

Göhlmann, Silja

**Working Paper**

## Who Smokes and How Much? - Empirical Evidence for Germany

Ruhr Economic Papers, No. 26

**Provided in Cooperation with:**

RWI – Leibniz-Institut für Wirtschaftsforschung, Essen

*Suggested Citation:* Göhlmann, Silja (2007) : Who Smokes and How Much? - Empirical Evidence for Germany, Ruhr Economic Papers, No. 26, ISBN 978-3-86788-021-3, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI), Essen

This Version is available at:

<https://hdl.handle.net/10419/26791>

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Silja Göhlmann

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# Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics

Universitätsstraße 150, 44801 Bochum, Germany

Universität Dortmund, Department of Economic and Social Sciences

Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics

Universitätsstraße 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI Essen)

Hohenzollernstrasse 1/3, 45128 Essen, Germany

## **Editors:**

Prof. Dr. Justus Haucap

RUB, Department of Economics

Competition Policy and Industrial Economics

Phone: +49 (0) 234/32 253 36, e-mail: justus.haucap@rub.de

Prof. Dr. Wolfgang Leininger

University of Dortmund, Department of Economic and Social Sciences

Economics – Microeconomics

Phone: +49 (0) 231 /7 55-32 97, email: W.Leininger@wiso.uni-dortmund.de

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International Economics

Phone: +49 (0) 201/1 83-36 55, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Christoph M. Schmidt

RWI Essen

Phone: +49 (0) 201/81 49-227, e-mail: schmidt@rwi-essen.de

## **Editorial Office:**

Joachim Schmidt

RWI Essen, Phone: +49 (0) 201/81 49-292, e-mail: schmidtj@rwi-essen.de

# Ruhr Economic Papers #26

Responsible Editor: Christoph M. Schmidt

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ISSN 1864-4872 (online) – ISBN 978-3-86788-021-3

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Ruhr Economic Papers

#26

Silja Göhlmann

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**Bibliografische Information der Deutschen Nationalbibliothek**

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

ISSN 1864-4872 (online)

ISBN 978-3-86788-021-3

**Silja Göhlmann\***

## **Who Smokes and How Much? – Empirical Evidence for Germany**

### **Abstract**

Smoking is associated with high economic costs, because it increases the risk and incidence of several illnesses. A promising instrument to reduce these costs is to decrease tobacco consumption by developing target group-oriented non-smoking campaigns. However, this purpose requires knowledge about the characteristics of the target group. Utilizing data from three waves of the Mikrozensus, this paper portrays the smoking population in Germany to ascertain the socio-demographic characteristics which are associated with (i) smoking prevalence and (ii) the conditional demand for cigarettes. The empirical results indicate that a target group-oriented non-smoking campaign should focus primarily on individuals with a lower level of education and income, singles, divorced or widowed individuals and unemployed, because these sub-groups of the population exhibit the highest smoking prevalence. Moreover, individuals with a lower level of education as well as singles, divorced or widowed individuals also tend to smoke more.

JEL Classification: I12

Keywords: Smoking, socio-demographic characteristics, Mikrozensus

August 2007

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\* RWI Essen, Germany. – The author is grateful to Michael Fertig for initiating the paper by providing the idea and Thomas K. Bauer, Christoph M. Schmidt, and Harald Tauchmann for helpful comments and suggestions. I also thank Veronika Trier for excellent research assistance. – All correspondence to Silja Göhlmann, RWI Essen, Hohenzollernstr. 1-3, 45128 Essen, Germany, Fax: +49 201 8149-200, Email: silja.goehlmann@rwi-essen.de.

# 1 Introduction

Smoking increases the risk of cancer, cardiovascular diseases and respiratory problems (Deutsches Krebsforschungszentrum, 2002). For Germany, the epidemiological literature suggests that the annual death toll caused by smoking amounts to about 117.000 persons; the costs of medical treatment, lost productivity as well as disablement and inability to work because of smoking are estimated to reach 17 billion Euros each year (Junge, 2002). From a policy perspective, implementing target group-oriented non-smoking campaigns might help to decrease the prevalence of smoking and might, therefore, be a promising tool to reduce the induced societal costs. However, *a priori* it is not clear to whom such a campaign should be addressed to or, in other words, who represents the appropriate target group.

What affects smoking behavior? Several factors have been discussed and analyzed in the literature. Firstly, prices influence smoking as discussed, for example, in Chaloupka and Grossman (1996), Chaloupka and Wechsler (1997), Tauras and Chaloupka (1999), Gruber and Zinman (2000), and Sheu et al. (2004). Secondly, advertising (bans) affects cigarette demand (see, for example, Lewit et al., 1981; Baltagi and Levin, 1986). Thirdly, health information and counter-advertising appear to reduce smoking (see, for example, Hu et al., 1995; Schneider et al., 1981) as well as, fourthly, restrictions such as smoking bans in public areas (analyzed, for example, by Wasserman et al. (1991), Evans et al. (1999), Tauras and Chaloupka (1999)). Finally, socio-demographic characteristics like education, marital and labor market status are correlated with smoking behavior (see, for example, Wasserman et al., 1991; Chaloupka and Wechsler, 1995; Chaloupka and Grossman, 1996; Gruber and Zinman, 2000; Hersch, 2000).

Epidemiological research typically concludes that smokers are on average less educated, more often unemployed, and have a lower income compared to non-smokers. This social gradient of smoking might be explained by the model of rational addiction as suggested by Becker and Murphy (1988). In their model, the probability to become addicted to a good depends not only on the characteristics of the good but also on how much the individuals discount the future: present-oriented individuals are more likely to become addicted, because then an increase in past consumption leads to a smaller rise in the full price, which also includes the money value of any future adverse health effects caused by the good. Moreover, the probability of becoming addicted is affected by the level of income and temporary stressful events like divorce or unemployment that increase the demand for an addictive good. In their model this is interpreted as an increase in the stock of consumption capital which is a function of past consumption and experiences. The level and path of prices af-

fect the probability, too. Their model further allows for unstable steady-states, i.e. depending on the stock of consumption capital, consumption of the addictive good will rise over time up to a stable steady-state or fall until abstention. Hence, this model might also be able to explain differences in the consumed level of addictive goods.

Descriptive statistics of the sample used in the following analysis confirm the socio-economic gradient for Germany (see Table 1): Individuals with a high school or university degree are less often found among smokers compared to non-smokers. Moreover, smokers are more likely to be either unemployed or employed, whereas non-smokers are more likely to be out of the labor force. Smokers have on average also lower incomes. With respect to demographic characteristics, smokers are more often singles, or, if living in a partnership, are less likely to marry. If they have children, their children are on average younger. There is a larger proportion of foreigners among smokers than non-smokers.

