Empirical Essays on Work, Well-being and Family Formation

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Cornelia Chadi, M.Sc.

Gutachter: Prof. Dr. Uwe Jirjahn (Universität Trier)
Prof. Dr. Normann Lorenz (Universität Trier)

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Preface - Vorbemerkungen

Die vorliegende Dissertation ist gemäß den Vorgaben der Promotionsordnung des Fachbereichs IV „Wirtschafts- und Sozialwissenschaften, Mathematik, Informatik und Wirtschaftsinformatik" der Universität Trier vom 28. September 2004 angefertigt worden. Kapitel 1 fasst die Kapitel 2 bis 6 inhaltlich zusammen, ordnet die Ergebnisse dieser Dissertation in den aktuellen Stand der Wissenschaft ein und stellt den inneren Zusammenhang sowie die wesentlichen Schlussfolgerungen der nachfolgenden Kapitel dar. Eine deutsche Zusammenfassung der Ergebnisse gemäß § 5 Abs. 4 der Promotionsordnung findet sich am Ende der Dissertation.

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* This chapter is joint work with John S. Heywood and Uwe Jirjahn.
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1. Introduction

1.1 Motivation

Applied microeconomics is an outward-looking branch of economics. It applies economic theories and methodologies to real-world problems in order to answer questions of individual behavior and societal outcomes. The branch includes, among other things, labor, health, and family economics. This doctoral thesis investigates several research questions across these different but ultimately connected fields. More specifically, the five studies that constitute this thesis deal with the topics work, well-being, and family formation, as well as their interaction. The studies aim to find answers to the following questions: Do workers' personality traits determine whether they sort into jobs with performance appraisals? Does job insecurity result in lower quality and quantity of sleep? Do public smoking bans affect subjective well-being by changing individuals' use of leisure time? Can risk preferences help to explain non-traditional family forms? And finally, are differences in out-of-partnership birth rates between East and West Germany driven by cultural characteristics that have evolved in the two separate politico-economic systems? To answer these questions, the following chapters use basic economic subjects such as working conditions, income, and time use, but also employ a range of sociological and psychological concepts such as personality traits and satisfaction measures. While each study addresses one of the three topics work, well-being, and family formation, all studies take differences in work characteristics, well-being, and marital status into account, when providing an answer to the respective research question.

The findings of this doctoral thesis are important for individuals, employers, and policymakers. For instance, the chapters 2 and 3 investigate occupational sorting and the

effects of job insecurity on sleep behavior, and, hence, are particularly relevant for workers and employers. Both groups benefit from knowing the determinants of occupational sorting, as vacancies can be filled more accurately. Moreover, knowing which job-related problems lead to lower well-being and potentially higher sickness absence likely increases efficiency in the workplace. The research on family formation in chapters 5 and 6 is particularly interesting for young women, as alternative family forms such as single motherhood are often exposed to major disadvantages (e.g., financial insecurity, adverse consequences for the child's development). However, the results of those two studies are also relevant from a policymaker's perspective. Understanding why women are willing to take the risks associated with single motherhood can help to improve policies targeting single mothers. Policymakers may also benefit from the findings presented in chapter 4. The results on the effects of smoking bans on subjective well-being suggest that the impacts of tobacco control policies could be weighed more carefully.

While each study considers a different research question, there are several aspects the studies have in common. For instance, the chapters 2, 5, and 6 investigate the influence of personality on individual decisions. Reframing traditional models to accommodate personality traits is a fairly new development in economics. Nonetheless, recent studies show that non-cognitive skills have significant impacts on both human capital formation and the functioning of the workplace (Almlund et al. 2011, Borghans et al. 2008, Heckman et al. 2006). Therefore, chapter 2 examines the effects of two personality characteristics, namely locus of control and risk attitude, on occupational sorting. Risk attitude also plays a major role in chapter 5. The chapter investigates the influence of risk tolerance on non-marital birth. Both studies show that personality traits are important determinants of individual behavior.

