Trick or treat?
Maternal involuntary job loss and children's non-cognitive skills

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Abstract

Negative effects of job loss on adults such as considerable fall in income have long been examined. If job loss has negative consequences for adults it may spread to their children. But potential effects on children's non-cognitive skills and the related mechanisms have been less examined. This paper uses propensity score matching to analyze maternal involuntary job loss and its potential causal effect on children's non-cognitive skills. Job loss is defined as end of employment either due to plant closure or due to dismissals by employer. Using a rich and representative data set, the German Socio-Economic Panel Study (SOEP), I estimate associations of maternal job loss on child outcomes for preschool children aged five/six and for adolescents aged seventeen. The paper analyzes influences on children's socio-emotional behavior and on adolescents' locus of control. The obtained results show that children whose mothers experience an involuntary job loss are more likely to have behavioral problems and are less likely to believe in self-determination.

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1 Introduction

Negative effects of job loss on adults such as a considerable fall in income, persistence of unemployment, or even divorce have been discussed widely in the literature (for instance Charles and Stephens; 2004). If job loss has negative consequences for adults it may spread to their children. These potential effects on children have been mainly studied for their academic performance, likelihood of grade repetition, or for earnings (Huff-Stevens and Schaller; 2011; Kalil and Ziol-Guest; 2008; Oreopoulos et al.; 2008; Rege et al.; 2011). But potential effects on children's non-cognitive skills and the related mechanisms have been less examined. Maternal involuntary job loss opposed to job loss of the main income earner has so far been examined only in addition to effects of fathers' job loss (for example Kalil and Ziol-Guest; 2008; Rege et al.; 2011). This paper investigates effects of maternal involuntary job loss on children's non-cognitive skills. Although mothers are in most cases second earners in households, they are still the main caregivers of children and therefore a shock experienced by mothers may be more closely related to children's (non-cognitive) skills than fathers' job loss.

This paper is interested in non-cognitive outcomes of preschoolers and adolescents. Research on human capital formation examines aside from cognitive outcomes also non-cognitive skills. Whereas cognitive skills have been widely studied non-cognitive skills have received less attention in the literature. Other than cognitive skills, non-cognitive skills are more malleable at later stages of a child's life[1]. Non-cognitive skills are traits enabling a person to communicate and interact with other people. They depict people's social ability. Motivation, socio-emotional regulation, or personality traits are examples of non-cognitive skills (see Heckman; 2008). But especially non-cognitive skills might affect children's success later in life, as studies show that these skills are good predictors for success on the labor market (see for instance the study by Carneiro et al.; 2007). This paper focuses on two non-cognitive outcome measures one assessed at age five/six and the other at age seventeen. For preschool children I analyze maternal job loss on socio-emotional behaviour using the SDQ measure developed by Goodman (1997), and for adolescents on locus of control based on the concept by Rotter (1966). Job loss is identified as end of employment due to plant closures or dismissals/layoffs by employer. Doing so, effects of maternal job loss on children's non-cognitive outcomes are estimated while accounting for mothers' selection to work based on the propensity score method.

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[1]Cunha et al. (2010) show that a successful way to remediate disadvantages in adolescence is to foster non-cognitive skills.

Identifying effects of maternal job loss on children's non-cognitive skills depends on maternal employment decisions, as I observe maternal involuntary job loss only for working mothers. The effect of maternal job ends on child outcomes has been less examined, whereas maternal employment and its influence on child well-being has been widely discussed. Yet the direction of potential effects of maternal employment on child outcomes remains unclear. Some studies find a negative influence of mothers' employment on children's outcomes focusing mainly on cognitive outcomes (see for example Hill et al.; 2005; James-Burdumy; 2005; Ruhm; 2004), whereas other analyses find both negative and positive results (Waldfogel et al.; 2002). These results indicate that the mere association of maternal employment and child well-being might be spurious, since childcare settings, maternal preferences, and maternal background determine a mother's decision to work. Consequently any paper interested in identifying an effect of maternal employment, or of *end of employment* for that matter, on child outcomes has to correct selection bias.

Different methods can be used to correct for selection bias: either using "selection on unobservables" applying a Heckman correction model or an instrumental variable approach, or using "selection on observables" by the propensity score method. Substantial evidence on mothers' "decision to work" exists, from which preferences, background characteristics and child-relevant factors leading to mothers (re)entering the labor market after childbirth can be determined (see for example among others Baum; 2003; Lucas-Thomson et al.; 2010; Ruhm; 2004, 2008, 2009). Hence relevant maternal characteristics driving mothers' selection in employment are most likely observable in survey data. Given that, this paper utilizes propensity score methods, since the heterogeneity of mothers who experience a job loss compared to those who keep their job can be *observed*. In addition a mother's self-selection in employment is not independent of her child's development. Thus although job loss is identified to be involuntary by uisng plant closure or dismissal by employer, the effect of job loss on non-cognitive skills of children can only be estimated if mothers do not differ in preferences and background characteristics.

Using the German Socio-Economic Panel Study (SOEP), which comprises information on characteristics of mothers and children, enables me to obtain bias-corrected estimates of involuntary job loss on children's non-cognitive skills. Other methods to solve selectivity such as the Heckman correction model or an instrumental variable approach are not applied in this paper, since a valid instrument correlated with mothers' job loss but not with children's non-cognitive skills is hard

to obtain. In addition Heckman's correction model is a sample selection model, i.e. the model analyzes outcome data observed only for the "treated". This paper focuses on children's outcomes which are observed for all children.

But in what way are maternal involuntary job loss and children's non-cognitive skills related? By asking trick or treat in the title, the paper implicitly suggests that mechanisms that mediate an effect may be twofold. Meaning maternal job loss could influence child outcomes negatively (as in trick) or positively (as in treat). One mechanism by which maternal job loss negatively affects outcomes of preschool children and adolescents is through a drop in income. An income loss may lead to a deterioration of a child's environment. As a result of a decrease in the household income parents might invest less in their children which may impede a child's progress (for example see Eliason; 2011; Kalil and Ziol-Guest; 2008). Eliason (2011) finds that job loss of workers influences not only individual earnings negatively but also family income. And a decrease in family income in turn can lead to lower financial investments in children. However Kalil and Ziol-Guest (2008) argue that negative impacts of father's involuntary employment ends depend less on income loss and more on "family dynamics" (p. 500).

Following results of Kalil and Ziol-Guest (2008) and looking at the vast literature on life satisfaction and unemployment, a potential drop in parents' mood could be an important mediator by which maternal job loss influences children's non-cognitive skills. The SOEP data used in this paper provides information on maternal life satisfaction and household income *before* and *after* maternal job loss. This allows me to roughly assess whether maternal job loss affects children's socio-emotional behavior or adolescents' locus of control via an income loss, via a change in maternal life satisfaction (used as a crude measure of frustration/stress), or via both. A third possibility through which children's outcomes could be affected is a substitution effect, as mothers who lose their job might substitute their working hours by spending more time on caring. This effect might be positively associated with children's outcomes, as a mother spends more time with her child than before the job loss supporting her child's development. The quality of mother-child activities cannot be measured directly in the SOEP data. But the information comprised in the data allows to assess whether mother-child activities increase or decrease. Thus an indirect analysis of this substitution mechanism might be possible.

My paper complements the existing literature by analyzing how maternal involuntary job loss affects children's non-cognitive skills. The literature has so far provided

scarce evidence on how job loss of parents is linked to children's non-cognitive outcomes. As mothers' job loss is identified based on survey data, the use of propensity score methods enables me to work in a quasi-experimental setting to provide robust estimates. Using maternal job loss due to plant closure or layoffs, this paper provides evidence on how *end of employment*, rather than maternal employment per se, is related to children's well-being and through which potential mediators. Furthermore, this paper adds to the scarce literature on children's non-cognitive skills and potential distortions influencing this outcome.

The remainder of the paper is structured as follows: Section 2 summarizes the related literature. In Section 3 the data set is described and Section 4 outlines the empirical strategy. In Section 5 the estimation results are discussed. Section 6 comprises several sensitivity analyses before Section 7 concludes.

2 Related literature

Besides parental employment affecting child outcomes, studies examine how *ends* of employment defined as exogenous income shocks influence child development (see Oreopoulos et al.; 2008; Rege et al.; 2011). Yet so far these have analyzed either paternal job loss or child outcomes that are considered to be cognitive skills, e.g., academic achievement. The study by Rege et al. (2011) analyses the effect of parental job loss on teenager's academic performance using Norwegian register data. As natural experiment setup they assume that plant closures in Norway between 1999 and 2005 are determined by exogenous shocks and are independent of unobservable determinants of children's school performance. For maternal job loss the authors find that the grade point average of children aged 16 is marginally increased[2]. A study based on Canadian data finds that fathers' job loss from plant downsizing lowers annual earnings of their children compared to those children whose fathers were not laid off (Oreopoulos et al.; 2008)[3].