Clearly, the socio-demographic characteristics of the smoker population reveal information on the "risk group" of smoking. Thus, knowledge of these characteristics is helpful for the implementation of target-group oriented information and counter-advertising campaigns. For Germany, despite the growing awareness of the risks and costs of smoking, remarkably little is known on the socio-demographic characteristics of the smoker population. Therefore, this paper contributes to the existing literature by investigating the socio-economic and demographic correlates of smoking prevalence in Germany in order to provide a statistical portrait of the German smoker population.

This study further contributes to the existing literature by examining the correlates of the conditional demand for cigarettes in Germany. Learning about these is interesting, because the level of consumption might be correlated with the probability of quitting smoking. Thus, Yen and Jones (1996) conclude from their empirical analysis that more addicted individuals, i.e. individuals with a high consumption, are less likely to quit than less addicted ones, although these heavier smokers would benefit most from quitting smoking. Knowledge on the correlation between socio-demographic characteristics and the conditional demand for cigarettes might therefore help to identify the group of individuals who should particularly be addressed by cessation programmes as these individuals might have more difficulty in quitting smoking than others.

In the subsequent analysis, I use three waves of the Mikrozensus for the years 1995, 1999 and 2003 to model both smoking participation and the conditional demand for cigarettes. Probit and ordered probit models are estimated separately for each



wave and separately for women and men, as well as for East- and West Germans. In this multivariate approach I control for socio-demographic factors such as age, education, employment, marital and family status. The results indicate that the probability to smoke increases with being unemployed, single, divorced or widowed and decrease with education and income.

The following section gives an overview over the related literature. Section 3 describes the method and the data. Section 4 presents the results and section 5 concludes.

## 2 Survey of Related Literature

The body of literature concerning the socio-demographic gradient to smoking behavior is mainly built on U.S. data. Yet, the focus of these studies is often not on the correlation of smoking prevalence with socio-demographic characteristics but on the price elasticity of tobacco demand or the effect of policy regulations on smoking behavior. Regarding the smoking behavior among adults, these studies indicate a significant correlation with age (following a U-shaped pattern), working status, and ethnicity. Moreover, results indicate a significant negative correlation with education, income, and having children (see, for example, Wasserman et al., 1991; Hersch, 2000; Sheu et al., 2004). There are mixed results of the correlation of smoking with marital status.

Concerning the correlations with youth smoking behavior, the results are less robust. Studies indicate a significant correlation with living in a city, ethnicity and religion, personal income and parental education, but mixed results regarding the correlation with age, gender, living with parents, having siblings, working status of the parents, family income, and marital status (see, for example, Wasserman et al., 1991; Chaloupka and Wechsler, 1995; Chaloupka and Grossman, 1996; Tauras and Chaloupka, 1999; Gilleskie and Strumpf, 2000; Gruber, 2000; Gruber and Zinman, 2000). Gruber (2001) tries to explain the rise in youth smoking during the 1990's in the U.S. with a change in socio-demographic characteristics but concludes that this alone could not be the reason.

Although there exists a number of studies regarding socio-demographic characteristics of smokers in Germany, these were usually not carried out by applying multivariate analyses (see, e.g., Helmert et al., 1997; Helmert and Maschewsky-Schneider, 1998; Helmert, 1999; Knopf et al., 1999; Lampert and Kroll, 2005). Lampert and Thamm (2004) estimate multivariate logit models of smoking prevalence based on

data from the National Health Survey 1998 of the Robert-Koch Institute. The authors control for age, education, income, marital status, labor market status, region and chronic diseases, but only present the results on education, income and labor market positions. They conclude that smoking prevalence decreases with education and that smoking prevalence is not significantly correlated with income and labor market position.

Helmert et al. (2001) use the 1995 wave of the Mikrozensus and indeed estimate multivariate models, but use the results only to identify significant correlates. Subsequently, the authors calculate the sample smoking rates among combinations of the socioeconomic characteristics that were identified to be correlated with smoking prevalence. Nonetheless, as significant correlates were identified education, occupational status, being unemployed, divorced, living in metropolitan areas, and income. In contrast, my study aims at investigating the correlation of individual socio-demographic characteristics with smoking behavior and at drawing a comprehensive picture of the smoking population. Moreover, in my paper this is done by using two more waves of the Mikrozensus (1999 and 2003) in order to test whether correlates are robust across time.

Bantle and Haisken-DeNew (2002) investigate smoking prevalence in Germany, yet focusing on the intergenerational transmission of smoking behavior on youths. They control for gender, equivalent income, children's and parental education, children's and parents' labor market status, social activities and attitudes. Obviously, variables indicating social activities and attitudes are not exogenous. Hence, controlling for such variables might bias the results. Notwithstanding this point of criticism, the authors find significant negative associations for education and significantly positive correlations with having a job or being in apprenticeship compared to not working at all. No significant associations are found regarding income.

### 3 Empirical Analysis

In the empirical analyses I utilize the 1995, 1999 and 2003 cross-sections of the German Mikrozensus. The Mikrozensus is a one percent random sample of all households in Germany with approximately 507,000 observations in each cross-section.<sup>1</sup> In all three waves there was a special voluntary questionnaire on health related information for a 0.5 percent sub-sample of the population that was answered by

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<sup>1</sup>For further information see [http://www.gesis.org/en/social\\_monitoring/GML/data/mc/index.htm](http://www.gesis.org/en/social_monitoring/GML/data/mc/index.htm).

about 200,000 respondents in each wave.<sup>2</sup> Restricting the sample to respondents aged 13-79 and eliminating all observations with missing values for at least one of the used variables results in a sample of around 150,000 to 175,000 individuals per wave used in the empirical analysis.

In a first step, I analyze the socio-demographic factors related with smoking prevalence using a binary probit model. An individual is defined as smoker, if she smokes regularly or occasionally. In a second step, I investigate socio-demographic correlates of the conditional demand for cigarettes. Here, the dependent variable is the number of cigarettes smoked. In the Mikrozensus this variable is coded into the following groups: (i) less than 5 cigarettes a day, (ii) 5-20 cigarettes, (iii) 21-40 cigarettes and (iv) more than 41 cigarettes a day. Thus, I estimate an ordered probit model conditional on being a smoker. All equations are estimated separately for men and women, as well as for East- and West Germany.<sup>3</sup>

I use the following set of control variables: age and age squared<sup>4</sup>; a dummy variable indicating being younger than 21; two dummy variables for the marital status (being single, divorced or widowed with being married acting as reference group) and three dummy variables for the family status (children younger than 3 years, between 3 and 17 years and older than 17 live in the household). Moreover, I include dummy variables for different levels of schooling (having an intermediate or high school degree and still attending school with having a basic secondary school degree acting as reference group) and vocational training (having a university degree, a vocational degree, still in vocational or educational training with having no vocational degree acting as reference group). Additionally, I use three dummy variables for labor market status (having a full-time job, a part-time job, being unemployed with individuals not participating in the labor market acting as reference group),

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<sup>2</sup>The fact that answering the question regarding smoking behavior is voluntary raises the question whether results might be subject to a selection bias. It is unlikely that individuals not answering the smoking question but the other questions systematically differ from individuals who answer the smoking question. Nonetheless, I estimated two step Heckman selection models on the subsamples and tested for significance of the inverse Mills ratio in the second stage regression as suggested by Jones (2007). This procedure indicates no sample selection bias. Yet, these Heckman models are estimated without exclusion restriction as it is not possible to identify any variable that is correlated with non-response but not with smoking. In this case identification relies on the non-linearity of the inverse Mills ratio (Jones, 2007). Graphical plots indicate that the inverse Mills ratio tends to be non-linear.

