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The Effect of Lone Motherhood on the Smoking Behaviour of Young Adults

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SOEP The German Socio-Economic Panel Study

SOEPpapers
on Multidisciplinary Panel Data Research

217

Marco Francesconi • Stephen P. Jenkins • Thomas Siedler

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Berlin, August 2009

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at DIW Berlin

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The effect of lone motherhood on the smoking behaviour of young adults

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6 August 2009

Abstract

We provide evidence that living with an unmarried mother during childhood raises smoking propensities for young adults in Germany.

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We are grateful to two anonymous referees for helpful comments and suggestions. No conflicts of interest exist that we are aware of. As our study has involved only secondary analysis of anonymised data, ethical approval was not required.

JEL Classification: I10, J12, J18

Keywords: smoking; lone parent; childhood family structure; divorce; unobserved heterogeneity.

Forthcoming in: Health Economics

Non-technical Summary

We consider whether experience of growing up in a family headed by a lone mother increases later-life smoking propensities. Arguably, there is a link on the grounds that growing up in a family headed by a lone mother may raise an individual's stress levels and lower their self-esteem and these factors, in turn, lead to a greater chance of smoking, as a large medical and psychological literature has documented. Assessing whether the association between living with a lone mother and the greater likelihood of smoking later in life is a genuinely causal link is tricky, however. The association may simply reflect other factors that affect both childhood family structure and later-life smoking. Characteristics such as non-monetary resources in the home and aspects of parenting style are examples of factors commonly cited in this connection.

We examine these issues using data from the German Socio-Economic Panel (SOEP). The advantages of the SOEP are that it contains a number of measures of smoking behaviour for relatively large samples of young adults, together with a comprehensive set of measures of the characteristics of those individuals (and their parents), including histories of family structure during childhood. These features mean, in turn, that we are better able to address issues of causality in the link between childhood experience of lone motherhood and later-life smoking. We control for many observed differences between young adults that might affect smoking behaviour. In addition, because we have some data for brothers and sisters from the same family, we are also able to control for unobserved factors within households that may be jointly correlated with lone motherhood and smoking. A feature of our paper is that we are to explore the robustness of our findings to the use of different types of estimators of the link between lone motherhood and smoking, each controlling for confounding factors in different ways. Moreover, the SOEP also enables us to consider whether effects differ according to socioeconomic origin – specifically differences between young adults who grew up in a family from the former West Germany versus those from the former East Germany versus those who grew up in a family headed by a guestworker – and also whether effects differ according to the childhood stage at which lone motherhood was experienced and how lone motherhood arose (paternal death, divorce, extra-marital birth).

Our research indicates that individuals who experience lone motherhood during childhood are more likely to smoke, and hence are at greater risk of poor lifetime health. This finding is clear cut according to models controlling for a wide range of observed confounding factors, and holds regardless of the socioeconomic origin of the young adult and the measure of smoking behaviour. According to models which control for fixed unobserved factors that are shared within families, the findings are not as clear cut. We find a link between experience of lone motherhood and later-life smoking for young adults from the former West Germany, but there is a less consistent pattern for individuals from the East German and Guestworker samples. In addition, there is variation in estimated effects according to how the lone motherhood arose and during which childhood stage.

Overall, our estimates suggest that policies aimed at reducing tobacco consumption may be more effective if they acknowledge the long-term influence that childhood family disruption may have on later life risky behaviours.

1. Introduction

Most empirical research on the determinants of smoking by young adults has focused on factors such as socioeconomic and family background, self-esteem, social interactions, cigarette prices, and tobacco control policies (Townsend et al. 1994; Blum et al. 2000; Gruber 2001; Emery et al. 2001; Kestilä et al. 2006). In this paper, we show that a factor that has received little attention, family disruption during childhood, may play a significant role.

There has been much debate about the extent to which experience of lone parenthood during childhood affects individuals' life chances, and discussion has referred to a wide range of child behaviours, from early cognitive and non-cognitive outcomes to later educational attainment, criminal activity, employment, and earnings. Therefore, knowing whether living with a lone mother during childhood affects later-life smoking propensities is a useful contribution to this debate. If growing up in a family headed by an unmarried mother is likely to trigger stress and lower self-esteem (Amato 1993), this in turn may lead to a greater chance of smoking, as a large medical and psychological literature has documented (see inter alia Conrad et al. 1992; Byrne and Mazanov 2003).