Yet not all studies identify exogenous job loss based on a natural experiment approach, researchers also examine involuntary job loss using survey data. Still those few studies based on survey data do not explicitly analyze maternal job loss or non-cognitive skills as child outcome for that matter. Kalil and Ziol-Guest (2008) esti-

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[2]Rege et al. (2011) find that fathers' exposure to plant closure imposes stress on a father. If future employment is discouraging this stress causes children to perform worse in school.

[3]Based on Norwegian employer-employee data, Bratberg et al. (2008) find no effect of fathers' displacement on earnings of children more than ten years after the employment shock.

mate children's academic performance as a function of parental employment patterns using US data from the Survey of Income and Program Participation. They determine involuntary job ends due to quitting, dismissal, or illness amongst others (p.506: (Kalil and Ziol-Guest; 2008)). They find no significant correlation between mothers' employment experiences and children's grade repetition or exclusion/suspension. Huff-Stevens and Schaller (2011) analyze job loss and children's likelihood of grade repetition based on the same data as Kalil and Ziol-Guest (2008), yet they define involuntary job ends more narrow focusing only on dismissals or plant closure. Applying child fixed effects they show that exogenous displacements of parents are detrimental for children's academic performance in the short-run[4].

Analyzing exogenous job loss of fathers circumvents the potential selection problem, namely the *selection to work*. Since this paper is interested in maternal involuntary job ends, which are defined to be exogenous, an involuntary job loss does not account for mothers' decision to work or mothers' selection into the labor market respectively. A prolific body of literature documents potential effects of maternal employment on child well-being showing at the same time that mothers have different preferences and face different obstacles for re-entry in employment after childbirth[5]. Papers analyzing maternal employment and its association with early child outcomes often assess the timing of mother's return to work (see for example Berger et al.; 2005). Yet, this type of research is confronted with selection, since mothers of young children who work differ in terms of their preferences and backgrounds from mothers who do not work. The studies by Berger et al. (2005) and Hill et al. (2005) have discussed matching methods as estimation technique to identify the causal impact of maternal employment on early child outcomes. Both papers apply the propensity score method beside ordinary least squares including a so-called "complete" set of covariates in their analyses. Hill et al. (2005) use US data from the National Longitudinal Study of Youth (NLSY) analyzing the effect of maternal employment during the first year after birth on children's cognitive and behavioral outcomes between ages three and eight. Based on propensity score matching they find that children's cognitive outcomes are less developed if mother return to work full-time within a year after childbirth. Berger et al. (2005) also examine data from the NLSY focusing on health and developmental outcomes of children. The authors investigate mothers return to work using variations in women's maternity leave taking and its effect on child outcomes, e.g., externalizing behavior problems or the Peabody Picture Vocabulary Test. Contrary to Hill et al. (2005) the paper finds that the

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[4]Parental job loss significantly increases children's likelihood of grade repetition.
[5]For example see the works by Baum (2003); Berger et al. (2005); Hill et al. (2005).

obtained propensity score estimates are consistent with OLS results and are "generally stronger for mothers returning full-time within 12 weeks" (Berger et al.; 2005, p. F45).

2.1 Mechanisms: how maternal job loss might be linked with children's non-cognitive skills

Before describing the data more thoroughly, the related literature with respect to potential mediators through which maternal job loss is associated with children's non-cognitive skills is discussed. Maternal job loss is supposed to affect children's socio-emotional behavior negatively. Meaning that experiencing maternal involuntary job ends during early childhood increases children's socio-emotional problems. Hence children are more likely to have peer problems or emotional problems. Maternal job loss might decrease a mother's life satisfaction which in turn could deteriorate the emotional stability of her relationship with her child, since a mother might have re-entered the labour market after being dissatisfied with "solely" being a mother (see for example the study by Berger and Spiess; 2011). Maternal job loss might also cause instability or stress at home due to income loss. This tension between parents could spread to their children leading to an unstable temper of children affecting their relationship with their peers. Adolescence who experience instability in their family environment due to an *exogenous* shock might no longer believe that their own action determines success. On the contrary it is likely that maternal job loss, due to plant closure for example, is regarded as something that has *happened* to the family due to others. Adolescents could thus believe that fate or actions of others determines success in life. Hence these adolescents may become externalizers. Some studies show that having an external locus of control is associated with negative labor market outcomes (Caliendo et al.; 2010; Heineck and Anger; 2010).[6]

Hence, other than the previous findings discussed in Section 2, job loss of mothers may affect child outcomes most likely via a change in maternal mood and not via an income loss. In Germany mothers are often second earners and their job loss might be more closely related to their preferences, as mothers face a different decision process for (re-) entering the labor market. Mothers who lose their job may rather be frustrated and stressed which indirectly affects their bond with their children. Although mothers also face an income loss due to an involuntary job loss,

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[6]Caliendo et al. (2010) show that individuals who have an external locus of control are less likely to leave unemployment.

a lot of mothers contribute in addition to their husband/partner to the household income. So an income loss could affect children's outcomes more strongly in a single parent household[7]. Other than a decrease in income, job loss might have an indirect effect due to changes in parental mood. Such a change is closely related to the literature on unemployment and life satisfaction (see for example the work by Clark et al.; 2010; Knabe et al.; 2010). Parents may perceive their life less positive due to job loss. In the economic literature a negative effect of unemployment on life satisfaction is identified. Clark et al. (2010) show that regional unemployment for a given level of perceived job security has a negative effect on life satisfaction. Given that, the incidence of job loss which leads to unemployment could affect mothers overall life satisfaction. Mothers who work and thus may experience an involuntary job loss compared to non-working mothers might have selected themselves in employment, because they are dissatisfied with "solely being a mother" for that matter. The overall life satisfaction may therefore decrease after experiencing a job loss due to unemployment *per se* or frustration of being "at home". The effect of maternal life satisfaction on child outcomes has also been studied. Berger and Spiess (2011) show that higher maternal life satisfaction decreases children's socio-emotional problems. They argue that the positive effect of maternal life satisfaction stems from more responsiveness to the children, which affects the quality of mother-child interactions.

Apart from maternal life satisfaction being directly related to children's outcomes, it might also be closely related to maternal working decisions which depend on preferences. Meaning that mothers who are forced to stay at home after an involuntary job loss may be less willing to engage in mother-child interaction. If mothers regard their job as fulfilling and not as sole means to earn money, mothers could be disappointed to be "only" a mother after experiencing a dismissal or plant closure. A job loss thus may also affect the *quality* of time spent together.

Yet this substitution effect of mothers' time could also mediate a positive effect of mothers' displacement. If mothers spent more time with their children it could increase children's development. A Norwegian study by Rege et al. (2011) for example finds that mothers' displacement due to plant closure marginally increases children's grade point average at age sixteen. Thus mothers' supervision, while spending time with their children, who are for example doing homework, seems to have a small but positive effect. However stress or frustration are also associated with job loss

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[7]In Germany 19 percent of families with children under 18 are single parent households (Statistisches Bundesamt, 2010). Although the share of single parent families increased since 1996 *(14 percent)*, this paper argues that other mechanisms than income loss might mediate maternal involuntary job loss.

and might indirectly aggravate the quality of time spent with children. Having to substitute working hours in time spent with children might be more difficult for mothers who decided to work instead of being a "housewife". Thus the quality of activities done with children might be mediocre, since mothers might show their discouragement after job loss while supervising their children. The SOEP data used comprise a crude measure of the quality of time spent with children. In the data activities done by mother and child, such as reading a book together or going to the playground, are observed. A change in, for instance, "reading together" after job loss could roughly assess a drop, no change, or even an increase in the quality of time. Thus at least in part I am able to assess whether a job loss and mothers' potential substitution of time has a positive or a negative effect.

3   Data

Using data from the German Socio-Economic Panel Study (SOEP), my analysis is based on a representative and rich data set. The SOEP started in 1984 and is an annual household panel[8] that comprises a series of mother-child questionnaires as well as a youth specific questionnaire. The child-specific modules of the SOEP contain detailed information on children, i.e. non-cognitive skills, birth weight, child care usage, school attendance, and grade repetition amongst others. In addition the SOEP has rich information on individual characteristics of children's mothers as well as on family characteristics. The SOEP accumulates information on current household compositions as well as on past formations. Based on this vast data set mothers' probability of involuntary job loss is estimated.

