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Abstract

Maternal leave policies aim at protecting the health of new mothers. However, the impact of such policies on precursors of health, such as smoking behavior, is both theoretically and empirically understudied. We investigate the effect of maternal leave duration on the long-term smoking behavior of mothers across 14 European countries by combining survey data on health behaviors with retrospective information on birth and employment histories, and link these with maternity and parental leave policies between 1960 and 2010. To identify the causal impact of maternal leave duration, we exploit between and within country variation in mothers' exposure to statutory leave duration policies in an instrumental variable framework. We find that a one-month increase in maternal leave duration increases the probability that a woman smokes in the long run by 2.3 percentage points. Similarly, a one-month increase in leave duration increases the lifetime duration of smoking by 13 months. We document non-linearity in this effect for the first time, showing that shorter leave durations have a protective effect, while very long maternal leave promotes harmful health behavior. Suggestive evidence shows lack of financial support from spouse around childbirth as a mediator of the observed effects, while employment and other socio-demographic characteristics play no role.

JEL classification: I12, J13, J22
Keywords: risky health behavior, maternity leave, parental leave policies, SHARE, instrumental variables

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1 Introduction

Most OECD countries offer some form of paid leave that allows new mothers to take time off work around the birth of their child to protect the health of mothers and their newborns (Gauthier, 2011a,b). Previously, empirical investigations have focused on immediate health outcomes, like mortality or mental health, due to their inherent importance to maternal health and well-being. However, a comprehensive assessment of leave policies merits investigating the impact of these policies on precursors of health, namely risky health behaviors, that shape health outcomes in the long run. Yet, evidence on the causal impact of maternal leave duration[1] on health behaviors is scarce. We contribute to the debate on expanding maternal leave duration by providing evidence of the causal effect of maternal leave duration on mothers' smoking behavior in later life across 14 European countries. We first identify linear effects on smoking later in life, lifetime duration of smoking, and daily cigarette consumption. We then provide novel evidence of the non-linear effect of mothers' leave duration on these smoking behaviors by exploiting the large differences in statutory leave duration in this multi-country setting over time.

The smoking behavior of women is relevant both from a public health perspective and an economic standpoint. Tobacco consumption has been found to be the most important risk factor for mortality in developed countries (Rehm et al., 2006). Moreover, the negative effect of smoking during pregnancy on both maternal and fetal health is well established (de la Chica et al., 2005; Castles et al., 1999; Gilliland, 2000; Wisborg, 2000), along with the intergenerational transmission of risky health behavior (Kalmijn, 2022). Smoking is also relevant for various labor market outcomes. For example, it is associated with reduced wages of up to eight percent (Levine et al., 1997) and has a detrimental impact on lifetime earnings (Böckerman et al., 2015). These negative implications of smoking are relevant for both high-income European countries, where women exhibit the highest global smoking rates (WHO, 2011), as well as for low-income countries experiencing rising smoking rates and contemplating changes in leave policies following childbirth.

While there are many potential pathways through which maternal leave might affect smoking behavior, we focus on two of them, namely habit formation and shifting of the

[1] In this paper, maternal leave refers to any maternity or parental leave taken by mothers around the birth of their child. Maternity leave is the employment-protected leave of absence granted to employed women directly prior to or after childbirth. Parental leave usually follows maternity leave and – in many European countries – can be taken by either parent. More information on maternal leave and statutory leave duration policies is provided in Section 2.1.

socio-economic trajectory, as they are closely linked to well-established theoretical and empirical models on the demand for health. Upon medical advice, pregnant women tend to discontinue certain risky behaviors; for example, in the UK and the US, more than half try to quit smoking (Committee on Obstetric Practice, 2020; Cooper et al., 2017). Such behavioral changes have been found to persist up to at least three months postpartum (Cooper et al., 2017). Longer maternal leave has the potential to reduce smoking due to more time spent with the vulnerable newborn and this change may continue to persist in the long run. However, a large body of the literature shows that the period after childbirth is particularly stressful and potentially harmful for maternal mental health. Findings from a nationwide survey across the US show that extended stay-at-home periods can increase sadness, anger, and depression compared to employed mothers and thus lead to lower mental well-being (Mendes et al., 2012). While maternal leave leads to better mental health of mothers in the short run (Chatterji and Markowitzj, 2005; Chatterji and Markowitz, 2012; Bilgrami et al., 2020), Chuard (2023) shows that an additional year of maternal leave from 1.5 to 2.5 years has a detrimental effect on mental health. Therefore, a longer duration of leave following childbirth may increase the risk of poor maternal mental health, which, in turn, could lead to smoking as a coping mechanism (Friedman, 2020). If the longer leave duration is accompanied by increased financial stress due to reduced income or higher expenses, these financial difficulties could aggravate the negative impact of maternal leave duration on mental health (Bridges and Disney, 2010). Since health and health behaviors are interrelated over the life cycle and affected by life transition events (Grossman, 1972), such as childbirth (Prinds et al., 2014), the short- and medium-term effects of leave duration on smoking are likely to persist in the long run due to habit formation over the life course (Becker and Murphy, 1988; Bernardi et al., 2019). For addictive behaviors like tobacco consumption, the success of cessation attempts depends on many interrelated factors, with stress being an important one (Hiscock et al., 2012; Sloan and Wang, 2008), especially in socio-economically disadvantaged groups, who are less likely to quit smoking and stay abstinent (Kock et al., 2019).

A second pathway, through which longer maternal leave may exacerbate smoking behavior, is by altering the career trajectories of women. This may be affecting their short- and long-run socio-economic status, reinforcing the stress and mental health channel, as described above. The related mechanisms might be similar to those explaining the positive effect of unemployment on smoking probability and intensity, where coping with stress was identified as an important driver (Everding and Marcus, 2020). Prior research extensively documents the non-linear effects of leave duration on women's labor market outcomes. In a review, Olivetti and Petrongolo (2017) con-

clude that the positive effects of parental leave on labor market participation are limited to shorter and intermediate leave duration. Relatedly, shorter leave does not affect wages, while the effect of longer leaves is negative but small (Ruhm, 1998). Schönberg and Ludsteck (2014) examine six reforms of parental leave in Germany and also conclude that the expansion of maternity benefits beyond the job protection period reduced mothers' employment and income significantly. While the short- and medium-term effects of interrupted working careers might be small, they accumulate over the life-cycle and, depending on the pension system, result in a lower income in old age (Möhring, 2018). This is in line with life course theory's assumption of cumulative (dis)advantage – that current circumstances are a result of accumulated past resources, experiences, and decisions (Bernardi et al., 2019). From this perspective, maternal leave interrupts the accumulation of human capital, thus shifting the socio-economic trajectories of women and thus affecting their health behavior.

Empirically identifying the causal effect of maternal leave duration on long-run smoking behavior presents several challenges. The first is the potential endogeneity of leave duration. Specifically, unobservable maternal attributes might be correlated with leave uptake and duration, and with health behaviors at the same time. Moreover, the duration of leave taken may depend on corresponding statutory cash benefits. Second, reliable data on fertility and employment histories along with data on risky health behaviors in later life is rarely collected, especially not across multiple countries. We identify causal effects of leave duration on long-run smoking behavior by exploiting plausibly exogenous variation in statutory maternal leave duration between countries and over time within countries. Conditional on controlling for statutory cash benefits, these leave policies are plausibly orthogonal to unobserved maternal attributes and therefore valid instruments for leave duration that satisfy the exclusion restriction. We use data from the first seven waves of the Survey of Health, Ageing and Retirement in Europe (SHARE) conducted among individuals aged 50 years and above. The SHARE data provide us with information on our main variables of interest, i.e. retrospective data on mothers' leave duration at each childbirth that we link with contemporaneous data on smoking behavior in later life captured during the respective SHARE wave. We complement the SHARE data with information on statutory leave duration and cash benefits that vary across countries and years from the publicly available Comparative Family Policy Database for OECD countries from 1960 to 2010 (Gauthier, 2011b). We also utilize data on tobacco-control policies (from ASPECT Consortium, 2004) to account for the possibility that family policies and smoking-related policies changed simultaneously.

Using a Two-stage least squares (2SLS) instrumental variable strategy, we show that longer leave duration causally affects smoking behavior across various outcome dimensions. First, a one-month increase in individual leave duration leads to a 2.3 percentage point increase in the probability that a woman smokes in the long run. Second, a one-month increase in maternal leave duration increases the lifetime duration of smoking by 13 months on average. For the third outcome, daily cigarette consumption, we find a weakly significant but positive effect of individual leave duration such that a one-month increase in leave duration increases the number of cigarettes smoked by 0.2 a day. Our results are largely robust to different specifications as well as placebo and falsification testing. We also address endogenous fertility in a robustness check, and discuss the implications and provide some descriptive evidence on the potential existence of survival bias.

It is reasonable to hypothesize that the effect of maternal leave duration varies across the length of leave taken, in that the effect may be positive or negative at different levels of leave length. A key advantage of our multi-country setup is that statutory leave duration varies to a large extent between countries and over time – it ranges between 3.6 months on average in 1960 to 18.9 months on average in 2010, with some countries granting 40 months of statutory leave. The wide range of values in the distribution of this instrument enables us to assess potential non-linearities in the effect of individual maternal leave duration on smoking using the approach in Løken et al. (2012). It is difficult to examine such non-linear effects by focusing on a single country, since changes to statutory leave tend to be either infrequent or small or both. Our key finding here is that there is a decreasing convex relationship between leave duration and all three smoking indicators. The detrimental effect of maternal leave duration on smoking in later life is driven by mothers at the higher end of the leave duration distribution, i.e., by women that take very long maternal leave. Our findings suggest that maternal leave has a protective effect up to around 20 months of leave, but that very long maternal leave promotes smoking.

To inform the design of optimal leave policies, it is also vital to shed light on the mechanisms that lead to behavioral changes. We thus assess heterogeneity in the effects by employment type around birth, the source of income around birth, educational attainment, relationship status, and parity. We only find the source of income around birth to be a relevant mediator of the observed effects. Specifically, we find that the positive effect of mothers' leave duration on smoking in later life is larger for mothers that had no financial support from their spouse as opposed to those that had financial support from their spouse around childbirth. In the case of lifetime smoking duration,

the magnitude of the coefficient is more than three times as large for mothers without financial support from their spouse around childbirth. In the absence of full income replacement, women that take longer leave and lack financial support from their spouse may resort to smoking to cope with financial stress.

Our paper is closely related to existing literature on the impact of maternal leave policies and the health of mothers in general. While previous findings and conclusions are mixed, most research exploits cohort differences in exposure to some form of exogenous variation in maternal leave duration due to leave policies, mandates, or reforms. A number of papers find that a longer duration of maternal leave is beneficial for the mental health of mothers (Chatterji and Markowitzj, 2005; Avendano et al., 2015; Chatterji and Markowitz, 2012; Bilgrami et al., 2020; Bütikofer et al., 2021). Others, such as Baker and Milligan (2008), find no effect on self-reported health, depression, or postpartum problems. Ahammer et al. (2020) exploit the extension of prenatal maternity leave in Austria from six to eight weeks and find no effect of the extension on mothers' mortality or healthcare utilization 25 to 40 years after birth. Beuchert et al. (2014) use a reform of the Danish maternal leave scheme and assess the impact of the length of maternity leave on healthcare utilization and depression. In general, they find limited effects of longer leave on health, but conclude that the beneficial effects accrue for low resource families. Chuard (2023) evaluates the effect of an increase in maternal leave from 1.5 to 2.5 years on maternal health. Long leave increases outpatient doctor visits, the number of prescriptions and costs – all likely explained by worse mental health. Closest to our research question is the work by Bütikofer et al. (2021) that uses the introduction of paid maternity leave in Norway to examine the effect of maternity leave on maternal outcomes, such as BMI, blood pressure, mental health, and health behavior. They find that longer leave improves the health outcomes of mothers at age 40 and also promotes healthy behavior, such as exercise and no smoking, in the short to medium term.

We contribute to the above literature and extend it in several ways. First, most prior research focuses on the effects of maternal leave on health in the short and medium run (Chatterji and Markowitzj, 2005; Chatterji and Markowitz, 2012; Dagher et al., 2014; Bilgrami et al., 2020; Chuard, 2023; Bütikofer et al., 2021). However, as Chuard (2023) acknowledges, effects might accumulate over time and the realization of complete effects may take longer than the time frame assessed in previous studies, including her own. We are able to overcome this limitation by focusing on smoking behavior in later life and therefore provide novel evidence of the long-run effect of maternal leave duration on health behaviors. Second, while Bütikofer et al. (2021) assess the effect of

leave length on smoking too, they do not explore the long run and have no information on the duration of individual leave taken. We make use of SHARE, where women report the duration of leave taken at childbirth for each of their children. Combining this with data on country-year specific leave policies from 14 European countries between 1960 until 2010, we are able to compute both the 'intention-to-treat', effect based on a reduced form model, and the local average treatment effect (LATE), based on an instrumental variable approach. Third, most papers assume linearity in the effects of maternity leave duration on health outcomes. Yet, it is entirely plausible that the marginal health benefits of longer maternity leave duration may not be constant but may instead increase or decrease at different levels of leave length. In fact, the findings in Bütikofer et al. (2021) and Chuard (2023) suggest that there may be diminishing returns with respect to maternal health as maternity leave duration increases. A distinguishing feature of our paper is that we move beyond linear IV estimation and use the approach in Løken et al. (2012) to examine, for the first time, non-linearity in the effect of maternal leave duration on smoking behavior. We believe this finding is a novel addition to the above literature and provides further insights for a holistic discussion on maternity or parental leave policies.

2 Research design

2.1 Maternal leave policies in Europe

We exploit exogenous variation in statutory leave policies across countries and years to elicit the causal effect of maternal leave duration on smoking behavior. Throughout this paper, maternal leave refers to the maternity and parental leave taken by mothers around the birth of their child. Information on statutory leave policies is taken from the publicly available Comparative Family Policy Database, which provides harmonized and comparable information on child-related leave policies based on international and country-specific data sources (Gauthier, 2011b). Amongst other information, the dataset includes data on statutory maternity leave, parental leave, and related cash benefits for OECD countries from 1960 to 2010.

