and Warner (1999) or Warner et al. (1999).

### 3.3 Peer Group Effects

The behavior of adolescents is influenced by a variety of factors, ranging from genetic predisposition to the media. Most importantly, their parents and their friends both seem to exert decisive influences on youngsters' choices. Parents are typically the dominant point of reference in early life, while teachers and classmates join them in this role later on. The influence of peer groups, i.e. those youngsters who form the inner circle of friends and associates, might indeed be the most important factor in shaping smoking behavior. Yet, at a conceptual level the genuine nature of this influence is difficult to capture. While it is true that groups of similar people tend to behave in similar fashion, this might both reflect the behavioral homogeneity of the individuals joining these groups and the (causal) influence of the typical behavior in the group on individual choices. It is immediately clear that it will be most difficult

to disentangle these two mechanisms empirically.

In his seminal contribution, Manski (1993) even distinguishes three different effects. Individual behavior might reflect the characteristics of the individuals forming the peer group ("contextual effects"), it might be influenced by the prevalence of that behavior in the peer group ("endogenous effects") and, moreover, by factors common to the peer group, but unobserved by the researcher ("correlated effects"). These factors may have influenced selection into the group in the first place, or they might reflect common shocks. As Manski (1993) and, more recently, Krauth (2006) point out, simple reduced-form models where individual behavior is modeled as a function of observable individual characteristics as well as the average behavior within the peer group or, alternatively, the peer group average of background characteristics, fail to identify the endogenous peer group effect. Most specifically, what appears to be endogeneity might simply reflect unobserved heterogeneity at the group level.

To address this identification problem, one could exploit situations in which individuals are randomly assigned to groups (see, e.g., Sacerdote, 2001), hoping that these groups are not confronted with unobserved common shocks. As an alternative, Krauth (2006, forthcoming) suggests estimating endogenous effects by using a structural approach. Other studies utilize instrumental variables (Norton et al., 1998; Gaviria and Raphael, 2001; Powell et al., 2005). However, it is difficult to find any instrument that affects the behavior of the peer group but not own behavior. Furthermore, it is often difficult to identify the peer group. In the context of smoking initiation, this might be only close friends, but also youths going to the same school more generally. Typically these studies find significant endogenous peer effects. However, their estimated size is generally much smaller than the estimates of simple reduced-form models.

In contrast to the difficulties in measuring peer effects, the effect of paternal smoking on children's smoking behavior is easier to identify, since parental smoking behavior might be considered to be exogenous. Generally, studies of intergenerational transmission state that there exists a significant, positive correlation between parental and children's smoking behavior for Germany (see, e.g., Bantle and Haisken-DeNew, 2002; Tauchmann et al., 2006; Göhlmann, 2007a). This correlation does not tell us, whether the underlying behavioral channel of transmission is rather imitation or genetic disposition. It might nevertheless suggest that health policy needs to address



parental behavior together with that of adolescents, if the prevention of take-up is its objective.

## 4 Control of Tobacco Consumption

Economic policy aiming at reducing tobacco consumption can address three related targets: (i) preventing youths from starting, (ii) reducing tobacco consumption of smokers, and (iii) helping smokers to quit smoking. The instruments available to pursue these targets comprise (i) price interventions via taxes, (ii) the provision of information via education or counter-advertising, or restrictions on advertising, and (iii) regulation of production and consumption of tobacco products. The most important empirical question in the design and implementation of economic and health policy is, whether policy measures indeed exert any substantial effects on the targeted outcomes. Even the most carefully designed and most diligently implemented intervention might fail to work. Yet, the answer to this question is notoriously difficult to give. Thus, policy evaluation has arguably become the most intensely debated issue in modern empirical economics (Schmidt, 2007), and also in health economics.

A related question is, whether any successful tobacco control measure might display unintended side effects. Individuals might compensate an induced reduction in tobacco consumption by a corresponding increase in the consumption of, for example, alcohol or marijuana (see, e.g., Jones, 1989; Florkowski and McNamara, 1992; Goel and Morey, 1995; Jimenez and Labeaga, 1994; Dee, 1999; Decker and Schwartz, 2000; Cameron and Williams, 2001; Bask and Melkersen, 2004; Zhao and Harris, 2004; Picone et al., 2004; Tauchmann et al., 2006). Estimating systems of demand functions and calculating cross-price effects or by using alternative approaches these studies usually find that tobacco and alcohol, but also tobacco and marijuana/cannabis are complements in consumption. Thus, it seems to be unlikely that tobacco control measures have negative side effects regarding the use of other drugs.