The sample of children aged five/six in the SOEP is restrict to children whose mothers answered the mother-child questionnaire, whose mothers were 20 years and older at childbirth, who have non-missing information on the measured non-cognitive skills, and whose mothers participated in the survey prior 2003, and therefore have non-missing information prior childbirth. These restrictions reduce the sample. For the implementation of propensity score matching, I determine a point in time at which mother's are observed to lose their jobs. Since mothers are entitled to three years of parental leave in Germany, I assess mothers' working status after a child's third birthday. In period $t > 3$ when children are aged three and older, I observe

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[8]A general overview of the SOEP is given by (Wagner et al.; 2007), whereas Schupp et al. (2008) and Siedler et al. (2009) describe the mother-child questionnaires used in this paper. Frick and Lohmann (2010) document the youth questionnaire.

whether mothers are working and thus may be prone to involuntary job loss. A detailed discussion of variables used for modeling the selection decision is given in the next section. Thus the sample used to examine effects of maternal job loss for children aged five/six includes *315 observations* of mothers who are observed to be working after age three of the child.

In the youth sample of the SOEP children aged 17 and older are pooled. The sample reduces due to the following restrictions. Children who are no longer living with their parents are dropped. Those who are born between 1984 and 1993 and thus are 17 years old at the time of the survey are kept, have non-missing non-cognitive skill information, whose mothers were 20 years and older at childbirth, and whose mothers have reported their employment status during early childhood. Unlike in the preschool sample maternal employment patterns prior childbirth cannot be observed for all birth cohorts, as the household panel started in 1984 and because a lot of households of the adolescents are part of the SOEP since 2000. Meaning that for those children not much information prior to 2000 is included in the SOEP (N=1397 of 3679 adolescents (*37.97 percent*)). Thus I have to use another cut-off date to predict mothers' propensity scores. In addition, for some mothers earlier working information coincides with unification and its transition year 1990/1991. A second reason for diverting from the cut-off date used for preschool children is related to children's school careers in Germany. From age ten onwards children transit from primary to secondary school. Thus if I were to use an earlier cut-off date observing an even longer period of time where mothers of adolescents might experience an involuntary job loss, the results could be spurious due to other events. Besides mothers of these birth cohorts were more likely to return to work full-time while children were in secondary school[9]. Hence the period during which maternal job loss is observed ranges from age ten until age seventeen of the child. The final sample of adolescents comprises *742 observations* of mothers who are observed to be working after age ten of their child. Similar to the preschool sample I predict maternal likelihood of job loss using a vast set of covariates (see next section for detailed discussion).

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[9]In 2008, for example, 59 percent of mothers with children below the age of six were employed compared to 70 percent of mothers with children age ten or older (Statistisches Bundesamt, 2010).

3.1 Involuntary job loss

Involuntary job loss is first and foremost identified as job ending due to *plant closure*. In the SOEP this particular job loss is experienced by mothers within a survey year and is reported by stating that they "left a job after December 31st and how this job was terminated" since the last interview. Mothers can choose among eight categories for job ends, including resignation, retirement, or suspension. Another reason is *dismissal by employer* or end of temporary contract. Since plant closure occurs less frequent in the data used, I include both, plant closure and layoff experiences, in my analyses as involuntary job loss measure. By adding dismissals to mothers' involuntary job loss, I follow Huff-Stevens and Schaller (2011) who define job ends based on the following answer categories: "the person was fired or discharged, if the employer was sold or went bankrupt, or if the job loss was due to slack work or business conditions" (p. 291).

Thus, analogue to previous works[10], this paper considers plant closure as a "truly" exogenous shock whereas layoffs might be partly endogenous. Compared to dismissal by employer a firm closure cannot be caused by maternal behavior. However, I argue that maternal behavior, such as lack of concentration or absence due to sickness of children, which may lead to a dismissal can be partly accounted for in the analyses. First by including child-related characteristics in the estimation of maternal propensity scores and second by including maternal personality traits in the analyses. Thus in both samples job loss is analyzed using a comprehensive measure including the relevant incidences of job loss. In the pooled sample of children aged five/six, 6 percent of working mothers lose their job in the observation period, whereas in the pooled sample of children aged seventeen 12 percent of mothers experience an involuntary job loss (see Table 1). Plant closures as job loss are experienced by 2 percent of mothers of children aged five/six and by 5 percent of mothers of adolescents. The different percentages can also be attributed to a variation in length of the observed time periods, since young children's mothers can loose a job in between two to three years, whereas adolescents' mothers face a seven year time frame and thus a higher chance of job loss.

[Table 1 about here]

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[10]See among others the studies by Coelli (2011); Huff-Stevens and Schaller (2011); Kalil and Ziol-Guest (2008).

3.2 Non-cognitive skills

In the SOEP non-cognitive skills are measured at different childhood stages using divergent scales. Non-cognitive outcomes often include behavioral, social and emotional skills. This is true fore the outcomes used in this paper as well. The *socio-emotional behavior* measures non-cognitive skills of preschool children, whereas *locus of control* is used for adolescents' non-cognitive outcome.

Socio-emotional behavior (SEB) describes a child's behavior in terms of feelings or relationships with family and peers. Goodman (1997) developed the Strength and Difficulties Questionnaire (SDQ), which assesses children's socio-emotional regulation. The SOEP uses a modified version of the SDQ to collect information on preschool children aged five/six. The construction of children's overall SEB accounts for the fact that mothers answer the questionnaire related to children's emotional symptoms, peer problems or conduct problems and others[11]. The reliability of this total difficulties score has also been shown by other studies (see for example Ermisch; 2008). In the preschool sample children's SEB ranges from 0 to 30 with a higher score representing a negative outcome of the child, e.g., having peer problems. In addition children can be grouped in different behavioral categories: normal, borderline, and abnormal[12].

Locus of control is the non-cognitive outcome in the adolescence sample based on the concept developed by Rotter (1966). The locus of control is part of the youth questionnaire since 2001 and adolescents report on a scale from 1 (completely disagree) to 7 (completely agree) regarding "what happens in life depends on me" or "what you achieve is a matter of luck". Factor analysis is used to extract two factors determining whether adolescents believe that their life depends on their own action (internal locus of control) or whether they believe that life is determined by others (external locus of control). In this paper the analyses focus on *internal locus of control*, since children's belief may be altered by experiencing maternal involuntary job loss. Adolescents may perceive an involuntary job end of their mother as unfair and imposed, which may change their idea of "everything is possible as long as you work hard".[13]

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[11]Information on the reliability and construction of the SEB, as well as the categorization into different behavioral groups can be found at *http://www.sdqinfo.org*

[12]Within the preschool sample 73 percent are in the group "normal", 12 percent in "abnormal" and the remaining 15 percent in "borderline". The sample mean of the total difficulties score is 10.26.

[13]Thus maternal job ends could decrease children's factor score, falling below the mean of zero indicating an external locus of control "loading".

A first descriptive comparison between mothers who lose their job and mothers who keep their job shows that the mean of preschoolers' total difficulties score differs by 3 score points between job losers and non-job losers (see Table 2). This difference is statistically significant and hinges towards a potential negative relationship between maternal involuntary job loss and children's socio-emotional behavior: the higher the total difficulties score the higher a child's socio-emotional problems. For adolescents' internal locus of control the difference between children who experience maternal job loss and those whose mothers keep their job is less statistically significant. Yet, the mean of internal locus of control of adolescents presented with maternal job loss is below zero indicating a likelihood to belief less in self-determination. Thus a first glance at the descriptives suggests that there might be negative effects on children's non-cognitive skills when a job loss occurs, although the difference between adolescents' internal locus of control is marginally statistically different from zero.

[Table 2 about here]

A summary of covariates used in the analyses, after predicting maternal propensity scores, distinguishing between job losers and non-job losers can be found in the Appendix (see Table A1 and A2). Mothers of preschool children presented with involuntary job loss live more often in East Germany, are less often living with a partner and work more often full-time compared to mothers who keep their job. Adolescents' mothers who lost their job have more often a university degree, live more often in East Germany and work less often full-time than mothers not experiencing an involuntary job end.

4 Empirical strategy

The goal of this paper is to identify an impact of a given treatment on children's non-cognitive skills. The association of maternal involuntary job loss and children's non-cognitive skills can be summarized by the following reduced from equation,where S_{ij} comprises non-cognitive outcome of child i at age j, $JOBL_{ij}$ is a variable capturing involuntary job loss, X_{ij} represents our measured covariates and v_{ij} is an error term.

$$S_{ij} = \beta_{ij} JOBL_{ij} + \gamma_{ij} X_{ij} + v_{ij} \tag{1}$$

The coefficient of interest is β_{ij} and it will render causal estimates if the following assumptions are satisfied. The estimates of β_{ij} are "true" if maternal job loss is uncor-

related with children's non-cognitive outcomes, i.e. $E(v \mid JOBL_{ij})=0$. Estimating Equation 1 yields unbiased estimates in case there is no correlation of involuntary job loss with the error term v_{ij} and thus job loss is exogenous with respect to non-cognitive skills. But since maternal involuntary job loss is only observed for working mothers, selectivity may bias the OLS estimates of β_{ij}.