Chapter 6 extends the fifth chapter by extensively examining out-of-partnership births. The study shows that risk preferences have a significant impact on out-of-partnership births but do not explain regional differences.

Regional differences play an important role across all five studies. The second and sixth chapter focus on differences between East and West Germany. The two studies demonstrate that the former communist regime in East Germany and the democratic system in West Germany have left its mark to this day, as they still affect individuals' behavior. Chapter 6 also highlights the impact of historical differences across the German states that predate the 1945 separation of Germany. The fourth chapter uses recent differences across the sixteen federal states for the purpose of identification. More specifically, the chapter can exploit regional variation in the implementation of smoking bans, as the German states introduced smoking bans on different dates between 2007 and 2008. In chapters 3 and 5 regional factors play a smaller role, but both studies still take differences across states into account when investigating individual behavior.

Furthermore, all five studies are based on data from the German Socio-Economic Panel (SOEP), a representative longitudinal panel of private households in Germany. Since 1984 the SOEP conducts each year interviews with more than 20,000 individuals in over 11,000 households on living conditions in Germany (Wagner et al. 2007). Due to its longitudinal nature and the large scope of households, the SOEP allows researchers to analyze life course models, social phenomena, and policy interventions, and hence, is well suited for many research questions. There are two features that make the data source particularly attractive for this thesis. First, the panel design allows the observation of individuals over several years, which is a very important aspect in chapters 5 and 6 where we

investigate fertility timing decisions. Moreover, controlling for individual fixed effects is essential to establish relationships in chapter 4. Second, the large sample size makes it possible to investigate rare events such as performance appraisals without financial consequences in chapter 2 and out-of-partnership births in chapters 5 and 6. Overall, the SOEP is a well-suited data set for this thesis.

One final characteristic the chapters have in common, is that all five studies apply state-of-the-art microeconometric methods. Since every research question in this thesis requires a different empirical approach, each chapter chooses the method that, on the one hand, provides the most credible identification, and, on the other hand, works best with the respective econometric peculiarities. For instance, chapter 2 applies a multinomial probit model, as the dependent variable consists of three categories that are not ordered. The third chapter employs an instrumental variable method to establish a causal link and chapter 4 applies a difference-in-differences estimation, while controlling for individual fixed effects. Finally, in chapters 5 and 6 the outcome is a rather rare event. To take this into account, the two studies use an estimation method that specifically deals with small-sample bias in maximum likelihood estimation, namely the Firth logit approach.

The following two subsections provide an overview of the content of this thesis and explain in detail how each chapter contributes to the literature.

1.2 Overview and Summary

The five chapters of this doctoral thesis use survey data to investigate occupational sorting, subjective well-being, and non-traditional family formation. While the studies do not focus on all three topics to the same extent, work characteristics, well-being measures, and marital

status play a notable role in each study.

Chapter 2 examines the link between locus of control and performance appraisals, where the locus of control identifies the extent to which individuals think that their actions cause the consequences they encounter. Together with John Heywood and Uwe Jirjahn, we show for West Germany that workers with a more internal locus (they more nearly think they control outcomes) sort into jobs with performance appraisals. We further show that West German workers who are risk tolerant also have a higher probability to receive performance appraisals. However, by estimating a significantly negative interaction, we demonstrate that the influence of the locus of control and risk tolerance is not additive. We find no association between locus of control and performance appraisal for East Germany. Our results offer valuable information about occupational sorting and, hence, are relevant for workers and employers to the same degree. The estimates suggest that extrinsic rewards (financial incentives) and intrinsic motivation, albeit weaker, play important roles in the sorting of workers with an internal locus of control.