### 4.1 Taxes and Prices

In principle, tax increases are a promising instrument to reduce tobacco consumption, regarding the smoking intensity of current smokers and, probably more im-

portantly, the take-up rates of youngsters. A key aspect for their effectiveness is the price elasticity of the demand for tobacco products. Unfortunately, estimating this elasticity is extremely difficult: The main reason for the small number of studies attempting to estimate price effects in Germany is the lack of (cross-sectional) variation of prices, as typically all individuals in the data set face identical prices at any given point in time. Even over time price variation has historically been quite limited. Consequently, the prevailing evidence for Germany has been almost entirely restricted to linking aggregate annual consumption of cigarettes to variations in the nominal cigarette price (see, e.g., Körner et al., 1996; Deutsches Krebsforschungszentrum, 2002; van Deuverden, 2004). Using a series of before-after comparisons of smoking prevalence, but not controlling for any other factor, Hanewinkel and Isensee (2002, 2003, 2004, 2005, 2006) analyze the five recent tax increases in Germany between 2002 and 2005 on the basis of micro data. While these studies conclude that there were significantly negative effects of each of these increases on the demand for tobacco, the particularly weak study design implies that they can at best be viewed as suggestive.

For a comprehensive overview of macro-level studies regarding the price elasticity of tobacco demand in the US and their shortcomings see, e.g., Chaloupka and Warner (1999). Typically, these studies conclude that the overall price elasticity of cigarette demand lies within a relatively small range centered at about -0.4. Individual-level studies tend to confirm this result. Apparently, price increases affect the all or nothing decision to smoke more intensely than they affect the conditional demand for cigarettes among smokers. Young people tend to react more strongly to price increases. Estimating hazard models, however, Douglas and Hariharan (1994) conclude that there is no significant effect of prices on the decision to start smoking (also see Douglas, 1998; DeCicca et al., 2002; Lopez-Nicolas, 2002). In contrast, Forster and Jones (2001) find indeed small but significant price effects on smoking initiation for the UK. The results concerning the effect of price increases on the decision to quit seem to be robust, though, as Douglas (1998), Forster and Jones (2001), and Lopez-Nicolas (2002) find significant price elasticities.

## 4.2 Health Information and Education

Sometimes health information undoubtedly has large effects. In 1953 a report by the American Cancer Society and the British Medical Research Council stated that smokers die significantly earlier than nonsmokers. In 1964 the US Surgeon General's Report established a causal relationship between tobacco consumption and lung cancer (Schneider et al., 1981). According to Chaloupka and Warner (1999), these studies significantly reduced smoking. Today the risks of smoking are commonly known and thus, further information on adverse health effects might have a smaller impact. Nevertheless, it might be worthwhile to attempt improving this knowledge in the population, especially among youngsters.

One way for governments to circulate information on adverse health effects of smoking is by marking cigarette packs with health warning labels. Somewhat disconcertingly, empirical evidence on the effects of such warnings on smoking behavior suggests that health warning labels only lead, at best, to small reductions in smoking (Chaloupka and Warner, 1999). Another way of disseminating information on adverse health effects of smoking is by launching mass media counter-advertising campaigns, such as the two major counter-advertising campaigns in the US, (i) the Fairness Doctrine of the Federal Communications Commission between 1967 and 1970 (see, e.g., Schneider et al., 1981; Baltagi and Levin, 1986), and (ii) the anti-smoking media campaign in California in 1988 (see, e.g., Hu et al., 1995). In their review of the literature Chaloupka and Warner (1999) conclude that econometric analyses of such campaigns tend to find significant negative effects on cigarette consumption.

Other studies analyze counter-advertising effects by comparing the smoking behavior or attitudes of those who recognized a campaign with those who were not aware of it (see, e.g., Kozlowski et al., 2000; Siegel and Biener, 2000). Yet, viewing anti-smoking advertisements might be endogenous (Flay, 1987). Other studies compared the effects of campaigns that were assigned only to a particular region to comparable regions which did not receive the campaign (see, e.g., Flynn et al., 1994; McVey and Stapleton, 2000). Yet other studies used an experimental setting (Shiffman et al., 2001). In general, most of these studies find a significant effect of counter-advertising on smoking behavior. In addition, smoking prevention or cessation programmes in schools might reduce smoking among youth. Although the empirical literature

evaluating such programmes mostly finds significant effects in the short-run (e.g. Botvin and Kantor, 2000; Sussman et al., 2001), there might not be a significant effect in the long-run (see, e.g., Bruvold, 1993; World Bank, 1999).