An estimation of maternal job loss has to consider endogeneity due to omitted variables which may bias the results. Mothers' decision to work is correlated with $JOBL_{ij}$. But mother's participation on the labor market is not independent of her child's development, of her educational background, of her preferences, or of her own skills. If the "selection to work" is ignored in the analyses, selectivity captured in the error term v_{ij}, will therefore bias any OLS estimates of β_{ij}.

Propensity score matching has only recently been applied to estimate effects of maternal employment on child development (Ruhm; 2008, 2009). Ruhm (2009) for instance discusses several methods to measure causal effects of parental employment amongst others family fixed effects, instrumental variables, and propensity score matching. Propensity score matching has an advantage compared to family fixed effects in this context, since it is not limited to children with siblings and allows to infer potential influences of maternal employment for *all* children. A similar advantage of the propensity score method applies when comparing it to an instrumental variable approach. Propensity score matching identifies an average treatment effect rather than a local average treatment effect. Meaning that a potential effect of involuntary job loss can be revealed for the population of all children comprised in the sample and not only for those where changes in the instrument are observed.

In a seminal paper Rosenbaum and Rubin (1983) show that the probability of receiving treatment (here involuntary job loss) is a vector of observed characteristics, called propensity score. And matching based on this propensity score can remove the bias. Predicting mothers' propensity score implements a "random sample", where mothers who work and lose a job do not differ from mothers who work and keep their job in terms of observables, e.g., education, income, or marital status amongst others. So far propensity score matching has been mainly applied for evaluating participation in job training programs (see the work by Ashenfelter; 1978; Dehejia and Wahba; 2002; Heckman et al.; 1997; LaLonde; 1986). Yet the empirical literature increasingly uses propensity score matching to account for various selection biases. For example Jiang et al. (2010) estimate the effect of breast feeding on child cognitive outcomes using propensity score matching, or Eliason (2011) analyzing job

loss effects on income, and Gebel (2009) uses propensity score matching to estimate the probability of fixed-term contracts at labor market entry using data from the German Socio-Economic Panel Study.

4.1 Propensity score methods

In order to predict maternal propensity scores, *observables* that predict mothers' decision to work have to be identified in the data. In the preschool sample maternal probability of job loss is observed after a child's third birthday. The data used in this paper consists only of those children whose mothers have the "most complete" information on preferences, background characteristics and employment behavior. Thus, only those mothers who can be observed prior child birth are utilized in the early childhood analyses. For the adolescence sample also only children with mothers providing longitudinal information on observables are included in the analyses, and thus mothers' probability of job loss is predicted after age ten of the child, as it is discussed in the previous section.

4.1.1 Description of observables

Following the previous literature on maternal employment decisions the following "observables" are used in the preschool sample to predict maternal propensity scores: employment status two years prior childbirth, employment status in the birth-year of the child, partner present at childbirth, years of education around birth, number of children < 16 present in the household in the birth-year of observed child, logarithmic household income around birth, whether the mother is satisfied with "only being a mother", living in East Germany around childbirth, living in an urban area around childbirth, care settings at childbirth, and age of mother at child birth using age group dummies. Table A3 of the appendix provides a summary of the distribution of observables used to predict maternal propensity scores in the preschool sample.

In the adolescence sample I utilize information available from age six onwards, since the sampling design of the SOEP reduces the number of observations even more when focusing on earlier childhood information[14]. Thus the following infor-

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[14]The original data file comprising all children aged 17 consists mainly of children sampled since 2000, so that for those children any previous information is not included in the SOEP (N=1397 of 3679 adolescents (*37.97 percent*))

mation is used to predict maternal propensity scores for adolescents: employment status as well as working hours at age six of child, partner present at age six, years of education around age six, number of children < 16 present in the household at age six of the observed child as well as logarithmic household income at that time, living in East Germany in 1989, overall life satisfaction when the child is six years old, tenure and size of firm, living in an urban area, and age of mother at childbirth using age group dummies. Table A4 of the appendix provides a summary of the distribution of the observables utilized.

4.1.2 Propensity score matching

Propensity score matching (Rosenbaum and Rubin; 1983, 1984) is a well-established method to correct selection bias. It is a quasi-experimental approach, comparing outcomes of those who are "treated" to those who are "untreated", simulating a random sample design. Similar to ordinary least squares, propensity score matching relies on the assumption that selection is based on observable characteristics. By using a rich set of variables predicting mothers' likelihood of job loss after age three or age ten respectively, this paper assumes that all relevant information related to maternal selection to work can be observed (for an overview of application of matching see Caliendo and Kopeinig; 2008). The assumption that selection only exists on observables is known as *conditional independence assumption (CIA)*. Under the conditional independence assumption, the outcome variable - children's non-cognitive skills - and maternal job loss, i. e. exposure to treatment, are independent given characteristics X. Given the data quality at hand, I argue that the analyses in this paper are able to meet this requirement and that relevant observable characteristics that affect mothers' decision to work are accounted for.

$$Y_1, Y_0 \perp T | X \tag{2}$$

Following Rosenbaum and Rubin (1983) mothers' probability of job loss is predicted based on the relevant X_s obtaining a comprehensive measure of all covariates for each person, i.e. the propensity score: $P(D = 1|X) = P(X)$, where X represents the set of observed maternal characteristics as well as relevant child and household characteristics, *D=1* is the "treatment condition", here maternal involuntary job loss after age three or age ten of the child respectively, and *P(X)* is the estimated propensity score.

A second requirement is the common support condition, which implements that

a match between mothers of the treatment group and those of the control group is obtained. By applying this restriction those children whose mothers do not overlap with regards to the relevant observables are discarded from the analysis.

$$0 < P(X) < 1, \forall X \tag{3}$$

Expression 3 simply states that the sample does not consist of only working mothers who kept their job *(P(X)=0* or of only working mothers who experienced an involuntary job loss *P(X)=1*.

After predicting mothers' propensity score, the observations are matched based on the obtained P(X). All observations who do not comply with the overlap condition are discarded from the sample. Hence the sample used for examining maternal involuntary job loss consists only of those working mothers who have a balanced match based on the same characteristics set X. Two different matching techniques are used: nearest neighbor and kernel matching[15]: Each method assigns different weights to the mothers that are "eligible matches" for working mothers who experienced an involuntary job loss, i.e. for the "treated". By using different weights the matching algorithms face trade-offs in terms of bias and variance (see Caliendo and Kopeinig; 2008).

Nearest neighbor (NN) matching simply chooses the mother of the comparison group who is identical to the mother of the "treatment" group based on their estimated propensity score. Different techniques can be applied: "with replacement", "without replacement", or using more than one neighbor called "oversampling" (Caliendo and Kopeinig; 2008). For instance the option "with replacement" uses those mothers of the comparison group with a high propensity score more than once matching them with "treated" mothers who have a high propensity score as well. By applying "oversampling" in the nearest neighbor algorithm one decides how many "untreated" mothers are used for each "treated". The nearest neighbor technique renders bad matches if the "best" fit in the control group is far away. In order to prevent bad matches a tolerance level can be imposed. This tolerance level defines a maximum propensity score distance referred to as caliper. Applying caliper matching may improve the "quality" of the match, but only if the correct tolerance level is chosen beforehand. A choice which is very difficult to make (Smith and Todd; 2005). Other than nearest neighbor and caliper matching, the kernel match-

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[15]Matching is implemented in Stata11 using the program *psmatch2* provided by Leuven and Sianesi (2003).

ing method uses weighted averages of those mothers in the control group depending
on the choice of the kernel function (see for an in depth discussion Imbens; 2000;
Stuart; 2010). Whilst the usage of nearly "all" untreated mothers is an advantage,
it may cause bad matches. Thus applying the common support restriction is im-
portant when utilizing kernel matching[16]. In this paper mothers who lose their job
are matched with "similar" mothers who keep their job based on nearest neighbor
matching with caliper in order to obtain a *balanced* sample. In the Appendix a
summary table depicts the balance of the used X_s between treatment and control
group before and after matching (see Table A5 and A6).

4.1.3 Propensity score weighting

After matching mothers on their propensity score the average treatment effect of
the treated (ATT) can be estimated. The ATT renders estimates of the difference
in child outcomes after experiencing an involuntary job loss.

$$ATT = E(Y_1|D = 1, P(X)) - E(Y_0|D = 1, P(X)) \tag{4}$$

Beside matching on the propensity score, the average treatment effect of the treated
can also be identified by propensity score weighted regressions (see Hirano and Im-
bens; 2001). Propensity score weighting weighs the outcomes of untreated mothers
with the inverse of the estimated propensity score *(P(X))*. A critical aspect of us-
ing the estimated propensity score as weight is its sensitivity to large estimated
propensity scores, since these large values receive a larger weight. This problem
decreases with sample size as each observation is less relevant for estimating the
coefficient of interest. However, the overall sample size of the samples used in this
paper are relatively small. Nonetheless I argue that I have a relative large number
of untreated mothers compared to the treatment group. And by restricting the post
estimations to the common support area, the problem of "large propensity score
values" should have only a minor impact. To estimate the ATT the regression of
non-cognitive skills on involuntary job loss is weighted by assigning $w = 1$ to moth-
ers who lost their job $(D = 1)$, and $w = 1/(1 - P(X))$ to mothers of the control
group $(D = 0)$. By weighting the estimated OLS regression, omitted variable bias
can be corrected[17]. I apply propensity score weighting in addition to matching, as

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[16]Kernel matching requires a decision on the kernel function and on a bandwidth parameter.
The former requirement is less important compared to the latter (Caliendo and Kopeinig; 2008).