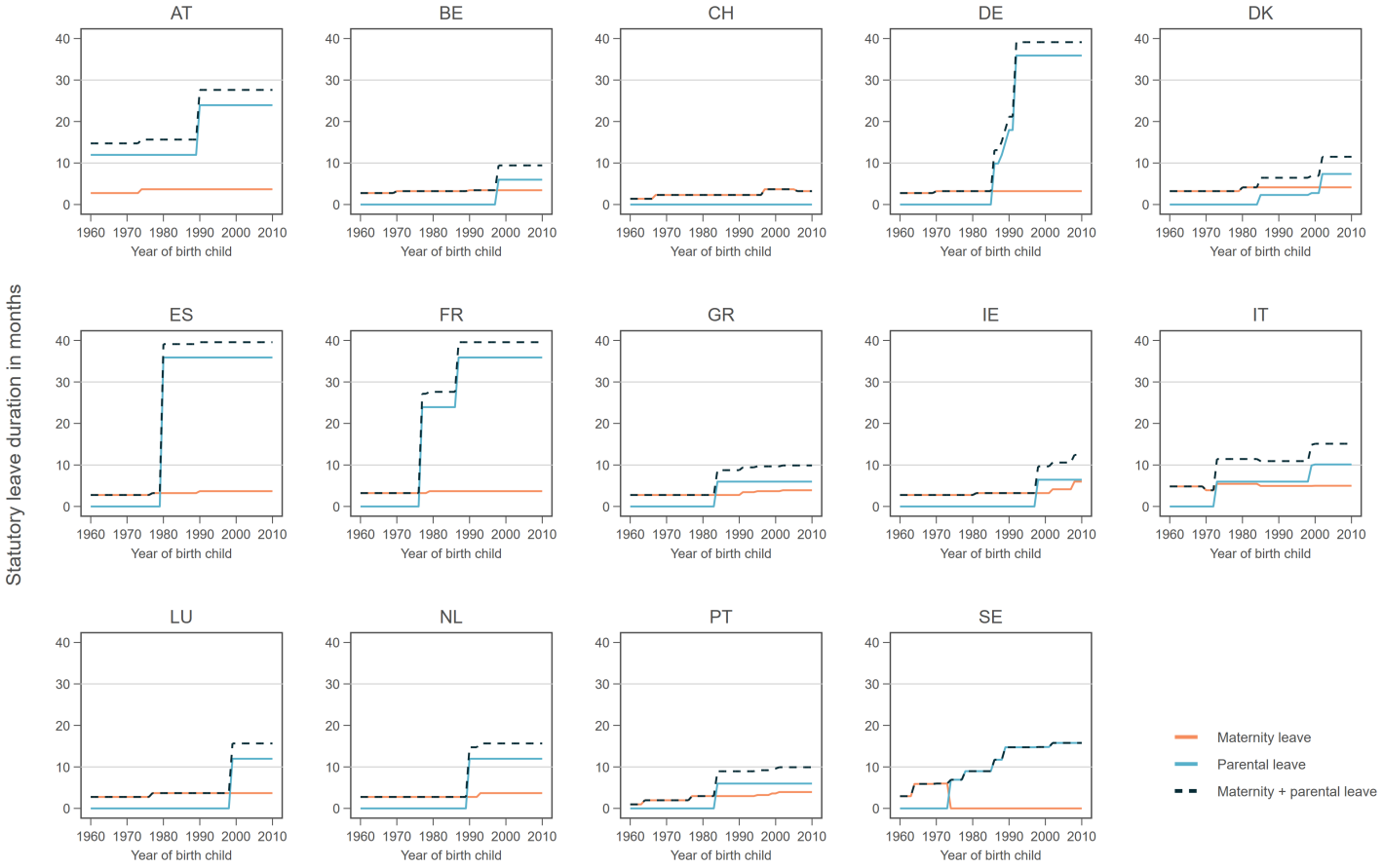
Maternity leave refers to the employment-protected leave granted to employed women directly around the time of childbirth. Its main objective is protecting the health of the mother and her newborn child. All 14 European countries analyzed in this paper already provided maternity leave at the beginning of the observation period in 1960, and most countries increased maternity leave thereafter (see Figure 1). Maternity

leave is generally well paid. In 2010, the statutory cash benefits paid during maternity leave in the 14 countries observed in this paper was 79.1 percent of the average female wages in manufacturing, with half of the countries providing full wage replacement.

In most countries, maternity leave is followed by parental leave, which can be taken by either parent. Some countries reserve certain periods for either the mother or the father (OECD Family Database, 2022). In practice, however, parental leave is taken almost exclusively by mothers, especially in the cohorts observed in this paper. In several countries, only one in five fathers take any parental leave and the number is as low as one in fifty in the Czech Republic and Poland (OECD, 2016). Parental leave increased substantially during our observation period from 1960 to 2010. In 1960, the only country providing parental leave – which was then only granted to mothers – was Austria. In 2010, the average statutory parental leave in our sample is 15.2 months, with cash benefits as a percent of average female wages in manufacturing of 26.1 percent.

For our IV approach, we require an instrument for individual leave duration (ILD), i.e. the actual leave taken by mothers around the birth of their child. Since both maternity and parental leave duration define how much time mothers can take off to be with their children, we use their sum as an instrument and refer to it as statutory leave duration (SLD). Taking the sum of statutory maternity and parental leave duration further accounts for variations in the exact configuration and definition of the two across countries and time – for example, Sweden has substituted maternity leave for parental leave entirely (see Figure 1). Importantly, SLD is plausibly orthogonal to unobserved maternal attributes and makes for a valid instrument satisfying the exclusion restriction. It has increased from an average of 3.6 months in 1960 to 18.9 months in 2010, with the highest SLD of almost 40 months in Spain, France, and Germany.

Figure 1: Statutory leave duration (SLD) in months by country and the child's year of birth



Notes: Statutory leave duration refers to the sum of statutory maternity leave and statutory parental leave. Statutory maternity leave is the leave granted to women directly around the time of childbirth. This figure provides statutory maternity leave prior to and after childbirth in months. Parental leave usually follows maternity leave and – in many European countries – can be taken by either parent. This figure shows the total number of statutory parental leave in months, irrespective of whether the entitlements are for mothers or fathers. More detailed definitions are provided at the OECD Family Database (2022) and country-specific configurations of maternity and parental leave policies are described in detail by Gauthier (2011a). The data for Germany before 1990 includes West Germany only. We thus provide sensitivity analyses that drop German childbirths before 1990 in Section 4.2.3.

2.2 Econometric analysis

Our goal is to identify the causal effect of maternal leave duration on mothers' smoking behavior in later life. We hypothesize that prolonged absence from work impacts smoking behavior due to habit formation and a potential shift in the socio-economic trajectory. As neither the direction nor the size of the effect can be derived unambiguously from theory, we rely on empirical modeling to elicit the causal effects. We begin by simply regressing smoking behavior on maternal leave duration; hence, in its basic form, our regression model looks as follows:

$$SMOKING_{m,c} = \beta_0 + \beta_1 ILD_{m,c} + \beta_2 X_{m,c} + \beta_3 C_m + \beta_4 P_{m,c} + \varepsilon_{m,c} \quad (1)$$

where $SMOKING_{m,c}$ reflects the smoking behavior of the observed mother m of child c that either refers to (1) a binary variable taking the value of one if the mother smokes in later life, (2) a continuous variable measuring the mother's overall smoking duration in months, or (3) a continuous variable measuring cigarettes smoked per day (more details in Section 3.2). $ILD_{m,c}$ is the individual leave duration taken by the mother m around the birth of child c and is measured as a continuous variable (more details in Section 3.3). As the correlation between mothers' individual leave duration and smoking behavior β_1 is likely confounded by other factors, such as maternal characteristics and cohort effects, we also control for a set of other observable variables. Vector $X_{c,m}$ includes the mother's birth cohort in single years, her age at birth, the number of children of mother m, as well as the birth rank of child c.

Additionally, we also include country dummies C_m and control for two important macro confounders in $P_{m,c}$. First, this vector includes statutory cash benefits during maternity and parental leave as a percent of average female wages in manufacturing during the child's year of birth. This is to control for potential effects of cash benefits on smoking behavior, a confounding channel that is further addressed in additional robustness analyses (more details in Section 4.2.3). Second, the vector accounts for the intensity of tobacco-control policies in case family policies and smoking-related policies changed simultaneously. More specifically, it includes a count variable that ranges from zero to five, depending on how many of the following anti-tobacco regulations were in place at the time of birth: age restriction, labeling and health warnings, (partial) restriction in public places, control of advertising and sponsorship, and other anti-tobacco regulations (information obtained from ASPECT Consortium, 2004).

However, identification still remains challenging, because the correlation between mothers' leave duration and smoking behavior in later life is likely confounded by selection due to other unobservable variables. To overcome these and identify the causal effect, the duration of leave would ideally be assigned randomly to each mother. However, in the absence of such random assignment, we rely on a plausibly exogenous source of variation in maternal leave duration.

2.2.1 Instrumental variable framework

Differences in child-related leave legislation between countries and state mandated expansions over time within countries offer an ideal opportunity to elicit exogenous variation in the individual leave duration of mothers. Mothers giving birth in different countries and in different periods within the same country will be exposed to varying lengths of state mandated paid and unpaid statutory leave duration, which will drive their choice of actual leave taken. As a national social policy that applies to all mothers-to-be, such statutory leave duration is plausibly exogenous to the characteristics of the mother and will affect smoking behavior only through individual leave duration taken at childbirth, thus satisfying the exclusion restriction. We apply this motivation in an instrumental variable framework using two-stage least squares to elicit the causal effect of maternal leave duration on smoking behavior.

In the first stage, we regress individual leave duration (ILD) of mother m with child c on the statutory leave duration (SLD) during the period the mother m gave birth to child c (see Equation 2).

First stage:

$$ILD_{m,c} = \alpha_0 + \alpha_1 SLD_{m,c} + \alpha_2 X_{m,c} + \alpha_3 C_m + \alpha_4 P_{m,c} + \upsilon_{m,c} \tag{2}$$

More specifically, we instrument ILD taken by mothers with the total country-specific SLD, i.e. the sum of maternity leave and parental leave[2]. Both ILD and SLD are given in months. We control for country dummies C_m and the same vectors of covariates $X_{m,c}$ and $P_{m,c}$ as in Equation 1. We then use predicted ILD from the first stage equation 2 as the independent variable in the second stage equation 3, again controlling for $X_{m,c}$, C_m, and $P_{m,c}$.

Second stage:

[2]As noted earlier, most parental leave is taken by mothers, especially in our period of observation (1960 – 2010).

$$SMOKING_m = \gamma_0 + \gamma_1 \widehat{ILD_{m,c}} + \gamma_2 X_{m,c} + \gamma_3 C_m + \gamma_4 P_{m,c} + \epsilon_{m,c} \tag{3}$$

The models are fitted by linear regression, thus resulting in linear probability models as frequently used in the health economics literature (Costa-Font et al., 2022; Green et al., 2021; Edwards et al., 2021; Lin et al., 2021; Nguyen, 2022). It produces consistent estimates of the LATE for binary outcomes (Basu et al., 2017; Chapman and Brooks, 2016), even if the model produces out-of-range predictions (Basu et al., 2017). For comparison, we also provide results from an IV Probit model using a maximum likelihood estimator for smoking in later life, which is a binary outcome. Our estimated LATE represents the average treatment effect for the compliers only, i.e., for those mothers that change their individual leave duration in response to a change in the statutory leave duration. We present more information on complier characteristics and discuss the implications of these for our results later. Additionally, we provide estimates from the reduced form (Equation 4) for comparison with the instrumental variable approach.

Reduced form:

$$SMOKING_m = \lambda_0 + \lambda_1 SLD_{m,c} + \lambda_2 X_{m,c} + \lambda_3 C_m + \lambda_4 P_{m,c} + \rho_{m,c} \tag{4}$$

For all models, standard errors are clustered at the mother's level, since mothers with more than one child enter the regression several times. Due to the clustering, we provide the Kleibergen-Paap F-statistic – which accounts for clustered standard errors – in addition to the more common Cragg-Donald F-statistic in the IV model results. In addition, we provide robustness analyses that only consider the first childbirth of each mother, i.e. mothers enter the regression only once.

2.2.2 Threats to identification

There are two key threats to our identification strategy. First, our estimates might be affected by endogenous fertility. If there is anticipation of an impending policy change in statutory maternity and/or parental leave duration and women respond to such a change by shifting the timing of the birth of their child, our exclusion restriction will be violated. Here, women can respond either by bringing forward the timing of birth through induced births (e.g. cesarean sections) or delaying planned cesarean sections (Dustmann & Schoenberg, 2012). While we cannot completely rule out such strategies, it is reasonable to presume that women may not be able to precisely anticipate such changes or precisely time childbirth. Nevertheless, to demonstrate the validity of our findings, we exclude mothers that gave birth in the year just before and just after

a major increase in statutory leave duration of at least six months.

We further address endogenous fertility more generally, by exploring if changes in statutory leave policies affect the number of children that a mother has. Family policies intend to provide favorable conditions that allow parents to have their desired number of children. While rarely explicit, the objective of family policies in low-fertility countries is often to increase fertility (Gauthier, 2007; Kalwij, 2010; Thévenon, 2008; Thévenon and Luci, 2012). However, evidence on the effect of family policies on fertility is inconclusive and depends on the region observed and the policies applied (Björklund, 2006; Kalwij, 2010; Riphahn and Wiynck, 2017). To check if changes in statutory leave duration affect fertility in our sample, we regress the number of children that a mother has on statutory leave duration, while controlling for her year of birth, statutory cash benefits, and country dummies.

The second threat to identifying the LATE is violation of the monotonicity assumption. Monotonicity in our case requires that all mothers who respond to an increase in statutory leave do so by increasing the individual leave taken, i.e., there are no mothers that would reduce their leave duration when exposed to an increase in SLD. We address this by analyzing the first stage relationship between SLD and ILD across several subgroups and maternal characteristics – the results support monotonicity.