A link between childhood experience of living in lone parent family and later life smoking behaviour was suggested by Griesbach et al. (2003), Bjarnason et al. (2003), and Antecol and Bedard (2007). Interpretation of such a link as causal is open to debate because unobserved or unobservable characteristics such as non-monetary resources in the home, parenting style, or parental 'abilities' may be associated with both inadequate parental investment and family breakdown during childhood. For example, the degree of parental supervision, inter-parent interaction, and family stress, or characteristics such as family income and maternal employment, may be associated with both poor parenting and family structure. As Painter and Levine (2000) point out, establishing the true causal pathway is important for policy. If parental and socioeconomic characteristics are the driving force

behind poor youth outcomes, then policies to prevent partnership dissolution will have little effect on youth outcomes. But if it is the absence of the father that causes poor outcomes, then such policies have a positive impact. These issues are economically important because the early adoption of deviant behaviours has long-run impacts on educational, labour market, and health outcomes: see Gruber (2001) and Antecol and Bedard (2007) and the references therein.

In this paper, we reconsider the link between childhood experience of lone parenthood and later-life smoking behaviour, but provide results that are better able to be interpreted as causal because of the ways in which we account for the potential confounding effects of observed and unobserved heterogeneity. Our data set, the German Socio-Economic Panel (SOEP), provides a comprehensive set of measures of observed characteristics for young adults and their parents. In addition, we estimate mother fixed effects (FE) models, thereby accounting for all unobserved factors that are fixed and shared within households and which may be jointly correlated with lone motherhood and smoking. Comparisons of the FE estimates with estimates derived from logistic and propensity score matching regressions allow us to explore the robustness of our findings to the use of different identifying assumptions.

2. Data

The SOEP is a representative longitudinal survey of individuals in private households in Germany (Haisken-DeNew and Frick 2005; Wagner et al. 2007). We combine information from the first 22 annual interview waves (1984–2005) with the retrospective lifetime employment, marital and fertility histories which span the pre-panel period for most respondents. We select individuals who were aged 18 or less in the first year that they were observed as SOEP respondents in their own right, who were living with their mother for at

least one year during the panel, and whose mothers (also respondents) had complete family and employment histories spanning the individual's childhood. The first selection avoids an over-representation of young adults who left the parental home at a relatively late age. Although, in principle, the condition may lead to sample selection bias if smoking behaviour and co-residence with one's mother share unobserved determinants, we believe the problem is not serious because, by age 18, only six percent of German children have left their parental home (Iacovou 2002). The second selection allows us to match young people to mothers who are SOEP respondents themselves, and the third selection ensures that we have complete information on family structure and maternal employment during the individual's childhood.

To control for differences in socioeconomic and cultural environment, we analyze three separate samples – individuals who grew up in a family from the former West Germany headed by a native German ('West German sample'); individuals from the former West Germany headed by a guestworker ('Guestworker sample'); and individuals from the former East Germany headed by a citizen of the former German Democratic Republic ('East German sample').

We use five measures of smoking behaviour. The first, *smoking*, is a standard measure of prevalence: it is equals one if a young adult reports at an annual interview that he/she currently smokes, and is zero otherwise. The second and third measures, *smoking 10+* and *smoking 20+*, equal one if a respondent says that she smokes on average ten or more and twenty or more cigarettes per day respectively, and zero if she smokes less or does not smoke at all. These two measures provide insight into smoking intensity. Information about these three prevalence measures is derived from the questions about smoking behaviour asked in survey years 1998, 1999, 2001, 2002 and 2004. In addition to these cross-sectional measures, we use hazard rate regressions to model two measures of smoking onset: whether an individual *started smoking by age 16*, and whether an individual *started smoking by age 21*.

Smoking onset was recorded only if the young adult also reported that she had smoked at least 100 cigarettes or other tobacco products during their life.

We use three different family structure measures, each of which was constructed using the marital histories of each respondent's mother. Our primary measure takes the value zero if the individual lived continuously with both biological (or adoptive) parents up to his/her sixteenth birthday, and one otherwise. An individual is defined as having grown up in a non-intact family if his or her biological or adoptive mother was not married at some time before his or her sixteenth birthday, either because of partnership dissolution (through divorce or father's death), or because the individual was born outside marriage and the mother did not subsequently marry the biological father.[1] If smoking onset occurred before an individual's sixteenth birthday, non-intactness was measured over the period prior to the first reported smoking occurrence. In essence, non-intactness refers to experience of living with an unmarried mother sometime during childhood.

A number of earlier studies have reported different impacts of the experience of a non-intact family depending on how old the child was when the dissolution occurred (Wojtkiewicz 1993; Ermisch and Francesconi 2001; Hill et al. 2001; Ermisch et al. 2004; Antecol and Bedard 2007; Francesconi et al. 2009). This motivates our second measure of family structure which distinguishes between three childhood stages: early childhood (birth to age 5), middle childhood (ages 6–10), and late childhood (ages 11–16).