[17]Berger et al. (2005) argue that using the propensity score as weight depends, similar to the
conditional independence assumption (CIA), on the specification of observables used to correct
selection bias.

both samples - preschoolers and adolescents - are rather homogeneous in terms of treated and untreated mothers.

5   Results

First the results are presented in three steps: the OLS estimates without correcting for maternal employment decisions, i.e. regressing maternal job loss on children's non-cognitive skills, and then the results obtained from propensity score matching[18] are shown. For example in Table 3 in column 2 the estimates of the average treatment effect on the treated (ATT) after matching are reported and in column 3 those of the ATT using propensity score weighted regression. In a second specification, e.g., in Table 4 in column 2, the estimates obtained from OLS "complete" comparing them to estimates obtained by propensity score weighting are presented. The model depicting OLS "complete" simply compares whether the propensity score method compared to an ordinary least squares analysis which includes *prior job loss* information of mothers is more efficient. Since the sample of preschoolers comprises 223 observations OLS "complete" may be less efficient, e.g., including prior treatment covariates could lead to larger standard errors, when accounting for selection than estimates based on the propensity score methods. In all tables only the main coefficient is depicted: involuntary job loss.

In addition as crude measure of maternal unemployment duration, I control in all regression analyses for regional unemployment rates which capture the rigidity of the local labor market of mothers. Analyzing maternal job loss in its potential influence on child outcomes requires to asses for how long mothers stay unemployed in the subsequent periods. The duration of unemployment is strongly linked to life satisfaction and overall well-being of mothers through which job loss might affect child outcomes Clark et al. (2010); Knabe et al. (2010).

5.1   Involuntary job loss and non-cognitive skills of preschoolers

In Table 3 the results of involuntary job loss affecting children's socio-emotional behavior are presented. Maternal involuntary job loss is significantly correlated with children's socio-emotional behavior. Using the matched sample renders the estimates

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[18]The estimates in the matched sample are obtained after applying *nearest neighbor matching with caliper*.

displayed in column 2. Including the same controls as in the OLS estimation the negative effect on children's total difficulties score remains statistically significant accounting for selection bias. This effect is negative since an increase in the score implies an increase in a child's likelihood of having behavioral problems. Accounting for selection bias yields a significant positive effect of maternal involuntary job loss: A child's total difficulties score increases by 3.4 score points, which "lifts" the mean child closer to "abnormal" behavior. The findings in column 3 compared to column 2 suggest that estimating the average treatment effect of the treated using propensity score weighted regression is slightly more moderate in terms of effect size. But the overall negative effect of involuntary job loss on non-cognitive skills remains marginally significant.

[Table 3 about here]

Another possibility to account for omitted variable bias would be to include employment behavior of mothers prior childbirth as well as other relevant pre-treatment characteristics that correlate job loss with the error term[19]. Therefore I also estimate an OLS model with "complete information" to compare a more detailed OLS examination to the propensity score method, as OLS might be more efficient if the analyses are not biased. Maternal involuntary job loss increases children's socio-emotional behavior by 2.9 score points using OLS complete (see column 2 of Table 4). An effect which is similar to the effect obtained by propensity score weighted regressions. Compared to propensity score weighted regressions, "complete" OLS estimates are less efficient, as the standard errors are nearly the same as using the propensity score method. Findings shown in Table 4 suggest that selection biases the OLS analysis of involuntary job loss and its influence on children's non-cognitive skills, if there is no prior treatment information included. But it also shows that the obtained OLS results are close, yet slightly less efficient than to those from the propensity score method.

[Table 4 about here]

However propensity score matching assumes that selection is only based on observables and does not account for unobserved heterogeneity. Children's non-cognitive skills may be correlated with maternal non-cognitive skills which in turn may be affected by an involuntary job loss. Thus in another specification I control for potential unobserved heterogeneity between the matched mothers by including maternal personality traits in my analysis. Controlling for mothers' personality traits slightly

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[19]An overview of pre-treatment characteristics is given in the previous section. In addition all covariates included in the OLS complete regression are listed in Table 4.

reduces the sample size and the significant effect of maternal involuntary job loss on children's socio-emotional behavior remains marginally significant using propensity score matching and weighting regression (see Table 5).

[Table 5 about here]

5.2 Involuntary job loss and non-cognitive skills of adolescents

Table 6 summarizes the relationship of adolescents' internal locus of control and maternal job loss. Using OLS without prior information as it is depicted in column 1 indicates that maternal job loss decreases the likelihood of believing in self-determination. The results based on propensity score matching show also a marginal significant average treatment effect of the treated. Meaning that adolescents whose mothers experience plant closure or dismissal by employer are less likely to believe that working hard or striving for ones own success helps to achieve ones goals. An involuntary job loss decreases adolescents belief in self-determination by $1/4^{th}$ of a standard deviation also controlling for covariates such as household income, household composition and maternal education. This effect remains stable and only decreases slightly in size when using propensity score weighted regressions (see column 3).

[Table 6 about here]

In Table 7 findings comparing complete ordinary least squares to propensity score weighted regressions are presented. The effect of maternal job loss on adolescents internal locus of control is similar to the effect obtained by propensity score matching. Although the estimate shown in column 2 suggests that the propensity score method corrects the selection problem, the standard errors are nearly the same, which can also be due to the homogeneous groups of treated and untreated mothers. The estimation technique does not show significantly different results comparing OLS "complete" and propensity score weighted regressions or matching for that matter. Analyses of maternal job loss on children's non-cognitive skills indicates that adolescents' likelihood to believe in one's own actions decreases by $1/4^{th}$ of a standard deviation independent of the estimation method. This might be due to relying on observables only to account for selection bias and unobserved heterogeneity might still bias the results.

[Table 7 about here]

Similar to the preschool sample, maternal personality traits are included in a third specification to control for unobserved heterogeneity. The significance of the effect of an experienced job loss on internal locus of control and the size of the effect remain stable. Both, including maternal personality traits and running a "complete" ordinary least squares analysis, indicate that the findings obtained by the propensity score method are robust and suggest that the results could hint towards a causal relationship between maternal involuntary job loss and children's non-cognitive skills.

[Table 8 about here]

6 Sensitivity analysis

6.1 Plant closure

Compared to studies using a natural experiment approach the incidence of observing job loss due to plant closure is relatively small, which makes it impossible to match on plant closure incidences only. However, plant closure is perceived to be exogenous meaning that maternal behavior has not lead to firm downsizing. In Table 11 the results of post matching estimations of the relationship between internal locus of control and involuntary job loss distinguishing between plant closure and dismissal by employer are shown. Meaning that the relationship of children's non-cognitive skills and job loss is inferred by using job loss due to plant closure and due to dismissals as separate dummy variables instead of including the overall measure *involuntary job loss* in the analyses. The direction of the effect remains negative, yet the coefficient of plant closure is not statistically significant. The results indicate that job ends due to layoffs by employer have a significant effect on adolescents' internal locus of control compared to maternal job loss due to plant closure. This could suggest that dismissals might be more closely related to mothers' mood which is assumed to be a potential mediator affecting children's outcomes.

[Table 9 about here]

6.2 Estimations of non-cognitive skills considering possible mechanisms mediating involuntary job loss

At the beginning of this paper potential mediators through which an involuntary job loss could affect children's non-cognitive skills are discussed. In order to test these complied hypotheses I compare changes in life satisfaction, changes in income, and changes in mother-child activities. By contrasting the observed means before

and after the incidence of maternal involuntary job loss I assess potential directions through which mothers' experiences are linked with child outcomes. In Table 10 a first descriptive examination shows the t-ratios of the mean comparison before and after treatment. In column 1 the differences in life satisfaction, household income, or in mother-child activities of all mothers in the *matched* preschool sample are shown. Column 2 depicts the results for *treated* mothers only. Maternal life satisfaction significantly decreased for mothers who experience a job loss. Whereas the difference in household income is not significant for mothers who are exposed to a job end. Indicating that household income is not significantly different after job loss. This could stem from husbands/partners that are still working and contributing to the overall household earnings. In column 4 the changes in life satisfaction or in household income for displaced mothers in the *matched* adolescents sample are shown. Only the mean difference of household income is found to be significantly different before and after treatment[20].