One may also worry about statutory cash benefits that might be an input in the leave duration decision. If women decide to take longer or shorter leave depending on the level of cash benefits they are expected to receive while on leave, and if cash benefits are linked with statutory leave duration, our exclusion restriction may not hold. As mentioned earlier, we control for cash benefits in all regressions – conditional on the level of statutory cash benefits, our instrument remains valid. As a second strategy, we also interact the instrument SLD with the statutory cash benefits during parental leave as a percent of average female wages in manufacturing during the child's year of birth. These statutory cash transfers are also plausibly exogenous. For this analysis, we exclude cash benefits from control vector P in Equation 2 and Equation 3.

Additional concerns could arise regarding the heterogeneity of smoking policies and tobacco control measures across different countries, as well as changes in anti-tobacco regulations over time. First, in all our first and second stage regressions, we control for mothers' birth cohort effects, thus alleviating this concern. Second, we control for the intensity of tobacco-control policies in all regressions – this variable is comprehensive in its coverage of tobacco regulations as it includes policies related to age restriction,

labeling and health warnings, restrictions in public places, control of advertising and sponsorship, and other anti-tobacco regulations.

2.2.3 Robustness and validity

We test the sensitivity of our results to several potential issues. The first concerns the measurement of our key independent variable – individual leave taken by mothers. This variable has finer categories up to one year of ILD and then becomes a continuous variable measuring ILD in years (see Section 3.3 for more details), which can lead to issues with comparability across different levels of ILD. We thus transform our main explanatory variable ILD in different ways (see Subsection 3.3) to account for the broad response categories in our survey data.

Second, we restrict our sample to include leave duration during the first birth to check robustness for several reasons. The first birth is often the most salient event in a woman's reproductive life and may have a greater impact on her smoking behavior compared to subsequent births. Additionally, after the first birth, women may gain important knowledge about maternity leave legislation that can impact leave duration decisions during subsequent births, creating path dependency in such decisions and leading to serial correlation in ILD. Further, subsequent births may either prepare women to better deal with postpartum stress or may worsen mental health due to repeated 'Allostatic load' – isolating the effect of maternal leave duration from that of additional births is therefore important. Also, the distance between multiple births might depend on mothers' health. Finally, mothers with more than one child enter our regression several times, which is not the case when estimating the sample of firstborn children only.

Third, in further robustness tests, we only include mothers that took any leave; hence, dropping mothers who stated taking zero leave after childbirth. Mothers who took zero leave may differ in important ways from mothers who took any leave. For instance, mothers who took no leave may work in different occupations that have lower job security – these differences may affect stress levels and hence be related to smoking behavior. Fourth, while in our main analysis we exclude mothers stating that they took more than seven years of individual leave, we reduce this cut-off to five and six years in our sensitivity analysis. Fifth, we look at the intensive margin of our effect by excluding non-smoking mothers from our sample. In doing so, we improve precision of our estimates by focusing on a more homogeneous population to understand the effect of maternal leave duration on the smoking behavior of mothers who smoke. Sixth,

we restrict our sample to mothers from countries with a relatively generous statutory leave policy of more than ten months, as these are likely countries where taking a longer leave after childbirth is the norm rather than the exception.

We also perform a set of placebo and falsification tests to check the identifying assumptions of our models. As a placebo test, we run our reduced form model on a sub-sample of mothers who did not work before their child was born. Hence, they should not be affected by changes in parental leave policies. We also randomize our instrument, statutory leave duration, which should give null-results in the first stage of our IV models. Finally, as a falsification test to rule out unobserved confounders, we use mothers' financial status in childhood as the outcome variable in the second stage.

Finally, we address changes in the time series related to the German reunification. For the period before 1990, the Comparative Family Policy Database provides information on West Germany only. From 1990 onward, all of Germany is included. We thus drop all childbirths that occurred in Germany before 1990 for sensitivity analyses.

2.2.4 Heterogeneity analysis

We conduct a set of heterogeneity analyses to elicit potential channels that might explain our results. As discussed above, an important pathway for the effect of maternal leave duration on health behaviors could be stress. We thus explore several dimensions that may increase mothers' stress around childbirth. First, we run separate regressions for mothers that are in a relationship around the birth of their child, and mothers who are single. The latter may suffer from increased stress that increases the likelihood of turning to smoking as a coping strategy. In a similar vein, we explore if the effect of leave duration on smoking behavior depends on the mother's financial situation during her leave. For this, we split our sample into mothers who received financial support from their spouses during maternal leave, and those who did not. Related to the 'Allostatic load' discussed above, we further run heterogeneity analyses by parity – mothers with several children might either experience increased stress, or better adapt to motherhood with each additional child. To explore if the effect of maternal leave on smoking behavior depends on socio-economic status, we provide separate analyses by educational attainment. The child earnings penalty for mothers varies by socioeconomic status, suggesting that the effect of maternal leave on financial stress and health behavior might be heterogeneous too (Bütikofer et al., 2018). Also, better-educated mothers may have higher health literacy, which prevents them

from smoking even when spending more time with their children. Finally, we explore differences in the effect by type of work. Occupation and smoking behavior are highly correlated (Syamlal et al., 2015). If mothers work in occupations with a high smoking prevalence, longer leave durations could help solidify mothers' smoking cessation after childbirth. We thus run separate analyses for mothers working in blue collar versus white collar jobs.

2.2.5 Non-linear effects

It is plausible that the marginal effects of maternal leave duration may not be constant, but may instead increase or decrease at different levels of leave length; moving from zero leave to one month might affect health behavior differently than moving from twelve to thirteen months. While there is little guidance from theory as to the non-linearity in the effects of maternity leave duration, empirical findings in Chuard (2023), Bütikofer et al. (2021), and Dagher et al. (2014) point towards such non-linear effects. To assess potential non-linearities in the effect of leave duration on smoking behavior, we include a quadratic term in our second stage (see Equation 5 below).

$$SMOKING_m = \pi_0 + \pi_1 \widehat{ILD_{m,c}} + \pi_2 \widehat{ILD_{m,c}}^2 + \pi_3 X_{m,c} + \pi_4 C_m + \pi_5 P_{m,c} + \omega_{m,c} \quad (5)$$

To identify both the linear and the squared ILD term in Equation 5, more than one instrument is needed for the first-stage estimates. We thus follow the approach proposed by Løken et al. (2012) for the construction of multiple instruments. First, we create various instruments by interacting SLD with every explanatory variable in vectors $X_{m,c}$ and $P_{m,c}$. The identifying assumption with this approach is that if SLD is a valid instrument, then any function of SLD and the above variables are valid instruments to the extent that the error term in model 3 is mean-independent of these covariates – see Løken et al. (2012) for details. Second, we run Equation 2 using all possible combinations of SLD interacted with each explanatory variable in vectors $X_{m,c}$ and $P_{m,c}$ as an instrument for ILD and ILD^2. Third, we select the combination of the new, interacted instruments with the highest Kleiberger-Paap F-statistic and use these to estimate the non-linear model as a second stage given in Equation 5. We then perform a set of sensitivity analyses to address the results from this non-linear model (Section 4.3.2).

3 Data

3.1 Survey data

Our analysis is based on a rich dataset from SHARE, the largest pan-European social science panel study, providing micro-level information on employment, health, and socioeconomic status for non-institutionalized Europeans aged 50 and older as well as their younger spouses (Börsch-Supan et al., 2013).[3] The data is based on more than 480,000 interviews from about 140,000 individuals in 28 European countries and Israel. All variables are ex-ante harmonized, enabling comparative analyses across countries.

Between 2004 and 2020, SHARE conducted eight survey waves, most of which aimed at assessing the survey participant's current living situation by collecting contemporaneous data. In addition, Waves 3 (2008-2009) and 7 (2017-2019) focused on people's life histories by collecting data on their childhood, relationships, fertility, and employment histories, and other retrospective information. Completed birth histories from this retrospective data are frequently used to answer fertility-related research questions (Avendano et al., 2015; Arpino et al., 2018; Havari and Savegnago, 2022). For the present study, we combine contemporaneous information on mothers' smoking behavior and living situation in later life from Waves 1, 2, 4, 5, 6, and 7 (2004-2019)[4] with retrospective data on their birth histories, work history, and relationships from Waves 3 and 7.[5]

Using survey data, especially from SHARE, to answer our research question provides several advantages. First, the harmonized data enables us to analyze a large set of European countries and thus to exploit variations in maternal leave policies as exogenous

[3]This paper uses data from SHARE Waves 1, 2, 3, 4, 5, 6, and 7 (DOIs: 10.6103/SHARE.w1.710, 10.6103/SHARE.w2.710, 10.6103/SHARE.w3.710, 10.6103/SHARE.w4.710, 10.6103/SHARE.w5.710, 10.6103/SHARE.w6.710, 10.6103/SHARE.w7.711, 10.6103/SHARE.w8.100). The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N211909, SHARE-LEAP: GA N227822, SHARE M4: GA N261982, DASISH: GA N283646) and Horizon 2020 (SHARE-DEV3: GA N676536, SHARE-COHESION: GA N870628, SERISS: GA N654221, SSHOC: GA N823782) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11, OGHA 04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

[4]All individuals covered in Wave 8 were already surveyed in Wave 7, which is why Wave 8 provides no additional information for the present study and thus is not included in the current analysis.

[5]Wave 7 provides both contemporaneous and retrospective data.

variation. Second, survey data allows us to analyze health behavior that is usually not captured in administrative data, such as smoking. Third, survey data is likely to capture the actual leave taken by mothers more accurately than official records. For a small subsample of Austrian mothers, we are able to compare individual leave duration according to the survey with their time spent in official leave according to administrative records (see Appendix A.5). The findings suggest that many mothers stay with their children long after the official leave is over, e.g. by dropping out of the labor market.

3.2 Outcome variables: smoking behavior

Smoking behavior is measured based on three outcome variables, namely smoking in later life, overall smoking duration, and the number of cigarettes smoked per day. Smoking in later life is a binary variable that indicates whether a person is smoking cigarettes, cigars, cigarillos, or pipes at the present time, i.e. the time of the contemporaneous interview. Smoking duration is a continuous variable that measures the total number of months a survey participant smoked throughout their lifetime, i.e. up until the contemporaneous interview, excluding any periods without smoking. This variable is set to zero if an individual never smoked and set to missing if the survey participant provides inconsistent answers, e.g. reports smoking since early childhood. The number of cigarettes is a continuous variable that counts the number of cigarettes smoked per day. It is set to zero if an individual never smoked. Both for smoking duration and number of cigarettes, we also look at the intensive margin of our effect by excluding non-smoking mothers. Summary statistics for the outcome variables, along with all other relevant variables, are provided in Table A.1 of the Appendix.

3.3 Explanatory variable: individual leave duration (ILD)

Our independent variable of interest is ILD after childbirth, based on the survey questions "Did you temporarily or permanently stop working when your child was born?" and "How long did you stop working for?", with possible answers "less than a month", "between one and three months", "between three and six months", "between six months and one year", "between one year and three years", and "longer than three years but worked at some point later". If parents report an ILD of at least one year, they are further asked "When did you start working again?" and report the year in which they return to the labor market. Hence, this variable has finer categories up to one year of ILD and then becomes a continuous variable measuring ILD in years,

i.e. 12-month steps. For ease of interpretation and estimation, we transform the lower values of the variable so that they also become continuous by taking the midpoint of each category, e.g. 4.5 months for the category "between three and six months".

For robustness analyses, we construct two alternative explanatory variables and use them in our regressions. First, we assign a random value between the two limits of each category, e.g. a random value between three and six months. Second, we measure ILD in yearly steps and thus assign a value of 12 months to all categories from "less than a month" to "between six months and one year". Histograms for all three versions of the ILD variable are provided in Figure A.1 of the Appendix.

3.4 Sample construction

Our main sample consists of mothers aged 14 to 49 who worked around birth and thus are eligible for statutory leave.[6] We only consider mothers who returned to work no later than seven years after giving birth, since compulsory primary education starts at age six in most of the countries analyzed. We assume that all children – including those born late in the year – should be in school after seven years, thus reducing the care obligations for their parents. In robustness analyses, we further apply cut-offs of five and six years. Mothers giving birth in a different country than the survey country are excluded from the analysis, as they cannot be unambiguously linked to a specific childcare policy regime. This results in a sample of 24,594 childbirths across 13,135 mothers from 1960 to 2010 in Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Spain, Sweden, Switzerland, and The Netherlands. These are the countries that are included in all three datasets needed for the analyses, namely SHARE, the Comparative Family Policy Database, and The ASPECT Consortium (2004).[7] Due to missing values, the samples for smoking duration and the number of cigarettes per day are smaller, comprising of 24,127 and 19,557 childbirths respectively. Mothers with more than one child are included in the sample several times to examine the length of leave related to each individual child. For robustness analyses, we only consider the first childbirth of each mother, i.e. mothers are included only once.

[6] While mothers who did not work around the birth might also be affected by changes in leave policies, e.g. through increased cash transfers, we are only interested in the effect of the leave duration. Hence, restricting the sample to working mothers does not diminish the external validity of our results.

[7] The ASPECT Consortium (2004) does not provide information on tobacco regulations for Finland.

Table 1: Smoking behavior in different (sub)samples

	(1) Sample size (max.)*	(2) Smoking in later life (%)	(3) Smoking duration (average months)	(4) Number of cigarettes (average per day)
Main sample				
Working mothers with ILD $\leq$ 7 years	24,594	18.9	113.2	3.6
Subsamples				
Working mothers born before 1950	11,764	13.6	102.0	3.2
Working mothers born 1950 and later	12,830	23.8	123.6	4.0
Working mothers with low education	8,611	18.1	99.7	3.2
Working mothers with medium education	8,248	21.9	127.0	3.9
Working mothers with high education	7,468	16.5	114.3	3.8
Working mothers with ILD $>$ 0	14,868	20.4	123.8	4.1
Other samples				
Working mothers with ILD $>$ 7 years	8,274	16.4	99.1	3.4
Non-working mothers	7,123	16.9	78.5	3.2

Notes: No weights applied. Mothers with more than one child are counted several times. For information on the mothers' level, where mothers are only counted once, see Table A.2 of the Appendix. *Due to missing values, the samples for smoking duration and the number of cigarettes per day are smaller, comprising of 24,127 and 19,557 children respectively.