Other studies find evidence of heterogeneous effects of non-intactness by type of non-intact family (Corak 2001; Francesconi et al. 2009). This motivates our third measure of family structure, which distinguishes between individuals whose mother was unmarried at

[1] Intactness refers to intactness of legal marriages, and does not take account of cohabiting partnerships. This is a limitation, since a non-negligible fraction of young households in Germany are formed by unmarried cohabiting individuals, but it is one forced on us by the data: the SOEP does not have cohabitation history data covering the pre-panel period. When we focused on the panel period only, and redefined intactness to also account for cohabiting couples using the partnership history data available from the panel, we derived similar results to those reported below, but the size of each estimating sample was greatly reduced. For brevity, these estimates are not reported.

their birth from individuals who ever lived with a separated/divorced mother and individuals who experienced the death of their father during childhood.

About 20 percent of individuals in the West German sample, 11 percent in the Guestworker sample, and more than 30 percent in the East German sample, lived with a lone mother during childhood. The reasons for lone motherhood also differ by sample. For example, divorce was the most common route into lone motherhood in the West German sample but, in the East German sample, unmarried motherhood was more prevalent, whereas both divorce and unmarried motherhood were equally relevant in the Guestworker sample. About 50 percent of family disruptions in the West German and Guestworker samples and 75 percent in the East German sample occurred between ages 0–5, mainly because of the substantial fraction of unmarried mothers. Smoking prevalence and smoking onset are substantially greater among young adults who experienced lone motherhood, regardless of socio-cultural background. For instance, in the West German sample 46 percent of young adults who lived with a lone mother during childhood smoked, but only 32 percent from intact families. For the East German sample, the corresponding proportions were 53 percent and 39 percent; for the Guestworker sample, 55 percent and 37 percent.

We used a rich set of variables to account for other potential influences on young people's smoking behaviour. The variables are described in the notes to Table 1.

3. Findings

The estimated effect of living with a lone mother during childhood on later-life smoking behaviour is reported in Table 1, by sample and estimation method. For each of the three samples, the logit estimates imply a positive and statistically significant association between having lived with a lone mother during childhood and the probability of smoking.[2] Living

[2] All logit regressions are estimated using samples of pooled person-year observations, i.e. each interview is treated as an occasion at which an individual is at risk of smoking.

with a lone mother is associated with an 8 percentage point increase in the case of the West German sample, and a 16 percentage point increase in the case of the other two samples. Similar positive associations emerge for both smoking intensity outcomes, although the marginal effect for smoking 20+ cigarettes per day is small, and also not statistically significant for the Guestworker sample.

< Table 1 near here >

Propensity score matching regressions yield estimates that are similar, though typically greater in magnitude than the corresponding logit estimate (and estimated more precisely), irrespective of the type of matching employed.[3] When the smoking outcome is changed to smoking at least 20 cigarettes per day from smoking per se, the impact of lone motherhood does not decline as strongly as it did according to the logit estimates. Living with a lone mother during childhood increases the likelihood of smoking 20 or more cigarettes a day by almost seven percentage points among the East German sample, eight points among the West German sample, and eleven points among the Guestworker sample.

Neither the propensity score matching estimates nor the logit estimates account for any mutual associations that childhood family structure and smoking share with some unmeasured true causal factor. Hence, we turn to the FE estimates, shown in the sixth column of Table 1.[4] For the West German sample, these are similar to the estimates reported earlier: living with an unmarried mother is associated with an increased smoking prevalence of

[3] For consistent estimation of the effect of childhood family non-intactness, matching methods require, at a minimum, that there be no unobservable differences between children in intact families and children in non-intact families after conditioning on the control variables (the "conditional independence" or "selection on observables" assumption). Thus, the issues raised by the large literature on endogenous treatment effects and selection bias ("selection on unobservables") are not considered. But compared to the standard logit estimation results discussed earlier, which incorporate assumptions of linearity and additivity, matching is a method in which no functional form restrictions on the relation between outcome, treatment, and control variables need be made. For excellent overviews of matching methods, see Dehejia and Wahaba (2002) and Moffitt (2004).