[Table 10 about here]

This first descriptive glance at mothers' outcomes shows that mothers who are displaced report a significantly lower overall life satisfaction. They also read less often stories with their young children, yet this difference is not statistically significant. Interestingly for mothers of children aged seventeen the overall life satisfaction is not significantly different before and after displacement. This could suggest that mothers of young children are more stressed or frustrated about their job loss than mothers of older children. Yet mothers' own perception of life could be affected by involuntary job loss which might influence their children's beliefs. However in the SOEP the questions on adults' locus of control are only surveyed in 2005 and 2010, so that a mean comparison before and after job loss cannot be applied. Instead I include mothers internal locus of control in the regression analysis beside maternal personality traits in order to account for this potential channel of discouragement.

In Table 11 the differences of potential mediators are included in the propensity score weighted regressions. Using the differences as covariates shows that the difference in household income and in life satisfaction are not statistically significant. However, in the preschool sample both mediators increase the overall sample fit indicating that they are explaining part of the variance of socio-emotional behavior. In addition including differences in mother-child interactions increases the overall sample fit even more. Yet the sample size decreases, as not all children can be observed

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[20]The t-ratio is negative suggesting that mothers' job loss does not affect children's non-cognitive skills via an income loss.

at age three and at age six. When controlling for changes in mother-child activities the coefficient on involuntary job loss becomes statistically insignificant. Nonetheless the relationship found in the descriptives suggests that mothers' are stressed or frustrated, as for instance maternal life satisfaction is 1 scale point lower after involuntary job loss in the preschool sample. Descriptive evidence is not sufficient to support the stress hypothesis, however it suggests that mothers are not satisfied after having lost their job.

[Table 11 about here]

In the adolescents sample the crude measures used to address underlying mechanisms do not sufficiently disentangle potential mediator effects. In Table 12 it is shown that none of the differences included in the regression analyses are significantly explaining parts of the variance of adolescents' internal locus of control. Other than in the preschool sample there is no difference in maternal life satisfaction due to experiencing a job loss. The hypothesis of a stressed or frustrated mother may already be captured by maternal non-cognitive skills which are controlled for as well. Mothers' internal locus of control is significantly correlated with adolescents' beliefs in self-determination. In addition the effect of involuntary job loss on children's outcome increases when maternal internal locus of control is included in the regression (see Model 4)[21]. Maternal locus of control and involuntary job loss are both closely related to their children's non-cognitive outcomes, suggesting a potential mechanism.

[Table 12 about here]

7 Conclusion

This paper is interested in the potential effect of maternal involuntary job loss on children's non-cognitive skills. Although mothers are often second earners in German households, they are on the other hand the main caregivers of children. Thus an exogenous shock does not affect the household's financial situation in a substantial way, yet it may effect the emotional stability of mothers causing stress and discouragement at home. Maternal satisfaction might decrease after job loss and thus might be closely related to children's development and in particular to the development of non-cognitive skills, such as motivation or socio-emotional regulation.

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[21]In Model 5, which also includes changes in income and life satisfaction in the regression, the difference in household income is now significantly associated with a drop in adolescents' internal locus of control.

A potential problem for the analysis of maternal involuntary job loss on child outcomes is selection. Maternal employment depends on maternal preferences, maternal background, available child care or on children's development which biases any results obtained from OLS. Meaning that mothers whose children are more independent and socio-emotional "stable" are more likely to work. Thus mothers' decision to work is not independent of children's skills. This paper therefore estimates the relationship between job loss and child outcomes whilst accounting for selection bias by using propensity score methods. Propensity score method assumes that selection is based on observables which are used to match "similar mothers", i.e. in terms of observed characteristics, who do not experience a job loss with those who are exposed to plant closure or dismissal by employers.

When comparing OLS estimates with those obtained in the matched samples, the effects of maternal job loss on non-cognitive outcomes are similar, and they only vary marginally in size of their standard errors.. I find a negative association between maternal job loss and children's non-cognitive skills. Experiencing maternal involuntary job ends during early childhood increases children's socio-emotional problems. Children are more likely to have peer problems or emotional problems. The hypothesis that mothers substitute lost working time with more time for caring does not result in "better" quality of time due to stress or discouragement. Analogue to the stress theory, which indicates that emotional bonds may be weakened by maternal stress exposure, I find descriptive evidence that mothers are less satisfied after experiencing a job loss and that they spend less time reading stories or going to the playground. Children's total difficulties score increases by 3 score points, which lifts the mean child closer to "abnormal" behavior.

For adolescents' outcome the same negative effect of maternal job loss can be found. Children are less likely to believe in self-determination if their mother experienced an involuntary job loss due to plant closure or dismissal. The effect of maternal job loss is substantial, since adolescents internal locus of control decreases by $1/4^{th}$ of a standard deviation using the propensity score method and correcting selection bias. Including maternal personality traits in the analysis to account for unobserved heterogeneity confirms this negative result. The results become even more statistically significant indicating that an involuntary job loss "causes" adolescents to believe less in self-determination, i. e. to be less motivated or striving for success. The results for both age groups indicate that mothers' job loss due to dismissal by employer is strongly correlated with children's non-cognitive outcomes. The findings from distinguishing between plant closure and layoffs should nonethe-

less be interpreted carefully, as plant closures are less frequently observed in the data.

The theory of stress is strongly linked with the non-cognitive skill formation of children. The difference of maternal life satisfaction suggests that maternal frustration could be affecting the mother-child relationship. In addition the negative association of maternal job loss and children's outcomes could be due to "meager" quality of time spent with children. The descriptive support for these potential mediators sheds some light on underlying mechanisms. Changes in income and life satisfaction that are included in the analyses cannot completely explain the relationship between maternal job loss and children's non-cognitive skills, as the coefficient remains marginally significant. Other than in the preschool sample for adolescents' mothers life satisfaction remains unchanged due to job loss. Their own belief in self-determination is closely related to their children's outcome, yet this paper cannot test whether maternal locus of control changed due to experiencing a displacement. This paper therefore infers potential mediators only in a limited way suggesting that future research should further analyze mechanisms linking parental job loss with children's outcomes.

The propensity score method suggests a potential causal relationship between children's non-cognitive skills and maternal involuntary job loss, since the estimates are consistent with the OLS results. Although the propensity score method reduces potential biases resulting from mothers' selection to work, it does not account for unobserved heterogeneity. But the findings remain robust even after including maternal personality traits in order to assess unobserved heterogeneity. Given the literature on negative effects of maternal employment on child well-being, this paper argues that maternal job loss and thus additional time for caring might be beneficial for cognitive outcomes, i.e. test scores (Rege et al.; 2011), but not for non-cognitive skills. As the negative effects of maternal involuntary job loss on non-cognitive skills may impede children's progress in school or on the labor market. Thus, further analyses regarding non-cognitive development and potential influences should be carried out.

With regards to policy implications, this paper shows that further research is necessary in order to disentangle potential influences of maternal job loss on children's non-cognitive skills. The evidence found in this paper indicates that financial support should not be the only means to help mothers who experience a displacement. For example job centers could provide additional help during job search for mothers, as their overall life satisfaction decreases affecting the mother-child rela-

tionship. Supporting mothers to be less stressed or discouraged with unemployment could be beneficial for their children.

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Tables

Table 1: Distribution of maternal involuntary job loss

	Mean	
	Preschool sample	Adolescence sample
Involuntary job loss	0.0644	0.1239
	[0.2459]	[0.3297]
Plant closure	0.0203	0.0512
	[0.1414]	[0.2206]
Dismissal by employer	0.0441	0.0727
	[0.2056]	[0.2599]
N	295	742

Note: Standard deviation in parentheses. SOEP v27 (2001-2010). Author's calculations. Samples only include working mothers.

Table 2: Distribution of maternal involuntary job loss and children's non-cognitive skills

	Mean			
	All	Job losers	Non-job losers	*t-ratio*
Preschool sample				
Total difficulties score	9.85	12.60	9.66	-2.03**
Normal	0.78	0.60	0.79	-1.72**
Borderline	0.12	0.20	0.12	-0.96
Abnormal	0.10	0.20	0.09	-1.33*
N	230	15	215	
Adolescence sample				
Internal locus of control	-0.003	-0.169	0.019	1.43*
External locus of control	-0.063	0.079	-0.083	1.14
N	561	65	496	

Note: SOEP v27 (2001-2010). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Author's calculations. Samples only include working mothers applying common support restriction.

Table 3: Estimation of socio-emotional behavior and maternal involuntary job loss (preschool sample)

	OLS	PS matching	PS weighting
Involuntary job loss	3.04**	3.37**	3.06**
	[1.5004]	[1.5314]	[1.5399]
N	223	221	223
R^2	0.134	0.140	0.135

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates age of child, gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal employment status (ref. category: not employed/full time, part time, minor employed, maternal education (ref. category: vocational degree/university degree, no degree), child care setting, regional unemployment rate, and time dummies. Author's calculations, SOEP v27 (2008-2010).