<sup>3</sup>Likelihood ratio tests of the restricted versus the unrestricted models support the latter.

<sup>4</sup>I also estimated specifications including age dummy variables. However, the estimates indicate that the age profile can be described appropriately by including age and age squared. Results regarding the other variables were robust to this modification.

two dummy variables for monthly equivalent income<sup>5</sup> (one dummy variable taking the value one for an income below 1,000 Euros and one that takes the value one for an income between 1,000 and 1,499 Euros with those having an income above 1,499 Euros acting as reference group), and one dummy variable for being foreigner.

Unfortunately, the core variable in any demand analysis, the price of cigarettes must be omitted as an explanatory variable in the models for tobacco demand, because there is neither regional variation nor considerable variation over time in real cigarette prices. Furthermore, there were no noteworthy changes in any anti-smoking regulations. A description of the control variables is presented in Table 6 and descriptive statistics are reported in Table 7 in the Appendix.

Figures 1 and 2 show the smoking rates separately for both genders for each wave based on the observations used for the empirical analysis. They reveal a distinct inversely U-shaped age profile with the peak in 1995 and 1999 at the group of individuals in their thirties. In 2003 the peak is flattened and smoking rates do not vary considerably between the age groups 20 to 39. Comparing the smoking rates in 1995 with the smoking rates in 2003 within particular age groups it becomes obvious that the smoking rates significantly increased among the youngsters aged between 15 to 19 and among females aged between 40 to 59. In contrast, among all other age groups smoking rates decreased or remained almost constant.

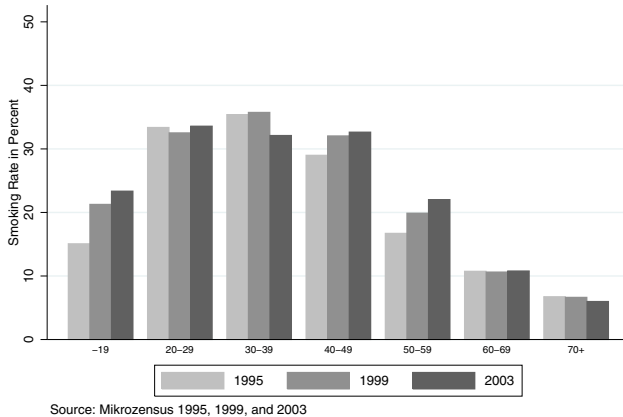


Figure 1: Smoking Rates by Age Group - Women

<sup>5</sup>Defined as "household net income/ $\sqrt{\text{household size}}$ ".

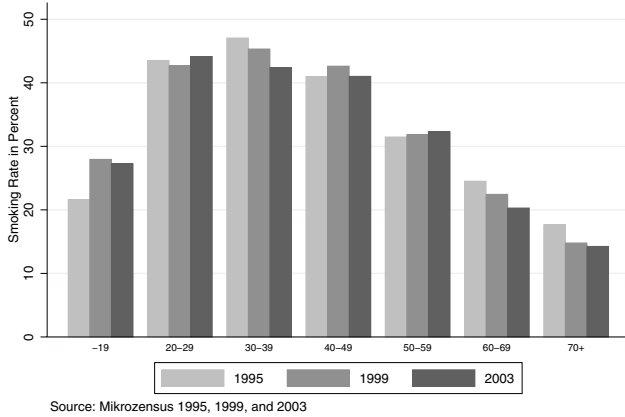


Figure 2: Smoking Rates by Age Group - Men

## 4 Results

### 4.1 Who smokes?

This section analyzes the association between socio-demographic characteristics and smoking prevalence. Tables 2 and 3 report the results for women and men, respectively. In both cases, results of are reported separately for East- and West Germany.<sup>6</sup>

The estimation results indicate that the probability of being a smoker follows an inversely U-shaped pattern with age for both genders and all years. The predicted turning points lie between 24 and 25 years of age in 1995 for women and men, respectively, at 31 in 1999 for both genders and between 28 (males) and 32 (females) in 2003.<sup>7</sup> This does not reflect an age profile of an individual regarding the hazard of starting at a particular age but the age profile regarding the smoking rates of particular cohorts in the particular year after controlling for socio-demographic characteristics. Consequently, that the turning point among men increased from 25 to 28 might be explained by the relatively clear peak of the age profile in 1995 at the age of 30 to 39, whereas in 2003 this peak was flattened (see Figure 2). This also applies to women. Yet, among those the even larger increase in the turning points over time might also be explained by the increasing smoking rates among the age group 40 to 59 (see Figure 1). Among men the smoking rate of this age

<sup>6</sup>Results for total Germany are available upon request.

<sup>7</sup>Note that these are the predictions based on the estimation results that also take into account level differences for individuals being younger than 21.

group remained almost constant. Obviously, these explanations might be hampered by the fact that they do not consider any changes in characteristics. Results further indicate that there is no additional difference in the probability to smoke between individuals being younger than 21 and their respective counterpart for most subsamples. Yet, in 1995 female youngsters in West Germany exhibit a significantly lower probability to smoke compared to women being older than 21, whereas this difference is reversed in 1999 and not longer significant in 2003.

As expected, the results exhibit a significant, negative correlation of the probability to smoke with education for both sexes. Women with a high school degree have a 5 to 9 percentage points lower probability to smoke than women with a basic school degree. Men with a high school degree are less likely to smoke by about 10 to 15 percentage points compared to men with a basic schooling degree. Furthermore, students are significantly less likely to smoke than individuals with a basic school degree (by 12 to 29 percentage points). A similar picture emerges for occupational training. Having a university degree is associated with a significantly lower probability to smoke compared to individuals without a vocational degree. Interestingly, this significant, negative correlation became significant larger for West German women during the period from 1995 to 2003. Comparing the smoking probability of individuals with a vocational degree with that of individuals without vocational degree, results indicate a significant higher probability to smoke for the latter.