In chapter 3 I investigate the influence of perceived job insecurity on sleep behavior. To circumvent the endogeneity of job insecurity, I rely on media coverage on downsizing as instrument. Using this strategy, the results show that job insecurity decreases satisfaction with sleep substantially. Moreover, job insecurity leads to a small but significant decrease in sleep duration. To better understand the influence of job insecurity on sleep, the study examines the roles of work stress and effort as potential mechanisms. Based on the IV approach, I find evidence that job insecurity strongly affects workers' perceived capability to cope with work stress. The estimates show that insecure workers have problems to stop thinking about their job before and after bedtime which likely results in lower quality and

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quantity of sleep. In contrast, I find no evidence that workers sleep less to increase effort (e.g., increase working hours). Given that insufficient sleep deteriorates health (e.g., Cappuccio et al. 2010, Giuntella et al. 2017) and is associated with higher sickness absence (Hafner et al. 2016), the results of this study suggest that workers, employers, and policymakers could consider sources of job insecurity more carefully.

Chapter 4 exploits regional variation in the implementation of smoking bans to identify effects of smoking bans on life satisfaction and leisure time satisfaction. Difference-in-differences estimates reveal that individuals who used to visit bars regularly are less satisfied with life and leisure time, following the enforcement of a smoking ban. The estimates are particularly strong in magnitude for predicted smokers. Exploiting time use data reveals that changes in use of leisure time likely explain these findings, as predicted smokers spend less time with friends and are less likely to go to night clubs and dancing, when covered by a smoking ban. On the contrary, predicted non-smokers who did not visit bars and restaurants frequently benefit from the smoking bans, as their satisfaction with leisure time increases. They show an increase in hours spent on free-time activities and are more likely to go out with smoking bans in effect. The results of my study suggest that policymakers should not only consider (intended) effects on smoking behavior and health but also unintended side effects, when evaluating the economic effects of smoking bans.

In chapter 5 I investigate with Uwe Jirjahn the influence of risk attitude on non-marital birth. If women feel uncertain about the availability of suitable partners or their ability to conceive, risk attitude likely plays an important role in understanding fertility timing decisions. Using panel data, we show that risk tolerance is associated with a higher probability of an out-of-partnership birth. In contrast, we find no association between risk

tolerance and the probability of a cohabiting birth. The results indicate that risk tolerance has predictive power in the context of demographic decisions. The findings of this study help society and policymakers to understand why women are willing to take the risks associated with single motherhood such as lower earnings and a higher risk of poverty (e.g., Brady and Burroway 2012).

Eventually, chapter 6 extends the analysis in chapter 5. The study considers exclusively out-of-partnership births but provides a very comprehensive analysis, as it distinguishes between planned and unplanned births. Moreover, we focus on differences between East and West Germany to explain out-of-partnership births. Our results show that single women in East Germany are significantly more likely to give birth to a child than single women in West Germany. This applies to both planned and unplanned births. Our analysis suggests that the difference in out-of-partnership births is driven by behavioral and cultural differences that, on the one hand, reflect different gender role models that evolved in the two separate politico-economic systems, and on the other hand, reflect a long historical divide that predates the 1945 separation of Germany. As our findings imply that more equal gender roles are associated with an increase in non-traditional childbearing, policies promoting gender equality and policies providing sufficient support for single mothers are likely complementary. Thus, the results of this study are particularly important from a policymaker's perspective. However, knowing the determinants of out-of-partnership births is also crucial for young women, as single motherhood is not only often associated with financial insecurity but also with potentially adverse consequences for the child's physical and cognitive development (e.g., Scharte and Bolte 2012).