4 Results

4.1 Descriptive findings

Details on smoking behavior for different samples and subsamples are provided in Table 1. In our main sample, 18.9 percent of the mothers report smoking in later life. The average smoking duration throughout the life course is 113.2 months and mothers smoke – on average – 3.6 cigarettes per day. These values are computed on the children's level, i.e. mothers with more than one child are counted several times. When calculating these values on the mothers' level, i.e. by counting each mother only once, the outcomes are almost identical (see Table A.2 of the Appendix).

Smoking increased across generations. This is shown by splitting the sample into earlier cohorts, born before 1950, and later cohorts, born from 1950 onwards. The difference is visible for all three outcome variables. On average, mothers born from

1950 onwards are 10.2 percentage points more likely to smoke in later life, smoked for 21.6 months longer, and smoked 0.8 more cigarettes per day. This pattern is in line with the well-established finding of a general increase in female smoking prevalence across cohorts, especially in Europe (WHO, 2011; Lopez et al., 1994). In addition to cohort effects, the observed pattern could also be driven by survival bias, i.e. smoking mothers from earlier cohorts died before participating in the survey due to their harmful health behavior. While this mortality-related attrition bias is likely leading to a relatively healthier sample, it is not clear how it affects the link between leave duration and smoking behavior. We do not know about mothers dying before the survey started and thus have no information on their leave duration or smoking behavior. Moreover, there appears to be no systematic relationship between leave duration and survival according to the literature. We can assume, however, that those who smoke more die earlier. Looking at our sample, ILD is 10.8 months for those who report smoking in later life and 10.1 months for those who do not. Hence, there appears to be a weak positive correlation between the length of maternal leave duration and the likelihood of smoking in later life, which – potentially – leads to lower survival and a higher risk of attrition. If this is the case, an estimated (positive) effect of ILD on smoking would be underestimated, as those with the strongest positive effect of ILD on smoking, and thus mortality, would be underrepresented in the main sample.

The relationship between education and smoking behavior appears u-shaped, i.e. mothers with low and high education smoke less than mothers with medium education. We also find that mothers who did temporarily stop working when their child was born smoke slightly more than those who did not take any leave. As a large proportion of the main sample (9,726 observations, or 39.6 percent) report that they did not take any leave when their child was born, we devote several robustness checks and a separate subsection to this group (see Section A.4 of the Appendix). Occupation appears to be important for the decision to take any leave. For example, 60 percent of mothers working in agriculture report not having taken any leave when their child was born.

Comparing the smoking behavior of working mothers in the main sample with non-working mothers shows that working mothers smoke more according to all three outcome variables. While this finding is plausible, it could also be driven by cohort effects, as later cohorts smoke more and are more likely to participate in the labor market. Similarly, mothers that stay with their children for more than seven years smoke less, which could be driven by intergenerational differences as well, as the mothers' year of

birth and ILD are negatively correlated.

Table A.2 of the Appendix shows the same statistics as Table 1, but on the mothers' level, i.e. mothers are only counted once. Information on the mothers' level allows us to compare the smoking behavior of mothers with that of other survey participants in SHARE. The additional findings in Table A.2 suggest that mothers smoke more than childless women, and that – in line with the literature – men smoke more than women, which is shown by the increased smoking prevalence once men are included in the sample, i.e. all women and men in SHARE.

4.2 Main analysis

Our main analysis relies on a two-stage approach, where individual leave duration (ILD) is instrumented by country- and year-specific statutory leave duration (SLD) in the first stage. In the second stage, the predicted ILD is then used as an explanatory variable for three different outcome variables: smoking in later life, smoking duration in months, and the number of cigarettes smoked per day.

4.2.1 Statutory and individual leave duration

Table 2 provides the first stage results as estimated via Equation 2. For all three outcomes, the coefficients are around 0.08 and statistically significant, i.e. a one-month increase in SLD increases ILD by 0.08 months, ceteris paribus. This positive relationship between the policies and individual behavior is also illustrated in Figure A.2 of the Appendix. The slight differences in the first-stage point estimates are due to different missing values in the outcome variables and subsequent variations in the sample size.

The instrument proves highly relevant, as the Cragg-Donald F-statistic is well above the recommended rule-of-thumb-threshold of 10 for all three samples, even when adjusting for the clustered standard errors with the Kleiberger-Paap F-statistic.

Estimated treatment effects in an instrumental variable framework have to be interpreted as the effect of the treatment on the population of compliers, i.e. mothers who changed their ILD because of a change in SLD. To assess the external validity of these LATEs, it is important to understand who the compliers are and what characteristics they have, i.e. which subpopulations we can make inference about. In the context of our analysis, it is thus essential to know if complying mothers differ from non-complying mothers with respect to pre-treatment characteristics like their demo-

Table 2: First stage results and complier characteristics ratios

	Sample: Smoking in later life (yes/no)	Sample: Smoking duration (in months)	Sample: Number of cigarettes (per day)
First stage coefficients (effect of SLD on ILD)	0.082***	0.084***	0.082***
	(0.021)	(0.021)	(0.023)
Cragg-Donald F-statistic	21.3	22.2	16.6
Keiberger-Paap F-statistic	15.5	16.1	12.0
N	24,594	24,127	19,557
Complier characteristics ratios			
Mother was born from 1950 onwards	1.288	1.302	1.293
Mother older than 30 years	1.133	1.153	1.208
Low educated mother	0.413	0.378	0.255
Mother worked full-time job	0.807	0.820	0.816
Mother was in a relationship	1.017	1.015	1.025

Notes: The table shows first stage results for the main sample along with F-statistics (Equation 2). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level. The complier characteristics ratios show the ratio of the group-specific first stage to the overall first stage from the main sample. Detailed results from the group-specific regressions are provided in Table A.3 of the Appendix.

graphics or socio-economic status.

While it is not possible to identify compliers in our setup – as they are defined by means of counterfactual outcomes – we can characterize them using variations in the first stage across demographic and socio-economic groups. This is commonly done using complier characteristics ratios, which provide the relative likelihood that a complier belongs to a certain group (Angrist and Pischke, 2009). These complier characteristics ratios are computed as the ratio of the group-specific first stage to the overall first stage and require both the treatment and the instrumental variable to be binary.

As our treatment and instrumental variable are not binary, we dichotomize them for the complier analysis. Following the suggestion by Marbach and Hangartner (2020), we identify the dichotomization cut-offs that lead to the strongest possible first stage. For this, we generate binary variables of both the treatment ILD and the instrumental variable SLD using all possible cut-offs. We then run the first stage for each possible combination of these binary variables. The Kleiberger-Paap F-statistic is strongest for the combination of SLD being larger than 18 months and ILD being larger than 24 months (F = 47.5 for the smoking in later life sample, 50.5 for the smoking dura-

tion sample, and 35.9 for the number of cigarettes sample). Regressing dichotomized ILD on dichotomized SLD leads to first-stage coefficients that are strikingly similar to the main first-stage estimates based on continuous variables (see Table A.3 of the Appendix for a comparison).

Table 2 provides complier characteristics ratios for relevant demographic and socio-economic characteristics, namely birth cohort, age, education, type of work, and relationship status. The group-specific first-stage coefficients used to compute the ratios are provided in Table A.3 of the Appendix. The findings suggest that the compliers in our sample are 1.3 times more likely to be born from 1950 onwards compared to non-compliers – the ratio is similar across all three samples. This means that those who changed their ILD in response to a change in SLD are more likely from younger cohorts, i.e. the ILD of younger cohorts depends more on statutory regulations than it did for earlier cohorts. Consequently, our results are more relevant for more recent cohorts and not as representative for those born before 1950. Similarly, our results are more relevant for mothers older than 30 years at the time of childbirth irrespective of parity, as they are more likely to comply with changes in SLD (ratio of 1.1 for the smoking in later life sample). Estimates are less relevant for low educated mothers, who appear to have much lower responses to changes in SLD than high educated mothers (ratio of 0.4). Also, mothers who worked full-time around the birth of their child have smaller first stage coefficients than the average mother in our sample (ratio of 0.8). Whether the mother was in a relationship around childbirth does not predict compliance (ratio of 1.0); hence, our estimates are representative irrespective of the relationship status. These complier characteristics ratios are important to keep in mind when interpreting our second-stage coefficients, as the LATEs are based on compliers only.

4.2.2 The effect of maternal leave duration on smoking behavior

Table 3 provides estimates for the causal effect of maternal leave duration on smoking behavior and compares them with estimates from simple regressions and the reduced form model. The main second-stage estimation results according to Equation 3 are provided in the first row. A one-month increase in individual leave duration significantly increases the probability that a mother smokes later in life by 2.3 percentage points (Column 1). This translates into an increase of 12.1 percent in the probability of a mother smoking in later life given a baseline smoking rate of 19 percent in our sample. The result from the linear IV model is almost identical to the marginal effect from the Probit IV model (0.026, second row of Column 1). Furthermore, one month

of additional leave duration increases the lifetime duration of smoking by 12.7 months, and the number of cigarettes smoked per day by 0.2. While the former point estimate is significantly different from zero at a conventional 5-percent level, the latter is significant at a 10-percent level.

Comparing the IV-effects with the coefficients from the simple Probit and OLS estimates suggests that endogeneity in the leave duration taken would bias our results downwards if not accounted for (third row of Table 3). Estimating Equation 1 with a simple Probit yields no significant effect of ILD on smoking in later life (Column 1). Similarly, OLS estimates of ILD on the smoking duration are insignificant (Column 2). By contrast, we find a weak positive effect of ILD on the number of cigarettes smoked per day (Column 3).

Reduced form estimates from Equation 4 are displayed in the fourth row of Table 3. These estimates capture the effect of the maternal leave policies on smoking behavior, thereby not differentiating between compliers and non-compliers. A one month increase in SLD increases the probability of smoking in later life by 0.8 percentage points, even after accounting for other macro confounders like the statutory cash benefits during maternity and parental leave, and the intensity of tobacco-control policies at the child's year of birth (Column 1). This translates into an increase of 4.2 percent in the probability of a mother smoking in later life given a baseline smoking rate of 19 percent in our sample. Similarly, a one-month increase in SLD increases smoking duration by 1.07 months (Column 2) and the number of cigarettes smoked per day by 0.02 (Column 2). These estimates are much lower than those from the second-stage results in the first row, suggesting that the effects on compliers may be counteracted by the effects on non-compliers in the reduced form model.

4.2.3 Robustness tests and further issues

Our results are highly robust to a number of sensitivity analyses, as shown in Figure 2 as well as the additional output tables in Appendix A.2. First, as described in section 3.3, there is some concern about the categorization of values below 12 months in our main explanatory variable, ILD. We therefore check if different transformations would affect our results. For this, we code ILD in yearly steps and then randomize the value of ILD below 12 months (see Figure A.1 of the Appendix). Tables A.5 and A.6 in the Appendix show that the point estimates are virtually unchanged by these different specifications of our independent variable (see also the light-blue rhombus and dot in

Table 3: The effect of maternal leave duration on smoking behavior

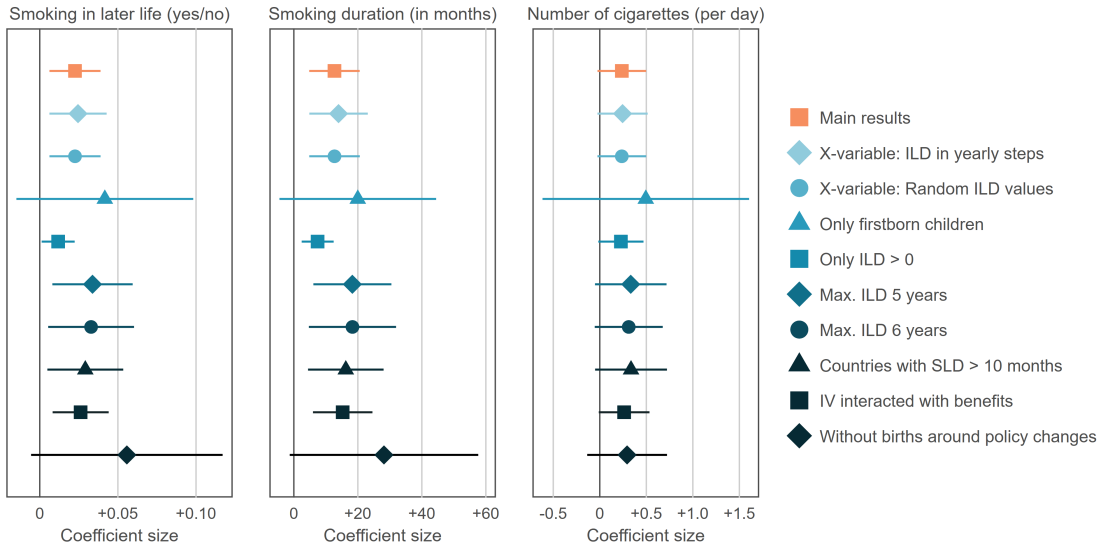
	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS – second stage			
Individual leave duration	0.023***	12.695***	0.237*
	(0.008)	(4.024)	(0.133)
IV: Probit			
Individual leave duration	0.026***		
	(0.009)		
Simple Probit and OLS			
Individual leave duration	0.000	0.093	0.008**
	(0.001)	(0.078)	(0.004)
Reduced form			
Statutory leave duration	0.008***	1.068***	0.019**
	(0.002)	(0.208)	(0.009)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. The dependent variable 'Smoking in later life' is binary and takes a value of one, if individuals smoke in later life, and zero otherwise (Column 1). 'Smoking duration' measures the overall smoking duration throughout the lifetime in months (Column 2). 'Number of cigarettes' gives the average number of cigarettes smoked per day (Column 3). The first row displays results from the Two-stage least-squares regressions (Equation 3), with the sum of statutory maternity leave duration and statutory parental leave duration in months at the child's year of birth in the child's country of birth as an instrument for the mothers' individual leave duration. The second row provides marginal effects from an instrumental variable Probit model for binary outcomes using maximum likelihood. The third row provides coefficients from a simple Probit regression for the binary outcome variable (Column 1), and OLS regressions for the continuous outcome variables (Columns 2 and 3). The final row shows results from the reduced form model (Equation 4). Control variables for all models include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2).