[4] Sibling difference (or "mother fixed effects") models exploit the fact that siblings or half-siblings share many family-specific characteristics and environmental factors. This estimation method is intended to eliminate these common factors by relating differences in outcomes between siblings to differences in their experience of life with a single mother as well as differences in other time-varying covariates. The effects of all variables that are fixed over time and shared among siblings (e.g. mother's education) cannot be identified. For other applications of this method, see Ermisch et al. (2004) and Francesconi et al. (2009).

between 8 and 11 percentage points. Similar point estimates emerge from the other two samples as well, but they lose statistical significance in some cases and retain significance and are quantitatively large in others. In particular, size and significance are retained by the estimates from the East German sample (except for smoking prevalence), which in fact are always larger than the corresponding logit (cross-sectional) estimates. By contrast, for the Guestworker sample, the estimate for the probability of smoking 20 or more cigarettes a day is the only one that retains statistical significance. (The estimated increase of 14 percentage points is about 30 percent greater than the propensity score matching estimates.) The estimates for the other two prevalence outcomes are statistically insignificant. But, as revealed by the last column of Table 1, such models are estimated using a relatively small sample. Since identification of FE models relies on having sufficient variation across siblings in the same family, our results may reflect limited statistical power rather than a genuine lack of an effect.

To explore the link between childhood family structure and youth smoking behaviour further, we analyzed smoking onset by age 16 (or by age 21) using discrete time hazard regression models. Individuals were assumed to be a risk of smoking onset from the year they turned 11 until the age at which the individual started smoking (a completed spell), or until age 16 (or 21), defining a right censored spell. The baseline hazard was allowed to vary non-parametrically, year by year. The hazard estimates are consistent with our earlier findings: see Table 1. That is, regardless of sample and estimation method, living with an unmarried mother during childhood is associated with an increased probability of starting smoking either by age 16 or by age 21. For example, for West German young adults, the risk of starting smoking by age 21 is between one and five percentage points higher for those living with a lone mother during childhood. The estimated impacts are similar among children of East

German descent, but could not be estimated from the Guestworker sample due to its small size.

The effect of living with a lone mother may differ according to how lone motherhood began. Table 2 reports cross-sectional logit estimates for two outcomes (*smoking* and *started smoking by age 21*) by sample (panel A). The estimates for the other outcomes are not shown for brevity.

Most of the effects of lone parenthood on the probability of smoking and on the hazard of smoking onset discussed earlier appear to be driven by the effects for children who lived with a divorced mother, rather than by those who lived with an unmarried mother or whose father died. Specifically, having lived with a divorced mother during childhood is associated with an increase of about 14 percentage points in the probability of smoking for West German youth, and of about 25 percentage points for young adults in the Guestworker and East German samples.

The impact of lone motherhood may also vary with the age at which it was experienced. The estimates in panel B of Table 2 demonstrate this while also showing that the result is sample-specific. For the Guestworker sample, lone motherhood in middle childhood appears to be more adverse than lone motherhood in early and late childhood. Among youths of East German origin, lone motherhood is associated with a greater risk of smoking prevalence and smoking onset regardless of the age at which it was experienced, though the effects appear larger for experience in middle and late childhood. All of the estimates for the West German sample are imprecisely estimated, and so we cannot reject the hypothesis that the estimated effects in the two childhood stages are the same.

The magnitude of the estimated effects on smoking prevalence of living with a lone mother during childhood can be benchmarked against the size of the effect of mother's smoking prevalence. Parental smoking has been found consistently to have a strong

association with higher risks of smoking initiation and smoking prevalence among adolescent and young adult offspring (Gilman et al. 2009; Göhlmann et al. 2009), although some argue that children of lone mothers have an increased risk of being smokers regardless of whether or not their mother smokes (Green et al. 1990; Turner-Warwick 1992). In line with the former studies, we also find that maternal smoking significantly increases the offspring's likelihood of smoking and hazard to start smoking across all samples.[5]

We used these estimates, together with the logit estimates shown in Table 1, to calculate the decrease in the proportion of mothers who smoke that would be required to keep their children's smoking prevalence and intensity unchanged were the proportion of respondents living with a lone mother during childhood also to be increased by 5 percent, or by 10 percent.[6] For the West German sample, the rise in smoking prevalence associated with a 5 percent increase in the proportion of individuals from lone mother families would be offset were the proportion of mothers smoking also to decrease by 2.3 percent. The decline in mother's smoking prevalence is greater for higher levels of smoking intensity: it is almost 5 percent if the outcome measure is smoking 10+ cigarettes a day and about 13 percent in the case of smoking 20+ cigarettes a day. Declines in maternal smoking prevalence of this magnitude would be remarkable according to other studies for Germany (see e.g. Bantle and Haisken-DeNew 2002; Göhlmann et al. 2009).