1.3 Contribution

While each chapter of this doctoral thesis makes an independent contribution to the literature, there is one contribution the five research papers have in common. All papers do not only present mere correlations but attempt to identify causal links or, if not possible, at least robust empirical associations. Analyzing causal relationships is of particular interest, as they allow us to make predictions about the consequences of changing conditions or policy interventions. Angrist and Pischke (2009: p. 3) state in this context "Although purely descriptive research has an important role to play, we believe that the most interesting research in social science is about questions of cause and effect". Of course, identifying causal effects is generally quite difficult. Experimental studies provide causal evidence by randomly assigning subjects to treatment and control group. However, for many research questions, conducting an experiment with random assignment is simply not possible or is complicated by ethical or financial constraints. In this case, researchers resort to observational data and exploit specific settings or apply econometric techniques for a credible identification. As the following five chapters are based on observational data, the present thesis also takes this path (e.g., chapters 2 and 5 rely on consistent and valid personality measures, chapter 3 applies an instrumental variable method, chapters 4 and 6 exploit policy and regime changes). These alternative strategies are based on identifying assumptions. Although the strategies are often very convincing, there is unfortunately no guarantee that the estimated effect is truly causal, as the assumptions cannot be tested. Hence, all studies include additional robustness checks to increase confidence in the pattern of results.

Each chapter also provides an independent contribution to the literature. Chapter 2 is one of the few economic studies examining the link between personality traits and

performance appraisals. Thereby, we are the first to show that the interaction of locus of control and risk attitude plays an important role in explaining occupational sorting. In addition, our analysis of performance appraisals provides a very nuanced view, as we distinguish between performance appraisals with and without consequences for the worker's earnings.

Chapter 3 is the first study investigating the impact of perceived job insecurity on satisfaction with sleep and sleep duration. By examining this relationship, the paper not only adds to the literature on job insecurity and well-being, but it is also one of the few economic papers relating work characteristics to sleep behavior. Furthermore, I extend previous literature by investigating individuals' difficulties to cope with work stress during leisure time as additional outcomes. By doing so, I not only identify a potential mechanism that helps to understand the effects of job insecurity on sleep behavior but also shed light on the role of job insecurity for the quality of waking leisure time.

The fourth chapter provides the first study on the consequences of smoking bans on well-being for Germany. Moreover, while previous articles have only considered overall well-being and life satisfaction, I also investigate the influence of smoking bans on satisfaction with leisure time. In addition, chapter 4 extends previous research by examining individuals' leisure time activities. This approach not only allows me to consider groups who are particularly affected by the bans but also to better understand the influence of smoking bans on well-being.

The fifth chapter examines the influence of risk attitude on nonmarital births. By doing so, it is the first study investigating the relationship for adults. Furthermore, as we explicitly differentiate between out-of-partnership births and cohabiting births, we consider

non-marital birth in its full dimension.

Finally, chapter 6 contributes to the literature by examining in detail the long-lasting effects of historical factors and different political regimes on out-of-partnership births. Moreover, it is one of the few studies distinguishing between planned and unplanned births. Chapter 6 also adds to the literature on gender identity, as previous research on this topic has so far not considered the influence of gender role models on planned and unplanned out-of-partnership births.

2. Locus of Control and Performance Appraisal*

Abstract: We show that West German workers with an internal locus of control sort into jobs with performance appraisals. Appraisals provide workers who believe they control their environment a tool to demonstrate their value and achieve their goals. We confirm that workers who are risk tolerant also sort into jobs with performance appraisals but explain why the influence of the locus of control and risk tolerance should not be additive. We demonstrate this by estimating a routinely large and significantly negative interaction in our sorting equations. We also show that important patterns of sorting are revealed only when taking into account the interaction of locus of control and risk tolerance.

2.1 Introduction

Economists increasingly recognize the role of non-cognitive skills in both human capital formation and the functioning of the workplace (Almlund et al. 2011, Borghans et al. 2008, Heckman et al. 2006). Cobb-Clark (2015: p. 1) identifies the recent reframing of traditional models to accommodate such skills as drivers of market outcomes as "one of the most exciting developments in labor economics over the past decade." Among the fundamental personality characteristics economists examine is the locus of control, a concept that has played a long role in psychology (Gatz and Karel 1993, Phares 1976, Ng et al. 2006, Rotter 1966). Locus of control identifies the extent to which individuals think that their actions cause the consequences they encounter. Those who see a tighter connection are identified as having a more internal locus (they more nearly think they control outcomes). Those who see a looser connection are identified as having a more external locus (they more nearly think that luck, chance or other people control outcomes).