The labor market status is significantly correlated with the probability to smoke, too. Being unemployed is associated with a significant higher probability to smoke for both sexes and regions compared to individuals not participating in the labor market. Moreover, the size of this correlation significantly increased for West German men from 11 percentage points in 1995 to 17 percentage points in 2003. Furthermore, full-time working individuals in the West (except males in 1995) are indeed significantly less likely to smoke than unemployed, but are also more likely to smoke by about 3 to 4 percentage points compared to individuals not participating in the labor market. This also holds for East Germans in 2003. Having a part-time job increases the probability to smoke among West German women, for women in the East and almost all male subsamples this correlation is not significant. This difference between East and West German women might be explained by different traditions: in East Germany it has been much more common that women work and that sufficient childcare has been offered by the government. In West Germany working women might more often be in situations where they pursue a career and at the same have to take care of their children. This might cause more stress and thus, might lead to higher smoking rates.

Except for East German women in 1995, income is found to be significantly neg-

atively correlated with the probability to smoke. This correlation is particularly pronounced for individuals with a monthly equivalent household income of less than 1,000 Euro compared to individuals with an income of more than 1,499 Euro. These low-income individuals have a 3 to 9 percentage points higher probability to smoke than individuals with an equivalent income of more than 1,499 Euro. Moreover, this difference significantly increased from 1995 to 2003 for women and East German men. This significantly negative correlation coincides with the prediction of the rational addiction model which claims that poorer individuals tend to discount the future more heavily and might therefore be more likely to become addicted.

Furthermore, in accordance with the rational addiction model estimation results suggest a significant, positive association of the probability to smoke with being divorced or widowed compared to married individuals. This might reflect the increased psychological stress of a divorce or even the death of a spouse. Quantitatively, this correlation ranges from 13 to 18 percentage points for men and 11 to 14 percentage points for women. Moreover, except for East German males in 1995 individuals being single tend to have a significantly higher smoking probability compared to married ones by about 3 to 6 percentage points. This difference became significantly larger from 1995 to 2003 for West German female singles.

Among West German men the probability to smoke is lower if children live in their household, irrespective of their age. Surprisingly, among East German men a significantly negative correlation is stated almost only for children older than 17. Among women children in the household tend to reduce the probability to smoke significantly particularly if the children are very young or older than 17. An explanation for this very robust (yet decreasing) correlation of the probability to smoke with living together with children older than 17 might be that this coefficient also captures something like a positive "family climate" since this variable indicates that children stay at their parents home this long. In consequence, the indicated significant correlation might capture a correlation that is not just due to having older children at all but reflects more a friendly family environment.

Finally, the estimation results suggest that foreign women in West Germany have a 2 to 3 percentage points lower smoking probability than their native counterparts, whereas foreign males in the West have an about 3 to 4 percentage points higher smoking probability than native men. That almost no significant correlation is found for East Germany might be due to the fact that there are hardly any foreigners in the East (except Berlin).

## 4.2 How much?

In a second step, I investigate socio-demographic correlates of the demand for cigarettes conditional on being a smoker. The results of ordered probit regressions for women are displayed in Table 4, whereas Table 5 reports the respective estimation results for men.

Overall, the picture is less clear regarding the socio-demographic correlates of the conditional demand than for the probability to smoke at all. One might think of unstable steady states as an explanation for this phenomenon. Hence, there might be a threshold where a lower stock of consumption capital causes individuals not to smoke at all and a higher stock to increase their consumption up to a certain level. Analyzing the conditional demand means that only individuals with a higher stock of consumption capital are considered. Additionally, among those stable steady states might lead to less variation in the conditional demand for cigarettes.

The results suggest an inversely U-shaped relationship between age and conditional demand. However, for almost none of the subgroups a difference in the level of tobacco consumption between individuals younger and older 21 is indicated. Moreover, conditional on age, results show a significant negative correlation of the number of smoked cigarettes with the age started smoking that is robust across all waves and regions. Thus, the earlier someone starts smoking, i.e. the longer someone has smoked, the more cigarettes she smokes.

The estimation results further indicate a significant negative correlation of schooling with the number of smoked cigarettes for women that is robust across years as well as regions, i.e. women with high or intermediate school degree do not only smoke with a lower probability but also smoke significantly less cigarettes than women with a basic school degree. For men a similar but less robust association is stated. Furthermore, female and male students tend to smoke significantly less cigarettes than individuals with a basic degree. A very similar picture emerges for vocational training.

The correlation of labor market status with the conditional demand for cigarettes is not robust. Among women results indicate almost no significant correlation with labor market status at all. Among East German men in 1995 being unemployed was associated with a significantly higher demand for cigarettes compared to men not participating in the labor market. Moreover, unemployed and full-time working men in the West tend to smoke significantly more cigarettes than men not participating in the labor market. Although low income individuals are more likely to smoke at all, results do not indicate a robust significant association with the conditional demand.



Among men there is almost no significant correlation stated by the results (except a significantly negative association with having a medium income and the conditional demand compared to having a high income among West German males in 1999), whereas it is indicated that in 1999 West German women with a low income smoked more cigarettes compared to their counterpart.

Again, a significant correlation is stated for marital status: divorced or widowed individuals are not only more likely to smoke than married ones, but also smoke significantly more cigarettes. Comparing singles with married individuals, a significant correlation with conditional demand is almost only stated for the East and here particularly for women. Thus, singles in the West indeed have a significantly higher probability to smoke than married individuals but do not tend to smoke more cigarettes conditional on being a smoker.

Among men in the West living together with children in the household is not only associated with a lower probability to smoke but also with a lower conditional demand regardless of the age of the children, particularly in 1999. Among men in the East these correlations are not found to be significant. A similar picture emerges for females. Women in the West tend to smoke significantly less cigarettes when living together with children regardless of their age, but among women in the East a lower conditional demand is only associated with living together with older children. This different behavior between East and West German women might reflect the fact that much more women in East Germany give their children into public childcare when they are young. This way, smoking does not affect a child as much as when the mother stays with the child all day long. Therefore, women with young children in East Germany may have a lower incentive to reduce tobacco consumption than similar women in West Germany.

Finally, results indicate a significant correlation with being foreigner only for West German women: foreign women do not only smoke with a lower probability they also smoke significantly less cigarettes than natives.

## 5 Conclusion

This paper provides a statistical portrait of the smoker population in Germany by analyzing three waves of the Mikrozensus for the years 1995, 1999 and 2003. Specifically, I estimate the partial correlation of socio-demographic variables like age, education, marital and labor market status with (i) smoking prevalence, and (ii) the conditional demand for cigarettes by employing multivariate probit mod-

els allowing for differences between females and males as well as East- and West Germany, respectively.