Tobacco advertising has been strongly criticized for affecting smoking behavior, particularly among the young. In consequence, this has often raised the claim for advertising bans. Yet, due to its encompassing nature, and since advertisers can easily substitute between a range of different media (Saffer and Chaloupka, 2000), with the internet being a most relevant new medium (Cohen et al., 2001), the effects of advertising can hardly be assessed on the basis of aggregate time-series data or in simple cross-country comparisons. The majority of studies modeled cigarette demand as some function of cigarette advertising expenditures (Chaloupka and Warner, 1999). Unfortunately, the results of studies using more promising individual-level data of youths and self-reported time spent watching TV (Lewit et al., 1981) can hardly be taken more seriously. More recent research aims at assessing the effect of comprehensive advertising bans on smoking. The empirical findings are mixed as well (see, e.g., Baltagi and Levin, 1986; Franke, 1994; Lewit et al., 1981; Schneider et al., 1981).

### 4.3 Smoking Restrictions

Smoking restrictions at the workplace, in restaurants or at public places target smokers and non-smokers alike. This universal coverage makes it extremely difficult to provide empirical evidence on its effectiveness, as one cannot contrast the smoking behavior of individuals who are covered by the regulation with those who are not, yet who live in the same region at the same time period. If the contrast is constructed over time, it is difficult to isolate the effect of the smoking ban from general tendencies like an increased anti-smoking sentiment, that might have set up the intellectual base for the implementation of the smoking ban in the first place. Using such aggregate data, Chaloupka and Saffer (1992) account for the endogeneity of smoking restrictions by using a two step least squares (2SLS) approach and conclude that comprehensive public place smoking bans tend to decrease consumption, while smoking bans at private workplaces are not found to have any significant effect.

Other studies of public smoking bans use micro-level data (Chaloupka, 1992;

Chaloupka and Pacula, 1999; DeCicca et al., 2002; Oshfeldt et al., 1998; Tauras and Chaloupka, 1999a,b). They have, in principle, to confront the same identification problem, as variation in coverage is only across time and place, but not across people in the same environment. This obstacle cannot be overcome convincingly by the use of longitudinal data and the inclusion of individual as well as year and region fixed effects. Overall, these studies tend to provide mixed evidence. Using the alternative study design of a choice experiment, Hammar and Carlsson (2005) conclude that smoking bans have almost no effect on the probability to quit. Coverage by smoking restrictions might vary substantially in the case of workplace smoking bans, though. Attempting to control for self-selection of workers into firms with bans, Evans et al. (1999) find robust empirical evidence of a significant effect of such bans on smoking prevalence as (also see Allwright et al., 2005; Farrelly et al., 1999).

A special smoking restriction is the enactment of youth access laws. However, the quest for empirical evidence again faces the obstacle of universal coverage. Existing studies of the effect of such laws do not solve this problem convincingly. They indicate no significant or only small effects. Wasserman et al. (1991) find no significant effect of the prohibition of the sale of cigarettes to minors, Chaloupka and Grossman (1996) even find significant positive effects of restrictions on vending machine sales. Chaloupka and Pacula (1999) conclude that there is a significant negative effect of strictly enforced youth access laws but only among black youth. The big practical problem of such restrictions is effective enforcement. According to Deutsches Krebsforschungszentrum (2002) Germany is a country with a very high density of vending machines (in 2005 about 1 vending machine per 120 inhabitants (Die Tabak Zeitung, 2007)). Up to 2007 the purchase of cigarettes from machines had not even required any validation of user's age. Thus, it is not surprising that German youths seem to obtain their cigarettes mainly through this route (Deutsches Krebsforschungszentrum, 2002), either themselves or via their friends.

## 5 The Political Agenda

Starting from the insight that the international death toll linked to the consumption of tobacco products is remarkable, this paper asks, whether this health burden indeed warrants any government intervention, and questions the available evidence

on the effectiveness of the control measures that have been enacted so far. The economic literature heavily debates the first question, culminating in the concept of rational addiction. Of all empirical tests of this concept, most studies apparently support the notion that tobacco addiction is rational. Yet, since many smokers later on regret having started smoking, it seems questionable that smokers had actually considered all future consequences of their behavior at the time of take-up. Moreover, the fact that smokers typically start when they are very young, provides an additional argument for the proponents of government intervention.

Regarding the second question, this paper has discussed extensively, how difficult it is, in principle, to provide solid empirical evidence on the effects of various control measures currently in operation. Whether it's prices and taxes, information policies, or smoking restrictions, empirical analysis is hampered by the universal coverage of any of these measures. The contrast between treated and untreated individuals, and consequently, a convincing analogy to the hypothetical gold standard of a randomized controlled trial, is difficult to find. Nevertheless, existing studies suggest that tax increases have the potential to dampen tobacco consumption both among youths but also among adults. Moreover, the implementation of tax increases is not expensive. When it comes to information policy, it very much seems that it might at best be possible to affect the decision to start smoking, albeit to quite a moderate extent. Finally, the effect of smoking bans is open for debate. The heterogeneity of legal restrictions currently enacted in the various German states might provide information that facilitates the generation of further empirical insights into this issue.

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