Those economists who see it as driver of outcomes take locus of control to be stable and, if not completely exogenous, unlikely to change in response to the outcomes being examined. Indeed, Cobb-Clark and Schurer (2013) examine this directly as part of testing the underpinnings of using the locus of control in labor economics. They show that typical locus measures change only very modestly over the short to medium run, that any changes are concentrated among the young and very old and that the changes are not related to demographic, labor market or health events. They conclude that the locus of control is "remarkably stable" and that applied researchers who limit their sample to working age subjects can, with suitable caution, take measures of the locus as drivers of economic behavior rather than as merely the reflection of labor market outcomes.

Previous research has shown a role for locus of control in a variety of settings. Those with a more internal focus believe that investing in human capital has a higher return than do those with an external locus. Thus, they perform better in school (Hadsell 2010, Mendolia and Walker 2014) and more likely complete high school and attend college (Coleman and DeLeire 2003).[1] They are also more likely to make long-term investments in personal health (Chiteji 2010, Cobb-Clark et al. 2014).[2] The unemployed with an internal locus believe that their search effort generates a larger increase in the job offer rate and have been shown to search more and retain higher reservation wages than those with an external locus (Caliendo et al. 2015, McGee 2015, McGee and McGee 2016). Similarly, individuals with an internal locus are more likely to become entrepreneurs (Caliendo et al. 2014). These results follow showings of a persistent earnings return to the non-cognitive skill of an internal locus (Bowles et al. 2001a, Duncan and Dunifon 1998, Stefanec 2010). While not exhaustive, this summary suggests that perceptions of returns can be critical in understanding behavior and that those perceptions reflect, in part, a reasonably stable locus of control.

We present a unique examination focused on performance appraisals. Performance appraisals remain the most common form of performance management.[3] They measure individual worker performance based on combinations of objective and subjective evaluation. Such appraisals are used to provide feedback to workers, to make job assignments, to determine training needs, and to allocate both short- and long-term rewards

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[1] We note the results from Cebi (2007) that the return to an internal locus of control as a teenager and young adult may not be in degree completion but in higher earnings later in life.

[2] Individuals with an internal locus of control also appear to be more resilient to negative life events such as illness and injury (Buddelmeyer and Powdthavee 2016, Schurer 2017).

[3] In Australia and Britain, two thirds of the workplaces use formal performance appraisal systems (Heywood and Brown 2005, Addison and Belfield 2008). The share is modestly higher in the Netherlands (Jirjahn and Poutsma 2013). In Germany, slightly more than half of private sector establishments use formal appraisal systems (Heywood and Jirjahn 2014).

including but not limited to annual bonuses and promotion. We examine the hypothesis that locus of control drives the sorting of workers into jobs with performance appraisal. Workers who have an internal locus should view performance appraisals as a mechanism that translates their efforts and skills into better assignments and greater earnings. Thus, they should sort into jobs with appraisals. By contrast, workers with an external locus should sort out of such jobs as they view the outcomes of their efforts as more nearly a random process such that performance appraisals are as likely to ignore as reward their efforts.

Using the German Socio-Economic Panel (SOEP), we confirm that those with an internal locus sort into jobs with performance appraisal. This result is particularly strong for performance appraisals that have consequences for workers' pay. The relationship with the locus of control remains when controlling for worker characteristics, basic firm characteristics, and for industry and occupation. It also remains when accounting for other major personality characteristics, namely risk preferences, time preferences, reciprocity, trust, and the Big Five.

Our results shed light on models arguing that more productive workers sort into jobs with performance pay (Booth and Frank 1999, Cornelissen et al. 2011, Lazear 1986, 2000). We show that a worker's belief that he or she can control outcomes plays an important role in such sorting. This belief influences the worker's motivation and job performance. We join the few economic studies examining the association between personality characteristics and performance pay (Dohmen and Falk 2010, 2011). Only Curme and Stefanec (2007) test for an association between locus of control and performance pay. Their study is based on U.S. data.