4. Conclusions

Our research suggests that childhood family structure may have a large impact on smoking behaviour. Living with a lone mother during childhood is associated with greater risks of

[5] For example, having a mother who smokes increases the probability of smoking by 17 percentage points for young adults in the West German and Guestworker samples and by 23 percentage points for East German young adults. Similarly large effects are found for the other prevalence outcomes and for smoking onset. These results are not shown, but can be obtained from the authors.

[6] We use the logit estimates because they are broadly representative of all the estimates. However, we do not report a benchmarking estimate for the East German or Guestworker samples, because the corresponding FE estimates were insignificant in this case.

smoking among German young adults. Regardless of whether children were brought up in the former West Germany or the former East Germany or are children of guestworkers, this evidence is strong according to estimates from cross-sectional logit models that do not control for possible correlations between common unobserved determinants of family structure and smoking behaviour. When the endogeneity of family disruption is accounted for using mother fixed effects models, there is also some evidence of adverse effects. However, whereas the FE-estimated effects are consistently large and well determined for all the various smoking behaviour measures for individuals from the former West Germany, there is a less consistent pattern across outcome measures for individuals from the East German and Guestworker samples. Some FE estimates are statistically significant, others are not, which may reflect low power associated with small sample sizes rather than an absence of effect. In addition, there is variation in estimates according to how the lone motherhood arose and during which childhood stage. Nonetheless our results and the associated benchmarking exercise suggest that policies aimed at reducing tobacco consumption may be more effective if they acknowledge the long-term influence that childhood family disruption may have on later life risky behaviours.

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Table 1
The effect of living with an unmarried mother during childhood on later-life smoking behaviour

Outcome	Logit[a]		Propensity score matching[b]			FE[c]	
		N[d]	Local linear regression	Biweight kernel	*N*		*N* (*n*)
West German Sample							
Smoking	0.077**	4,055	0.132***	0.132***	3,961	0.088*	751
	(0.038)		(0.022)	(0.022)		(0.047)	(37)
Smoking 10+	0.072**	3,222	0.118***	0.118***	3,083	0.107**	749
	(0.035)		(0.023)	(0.023)		(0.051)	(34)
Smoking 20+	0.055**	3,222	0.076***	0.080***	3,083	0.079*	749
	(0.024)		(0.021)	(0.020)		(0.041)	(34)
Start smoking by age 16	0.007	3,570	0.037***	0.043***	3,570	0.013	634
	(0.005)		(0.014)	(0.014)		(0.028)	(16)
Start smoking by age 21	0.012*	5,465	0.034***	0.039***	5,465	0.047**	634
	(0.006)		(0.011)	(0.012)		(0.023)	(16)
Guestworker Sample							
Smoking	0.159**	1,657	0.169***	0.201***	1,645	0.061	290
	(0.080)		(0.045)	(0.049)		(0.073)	(18)
Smoking 10+	0.134*	1,301	0.157***	0.189***	1,289	0.044	290
	(0.081)		(0.049)	(0.054)		(0.080)	(18)
Smoking 20+	0.029	1,301	0.103***	0.110***	1,289	0.139**	290
	(0.044)		(0.040)	(0.038)		(0.067)	(18)
Start smoking by age 16	0.039	1,522	0.087**	0.082**	1,471		
	(0.024)		(0.037)	(0.035)			
Start smoking by age 21	0.051*	2,318	0.083**	0.082**	2,318		
	(0.026)		(0.034)	(0.036)			
East German Sample							
Smoking	0.161**	2,452	0.145***	0.154***	2,401	0.021	440
	(0.043)		(0.027)	(0.025)		(0.056)	(33)
Smoking 10+	0.093**	2,001	0.112***	0.120***	1,950	0.106*	440
	(0.038)		(0.026)	(0.025)		(0.056)	(26)
Smoking 20+	0.037*	2,001	0.067***	0.067***	1,950	0.093**	440
	(0.020)		(0.017)	(0.016)		(0.042)	(26)
Start smoking by age 16	0.014**	2,418	0.035***	0.034***	2,418	0.094**	415
	(0.007)		(0.014)	(0.014)		(0.042)	(10)
Start smoking by age 21	0.013**	3,388	0.033***	0.033***	3,388	0.066*	415
	(0.006)		(0.013)	(0.013)		(0.037)	(10)

***, **, * significant at the 1 percent, 5 percent and 10 percent level, respectively. Standard errors in parentheses.

[a] Marginal effects from logit regressions computed at average values of all variables used. Other variables are: age group, sex, year of birth, mother's highest educational attainment, mother's age at the child's birth, whether the respondent is an only child, number of brothers and sisters, birth order, regional dummy variables, average post-government household income during childhood years, number of years mother was part-time and full-time employed during childhood years, whether mother smokes (or ever smoked), average annual cigarette prices, a linear time trend, and a constant. Household income was deflated using the Consumer Price Index. Estimates on smoking, smoking 10+ and smoking 20+ were estimated using person-year data with standard errors clustered at the individual level.