Second, to avoid giving too much weight to mothers with multiple children who might exhibit some path dependency in the choice of leave duration, we use a subsample with

Figure 2: The effect of maternal leave duration (in months) on smoking behavior: results from sensitivity analyses



Notes: Full output tables for each robustness check are provided in Appendix A.2. The Appendix also includes additional placebo and falsification analyses, all of which are discussed in Section 4.2.3.

firstborn children only, i.e. each mother is included in the sample only once, namely with their firstborn child. This sample restriction leads to qualitatively similar results, although with much larger standard errors due to the smaller sample (see blue triangle in Figure 2 and Table A.7 in the Appendix).

Third, we address the finding that a substantial proportion of mothers report that they did not temporarily nor permanently stop working when their child was born, i.e. they report zero ILD. When excluding mothers with zero individual leave taken, the point estimates for smoking in later life and smoking duration in months somewhat decrease, but they remain positive and statistically significant. The estimates for the number of daily cigarettes do not change (see blue rectangle in Figure 2 and Table A.8 in the Appendix). Moreover, we provide evidence based on regression and relative importance analyses that show that the large share of mothers with zero leave is mostly due to mothers working in the agricultural sector, and that taking zero leave versus some leave is not related to smoking behavior once we account for relevant control variables (see Appendix A.4).

Fourth, our main sample excludes mothers with ILD of more than seven years. Decreasing this cut-off to five or six years leaves the estimates virtually unchanged (see

dark-blue rhombus and dot in Figure 2 and Table A.9).

Fifth, we consider whether the configuration of leave policies may impact our results. For this, we first analyze a subsample of 'generous' countries that provide SLD of at least 10 months. Estimates based on this subsample lead to the same results (see dark triangle in Figure 2 and Table A.10). We also interact the instrument SLD with the statutory cash benefits during parental leave during the child's year of birth to assess if the amount of benefits is important for ILD. Table A.11 shows that the amount of cash benefits is not important for explaining ILD and, furthermore, the inclusion of the interaction hardly affects the estimates (see dark rectangle in Figure 2). Dropping births that occurred in the years before and after a large change in SLD results in much weaker instruments, larger standard errors, and higher point estimates, as shown by the black rhombus in Figure 2 as well as Table A.12. However, the point estimates for all three outcomes remain similar to those with the full sample.

For the smoking duration and the number of cigarettes smoked per day, we also provide estimates on the intensive margin by only including those who smoked for at least a month or at least one cigarette per day, respectively (Table A.13 of the Appendix). For the subsample of mothers with a lifetime smoking duration larger than zero, the effect of one month in leave duration on smoking duration is 7.8 months and thus much lower than the LATE from the analysis on the whole sample. The effect of ILD on the number of cigarettes per day for those who smoke at least one cigarette per day is insignificant, potentially due to the small number of observations.

Placebo analyses further suggest highly robust results and a valid instrumental variable design. First, changes in SLD should not affect the smoking behavior of non-working mothers. Given that the leave duration for non-working mothers is not defined, i.e. they do not leave work, we use the reduced form model (Equation 4) to formally test this prerequisite. Table A.14 of the Appendix compares the reduced form estimates for working mothers with those for non-working mothers and shows that, indeed, the effect of these policy changes on non-working mothers are insignificant, while they are significantly positive for the subsample of working mothers. Second, we conduct a placebo analysis using a randomized instrument to further explore the soundness of our instrument. For this, we generate a random variable that is normally distributed and has the same limits as the original SLD variable. Hence, SLD is entirely randomized across mothers, irrespective of their country of residence and the year of birth of their child. This randomized instrument leads to an insignificant first stage, as intended

(Table A.15).

We also provide evidence that suggests that our instrumental variable strategy takes care of unobserved confounding via a falsification analysis. In particular, we use the mother's financial status at ages zero to 16 as an outcome in the second stage – her socio-economic status in childhood should not be affected by her leave duration. The financial situation in childhood is assessed by asking survey participants "Now think about your family when you were growing up, from birth to age 16. Would you say your family during that time was pretty well off financially, about average, or poor?". We dichotomize this variable so that it is one if the mother grew up poor, and zero otherwise. Results are provided in Table A.16 and suggest that our instrumental variable approach takes care of confounding factors like socio-economic status.

Before 1990, the Comparative Family Policy Database includes information on West Germany only. We thus drop German childbirths before 1990 for a robustness check. This leads to smaller F-statistics and larger coefficients, but the estimated effects are still statistically significant and suggest that longer maternal leave duration increases smoking (Table A.17).

To address endogenous fertility, we further check if changes in statutory leave duration affect fertility in our sample. For this, we regress the number of children that a mother has on statutory leave duration and a set of control variables, employing OLS regression, a Poisson regression model, and a Negative Binomial regression model (Table A.18). All three models suggest that statutory leave duration has no effect on the number of children, ceteris paribus, and thus endogenous fertility is not a threat to the robustness of our results.

4.2.4 Heterogeneity in the effects

We find important income-related heterogeneities in our point estimates. The respective output tables are provided in Appendix A.3. The data allows us to split our sample into mothers who received financial support from their spouse during maternal leave, versus those who did not, indicating financial hardship (Table A.19 in the Appendix). The results show that the effects of leave duration on smoking behavior are much larger for those who received no financial support from their spouse and were thus dependent on other sources of income, such as benefits or savings. Note, however, that we do control for statutory cash benefits. The lack of financial support is likely to increase stress and thus, potentially, smoking. Hence, this finding is well in line

with prior work that found negative implications of longer maternal leave duration on mental health (Chuard, 2023).

Additional heterogeneity analyses by educational attainment (Table A.21), relationship status around birth (Table A.22), and type of work around birth, i.e. blue collar versus white collar (Tables A.23) do not suggest any important heterogeneities in the effects, or provide coefficients with large standard errors due to the small numbers of observations in subgroups that renders an interpretation of the point estimates impossible. Heterogeneity analyses by educational attainment, however, confirm the results from the complier analysis, showing that the instrument is much weaker for low educated mothers, whose ILD responds less to policy changes than the other education groups (Table A.21).

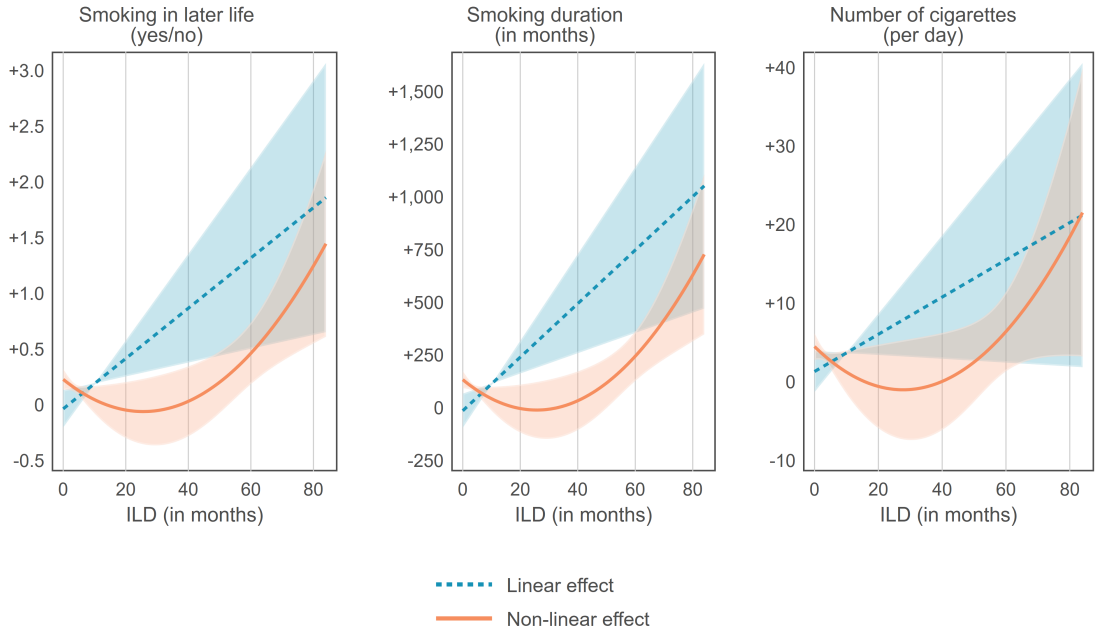
4.3 Non-linearities

4.3.1 The non-linear effect of maternal leave duration on smoking behavior

The results of our polynomial model (Equation 5) suggest important non-linearities in the effect of maternal leave duration on smoking behavior. Marginal effects of ILD on smoking behavior are displayed in Figure 3, together with the – linear – results from the main analysis. The corresponding estimation results are provided in Table A.4 of the Appendix. The five instruments leading to the highest Kleiberger-Paap F-statistic were the interaction of SLD with the mother's year of birth, the mother's age at birth, a dummy that is one if the child's birthrank is three, cash benefits during maternity leave, and cash benefits during parental leave. The F-statistic is, however, much smaller than for the linear model, namely 5.8 for the smoking in later life sample, 5.4 for smoking duration, and 3.8 for the number of cigarettes.

Our second-stage results indicate a U-shaped relationship between ILD and all three smoking outcomes. In the non-linear model (Equation 5), the coefficients for the effect of ILD on smoking behavior are all negative, but the squared term is positive, albeit small. The effect of maternal leave on smoking in later life, smoking duration, and cigarettes smoked per day is thus weakly negative up until around 20 months of leave, when the curve starts turning (Figure 3). After 40 months of maternal leave, the curves start becoming increasingly steeper, resulting in a strong positive effect of maternal leave duration on smoking behavior. This pattern implies that increasing shorter leave durations have a protective effect, while further increasing already long maternal leave promotes harmful health behavior. This is in line with the findings by Chuard (2023),

Figure 3: Linear and non-linear effects of mothers' leave duration after childbirth on their smoking behavior



Notes: Predictive margins from linear predictions with 95% confidence intervals. The corresponding regression output is provided in Table A.4 of the Appendix, along with estimates from an instrumental variable model for binary outcomes for 'smoking in later life'.

who also provides suggestive evidence for an optimal maternal leave duration in the range of one to two years when considering mothers' mental health as the outcome.

4.3.2 Robustness checks for the non-linear model

We also repeat some of the robustness checks from the main analysis in section 4.2.3 to assess the non-linear results. Here, we focus on those sensitivity analyses that showed slight changes in the point estimates for the main regressions and that might be relevant for assessing the optimal length of leave duration. First, we exclude all mothers who did not temporarily nor permanently stop working when their child was born, i.e. mothers who report zero ILD (first column of Figure A.3 of the Appendix). The non-linear estimates from this subsample are almost identical to those from the main sample, with a protective effect of maternal leave duration up to around 20 months of leave and an increasingly steeper curve after 40 months of leave.

Second, we estimate the non-linear model with the subsample of firstborn children only, where each mother is included only once. This reduces the sample size substan-

tially, which leads to larger standard errors but qualitatively similar results for the smoking in later life and smoking duration sample. For the 'number of cigarettes' sample, we also find a U-shaped relationship between maternal leave duration and smoking behavior, but the point estimates differ from the main results and the large standard errors hamper a meaningful interpretation. Note that the sample for the number of cigarettes was already smaller to begin with and, for this robustness check, is further reduced by dropping children of higher birth order.

Third, we only analyze a subsample of 'generous' countries that provide SLD of at least 10 months. While the marginal effects from these regressions are very similar to the main results, the curve minimum is slightly lower for smoking in later life and smoking duration, and slightly higher for the number of cigarettes smoked per day. Considering standard errors and confidence intervals, however, these differences are negligible.

Fourth, we drop all births that occurred in the years before and after a large change in SLD, analogously to the sensitivity analysis in Section 4.2.3. Although the exact curve minimum differs slightly using this alternative subsample, the main findings remain robust.

Finally, we assess our finding that the optimal length of leave duration lies in the range of one to two years, when smoking behavior is the outcome of interest. The squared term in Equation 5 imposes a u-shape on the effect of maternal leave duration on smoking behavior, with the curve minimum potentially depending on the value range of observed ILD, i.e. the curve minimum moves with the maximum observed value of ILD. For the main analyses, we do not consider mothers who returned to work later than seven years after giving birth. For robustness analyses, we lower this cut-off to six and then five years. The results are provided in the second column of Figure A.3 of the Appendix. The u-shaped effect of maternal leave duration on smoking behavior is clearly visible for all cut-offs for the smoking in later life and smoking duration sample. Also, maternal leave appears to have a protective effect up to an ILD of around 20 months, irrespective of the cut-off. When applying the lower cut-offs, however, the curve starts increasing much earlier and the positive slope of the u-shape becomes steeper. This suggests that the magnitude of the positive effect of maternal leave duration on smoking behavior depends on the value range of ILD, when estimating the non-linear model. We did not find such sensitivities for the linear model (see Figure 2). Due to their large standard errors, the marginal effects from the number of cigarettes

sample cannot be interpreted meaningfully.

5 Conclusions

Our paper provides first evidence on the causal relationship between leave duration after childbirth and long-term risky health behaviors. In particular, we shed light on the later-life smoking behavior of mothers and whether this is driven by differences in individual maternal leave duration. Hence, we add a long-term perspective on the link between maternal leave duration and health outcomes to the literature. We further contribute to existing evidence by exploring non-linearities in the effects.

Besides contextual factors, such as national leave policies, leave duration after childbirth is driven by individual characteristics and preferences that cannot be assumed to be uncorrelated with health outcomes. We therefore exploit exogenous policy changes in statutory leave duration across 14 European countries from 1960 until 2010 and combine this information with comprehensive retrospective survey data on older European women. Using an instrumental variable estimation, we find that, on average, longer leave after childbirth significantly increases the probability of smoking and the number of cigarettes consumed in later life as well as the overall lifetime smoking duration. This negative return to maternal leave duration is in contrast to earlier studies that find positive effects on the mental health of mothers and other health outcomes (Avendano et al., 2015; Bütikofer et al., 2021). These previous studies focused on policies that not only affected the length of leave but also related benefits. If cash benefits offset parts of the detrimental effect of leave duration on health outcomes, this difference could explain the diverging findings.

Several robustness, falsification, and placebo checks confirm this detrimental effect of absence from work after childbirth on health behavior. Based on a heterogeneity analysis, we find tentative evidence that financial stress might be a driver of these results. This points towards the hypothesis that longer absence from work increases stress, especially for those who cannot rely on financial support from their partner, leading to a higher probability of smoking. Other heterogeneity checks, such as on the level of education or type of work, do not reveal any differential impacts of leave after childbirth on smoking behavior later in life.