The results of the empirical analysis suggest that smoking prevalence is significantly higher among less educated and single, divorced or widowed individuals and individuals with a low income and without young children compared to their respective counterparts. Furthermore, there seems to be a significant, positive correlation with having a full-time job and unemployment compared to not participating in the labor market and an inversely U-shaped correlation with age. Moreover, estimation results indicate that the amount of smoked cigarettes conditional on being smoker is significantly higher for divorced or widowed and increases with the time an individual has smoked. Moreover, tobacco consumption decreases with education and vocational training. Significant associations with the labor market status are not robust across waves and tend to exist more for West German residents. Concerning income, results do not exhibit a clear-cut picture.

From a policy perspective the results indicate that target group-oriented non-smoking campaigns like information campaigns should focus primarily on individuals with a lower level of education and income, singles, divorced or widowed individuals and unemployed since these sub-groups of the population exhibit the highest smoking prevalence. Moreover, individuals with a lower level of education as well as singles, divorced or widowed individuals also tend to smoke more. Obviously, the empirical analysis cannot provide an answer to the question why people smoke and others not. Consequently, it can not be concluded from the results that e.g. income transfers will reduce smoking prevalence. Nevertheless, this paper provides a comprehensive descriptive overview on the socio-demographic characteristics of the German smoker population and, thus, provides a base for future research on the causes of tobacco consumption in Germany.

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Table 1: Means of Descriptive Statistics by Gender and Smoking Status

	Women		Men	
	Non-Smoker	Smoker	Non-Smoker	Smoker
Age	48.000	39.700	46.100	41.000
School degree high	0.173	0.154	0.253	0.171
School degree intermediate	0.276	0.362	0.227	0.295
School degree basic	0.500	0.459	0.460	0.514
Still school	0.050	0.025	0.059	0.021
University degree	0.082	0.058	0.161	0.087
Vocational degree	0.567	0.641	0.622	0.700
No vocational degree	0.246	0.203	0.089	0.124
Still training	0.105	0.098	0.128	0.089
Part-time job	0.166	0.215	0.030	0.029
Full-time job	0.266	0.393	0.565	0.680
Unemployed	0.043	0.085	0.040	0.095
Not participating	0.525	0.307	0.365	0.196
Single	0.224	0.295	0.294	0.352
Divorced or widowed	0.173	0.171	0.061	0.093
Married	0.604	0.534	0.645	0.556
Children aged 0-2	0.058	0.072	0.054	0.070
Children aged 3-17	0.276	0.373	0.286	0.311
Children older 17	0.226	0.202	0.270	0.248
Income less than 1,000 Euro	0.326	0.381	0.267	0.339
Income 1,000 - 1,499 Euro	0.303	0.295	0.292	0.310
Income more than 1,499 Euro	0.310	0.278	0.375	0.300
East German	0.239	0.234	0.225	0.251
Foreigner	0.044	0.052	0.046	0.068
Number of observations	189,149	57,643	152,586	81,746

Notes: Means are based on pooled cross-sections.

Table 2: Probit Estimates of Smoking Prevalence - Women

Variable	East Germany			West Germany		
	1995	1999	2003	1995	1999	2003
Age*10 <sup>-2</sup>	0.369* (0.157)	1.157** (0.178)	1.174** (0.183)	1.016** (0.086)	1.556** (0.095)	1.677** (0.098)
Age squared*10 <sup>-2</sup>	-0.012** (0.002)	-0.021** (0.002)	-0.021** (0.002)	-0.020** (0.001)	-0.024** (0.001)	-0.026** (0.001)
Younger than 21	-0.047* (0.017)	0.019 (0.020)	0.021 (0.019)	-0.035** (0.009)	0.051** (0.013)	0.026* (0.012)
School degree high	-0.050** (0.012)	-0.059** (0.013)	-0.080** (0.013)	-0.076** (0.005)	-0.080** (0.006)	-0.090** (0.005)
School degree intermediate	0.003 (0.009)	0.017 (0.010)	0.001 (0.010)	-0.046** (0.004)	-0.033** (0.004)	-0.042** (0.004)
Still school	-0.157** (0.010)	-0.133** (0.012)	-0.132** (0.012)	-0.137** (0.007)	-0.146** (0.007)	-0.123** (0.008)
University degree	-0.075** (0.013)	-0.084** (0.014)	-0.054** (0.017)	-0.033** (0.008)	-0.058** (0.008)	-0.075** (0.008)
Vocational degree	-0.060** (0.010)	-0.056** (0.011)	-0.042** (0.012)	0.004 (0.004)	-0.012** (0.005)	-0.013** (0.005)
Still training	-0.095** (0.014)	-0.068** (0.016)	-0.013 (0.017)	-0.056** (0.008)	-0.037** (0.009)	-0.031** (0.009)
Part-time job	0.006 (0.012)	0.003 (0.012)	0.011 (0.012)	0.025** (0.005)	0.034** (0.005)	0.035** (0.005)
Full-time job	0.015 (0.010)	0.010 (0.010)	0.025* (0.010)	0.036** (0.005)	0.032** (0.005)	0.043** (0.006)
Unemployed	0.057** (0.012)	0.057** (0.013)	0.061** (0.013)	0.078** (0.010)	0.104** (0.011)	0.083** (0.011)
Single	0.075** (0.011)	0.063** (0.012)	0.052** (0.011)	0.034** (0.006)	0.051** (0.007)	0.062** (0.007)
Divorced or widowed	0.136** (0.010)	0.114** (0.010)	0.121** (0.010)	0.139** (0.006)	0.129** (0.006)	0.132** (0.006)
Children aged 0-2	-0.025 (0.013)	-0.043** (0.013)	-0.050** (0.011)	-0.056** (0.005)	-0.049** (0.006)	-0.065** (0.006)
Children aged 3-17	0.012 (0.007)	0.019* (0.008)	-0.002 (0.008)	-0.011** (0.004)	-0.004 (0.004)	-0.019** (0.004)
Children older 17	-0.057** (0.007)	-0.045** (0.007)	-0.036** (0.007)	-0.059** (0.004)	-0.054** (0.004)	-0.039** (0.004)
Income less than 1,000 Euro	-0.005 (0.008)	0.030** (0.009)	0.073** (0.009)	0.031** (0.004)	0.028** (0.005)	0.045** (0.005)
Income 1,000 - 1,499 Euro	-0.010 (0.008)	-0.004 (0.009)	0.023** (0.008)	0.011** (0.004)	0.010* (0.005)	0.025** (0.004)
Foreigner	0.036 (0.027)	-0.010 (0.023)	-0.007 (0.021)	-0.025** (0.007)	-0.023** (0.007)	-0.027** (0.007)
Wald-Statistic ( $\chi^2$ )	1794.357	1743.643	1758.995	5420.864	4355.647	4315.220
Number of observations	21,051	18,989	18,631	70,141	60,006	57,974

Notes: \*\* significant at 1%; \* significant at 5%. Dependent variable: 1 if currently smoking; 0 otherwise. Marginal effects are reported; Heteroscedasticity robust z-statistics in parentheses. See Table 6 for a description of variables. Reference group is a married individual, with a basic school degree and no vocational degree, not participating in the labor market with no children and a monthly income over 1,499 Euro.