[b] Average treatment effects of the treated. Variables used to estimate propensity scores: age group, sex, year of birth, mother's highest educational attainment, mother's age at the child's birth and number of years mother was part-time and full-time employed during childhood years.

[c] Marginal effects computed at average values of all variables used. FE: fixed-effects linear probability models. Other regressors were the (sibling) differences in gender, age, mother's age at the child's birth, whether the respondent is the second or third-born, average post-government household income during childhood years and number of years mother was part-time and full-time employed during childhood years. Standard errors are robust to any form of correlation between siblings.

[d] *N* is the number of person-year observations for the logit and propensity score matching methods. For the family-fixed effects estimation, *N* reports the number of families and *n* is the number of mothers with at least two children who experience different family structures.

Table 2
The effect of living with an umarried mother during childhood on later-life smoking behaviour

	West German sample		Guestworker sample		East German sample	
	Smoking	Start smoking by age 21	Smoking	Start smoking by age 21	Smoking	Start smoking by age 21
Panel A						
Born to unmarried mother	0.005	0.001	0.129	0.034	0.071	0.002
	(0.058)	(0.008)	(0.118)	(0.028)	(0.054)	(0.007)
Parents divorced	0.137**	0.015*	0.254**	0.061	0.259***	0.025**
	(0.047)	(0.008)	(0.108)	(0.050)	(0.053)	(0.012)
Father died	-0.026	0.026	-0.026	0.197	0.166	0.042
	(0.090)	(0.018)	(0.129)	(0.152)	(0.152)	(0.037)
Panel B						
Ever lived with a lone mother at ages:						
0–5	0.078	0.006	0.140	0.036**	0.128***	0.013
	(0.051)	(0.007)	(0.103)	(0.017)	(0.048)	(0.008)
6–10	0.073	0.004	0.228*	0.091***	0.243***	0.036**
	(0.063)	(0.009)	(0.134)	(0.030)	(0.092)	(0.017)
11–16	0.084	0.006	0.163	0.011	0.250***	0.036**
	(0.062)	(0.008)	(0.144)	(0.033)	(0.073)	(0.016)
Number of observations	4,055	5,465	1,657	2,318	2,452	3,388

***, **, * significant at the 1 percent, 5 percent and 10 percent level, respectively. Standard errors in parentheses. Figures are marginal effects from logit regressions computed at average values of all variables used. Other variables are: age group, sex, year of birth, mother's highest educational attainment, mother's age at the child's birth, whether the respondent is an only child, number of brothers and sisters, birth order, regional dummy variables, average post-government household income during childhood years, number of years mother was part-time and full-time employed during childhood years, whether mother smokes (or ever smoked), a linear time trend, and a constant. Household income was deflated using the Consumer Price Index. Household incomes are expressed in Euros (year 2000 prices).

Appendix (not intended for publication)

Supplementary tables

Table A1. Means of the outcome variables, by sample and childhood family structure
Table A2. Summary statistics, by sample
Table A3. Living with an unmarried mother during childhood on later-life smoking behaviour on whether currently smoking: effects of other regressors (marginal effects from logit regressions):
Table A4. The intergenerational association in smoking behaviour
Table A5. Benchmarking the effect of living with a lone mother during childhood against the effect of decreasing the prevalence of mothers who smoke
Table A6. Discrete time hazard regression estimates (smoking onset by age 21)

Table A1
Means of the outcome variables, by sample and childhood family structure

	West German Sample		Guestworker sample		East German sample	
	Non-intact Family	Intact Family	Non-intact Family	Intact Family	Non-intact Family	Intact Family
Started smoking by age 16	0.424	0.262	0.458	0.203	0.465	0.314
N	144	588	24	271	144	347
Started smoking by age 21	0.563	0.391	0.667	0.472	0.625	0.461
N	144	588	24	271	144	347
Currently smoking	0.456	0.315	0.529	0.387	0.552	0.374
N	241	941	51	434	248	546
Currently smoking 10+ per day	0.352	0.220	0.404	0.282	0.339	0.246
N	210	840	47	383	227	505
Currently smoking 20+ per day	0.181	0.094	0.085	0.123	0.132	0.079
N	210	840	47	383	227	505

N is the number of individuals. Means are measured in the last year that individuals' outcomes were observed in the panel.