Finally, we add to the literature by analyzing the non-linearities in the relationship between maternal leave duration and smoking behavior in the long run. Similar to

other papers (Chuard, 2023; Bütikofer et al., 2021), our analysis suggests that the marginal effects of maternal leave duration are not constant. Our results show a u-shaped relationship between individual leave duration and smoking behavior later in life. At lower levels, an increase in individual leave duration decreases the likelihood of engaging in the risky health behavior of smoking in old age. On the contrary, if leave after childbirth exceeds a certain duration – around 20 months –, the likelihood of smoking later in life and the overall smoking duration throughout life increases with increased individual leave taken. Given these results, there seems to be an optimal level of maternal leave duration that minimizes the probability and extent of smoking throughout life. This finding is in line with a recent paper by Chuard (2023), who finds that an Austrian reform that reduced maternal leave from 2 to 1.5 years improved mothers' health outcomes in the medium run, while increasing maternal leave from 1.5 to 2.5 years negatively affects mothers' health outcomes. The latter is driven by the detrimental impact on mental health, which ties in with our findings that financial stress is a driver for increased smoking in later life.

Labor economists have long pointed out that long leave durations can reduce mothers' labor market participation and income significantly (Olivetti and Petrongolo, 2017; Schönberg and Ludsteck, 2014), which, in turn, might lead to financial stress that potentially triggers mental health problems and risky health behaviors. Given the strong evidence on child development and intergenerational transmission of health behaviors, future research on the effects of maternal leave duration should consider non-linearities to inform the optimal design of leave policies – such as encouraging mothers' return to the labor market as well as fathers' uptake of parental leave.

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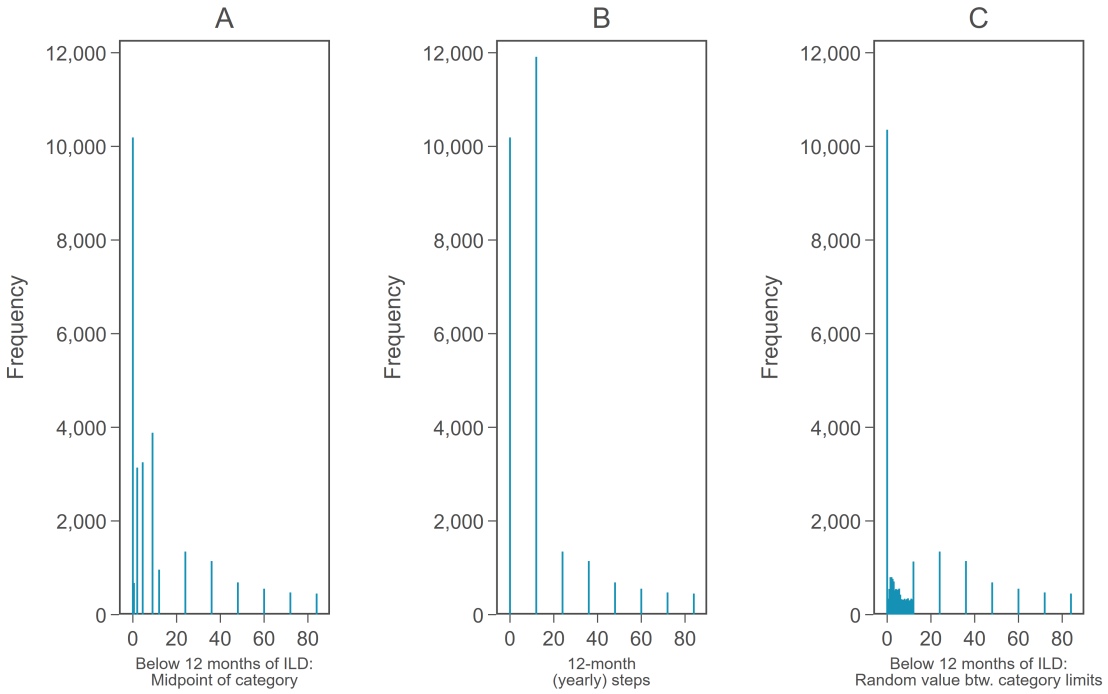
A Appendix

A.1 Additional tables and figures

Figure A.1: Individual leave duration – different specifications



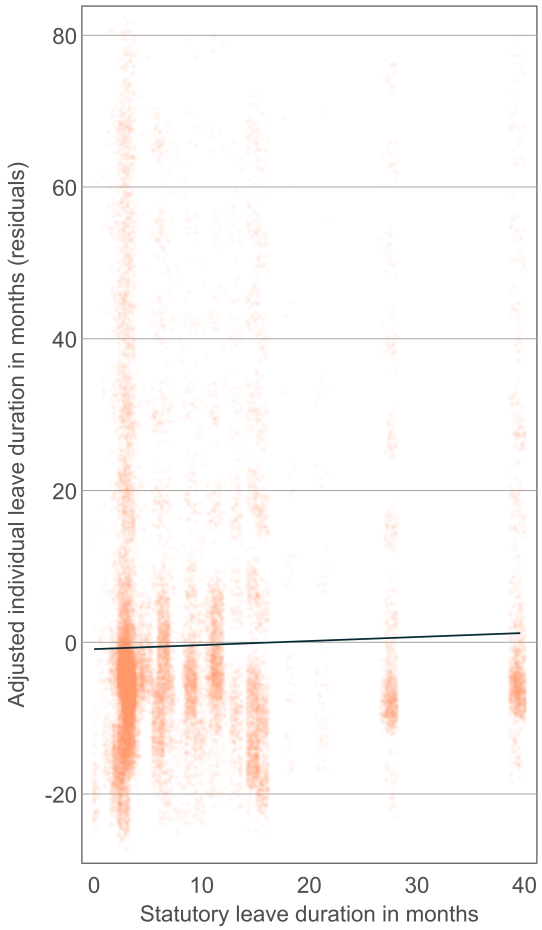
Notes: The explanatory variable "individual leave duration" (ILD) is categorical up to 12 months of ILD ("No interruption", "1 month or less", "more than 1 month but less than 3 months", "more than 3 months but less than 6 months", "more than 6 months but less than 1 year"). For the main estimations, the midpoint of each category is taken (panel A). For sensitivity analyses, ILD is rounded up to the next full year (panel B), and random values between the category limits are computed (panel C).

Table A.1: Summary statistics

Variable	N	Mean	Std. Dev.	Min.	Max.	Median
Individual leave duration (in months)	24,594	10.233	18.527	0	84.097	1.979
Smoking in later life (1=yes)	24,594	0.189	0.391	0	1	0
Smoking duration (in months)	24,127	113.242	175.111	0	840	0
Smoking duration (in months) > 0	9,627	283.804	168.650	12	840	300
Number of cigarettes (per day)	19,557	3.608	7.666	0	115	0
Number of cigarettes (per day) > 0	5,047	13.981	9.093	1	115	12
Year of birth child	24,594	1977.507	9.766	1960	2010	1977
Year of birth mother	24,594	1949.499	8.793	1918	1981	1950
Age at birth mother	24,594	28.008	5.294	14	49	28
Number of children mother	24,594	2.599	1.190	1	13	2
Single around birth (1=yes)	24,586	0.047	0.212	0	1	0
Financial support from spouse or partner around childbirth (1=yes)	24,502	0.61	0.488	0	1	1
Child benefits from state or other institution around childbirth (1=yes)	24,502	0.481	0.500	0	1	0
Total household income in later life (Euros per year)	24,429	37,409.77	36,527.47	0	764,045	30,000
Statutory cash benefits during maternity leave (as % of female wages in manufacturing)	24,594	70.279	31.270	0	100	79.500
Statutory cash benefits during parental leave (as % of female wages in manufacturing)	24,594	17.341	31.059	0	105.724	0
Intensity of tobacco-control policies	24,594	0.743	1.189	0	5	0
Birth rank of child	24,594					
1st child	11,174	0.454	0.498	0	1	0
2nd child	8,608	0.350	0.477	0	1	0
3rd child	3,300	0.134	0.341	0	1	0
4+ child	1,512	0.061	0.240	0	1	0
Educational attainment of mother	24,327					
Low education	8,611	0.354	0.478	0	1	0
Medium education	8,248	0.339	0.473	0	1	0
High education	7,468	0.307	0.461	0	1	0
Type of work around childbirth	8,178					
Blue collar worker	2,622	0.321	0.467	0	1	0
White collar worker	5,556	0.679	0.467	0	1	1

Notes: No weights applied. This information is given on the child's level, i.e. mothers with more than one child are counted several times

Figure A.2: Statutory leave duration versus adjusted individual leave duration



Notes: This Figure shows the relationship between statutory leave duration (SLD) and adjusted individual leave duration (ILD) in months. Adjusted ILD values are residuals from a regression of ILD on the vector of control variables X, C, and P; in particular, the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level. The scatter plot values are slightly jittered along the x-axis for better readability – darker shades indicate a larger number of observations. The solid line represents a linear regression of adjusted ILD on SLD.

Table A.2: Smoking behavior in different (sub)samples: mothers' level

	(1) Sample size (max.)*	(2) Smoking in later life (%)	(3) Smoking duration (average months)	(4) Number of cigarettes (average per day)
Main sample				
Working mothers with ILD $\leq$ 7 years	13,135	19.4	116.5	3.8
Subsamples				
Working mothers born before 1950	6,321	14.0	105.7	3.4
Working mothers born 1950 and later	6,814	24.5	126.5	4.1
Working mothers with low education	4,608	18,1	102.1	3.4
Working mothers with medium education	4,586	22.6	130.7	4.0
Working mothers with high education	3,798	17.3	117.4	3.9
Other samples				
Non-working mothers	15,710	15.6	79.7	3.0
All women in SHARE	66,211	18.3	99.9	2.9
All women and men in SHARE	119,374	21.5	149.0	5.1

Notes: No weights applied. Mothers are counted only once. For information on the child's level, where mothers with more than one child are counted several times, see Table 1. *Due to missing values, the samples for smoking duration and the number of cigarettes per day are smaller than the sample for smoking in later life.

Table A.3: First stage results and complier characteristics ratios – full table

	Smoking in later life (yes/no)	Smoking duration (in months)	Number of cigarettes (per day)
OVERALL FIRST STAGE			
First stage full sample (continuous)	0.082***	0.084***	0.082***
	(0.021)	(0.021)	(0.023)
Cragg-Donald F-statistic	21.3	22.2	16.6
Keiberger-Paap F-statistic	15.5	16.1	12.0
N	24,594	24,127	19,557
First stage full sample (dichotomised)	0.087***	0.090***	0.085***
	(0.013)	(0.013)	(0.014)
Cragg-Donald F-statistic	69.0	73.2	51.9
Keiberger-Paap F-statistic	47.5	50.0	35.9
N	24,594	24,127	19,557
GROUP-SPECIFIC FIRST STAGES			
Low educated mother			
Group-specific first stage	0.036*	0.034*	0.022
	(0.019)	(0.019)	(0.021)
Ratio (Group-specific / overall)	0.413	0.378	0.255
N	8,611	8,513	7,407
Mother older than 30 years			
Group-specific first stage	0.099***	0.104***	0.103***
	(0.022)	(0.022)	(0.024)
Ratio (Group-specific / overall)	1.133	1.153	1.208
N	7,451	7,312	6,014
Mother worked full-time job			
Group-specific first stage	0.070***	0.074***	0.070***
	(0.013)	(0.013)	(0.014)
Ratio (Group-specific / overall)	0.807	0.820	0.816
N	16,184	15,883	12,810
Mother was in a relationship			
Group-specific first stage	0.089***	0.092***	0.087***
	(0.013)	(0.013)	(0.015)
Ratio (Group-specific / overall)	1.017	1.015	1.025
N	23,427	22,990	18,718
Mother was born from 1950 onwards			
Group-specific first stage	0.112***	0.118***	0.110***
	(0.018)	(0.019)	(0.022)
Ratio (Group-specific / overall)	1.288	1.302	1.293
N	12,830	12,541	9,450

Notes: The table shows first stage results for the main sample along with F-statistics (Equation 2). It also provides first stage results for the main sample using dichotomized treatment and instrumental variables. The group-specific first stages also use these dichotomized variables. The complier characteristics ratios show the ratio of the group-specific first stage to the overall first stage from the main sample. Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level.