Table 3: Probit Estimates of Smoking Prevalence - Men

Variable	East Germany			West Germany		
	1995	1999	2003	1995	1999	2003
Age*10 <sup>-2</sup>	0.867** (0.212)	1.169** (0.220)	0.859** (0.215)	0.851** (0.108)	1.391** (0.115)	1.030** (0.115)
Age squared*10 <sup>-2</sup>	-0.019** (0.002)	-0.021** (0.002)	-0.017** (0.002)	-0.017** (0.001)	-0.022** (0.001)	-0.018** (0.001)
Younger than 21	-0.014 (0.024)	0.029 (0.024)	0.021 (0.024)	-0.028* (0.012)	0.028* (0.014)	0.014 (0.014)
School degree high	-0.099** (0.015)	-0.147** (0.015)	-0.139** (0.016)	-0.102** (0.007)	-0.102** (0.007)	-0.109** (0.007)
School degree intermediate	-0.024* (0.010)	-0.031** (0.011)	-0.028* (0.011)	-0.040** (0.005)	-0.043** (0.005)	-0.048** (0.005)
Still school	-0.294** (0.014)	-0.247** (0.017)	-0.236** (0.016)	-0.215** (0.010)	-0.186** (0.011)	-0.196** (0.010)
University degree	-0.145** (0.018)	-0.107** (0.021)	-0.106** (0.022)	-0.112** (0.009)	-0.097** (0.009)	-0.103** (0.009)
Vocational degree	-0.078** (0.017)	-0.067** (0.017)	-0.065** (0.018)	-0.044** (0.006)	-0.039** (0.007)	-0.041** (0.007)
Still training	-0.177** (0.020)	-0.113** (0.021)	-0.096** (0.021)	-0.149** (0.009)	-0.090** (0.010)	-0.094** (0.010)
Part-time job	0.010 (0.026)	-0.014 (0.026)	0.060* (0.024)	0.026 (0.014)	0.011 (0.013)	0.041** (0.012)
Full-time job	-0.008 (0.014)	0.013 (0.014)	0.040** (0.014)	0.008 (0.007)	0.026** (0.007)	0.042** (0.007)
Unemployed	0.093** (0.018)	0.114** (0.017)	0.124** (0.017)	0.110** (0.011)	0.145** (0.012)	0.165** (0.012)
Single	0.016 (0.013)	0.038** (0.013)	0.061** (0.013)	0.029** (0.007)	0.032** (0.007)	0.038** (0.007)
Divorced or widowed	0.177** (0.014)	0.127** (0.015)	0.162** (0.014)	0.165** (0.009)	0.143** (0.009)	0.130** (0.009)
Children aged 0-2	-0.004 (0.019)	-0.031 (0.018)	-0.066** (0.017)	-0.021** (0.008)	-0.037** (0.008)	-0.045** (0.008)
Children aged 3-17	0.000 (0.009)	-0.004 (0.010)	-0.005 (0.010)	-0.020** (0.005)	-0.023** (0.005)	-0.030** (0.005)
Children older 17	-0.042** (0.009)	-0.036** (0.009)	-0.030** (0.009)	-0.057** (0.004)	-0.049** (0.005)	-0.030** (0.005)
Income less than 1,000 Euro	0.047** (0.010)	0.055** (0.011)	0.090** (0.011)	0.052** (0.005)	0.058** (0.006)	0.066** (0.006)
Income 1,000 - 1,499 Euro	0.014 (0.010)	0.003 (0.011)	0.026** (0.010)	0.034** (0.005)	0.030** (0.005)	0.050** (0.005)
Foreigner	0.032 (0.029)	0.076** (0.027)	-0.017 (0.024)	0.041** (0.008)	0.023** (0.008)	0.029** (0.009)
Wald-Statistic	1778.354	1728.403	1906.174	5062.147	4232.275	4606.699
Number of observations	19,679	17,557	17,551	67,116	57,067	55,362

Notes: \*\* significant at 1%; \* significant at 5%. Dependent variable: 1 if currently smoking; 0 otherwise. Marginal effects are reported; Heteroscedasticity robust z-statistics in parentheses. See Table 6 for a description of variables. Reference group is a married individual, with a basic school degree and no vocational degree, not participating in the labor market with no children and a monthly income over 1,499 Euro.



Table 4: Ordered Probit Estimates of Conditional Demand - Women

Variable	East Germany			West Germany		
	1995	1999	2003	1995	1999	2003
Age*10 <sup>-2</sup>	6.477** (1.135)	6.804** (1.147)	7.776** (1.199)	5.073** (0.537)	4.941** (0.607)	5.141** (0.609)
Age squared*10 <sup>-2</sup>	-0.074** (0.013)	-0.070** (0.013)	-0.080** (0.013)	-0.056** (0.006)	-0.052** (0.007)	-0.052** (0.007)
Younger than 21	-0.121 (0.118)	0.166 (0.114)	0.207* (0.104)	-0.024 (0.059)	0.037 (0.062)	0.020 (0.060)
School degree high	-0.249** (0.092)	-0.370** (0.090)	-0.223* (0.093)	-0.231** (0.039)	-0.204** (0.040)	-0.271** (0.041)
School degree intermediate	-0.222** (0.057)	-0.280** (0.057)	-0.153* (0.062)	-0.156** (0.024)	-0.080** (0.026)	-0.127** (0.026)
Still school	-0.799** (0.186)	-0.598** (0.136)	-0.596** (0.135)	-0.481** (0.099)	-0.117 (0.084)	-0.355** (0.083)
University degree	-0.366** (0.112)	-0.393** (0.122)	-0.318* (0.132)	-0.247** (0.059)	-0.128* (0.065)	-0.181** (0.069)
Vocational degree	-0.162** (0.059)	-0.219** (0.070)	-0.147 (0.076)	-0.127** (0.024)	-0.135** (0.027)	-0.128** (0.029)
Still training	-0.191 (0.128)	-0.320** (0.113)	-0.224* (0.105)	-0.235** (0.060)	-0.257** (0.056)	-0.187** (0.056)
Part-time job	-0.129 (0.080)	0.059 (0.083)	-0.116 (0.076)	-0.049 (0.030)	-0.062* (0.031)	-0.078* (0.032)
Full-time job	-0.087 (0.069)	0.046 (0.070)	-0.041 (0.069)	-0.003 (0.029)	0.081* (0.033)	0.018 (0.034)
Unemployed	-0.041 (0.075)	0.030 (0.075)	0.023 (0.074)	0.081 (0.046)	0.121* (0.049)	0.074 (0.050)
Single	0.167** (0.058)	0.142* (0.063)	0.238** (0.064)	0.063* (0.032)	-0.055 (0.037)	0.036 (0.036)
Divorced or widowed	0.220** (0.054)	0.158** (0.055)	0.215** (0.058)	0.195** (0.030)	0.114** (0.032)	0.127** (0.032)
Children aged 0-2	-0.001 (0.080)	-0.051 (0.086)	-0.118 (0.083)	-0.130** (0.039)	-0.186** (0.045)	-0.085 (0.049)
Children aged 3-17	-0.090* (0.046)	-0.118** (0.045)	-0.094* (0.045)	-0.072** (0.024)	-0.134** (0.027)	-0.064* (0.027)
Children older 17	-0.080 (0.048)	-0.113* (0.047)	-0.135** (0.047)	-0.062* (0.026)	-0.074** (0.028)	-0.143** (0.028)
Income less than 1,000 Euro	-0.132* (0.057)	-0.013 (0.062)	0.012 (0.057)	0.015 (0.027)	0.080** (0.030)	0.025 (0.031)
Income 1,000 - 1,499 Euro	-0.072 (0.058)	-0.058 (0.063)	0.035 (0.054)	-0.032 (0.025)	0.047 (0.029)	0.026 (0.027)
Foreigner	0.068 (0.161)	0.162 (0.167)	0.164 (0.156)	-0.118** (0.043)	-0.162** (0.046)	-0.124** (0.048)
Starting Age	-0.038** (0.004)	-0.037** (0.004)	-0.035** (0.004)	-0.035** (0.002)	-0.030** (0.002)	-0.039** (0.002)
Wald-Statistic	252.323	264.771	238.530	798.617	641.888	736.701
Number of observations	4,477	4,215	4,055	15,392	12,774	12,453