Table A2
Summary statistics, by sample

	West German sample	Guestworker sample	East German sample
Age	24.88	24.85	21.58
	(6.21)	(5.57)	(3.59)
Age < 22	0.371	0.324	0.524
Age 22–25	0.218	0.249	0.307
Age > 25	0.410	0.427	0.169
Year of birth	1977.82	1977.54	1981.26
Female	0.500	0.487	0.487
Mother's highest educational attainment			
No degree or secondary general school certificate	0.577	0.883	0.145
Intermediate school certificate	0.309	0.037	0.457
Grammar school certificate (*Abitur*)	0.040	0.008	0.020
Technical college or university degree	0.073	0.072	0.377
Mother's age at birth	26.82	26.20	24.70
	(5.10)	(6.05)	(4.37)
Only child	0.127	0.043	0.145
Number of brothers[a]	0.771	1.109	0.681
Number of sisters[a]	0.759	1.181	0.611
Birth order[a,b]			
First child	0.405	0.321	0.446
Second child	0.405	0.325	0.437
Third child or more	0.190	0.353	0.116
Average post-government household income during childhood years[c]	35,335	30,123	30,533
	(14,391)	(9,171)	(10,025)
Mother currently smokes	0.319	0.285	0.311
Mother's employment during childhood years:			
Number of years full-time employed	3.11	6.15	12.19
	(4.69)	(6.26)	(4.30)
Number of years part-time employed	5.74	2.84	3.22
	(5.43)	(3.96)	(4.30)
Ever lived in a non-intact family	0.20	0.11	0.31
Born to unmarried mother	0.06	0.04	0.16
Parents divorced	0.13	0.05	0.13
Father died	0.02	0.02	0.02
Ever lived with a lone mother at ages:			
0-5	0.10	0.06	0.23
6-10	0.05	0.02	0.04
11-16	0.05	0.03	0.04
N	1,182	485	794

Table shows sample means, with standard deviations in parentheses.
[a] Includes adopted and foster children.
[b] Computed for children with siblings only.
[c] Computed for all childhood years for which positive household income was available.
Household income was deflated using the Consumer Price Index and is expressed in Euros (year 2000 prices).

Table A3
Living with an unmarried mother during childhood on later-life smoking behaviour on whether currently smoking: effects of other regressors
(marginal effects from logit regressions):

	West German sample	Guestworker sample	East German sample
Age 22–25	0.060*	0.041	-0.138***
	(0.034)	(0.054)	(0.031)
Age > 25	–0.007	0.014	-0.246***
	(0.055)	(0.086)	(0.045)
Female	–0.039	-0.155***	-0.081**
	(0.026)	(0.043)	(0.037)
Year of Birth	–0.003	-0.021***	-0.040***
	(0.005)	(0.008)	(0.008)
Intermediate school certificate	–0.052*	0.239**	-0.067
	(0.030)	(0.108)	(0.060)
Grammar school certificate (*Abitur*)	–0.060	-0.152	-0.194**
	(0.070)	(0.131)	(0.075)
Technical college or university degree	–0.123**	0.219**	-0.097
	(0.052)	(0.093)	(0.065)
Mother's age at birth	–0.006*	-0.006	-0.012***
	(0.003)	(0.004)	(0.006)
Only child	0.047	-0.037	0.033
	(0.054)	(0.094)	(0.072)
Number of brothers	0.031	-0.003	-0.064
	(0.019)	(0.027)	(0.041)
Number of sisters	0.013	0.045	0.012
	(0.019)	(0.028)	(0.036)
Second child	0.101**	-0.042	0.035
	(0.033)	(0.054)	(0.045)
Third child or more	0.092*	0.048	0.352***
	(0.054)	(0.069)	(0.079)
Linear time trend	-0.004	0.021***	0.046***
	(0.005)	(0.008)	(0.008)
Mother currently smokes	0.172**	0.167***	0.232***
	(0.030)	(0.054)	(0.040)
Average household income	–0.001	-0.003	0.001
	(0.001)	(0.003)	(0.002)
Mother's employment during childhood years:			
Number of years full-time employed	0.004	-0.004	0.004
	(0.003)	(0.007)	(0.008)
Number of years part-time employed	0.001	0.005	0.004
	(0.003)	(0.004)	(0.007)
Observations	4055	1657	2452

***, **, * significant at the 1 percent, 5 percent and 10 percent level, respectively. Standard errors in parentheses. Marginal effects from logit regressions computed at average values of all variables used. Other variables not reported are: regional dummy variables. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A4
The intergenerational association in smoking behaviour