Table A.4: Non-linearities in the effect of mothers' leave duration

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: Probit			
ILD	-0.122***		
	(0.029)		
ILD × ILD	0.002***		
	(0.000)		
IV/2SLS First stage			
SLD	-2.717	-2.080	-1.657
	(5.041)	(5.090)	(5.786)
SLD × Year of birth mother	0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)
SLD × Age at birth mother	-0.004	-0.004	-0.005
	(0.003)	(0.003)	(0.003)
SLD × Birth rank == 3	0.150***	0.147***	0.198***
	(0.037)	(0.037)	(0.043)
SLD × Cash benefits during maternity leave	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)
SLD × Cash benefits during parental leave	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)
IV/2SLS Second stage			
ILD	-0.023*	-11.200**	-0.396
	(0.012)	(5.517)	(0.255)
ILD × ILD	0.000**	0.218**	0.007*
	(0.000)	(0.086)	(0.004)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	5.81	5.40	3.76
Cragg-Donald F-statistic	6.85	6.38	4.02
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: The table shows the estimated effects of mothers' individual leave duration in months and its squared term on their smoking behavior. It displays first and second stage (Equation 5) estimates, using a set of interacted instruments, namely the interaction of SLD with the mother's year of birth, the mother's age at birth, a dummy that is one if the child's birthrank is three, cash benefits during maternity leave, and cash benefits during parental leave. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). For this outcome variable, the table also provides coefficients (not marginal effects) from a Probit model for binary outcomes using maximum likelihood. "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.2 Sensitivity analyses

Table A.5: The effect of maternal leave duration on smoking behavior: ILD rounded up to the next full year

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.075***	0.076***	0.079***
	(0.020)	(0.021)	(0.023)
IV: 2SLS Second stage			
ILD in full 12-month-steps	0.024***	13.977***	0.245*
	(0.009)	(4.660)	(0.138)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	13.53	13.66	12.17
Cragg-Donald F-statistic	19.12	19.36	16.38
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: For this sensitivity analysis, individual leave duration is rounded up to the next full year (see panel B in Figure A.1). The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave as a percent of average female wages in manufacturing during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6: The effect of maternal leave duration on smoking behavior: ILD randomized below 12 months

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.082***	0.084***	0.082***
	(0.021)	(0.021)	(0.023)
IV: 2SLS Second stage			
ILD in months (partly randomized)	0.023***	12.713***	0.237*
	(0.008)	(4.030)	(0.134)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	15.51	16.06	12.61
Cragg-Donald F-statistic	21.28	22.12	16.57
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: For this sensitivity analysis, random values between the category limits of the explanatory variable ILD are computed (see panel C in Figure A.1). The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7: **The effect of maternal leave duration on smoking behavior:** Subsample with firstborn children only

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.039*	0.043*	0.031
	(0.023)	(0.023)	(0.025)
IV: 2SLS Second stage			
Individual leave duration	0.042	19.982	0.494
	(0.029)	(12.488)	(0.566)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	2.91	3.34	1.50
Cragg-Donald F-statistic	2.45	2.82	1.14
Mean of dependent variable	0.20	118.21	3.81
Number of observations	11,174	10,967	8,805

For this sensitivity analysis, only the subsample of firstborn children is used. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.8: The effect of mothers' leave duration after childbirth on their smoking behavior for mothers with ILD > 0

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.151***	0.156***	0.131***
	(0.036)	(0.037)	(0.040)
IV: 2SLS Second stage			
Individual leave duration	0.012**	7.444***	0.227*
	(0.005)	(2.548)	(0.124)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	17.58	18.11	10.83
Cragg-Donald F-statistic	27.81	28.86	16.29
Mean of dependent variable	0.20	123.82	4.10
Number of observations	14,868	14,604	11,705

Notes: For this sensitivity analysis, only mothers that take any leave are considered. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9: The effect of mothers' leave duration after childbirth on smoking in later life: different cut-offs

	Smoking in later life (yes/no)			Smoking duration (in months)			Number of cigarettes (per day)		
	(1) 5 years	(2) 6 years	(3) 7 years	(4) 5 years	(5) 6 years	(6) 7 years	(7) 5 years	(8) 6 years	(9) 7 years
IV: 2SLS First stage									
Statutory leave duration	0.055***	0.056***	0.082***	0.057***	0.057***	0.084***	0.057***	0.061***	0.082***
	(0.016)	(0.018)	(0.021)	(0.016)	(0.018)	(0.021)	(0.018)	(0.021)	(0.023)
IV: 2SLS Second stage									
Individual leave duration	0.034***	0.033**	0.023***	18.291***	18.318***	12.695***	0.333*	0.311*	0.237*
	(0.013)	(0.014)	(0.008)	(6.221)	(6.950)	(4.024)	(0.196)	(0.186)	(0.133)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F-statistic	12.66	9.38	15.49	13.46	9.73	16.07	10.53	8.76	12.60
Cragg-Donald F-statistic	17.87	13.29	21.28	18.99	13.82	22.16	15.03	12.65	16.59
Mean of dependent variable	0.19	0.19	0.19	112.78	113.02	113.24	3.58	3.60	3.61
Number of observations	23,733	24,165	24,594	23,280	23,704	24,127	18,872	19,218	19,557

Notes: For this sensitivity analysis, we compare the main results (Columns 3, 6, and 9) with the subsample of mothers with a maximum leave duration of five years (Columns 1, 4, and 7) and the subsample of mothers with a maximum leave duration of six years (Columns 2, 5, and 8). The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.10: The effect of mothers' leave duration after childbirth on smoking in later life: countries with SLD > 10 months

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.069***	0.073***	0.067***
	(0.023)	(0.023)	(0.025)
IV: 2SLS Second stage			
Individual leave duration	0.029**	16.239***	0.336*
	(0.012)	(6.025)	(0.197)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	9.16	9.91	7.00
Cragg-Donald F-statistic	12.24	13.35	8.88
Mean of dependent variable	0.19	118.95	3.56
Number of observations	18,080	17,723	14,122

Notes: For this sensitivity analysis, only countries that provide at least 10 months of SLD at some point during the observation period are considered. This includes Austria, Germany, Denmark, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, and Sweden. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.11: The effect of mothers' leave duration after childbirth on smoking in later life: instrument interacted with benefits

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.081***	0.082***	0.080***
	(0.021)	(0.022)	(0.024)
Statutory leave duration × Cash benefits	-0.001*	-0.001*	-0.001*
	(0.001)	(0.001)	(0.001)
IV: 2SLS Second stage			
Individual leave duration	0.026***	15.269***	0.262*
	(0.009)	(4.743)	(0.139)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	7.47	7.39	5.84
Cragg-Donald F-statistic	9.73	9.66	7.53
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: For this sensitivity analysis, we interact the main instrument (sum of statutory maternity leave duration and statutory parental leave duration in months) with the cash benefits during parental leave during the child's year of birth. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.12: The effect of maternal leave duration on smoking behavior: dropping births that happened around large policy changes

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.044**	0.046**	0.057**
	(0.022)	(0.023)	(0.025)
IV: 2SLS Second stage			
Individual leave duration	0.056*	28.165*	0.294
	(0.031)	(15.027)	(0.219)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	3.90	4.04	5.10
Cragg-Donald F-statistic	4.69	4.88	6.14
Mean of dependent variable	0.19	112.21	3.59
Number of observations	21,534	21,127	17,282

Notes: For this sensitivity analysis, children that are born in the year before and after a change in SLD of more than six months are dropped from the analysis. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.13: The effect of maternal leave duration on smoking behavior: smokers only, i.e. smoking duration and number of cigarettes > 0

	(1) Smoking duration (in months)	(2) Number of cigarettes (per day)
IV: 2SLS First stage		
Statutory leave duration	0.132***	0.130**
	(0.038)	(0.053)
IV: 2SLS Second stage		
Individual leave duration	7.810**	0.024
	(3.572)	(0.240)
Country dummies	Yes	Yes
Other control variables	Yes	Yes
Kleibergen-Paap F-statistic	12.02	6.04
Cragg-Donald F-statistic	17.29	6.85
Mean of dependent variable	283.80	13.98
Number of observations	9,627	5,047

Notes: For this sensitivity analysis, only smokers are considered. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.14: The effect of maternal leave duration on smoking behavior: placebo analysis with non-working mothers

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
Reduced form: working mothers			
Statutory leave duration	0.008***	1.068***	0.019**
	(0.002)	(0.208)	(0.009)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Number of observations	24,594	24,127	19,557
Reduced form: non-working mothers			
Statutory leave duration	0.000	0.288	-0.006
	(0.001)	(0.221)	(0.012)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Number of observations	15,710	15,405	14,105

Notes: The table shows results from the reduced form model (Equation 4) for the main sample, as well as a placebo analysis for the sample of non-working mothers. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.15: The effect of maternal leave duration on smoking behavior: placebo analysis with randomized statutory leave duration, i.e. randomized instrumental variables

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration (randomized)	-0.000	0.001	-0.002
	(0.010)	(0.010)	(0.011)
IV: 2SLS Second stage			
Individual leave duration	0.467	46.668	-0.973
	(13.395)	(523.048)	(5.338)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	0.00	0.01	0.04
Cragg-Donald F-statistic	0.00	0.01	0.04
Mean of dependent variable	0.19	113.24	3.61
Number of observations	24,594	24,127	19,557

Notes: For this sensitivity analysis, the instrument is randomized. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the randomized sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.16: The effect of maternal leave duration on smoking behavior: falsification analysis with socio-economic status at childhood as outcome

	(1) Poor financial status of mother at ages 0-16
IV: 2SLS First stage	
Statutory leave duration	0.047*
	(0.026)
IV: 2SLS Second stage	
Individual leave duration	-0.006
	(0.013)
Country dummies	Yes
Other control variables	Yes
Kleibergen-Paap F-statistic	3.30
Cragg-Donald F-statistic	4.95
Mean of dependent variable	0.19
Number of observations	15,791

Notes: For this sensitivity analysis, the outcome variable is the mother's socio-economic status during childhood. The table shows the estimated effects of mothers' individual leave duration in months on whether she was poor between ages zero to 16. It displays first (Equation 2) and second stage (Equation 3) estimates, using the randomized sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.17: **The effect of maternal leave duration on smoking behavior:** Subsample without East Germany before 1990

	(1) Smoking in later life (yes/no)	(2) Smoking duration (in months)	(3) Number of cigarettes (per day)
IV: 2SLS First stage			
Statutory leave duration	0.045**	0.046**	0.053**
	(0.021)	(0.021)	(0.023)
IV: 2SLS Second stage			
Individual leave duration	0.052*	29.870**	0.540*
	(0.027)	(14.465)	(0.298)
Country dummies	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
Kleibergen-Paap F-statistic	4.68	4.81	5.34
Cragg-Donald F-statistic	5.68	5.86	6.48
Mean of dependent variable	0.19	113.87	3.70
Number of observations	22,381	21,948	17,934

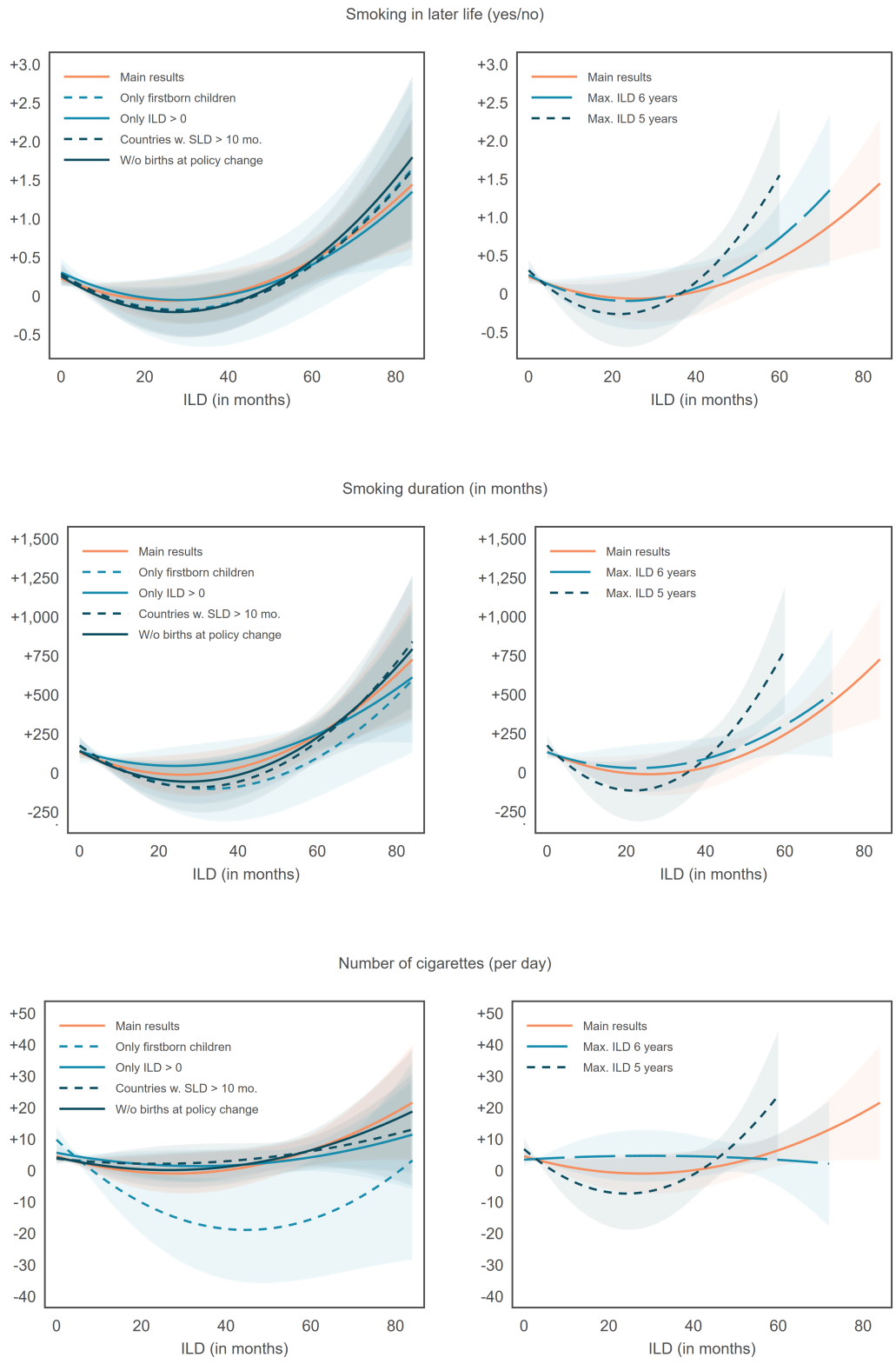
Notes: For this sensitivity analysis, childbirths in East Germany before 1990 are dropped. The table shows the estimated effects of mothers' individual leave duration in months on their smoking behavior. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Column 1). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Column 2). "Number of cigarettes" gives the average number of cigarettes smoked per day (Column 3). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.18: The effect of statutory leave duration on the mother's number of children

	(1) OLS	(2) Poisson	(3) Negative Binomial
Statutory leave duration	-0.001	-0.000	-0.000
	(0.002)	(0.001)	(0.001)
Year of birth mother	-0.026***	-0.010***	-0.010***
	(0.002)	(0.001)	(0.001)
Statutory cash benefits maternity leave	-0.003***	-0.001***	-0.001***
	(0.001)	(0.000)	(0.000)
Statutory cash benefits parental leave	0.003***	0.001***	0.001***
	(0.001)	(0.000)	(0.000)
Country dummies	Yes	Yes	Yes
Number of observations	24,594	24,594	24,594

Notes: This sensitivity analysis addresses endogenous fertility. The table shows the estimated effects of statutory leave duration on the mother's number of children. It displays coefficients from an OLS regression (Column 1), as well as a Poisson regression model (Column 2) and a Negative Binomial regression model (Column 3). Control variables include the mother's year of birth in single years, country dummies, and statutory cash benefits during maternity and parental leave during the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A.3: Sensitivity analyses for the non-linear effect of mothers' leave duration after childbirth on their smoking behavior



Notes: Predictive margins from linear predictions with 95% confidence intervals. The corresponding output tables will be provided upon request.