*Notes:* \*\* significant at 1%; \* significant at 5%. Dependent variable: number of smoked cigarettes (categorized in four groups) conditional on currently smoking. Marginal effects are reported; Heteroscedasticity robust z-statistics in parentheses. See Table 6 for a description of variables. Reference group is a married individual, with a basic school degree and no vocational degree, not participating in the labor market with no children and a monthly income over 1,499 Euro.

Table 5: Ordered Probit Estimates of Conditional Demand - Men

Variable	East Germany			West Germany		
	1995	1999	2003	1995	1999	2003
Age*10 <sup>-2</sup>	7.262** (0.936)	8.613** (0.943)	6.525** (0.946)	8.303** (0.470)	7.851** (0.521)	6.333** (0.520)
Age squared*10 <sup>-2</sup>	-0.073** (0.011)	-0.096** (0.011)	-0.067** (0.011)	-0.086** (0.005)	-0.081** (0.006)	-0.060** (0.006)
Younger than 21	-0.140 (0.090)	-0.057 (0.089)	0.072 (0.085)	0.024 (0.049)	0.050 (0.052)	0.071 (0.053)
School degree high	-0.026 (0.075)	-0.243** (0.076)	-0.191* (0.081)	-0.067* (0.033)	-0.113** (0.034)	-0.144** (0.035)
School degree intermediate	-0.050 (0.041)	-0.141** (0.043)	-0.079 (0.047)	-0.067** (0.021)	-0.068** (0.023)	-0.037 (0.024)
Still school	-0.493** (0.154)	-0.547** (0.122)	-0.580** (0.123)	-0.159* (0.080)	-0.228** (0.070)	-0.178* (0.080)
University degree	-0.427** (0.100)	0.101 (0.104)	-0.264* (0.117)	-0.243** (0.048)	-0.250** (0.052)	-0.138* (0.055)
Vocational degree	-0.165** (0.064)	0.010 (0.066)	-0.083 (0.068)	-0.061** (0.024)	-0.092** (0.028)	-0.054 (0.028)
Still training	-0.367** (0.101)	-0.193* (0.093)	-0.240** (0.088)	-0.194** (0.048)	-0.179** (0.047)	-0.187** (0.047)
Part-time job	-0.033 (0.118)	-0.222 (0.130)	0.021 (0.100)	-0.008 (0.060)	0.040 (0.060)	0.141* (0.057)
Full-time job	0.125* (0.063)	-0.059 (0.063)	0.074 (0.064)	0.081* (0.032)	0.084* (0.035)	0.151** (0.037)
Unemployed	0.205** (0.073)	0.022 (0.070)	0.085 (0.069)	0.165** (0.041)	0.100* (0.047)	0.186** (0.044)
Single	0.187** (0.051)	0.132* (0.053)	0.001 (0.051)	0.097** (0.026)	0.035 (0.029)	0.054 (0.029)
Divorced or widowed	0.262** (0.052)	0.154** (0.058)	0.073 (0.057)	0.170** (0.032)	0.143** (0.035)	0.122** (0.035)
Children aged 0-2	0.069 (0.075)	0.088 (0.079)	-0.127 (0.073)	-0.078* (0.030)	-0.102** (0.036)	-0.024 (0.039)
Children aged 3-17	-0.028 (0.038)	-0.069 (0.040)	-0.074 (0.042)	-0.044* (0.021)	-0.082** (0.023)	-0.054* (0.024)
Children older 17	-0.068 (0.037)	-0.075 (0.038)	-0.083* (0.039)	-0.114** (0.020)	-0.129** (0.023)	-0.096** (0.024)
Income less than 1,000 Euro	-0.110* (0.045)	-0.124* (0.049)	0.020 (0.048)	-0.037 (0.022)	-0.050* (0.025)	0.004 (0.028)
Income 1,000 - 1,499 Euro	-0.077 (0.045)	-0.059 (0.049)	-0.005 (0.043)	-0.034 (0.020)	-0.114** (0.024)	-0.006 (0.023)
Foreigner	0.009 (0.106)	0.062 (0.104)	0.156 (0.100)	0.060* (0.030)	0.001 (0.035)	0.041 (0.035)
Starting Age	-0.053** (0.005)	-0.045** (0.006)	-0.052** (0.005)	-0.046** (0.003)	-0.041** (0.003)	-0.042** (0.003)
Wald-Statistic	478.354	430.344	435.075	1224.130	1173.830	941.987
Number of observations	6,969	6,054	5,805	21,295	16,826	15,687

Notes: \*\* significant at 1%; \* significant at 5%. Dependent variable: number of smoked cigarettes (categorized in four groups) conditional on currently smoking. Marginal effects are reported; Heteroscedasticity robust z-statistics in parentheses. See Table 6 for a description of variables. Reference group is a married individual, with a basic school degree and no vocational degree, not participating in the labor market with no children and a monthly income over 1,499 Euro.