Table 4: Comparing propensity score weighting to OLS complete estimation (preschool sample)

	Socio-emotional behavior	
	PS weighting	OLS complete
Involuntary job loss	3.06**	2.86*
	[1.5399]	[1.5388]
Including prior treatment variables		
Employment prior birth	-	Yes
Employment status around birth	-	Yes
Partner present at birth	-	Yes
Years of education around birth	-	Yes
Number of children <16 at birth	-	Yes
Logarithmic household income around birth	-	Yes
Maternal satisfaction around birth	-	Yes
Living in East Germany around birth	-	Yes
Living in an urban area around birth	-	Yes
Grandparent care around birth	-	Yes
Maternal age at birth	-	Yes
N	223	223
R^2	0.135	0.227

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates age of child, gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal employment status (ref. category: not employed/full time, part time, minor employed, maternal education (ref. category: vocational degree/university degree, no degree), child care setting, regional unemployment rate, and time dummies. Author's calculations, SOEP v27 (2008-2010).

Table 5: Estimations of socio-emotional behavior under inclusion of maternal personality traits (preschool sample)

| | Socio-emotional behavior | |
	PS matching	PS weighting
Involuntary job loss	2.91*	2.79*
	[1.5117]	[1.5144]
Maternal personality traits	✓	✓
N	220	222
R^2	0.177	0.172

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates age of child, gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal employment status (ref. category: not employed/full time, part time, minor employed, maternal education (ref. category: vocational degree/university degree, no degree), child care setting, regional unemployment rate, and time dummies. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Due to sample size restrictions only the factor *Neuroticism* is included as maternal personality trait, which correlates the most with children's non-cognitive outcomes. Author's calculations, SOEP v27 (2008-2010).

Table 6: Estimation of internal locus of control and maternal involuntary job loss (adolescence sample)

	OLS	PS matching	PS weighting
Involuntary job loss	-0.24*	-0.25*	-0.23*
	[0.1279]	[0.1329]	[0.1335]
N	536	533	536
R^2	0.133	0.134	0.131

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates attended school track(ref. category: lower school track/middle school track, upper school track, comprehensive school track, vocational school track), gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal working hours, maternal education (ref. category: vocational degree/university degree, no degree), regional unemployment rate, and time dummies. Author's calculations, SOEP v27 (2001-2010).

Table 7: Comparing propensity score weighting to OLS complete estimation

| | Internal locus of control | |
	PS weighting	OLS complete
Involuntary job loss	-0.23*	-0.23*
	[0.1335]	[0.1316]
Prior treatment covariates		
Employment status at age six of child	-	Yes
Working hours at age six of child	-	Yes
Partner present at age six of child	-	Yes
Years of education around age six of child	-	Yes
Number of children <16 at age six of child	-	Yes
Logarithmic household income at age six of child	-	Yes
Living in East Germany in 1989	-	Yes
Maternal life satisfaction at age six of child	-	Yes
Tenure at firm around age six of child	-	Yes
Size of firm around age six of child	-	Yes
Living in an urban area at age six of child	-	Yes
Maternal age at birth	-	Yes
N	536	536
R^2	0.131	0.169

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates attended school track(ref. category: lower school track/middle school track, upper school track, comprehensive school track, vocational school track), gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal working hours, maternal education (ref. category: vocational degree/university degree, no degree), regional unemployment rate, and time dummies. Author's calculations, SOEP v27 (2001-2010).

Table 8: Estimations of internal locus of control under inclusion of maternal personality traits (adolescence sample)

| | Internal locus of control | |
	PS matching	PS weighting
Involuntary job loss	-0.29**	-0.27*
	[0.1373]	[0.1372]
Maternal personality traits	✓	✓
N	513	516
R^2	0.135	0.133

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariates attended school track(ref. category: lower school track/middle school track, upper school track, comprehensive school track, vocational school track), gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal working hours, maternal education (ref. category: vocational degree/university degree, no degree), regional unemployment rate, and time dummies. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Again only the factor *Neuroticism* is included as maternal personality trait, which correlates the most with adolescents' non-cognitive outcome. Author's calculations, SOEP v27 (2001-2010).

Table 9: Estimation of internal locus of control distinguishing on plant closure and dismissal by employer (PS weighting)

| | Adolescence sample |
	Internal locus of control
Job loss due to plant closure	-0.05
	[0.2177]
Job loss due to dismissals	-0.34**
	[0.1637]
N	536
R^2	0.133

Standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that the model includes as additional covariates attended school track(ref. category: lower school track/middle school track, upper school track, comprehensive school track, vocational school track), gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal working hours, maternal education (ref. category: vocational degree/university degree, no degree), regional unemployment rate and time dummies. Author's calculations, SOEP v27 (2001-2010).

Table 10: Underlying mechanisms: Comparing potential drivers *before* and *after* treatment $(mean(x_{before})=mean(x_{after}))$

	Preschool sample t-ratio		Adolescence sample t-ratio	
	All	Job losers	All	Job losers
Life satisfaction	4.15***	2.55**	3.05***	0.27
Household income	-3.36***	-0.68	-10.14***	-3.88***
Mother-child activities				
Going to the playground	-3.87***	-0.92	-	-
Reading stories	-0.94	-0.44	-	-
N	230	15	566	66

Note: SOEP v27 (2001-2010). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Author's calculations. Samples only include working mothers applying common support restriction.

Table 11: Estimation of socio-emotional behavior including differences in life satisfaction, household income and mother-child activities (using PS weighting) *(preschool sample)*

	Socio-emotional behavior			
	Model 1	Model 2	Model 3	Model 4
Involuntary job loss	3.01**	2.76*	2.99*	2.27
	[1.5135]	[1.5314]	[1.5319]	[1.7371]
Potential mechanisms:				
Δ *Life satisfaction*		-0.05	-0.03	
		[0.2329]	[0.2327]	
Δ *Household income*	-1.82*		-1.82	-1.71
	[1.1001]		[1.1108]	[1.3442]
Δ *Reading stories*				-0.10
				[0.6664]
Δ *Going to the playground*				0.15
				[0.4074]
Maternal personality traits	✓	✓	✓	✓
N	222	221	221	145
R^2	0.184	0.172	0.183	0.335

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Samples only include working mothers. PS=propensity score. Note that all models include as additional covariates age of child, gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal employment status (ref. category: not employed/full time, part time, minor employed, maternal education (ref. category: vocational degree/university degree, no degree), child care setting, regional unemployment rate, and time dummies. Author's calculations. SOEP v27 (2001-2010). Please note that in column 4 the sample size is smaller than in column 1-3, as not all children have valid information on mother-child activities at age three.

Table 12: Estimation of internal locus of control including differences in life satisfaction, household income and maternal locus of control (using PS weighting) *(adolescence sample)*

| | Internal locus of control | | | | |
	Model 1	Model 2	Model 3	Model 4	Model 5
Involuntary job loss	-0.25*	-0.26*	-0.25*	-0.29**	-0.27*
	[0.1385]	[0.1374]	[0.1388]	[0.1375]	[0.1390]
Potential mechanisms:					
Δ *Life satisfaction*		-0.01	-0.01		-0.01
		[0.0251]	[0.0252]		[0.0252]
Δ *Household income*	-0.06		-0.06		-0.06*
	[0.0350]		[0.0351]		[0.0351]
Maternal internal locus of control				0.15***	0.15***
				[0.0444]	[0.0445]
Maternal personality traits	✓	✓	✓	✓	✓
N	515	516	515	510	509
R^2	0.136	0.133	0.136	0.153	0.157

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Samples only include working mothers. PS=propensity score. Note that all models of include as additional covariates attended school track(ref. category: lower school track/middle school track, upper school track, comprehensive school track, vocational school track), gender(female=1), migration background, region(East Germany=1), logarithmic household income, partner present(yes=1), number of children <16, maternal working hours, maternal education (ref. category: vocational degree/university degree, no degree), regional unemployment rate, and time dummies. Author's calculations. SOEP v27 (2001-2010).

Appendix

Table A1: Summary of covariates used in analyses in preschool sample *(after matching)*

| | Mean | | |
	All	Job losers	Non job losers
Total difficulties score	9.85	12.60	9.66
Age of child in months	69.16	69.40	69.15
Gender (Female=1)	0.49	0.47	0.50
Migration background	0.14	0.27	0.13
Child care	0.75	0.86	0.75
Grandparent care	0.62	0.79	0.61
Logarithmic HH income	8.07	7.91	8.08
Region (East Germany)	0.32	0.47	0.31
Number of children < 16	1.91	1.79	1.92
Partnered	0.88	0.80	0.89
Years of education	13.13	12.33	13.18
Ref. Vocational degree			
No degree	0.06	0.06	0.05
University degree	0.25	0.13	0.26
Ref. Not employed			
Full time	0.26	0.40	0.25
Part time	0.51	0.33	0.53
Minor employed	0.11	0.13	0.11
N	230	15	215

Note: SOEP v27 (2001-2010). Author's calculations. Samples only include working mothers.