	West German sample	Guestworker sample	East German sample
Smoking[a]	0.172***	0.167**	0.232**
	(0.030)	(0.054)	(0.040)
Smoking 10+[a]	0.136**	0.174**	0.160**
	(0.028)	(0.049)	(0.034)
Smoking 20+[a]	0.043**	0.087**	0.030**
	(0.018)	(0.035)	(0.016)
Start smoking by age 16[b]	0.022**	0.003	0.027**
	(0.005)	(0.007)	(0.006)
Start smoking by age 21[b]	0.022**	0.005	0.016*
	(0.005)	(0.008)	(0.008)

Table shows marginal effects from logit regressions computed at average values of all the variables used. [a] Explanatory variable equals one if mother currently smokes, and zero otherwise. [b] Explanatory variable equals one if mother ever smoked, and zero otherwise. For the other covariates included in the regressions, see notes to Table 1.

Table A5
Benchmarking the effect of living with a lone mother during childhood against the effect of decreasing the prevalence of mothers who smoke

	West German sample		Guestworker sample		East German sample	
	Percent increase in the proportion of children experiencing life with a lone mother during childhood					
	5%	10%	5%	10%	5%	10%
Smoking	–2.3	–2.8	–12.2	–12.7	–1.0	–2.0
Smoking 10+ cigarettes per day	–4.7	–5.2	–10.0	–10.4	–1.0	–1.8
Smoking 20+ cigarettes per day	–12.9	–14.2	–15.1	–15.3	–2.2	–4.3

Computed using the logit results presented in Table 1. Table shows the percentage decrease in the proportion of mothers smoking that is required to offset the effect of an increase (5% or 10%) in the proportion of individuals experiencing living with a lone mother during childhood..

Table A6
Discrete time hazard regression estimates (smoking onset by age 21)

	West German sample	Guestworker sample	East German sample
Experience of lone motherhood	0.350**	0.959***	0.368**
	(0.161)	(0.354)	(0.166)
Age	0.760***	0.612**	1.041**
	(0.285)	(0.359)	(0.426)
Female	–0.031	–0.199	–0.062
	(0.125)	(0.187)	(0.141)
Year of Birth	0.014	0.009	0.012
	(0.016)	(0.027)	(0.030)
Intermediate school certificate	–0.304**	0.760	–0.453*
	(0.149)	(0.483)	(0.235)
Grammar school certificate (*Abitur*)	–0.054	–0.646	–0.625
	(0.371)	(1.161)	(0.591)
Technical college or university degree	–1.148***	0.400	–0.364
	(0.384)	(0.355)	(0.255)
Mother's age at birth	–0.045***	–0.033	–0.047**
	(0.016)	(0.021)	(0.022)
Only child	–0.040	0.092	0.489*
	(0.245)	(0.531)	(0.267)
Number of brothers	0.047	–0.121	0.025
	(0.098)	(0.114)	(0.149)
Number of sisters	0.113	–0.004	0.250*
	(0.095)	(0.111)	(0.132)
Second child	0.357**	–0.139	0.302
	(0.163)	(0.245)	(0.188)
Third child or more	0.466*	0.042	0.967***
	(0.261)	(0.318)	(0.336)
Mother ever smoked	0.739***	0.150	0.828***
	(0.141)	(0.209)	(0.154)
Price per cigarette	–0.280	–0.453	–0.450**
	(0.209)	(0.313)	(0.220)
Average household income/10,000	0.035	0.065	–0.018
	(0.049)	(0.131)	(0.086)
Duration dependence (elapsed years at risk)			
1–3 years	–37.806	–22.773	–35.028
	(31.202)	(51.285)	(58.244)
4 years	–37.183	–23.217	–34.407
	(31.255)	(51.344)	(58.302)
5 years	–37.581	–22.644	–34.837
	(31.292)	(51.375)	(58.347)
6 years	–37.615	–22.801	–35.515
	(31.329)	(51.418)	(58.409)
7 years	–39.452	–23.199	–36.761
	(31.371)	(51.458)	(58.457)
8 years	–39.595	–23.359	–37.989
	(31.417)	(51.496)	(58.509)
9 years	–41.681	–24.994	–40.191
	(31.470)	(51.553)	(58.565)
10–11 years	–42.981	–26.665	–42.659
	(31.550)	(51.644)	(58.672)
Number of observations	5,465	2,318	3,388

***, **, * significant at the 1 percent, 5 percent and 10 percent level, respectively. Standard errors in parentheses.
Coefficient effects from logit hazard regressions. Marginal effects reported in text were computed at average values of all explanatory variables used. Variables not reported are: regional dummy variables and the number of years mother was part-time employed and full-time employed during childhood years.