## 6 Appendix

Table 6: Description of Variables

Variable	Description
Smoker	1 if individual smokes regularly or occasionally
Number cigarettes	2.5 if less than 5 cigarettes per day, 12.5 if 5-20 cigarettes, 30.5 if 21-40 cigarettes, 45 if more than 40 cigarettes per day
Age	Age of individual in years
Younger than 21	1 if individuals is younger than 21 years old; 0 otherwise
School degree high	1 if individual has a high school degree ("Abitur / Fachabitur"); 0 otherwise
School degree intermediate	1 if individual has an intermediate secondary school degree ("Realschulabschluss"); 0 otherwise
Still school	1 if individual still attends school; 0 otherwise
University degree	1 if individual has a University degree; 0 otherwise
Vocational degree	1 if individual has a vocational degree; 0 otherwise
Still training	1 if individual is still in vocational training or attends school; 0 otherwise
Part-time job	1 if individual has a part-time job; 0 otherwise
Full-time job	1 if individual has a full-time job; 0 otherwise
Unemployed	1 if individual is unemployed and looking for a job; 0 otherwise
Single	1 if individual is single; 0 otherwise
Divorced or widowed	1 if individual is divorced or widowed; 0 otherwise
Children aged 0 - 2	1 if there is at least one child aged between 0 and 2 in the individual's household; 0 otherwise
Children aged 3 - 17	1 if there is at least one child aged between 3 and 17 in the individual's household; 0 otherwise
Children older 17	1 if there is at least one child older than 17 years old in the individual's household; 0 otherwise
Income less than 1,000 Euro	1 if individual's monthly equivalent household income is less than 1,000 Euro; 0 otherwise
Income 1,000 - 1,499 Euro	1 if individual's monthly equivalent household income is between 1,000 and 1,499 Euro; 0 otherwise
East German	1 if individual residents in East Germany; 0 otherwise
Foreigner	1 if individual is a foreigner; 0 otherwise
Starting age	Age when individual started smoking

Table 7: Descriptive Statistics

	Women			Men		
	MZ 1995	MZ 1999	MZ 2003	MZ 1995	MZ 1999	MZ 2003
Smoker	0.229 (0.420)	0.237 (0.425)	0.235 (0.424)	0.359 (0.480)	0.350 (0.477)	0.336 (0.472)
Conditional Demand for Cigarettes <sup>1</sup>	12.446 (7.412)	12.614 (7.542)	12.411 (7.227)	14.942 (8.717)	15.184 (8.860)	14.875 (8.580)
Age	45.377 (17.380)	46.360 (17.786)	46.643 (17.673)	43.375 (16.448)	44.528 (16.906)	45.326 (17.046)
Younger than 21	0.075 (0.264)	0.082 (0.274)	0.082 (0.274)	0.083 (0.275)	0.087 (0.282)	0.084 (0.277)
School degree high	0.149 (0.356)	0.166 (0.373)	0.195 (0.397)	0.208 (0.406)	0.220 (0.414)	0.249 (0.433)
School degree intermediate	0.289 (0.454)	0.293 (0.455)	0.307 (0.461)	0.247 (0.431)	0.250 (0.433)	0.258 (0.437)
Still school	0.042 (0.199)	0.046 (0.210)	0.046 (0.210)	0.043 (0.203)	0.047 (0.212)	0.047 (0.212)
School degree basic	0.520 (0.500)	0.494 (0.500)	0.451 (0.498)	0.503 (0.500)	0.483 (0.500)	0.446 (0.497)
University degree	0.071 (0.257)	0.074 (0.262)	0.086 (0.281)	0.131 (0.337)	0.132 (0.338)	0.143 (0.350)
Vocational degree	0.590 (0.492)	0.579 (0.494)	0.585 (0.493)	0.661 (0.473)	0.649 (0.477)	0.636 (0.481)
Still training	0.086 (0.281)	0.107 (0.309)	0.119 (0.324)	0.103 (0.304)	0.117 (0.322)	0.126 (0.331)
No vocational degree	0.254 (0.435)	0.239 (0.427)	0.211 (0.408)	0.105 (0.306)	0.103 (0.304)	0.095 (0.294)
Part-time job	0.159 (0.366)	0.177 (0.382)	0.198 (0.399)	0.023 (0.150)	0.030 (0.172)	0.036 (0.186)
Full-time job	0.306 (0.461)	0.293 (0.455)	0.287 (0.452)	0.638 (0.481)	0.601 (0.490)	0.571 (0.495)
Unemployed	0.052 (0.223)	0.051 (0.221)	0.055 (0.227)	0.051 (0.219)	0.059 (0.236)	0.071 (0.257)
Not participating	0.482 (0.500)	0.479 (0.500)	0.460 (0.498)	0.288 (0.453)	0.310 (0.462)	0.322 (0.467)
Single	0.231 (0.421)	0.239 (0.427)	0.252 (0.434)	0.305 (0.461)	0.314 (0.464)	0.325 (0.469)
Divorced or widowed	0.168 (0.374)	0.176 (0.381)	0.173 (0.378)	0.066 (0.248)	0.072 (0.259)	0.079 (0.269)
Married	0.601 (0.490)	0.585 (0.493)	0.575 (0.494)	0.629 (0.483)	0.614 (0.487)	0.596 (0.491)
Children aged 0-2	0.063 (0.242)	0.062 (0.241)	0.060 (0.237)	0.063 (0.242)	0.060 (0.237)	0.056 (0.231)
Children aged 3-17	0.306 (0.461)	0.299 (0.458)	0.291 (0.454)	0.306 (0.461)	0.295 (0.456)	0.281 (0.449)
Children older 17	0.227 (0.419)	0.221 (0.415)	0.213 (0.409)	0.274 (0.446)	0.262 (0.440)	0.248 (0.432)
Income less than 1,000 Euro	0.369 (0.482)	0.388 (0.487)	0.254 (0.436)	0.316 (0.465)	0.337 (0.473)	0.218 (0.413)
Income 1,000 - 1,499 Euro	0.293 (0.455)	0.307 (0.461)	0.305 (0.460)	0.298 (0.458)	0.306 (0.461)	0.291 (0.454)
Income more than 1,499 Euro	0.253 (0.435)	0.267 (0.442)	0.400 (0.490)	0.295 (0.456)	0.315 (0.465)	0.448 (0.497)
East German	0.231 (0.421)	0.240 (0.427)	0.243 (0.429)	0.227 (0.419)	0.235 (0.424)	0.241 (0.428)
Foreigner	0.045 (0.207)	0.045 (0.207)	0.049 (0.215)	0.054 (0.227)	0.054 (0.226)	0.054 (0.225)
Number of observations	91,192	78,995	76,605	86,795	74,624	72,913

Notes: <sup>1</sup> Based on the subsample of smokers. Standard deviations in parentheses.