Table A2: Summary of covariates used in analyses in adolescence sample *(after matching)*

	Mean		
	All	Job losers	Non job losers
Internal locus of control	-0.0059	-0.1688	0.0153
Gender (Female=1)	0.47	0.54	0.46
Migration background	0.16	0.15	0.16
Ref. Lower school track[a]			
Middle school track	0.28	0.33	0.28
Upper school track	0.37	0.32	0.38
Comprehensive school	0.06	0.02	0.06
Vocational school	0.21	0.24	0.21
Logarithmic HH income[b]	8.08	7.91	8.09
Region (East Germany)	0.36	0.46	0.35
Number of children < 16[c]	1.47	1.35	1.48
Partnered[c]	0.88	0.85	0.89
Years of education[d]	12.21	12.51	12.18
Ref. Vocational degree[e]			
No degree	0.15	0.14	0.16
University degree	0.24	0.28	0.23
Ref. Not employed[c]			
Full time	0.38	0.37	0.38
Part time	0.44	0.38	0.44
Minor employed	0.08	0.08	0.08
N	561	65	496

Note: SOEP v27 (2001-2010). Author's calculations. Samples only include working mothers. [a]: Here N=551 for all / N=63 for job losers / N=488 for non job losers. [b]: Here N=558 for all / N=64 for job losers / N=494 for non job losers. [c]: Here N=559 for all / N=494 for non job losers. [d]: Here N=553 for all / N=488 for non job losers. [e]: Here N=552 for all / N=487 for non job losers.

Table A3: Summary statistics of observables used for propensity score estimation *(preschool sample)*

	Mean	Std. deviation	Min	Max	N
Full time employed prior childbirth	0.46	0.49	0	1	273
Part time employed prior childbirth	0.24	0.43	0	1	273
Full time employed in the birth-year of child	0.37	0.48	0	1	283
Part time employed in the birth-year of child	0.23	0.42	0	1	283
Years of education around childbirth	13.27	2.72	7	18	276
Partner present in birth-year of child	0.92	0.27	0	1	283
Number of children < 16 in HH in birth-year of child	1.73	0.81	1	6	292
Logarithmic household income around childbirth	8.02	0.46	6.19	9.79	286
Satisfaction with "only being mother" (1=not satisfied)	0.18	0.38	0	1	288
Living in East Germany in 1989	0.33	0.47	0	1	313
Living in an urban area around childbirth	0.27	0.45	0	1	314
Grandparent care around childbirth	0.57	0.49	0	1	290
Age of mother at childbirth:					
Age group 20-25	0.06	0.24	0	1	315
Age group 25-30	0.30	0.46	0	1	315
Age group 35+	0.28	0.45	0	1	315

Author's calculations. SOEP 27v (2008-2010).

Table A4: Summary statistics of observables used for propensity score estimation *(adolescence sample)*

	Mean	Std. deviation	Min	Max	N
Full time employed at age six of child	0.29	0.46	0	1	685
Part time employed at age six of child	0.33	0.47	0	1	685
Working hours at age six of child	19.98	17.51	0	70	677
Years of education at age six of child	12.15	2.59	7	18	677
Partner present at age six of child	0.93	0.26	0	1	685
Number of children < 16 in HH at age six of child	2.11	0.83	1	7	687
Logarithmic household income at age six of child	7.31	1.79	2.12	9.01	689
Living in East Germany in 1989	0.35	0.48	0	1	803
Living in an urban area at age six of child	0.25	0.43	0	1	808
Overall life satisfaction at age six of child	6.98	1.66	0	10	803
Tenure at age six of child	3.97	5.33	0	24.8	690
Size of firm at age six of child	5.26	4.04	0	11	671
Age of mother at childbirth					
Age group 20-25	0.28	0.45	0	1	808
Age group 30-35	0.22	0.41	0	1	808
Age group 35+	0.07	0.25	0	1	808

Author's calculations. SOEP 27v (2001-2010).

Table A5: Balance of covariates between treatment and control group *(preschool sample)*

	Mean		Bias	
	Treated	Untreated	|Bias|	p>|t|
Propensity score				
Unmatched	0.156	0.062	89.3	0.000
Matched	0.131	0.126	4.6	0.880
Full time employed - prior childbirth				
Unmatched	0.50	0.45	9.0	0.725
Matched	0.47	0.48	2.6	0.844
Part time employed - prior childbirth				
Unmatched	0.31	0.23	18.0	0.462
Matched	0.33	0.35	3.0	0.941
Full time employed				
Unmatched	0.47	0.36	22.7	0.350
Matched	0.40	0.40	0.0	1.000
Part time employed				
Unmatched	0.24	0.22	2.4	0.921
Matched	0.27	0.31	9.3	0.816
Years of education				
Unmatched	11.91	13.27	56.4	0.044
Matched	12.13	12.15	0.8	0.980
Partnered				
Unmatched	0.76	0.94	48.2	0.010
Matched	0.80	0.83	9.4	0.821
Logarithmic household income				
Unmatched	7.79	8.02	50.4	0.038
Matched	7.81	7.85	8.6	0.827
Number of children < 16				
Unmatched	1.53	1.75	27.8	0.298
Matched	1.53	1.51	3.4	0.919
Living in East Germany 1989				
Unmatched	0.42	0.33	18.9	0.410
Matched	0.47	0.40	13.6	0.726
Living in East Germany				
Unmatched	0.32	0.29	5.6	0.811
Matched	0.40	0.36	8.6	0.829
Living in an urban community				
Unmatched	0.26	0.27	2.1	0.928
Matched	0.33	0.35	3.0	0.941
Grandparent care				
Unmatched	0.53	0.58	10.6	0.668
Matched	0.53	0.53	1.3	0.972
Satisfaction with being a mother				
Unmatched	0.24	0.17	15.8	0.499
Matched	0.27	0.26	1.6	0.968
Aged 20 - 25 at childbirth				
Unmatched	0.11	0.06	15.6	0.455
Matched	0.13	0.14	2.4	0.959
Aged 30 - 35 at childbirth				
Unmatched	0.42	0.29	25.7	0.258
Matched	0.33	0.32	2.8	0.941
Aged 35+ at childbirth				
Unmatched	0.16	0.29	31.7	0.217
Matched	0.13	0.13	1.6	0.959

Note: All variables are measured around child birth unless indicated otherwise.
Author's calculations. SOEP 27v (2001-2010).

Table A6: Balance of covariates between treatment and control group *(adolescence sample)*

| | Mean | | Bias | |
	Treated	Untreated	|Bias|	p>|t|
Propensity score				
Unmatched	0.187	0.112	67.6	0.000
Matched	0.166	0.164	1.2	0.934
Full time employed				
Unmatched	0.39	0.29	20.9	0.081
Matched	0.38	0.39	2.6	0.887
Part time employed				
Unmatched	0.29	0.33	7.1	0.570
Matched	0.31	0.34	6.6	0.710
Working hours				
Unmatched	22.61	19.95	14.6	0.218
Matched	22.92	24.31	7.6	0.663
Years of education				
Unmatched	12.34	12.13	7.9	0.509
Matched	12.44	12.49	2.3	0.902
Partnered				
Unmatched	0.92	0.93	3.5	0.774
Matched	0.92	0.92	2.3	0.898
Logarithmic household income				
Unmatched	6.76	7.37	30.3	0.006
Matched	6.77	6.93	8.1	0.679
Number of children < 16				
Unmatched	2.09	2.08	2.2	0.857
Matched	2.08	2.09	2.3	0.898
Living in East Germany 1989				
Unmatched	0.48	0.34	29.3	0.007
Matched	0.49	0.46	6.9	0.702
Living in an urban community				
Unmatched	0.19	0.26	17.8	0.127
Matched	0.22	0.23	3.0	0.867
Overall life satisfaction				
Unmatched	6.53	7.06	32.1	0.007
Matched	6.51	6.45	3.8	0.832
Aged 20 - 25 at childbirth				
Unmatched	0.28	0.28	0.9	0.937
Matched	0.29	0.26	6.1	0.727
Aged 30 - 35 at childbirth				
Unmatched	0.27	0.21	13.9	0.196
Matched	0.25	0.25	1.4	0.936
Aged 35+ at childbirth				
Unmatched	0.05	0.07	6.9	0.551
Matched	0.06	0.08	8.9	0.639
Tenure at firm				
Unmatched	3.29	4.06	15.2	0.246
Matched	3.46	3.84	7.7	0.647
Size of firm				
Unmatched	4.68	5.39	18.3	0.157
Matched	4.86	5.21	8.8	0.606

Note: All variables are measured at age six of child. Author's calculations. SOEP 27v (2001-2010).