A.3 Heterogeneity analyses

Table A.19: The effect of mothers' leave duration after childbirth on smoking in later life by source of income

	Smoking in later life (yes/no)		Smoking duration (in months)		Number of cigarettes (per day)	
	(1)	(2)	(3)	(4)	(5)	(6)
	No financial support from spouse	Financial support from spouse	No financial support from spouse	Financial support from spouse	No financial support from spouse	Financial support from spouse
First stage						
Statutory leave duration	0.061**	0.097***	0.065**	0.099***	0.071**	0.081***
	(0.026)	(0.028)	(0.026)	(0.028)	(0.030)	(0.030)
Second stage						
Individual leave duration	0.058**	0.007	23.254**	7.094**	0.488	0.110
	(0.028)	(0.006)	(10.916)	(3.192)	(0.311)	(0.146)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F	5.64	12.32	6.31	12.45	5.56	7.46
Cragg-Donald F	7.46	15.97	8.32	16.25	7.46	9.22
Mean of Y	0.20	0.18	124.86	105.73	3.60	3.61
Number of observations	9,551	14,951	9,333	14,703	7,152	12,331

Notes: This table provides heterogeneity analyses by income source. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.20: The effect of mothers' leave duration after childbirth on smoking in later life by parity

	Smoking in later life (yes/no)				Smoking duration (in months)				Number of cigarettes (per day)			
	(1) 1 child	(2) 2 children	(3) 3 children	(4) 4+ children	(5) 1 child	(6) 2 children	(7) 3 children	(8) 4+ children	(9) 1 child	(10) 2 children	(11) 3 children	(12) 4+ children
First stage												
Statutory leave duration	0.027	0.071**	0.158***	0.079	0.031	0.072**	0.170***	0.075	0.022	0.062*	0.151***	0.095
	(0.044)	(0.030)	(0.045)	(0.057)	(0.045)	(0.031)	(0.046)	(0.057)	(0.049)	(0.033)	(0.049)	(0.063)
Second stage												
Individual leave duration	-0.033	0.045**	0.014*	0.002	6.846	20.926**	5.696*	13.646	-0.121	0.401	0.270*	-0.020
	(0.066)	(0.022)	(0.008)	(0.017)	(18.785)	(9.872)	(2.990)	(12.983)	(1.101)	(0.326)	(0.157)	(0.246)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F	0.37	5.54	12.32	1.92	0.47	5.61	13.89	1.69	0.20	3.41	9.40	2.23
Cragg-Donald F	0.32	6.96	19.42	3.39	0.40	7.11	21.92	3.01	0.17	4.02	14.35	3.75
Mean of Y	0.23	0.20	0.18	0.17	130.74	117.47	108.26	97.98	4.20	3.83	3.43	2.92
Number of observations	2,751	11,044	6,802	3,997	2,691	10,860	6,658	3,918	2,135	8,703	5,483	3,236

Notes: This table provides heterogeneity analyses by parity. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.21: The effect of mothers' leave duration after childbirth on smoking in later life by educational attainment

	Smoking in later life (yes/no)			Smoking duration (in months)			Number of cigarettes (per day)		
	(1) Low education	(2) Medium education	(3) High education	(4) Low education	(5) Medium education	(6) High education	(7) Low education	(8) Medium education	(9) High education
First stage									
Statutory leave duration	0.009	0.213***	0.111***	0.004	0.218***	0.114***	0.003	0.215***	0.137***
	(0.031)	(0.044)	(0.036)	(0.031)	(0.044)	(0.036)	(0.034)	(0.049)	(0.042)
Second stage									
Individual leave duration	0.084	0.007	0.013	171.516	2.919	4.522	-4.282	-0.000	0.013
	(0.284)	(0.005)	(0.009)	(1468.901)	(1.858)	(4.299)	(46.300)	(0.085)	(0.163)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F	0.09	23.79	9.60	0.01	24.47	9.85	0.01	18.88	10.80
Cragg-Donald F	0.11	33.75	12.98	0.02	34.72	13.33	0.01	24.39	14.96
Mean of Y	0.18	0.22	0.16	99.68	126.98	114.33	3.23	3.89	3.79
Number of observations	8,611	8,248	7,468	8,513	8,154	7,370	7,407	6,221	5,839

Notes: This table provides heterogeneity analyses by educational attainment. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.22: The effect of mothers' leave duration after childbirth on smoking in later life by relationship status around birth

	Smoking in later life (yes/no)		Smoking duration (in months)		Number of cigarettes (per day)	
	(1) In a relationship	(2) Single	(3) In a relationship	(4) Single	(5) In a relationship	(6) Single
First stage						
Statutory leave duration	0.085***	0.017	0.088***	0.023	0.085***	0.039
	(0.021)	(0.049)	(0.022)	(0.050)	(0.024)	(0.064)
Second stage						
Individual leave duration	0.023***	-0.081	12.125***	20.016	0.233*	-0.214
	(0.008)	(0.282)	(3.849)	(60.206)	(0.129)	(1.486)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F	15.77	0.12	16.22	0.21	12.77	0.38
Cragg-Donald F	22.04	0.06	22.76	0.10	17.13	0.22
Mean of Y	0.18	0.28	111.39	150.66	3.57	4.46
Number of observations	23,427	1,159	22,990	1,129	18,718	839

Notes: This table provides heterogeneity analyses by relationship status around birth. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.23: The effect of mothers' leave duration after childbirth on smoking in later life by type of work

	Smoking in later life (yes/no)		Smoking duration (in months)		Number of cigarettes (per day)	
	(1) Blue collar	(2) White collar	(3) Blue collar	(4) White collar	(5) Blue collar	(6) White collar
First stage						
Statutory leave duration	0.087	0.045	0.079	0.051	0.094*	0.052
	(0.055)	(0.037)	(0.058)	(0.038)	(0.057)	(0.037)
Second stage						
Individual leave duration	0.018	0.028	10.767	13.379	0.392	0.303
	(0.021)	(0.035)	(9.737)	(14.740)	(0.474)	(0.573)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap F	2.48	1.50	1.86	1.82	2.74	1.96
Cragg-Donald F	3.44	1.40	2.57	1.74	3.87	1.86
Mean of Y	0.21	0.21	97.86	126.20	4.82	6.30
Number of observations	2,622	5,556	2,514	5,354	2,576	5,416

Notes: This table provides heterogeneity analyses by type of work around birth. It displays first (Equation 2) and second stage (Equation 3) estimates, using the sum of statutory maternity leave duration and statutory parental leave duration in months as an instrument for individual leave duration. The dependent variable "Smoking in later life" is binary and takes a value of one if individuals smoke in later life, and zero otherwise (Columns 1-3). "Smoking duration" measures the overall smoking duration throughout the lifetime in months (Columns 4-6). "Number of cigarettes" gives the average number of cigarettes smoked per day (Columns 7-9). Control variables include the mother's year of birth in single years, her age at birth in single years, her number of children, the child's birth rank, country dummies, statutory cash benefits during maternity and parental leave during the child's year of birth, and a variable indicating the intensity of tobacco-control policies at the child's year of birth. Standard errors are clustered at the mothers' level and given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.4 Who takes leave and who does not?

A large proportion of our sample (9,726 observations, 39.6 percent of the main sample) report that they did not temporarily nor permanently stop working when their child was born, i.e. they report zero ILD. For sensitivity analyses, Table A.8 provides estimates for the subsample of mothers with ILD > 0. Differences to the main results are negligible, which is also shown in Figure 2.

According to a simple Logistic regression (Table A.24), mothers that take any leave – as opposed to ILD $= 0$ – are born more recently, have fewer children, are less likely to be single around birth, are more likely to receive income from benefits or spouses around birth, and are more likely to be working in any other industry but agriculture. More specifically, 60 percent of mothers working in agriculture report not having taken any leave. There are also substantial country differences in the likelihood of taking any leave. Importantly for our analysis, smoking in later life does not predict taking any leave.

To better understand what explains the take-up of any leave, we conduct a relative importance analysis for which we decompose the Pseudo R-squared of the above regression analysis, which is 0.18. This relative importance analysis reveals that 77 percent of the explained variation in "took leave > 0" is explained by variations in the country of residence, 11 percent by whether the mother received benefits during birth, and 6 percent by the industry that the mother works in. All other variables explain less than 2 percent of the explained variation. "Smoking long term" explains only 0.3 percent of the explained variation. In summary, along with country differences and the provision of benefits, industry appears to be an important driver for the decision to take up leave, especially whether women work in agriculture or not.

Table A.24: Determinants of taking any leave versus zero leave

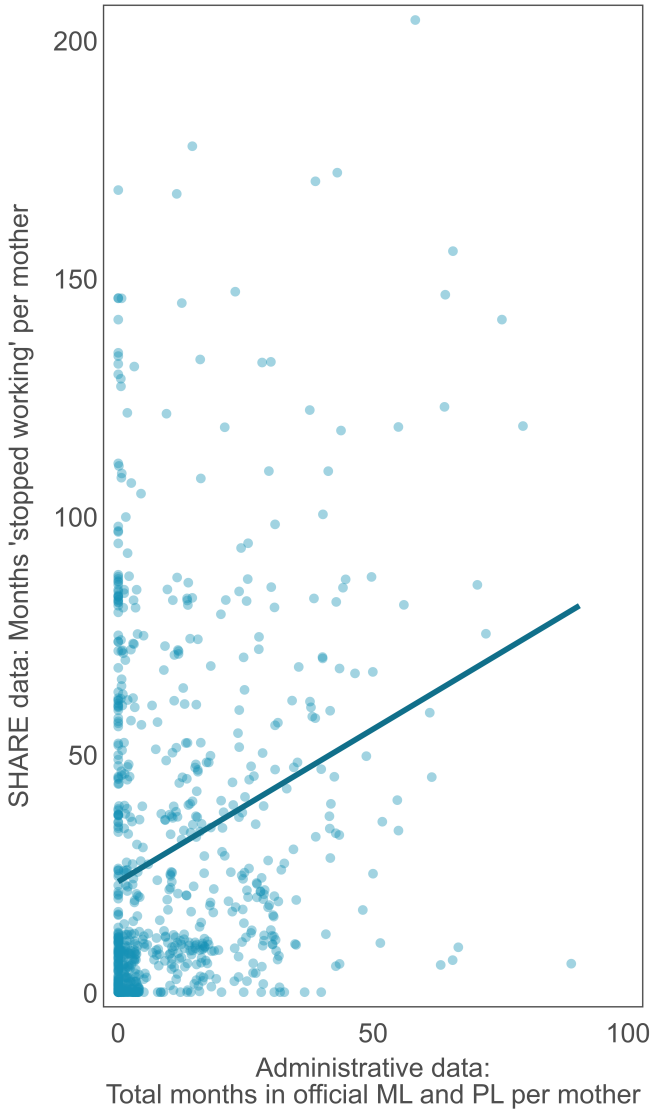
	Mother took leave (ILD > 0)	
Mother's year of birth	0.016***	(0.00)
Year of birth child	0.003	(0.00)
Medium education (ref. = low education)	-0.059	(0.05)
High education (ref. = low education)	-0.072	(0.05)
Number of children mother	-0.059***	(0.01)
Single around birth (ref. = no)	-0.232***	(0.08)
Smoking in later life (ref. = no)	0.068	(0.04)
Income from spouse around birth (ref. = no)	0.439***	(0.04)
Child benefits from state or other institution around childbirth	0.710***	(0.04)
Total household income in later life (Euros per year)	-0.000	(0.00)
Industry (ref. = agriculture, hunting, forestry, fishing)		
Mining and quarrying	1.018***	(0.23)
Manufacturing	0.883***	(0.07)
Electricity, gas, and water supply	0.912***	(0.21)
Construction	0.775***	(0.14)
Wholesale and retail trade	0.718***	(0.08)
Hotels and restaurants	0.662***	(0.10)
Transport, storage, and communication	1.037***	(0.14)
Financial intermediation	0.939***	(0.11)
Real estate, renting and business activities	0.793***	(0.16)
Public administration and defense	0.874***	(0.09)
Education	0.837***	(0.08)
Health and social work	0.895***	(0.08)
Other community	0.816***	(0.08)
Country (ref. = Austria)		
Germany	-0.315***	(0.07)
Sweden	2.005***	(0.11)
Netherlands	-0.484***	(0.12)
Spain	-1.064***	(0.08)
Italy	-0.252***	(0.08)
France	-1.580***	(0.07)
Denmark	0.952***	(0.08)
Greece	0.368***	(0.10)
Switzerland	-0.822***	(0.09)
Belgium	-1.632***	(0.07)
Ireland	-0.007	(0.16)
Luxembourg	-1.070***	(0.13)
Portugal	-0.576***	(0.11)
Constant	-38.338***	(4.03)
Pseudo R-squared	0.18	
Number of observations	19,945	

Notes: The table provides results from a Logistic regression for ILD > 0. Standard errors are clustered at the mothers' level and given in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

A.5 Leave duration in SHARE versus in administrative data

In the SHARE survey, mothers are asked "How long did you stop working for?" after their child was born. While their leave duration is assumed to include both times spent in maternity and parental leave, many mothers in our sample report individual leave durations that well exceed the statutory maternity and parental leave at the time of birth. This suggests that mothers stay with their children even after their official leave is over, either by becoming unemployed, dropping out of the labor market entirely, or taking sick leave. For a small subsample of Austrian women, we are able to compare individual leave duration according to the survey with their time spent in official leave according to Austrian administrative data. This is possible, because SHARE Austria matched a small sample from the early waves with the Austrian social security database. While there is a clear positive correlation between official maternity and parental leave, and the time mothers stopped working according to SHARE, the results confirm that the actual leave taken is – on average – higher than the official maternity and parental leave (Figure A.4).

Figure A.4: Individual leave duration versus leave duration from Austrian administrative data



Notes: This figure compares data from the SHARE survey for 798 Austrian mothers with their official maternity and parental leave duration according to Austrian administrative data. The x-axis shows the total number of months that mothers stopped working for after the birth of their children. The y-axis shows the total time these mothers officially spent on either maternity or parental leave, again summing up over all their children. The blue line provides predictions from a linear regression of individual leave duration from the survey data on the total months spent in maternity and parental leave.