While previous research focused on sorting into performance pay, our study provides

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a more nuanced view. We differentiate between performance appraisals with and without consequences for the worker's earnings. Economists may see locus of control primarily as a subjective perception of the expected value of extrinsic rewards. However, as we make clear in the next section, psychologists stress that locus of control contributes to self-esteem and happiness. Thus, performance appraisals may have intrinsic value to workers with an internal locus. These workers expect that they can influence performance appraisals through successful accomplishment of tasks to obtain positive feedback resulting in feelings of pride, competence and self-worth. Thus, workers with an internal locus should not only sort into performance appraisals with monetary rewards but also, albeit to a lesser extent, into performance appraisals without such rewards. Indeed, our estimates support this hypothesis.

We also examine the interaction of locus of control with risk attitude. While risk attitude reflects a worker's preference towards risk, locus of control involves expectations about the risks influencing the worker's outcomes. Thus, locus of control and risk attitudes should play an intertwined role in the sorting into performance appraisals. An internal locus implies that the worker expects to control the outcome of performance appraisals so that he or she perceives little uncertainty. Risk-averse workers positively value low uncertainty whereas risk-loving workers negatively value it. Thus, a high degree of risk aversion should reinforce the propensity of workers with an internal locus to sort into performance appraisals while a high degree of risk love should weaken that propensity. This prediction is supported by our estimates showing a large and significantly negative interaction of risk tolerance and internal locus of control. Moreover, the estimates demonstrate that the full pattern of sorting is only revealed when taking into account this interaction effect.

Finally, we show that the sorting of workers into performance appraisals depends on

the economic and cultural context. Separate regressions for West and East Germany demonstrate that the relationship between locus of control and performance appraisals only holds for West German workers. The socialist regime that existed for 45 years has had deep cultural consequences for the people in East Germany that appear to be still visible even more than two decades after reunification. Previous research has shown that East and West Germans do differ *on average* in their personality characteristics. Our findings suggest that they also differ in the way personality characteristics translate into labor market behavior.

In what follows, the next section provides a background discussion presenting the primary hypotheses. Section 2.3 develops a formal model that derives our hypotheses and section 2.4 describes the data and variables. Section 2.5 presents empirical results. The final section concludes.

2.2 Concepts and Hypotheses

2.2.1 Locus of Control and Sorting into Jobs with Performance Appraisals

Rotter (1966: p. 2) identifies locus of control as "a generalized attitude, belief, or expectancy regarding the nature of the causal relationship between one's own behavior and its consequences." Motivation largely depends on this perception of the extent of control. If individuals believe that they cannot produce desired effects, they have virtually no motivation to put forth effort (Bandura 2000). Thus, as important as incentives can be, they need not be synonymous with motivation (Cobb-Clark 2015). The individual with an external locus of control believes that outcomes are determined by luck, the actions of others or the way the system works. They will be weakly motivated by incentives. The individual with an internal locus of control believes that outcomes are determined by their own actions. They will be

strongly motivated by incentives. Thus, an internal locus has an incentive-enhancing effect and an external locus has an incentive-depressing effect (Bowles et al. 2001b).

Against this background, we hypothesize that the locus of control should influence workers' sorting in jobs that involve performance appraisals. Explaining this hypothesis requires recognizing the functions of performance appraisals. Performance appraisals reflect the employer's need for a comprehensive measurement of worker performance. As objective indicators often exist for only some performance dimensions, subjective evaluation by supervisors, co-workers or clients is common (Baker et al. 1988, Gibbons 1998, Jackson and Schuler 2003, Prendergast 1999). While group performance may be evaluated, the usual object is to evaluate individual worker performance (Murphy and Cleveland 1995). The end result can be a detailed written report, performance metrics and periodic performance review meetings.

Performance appraisals provide formalized and detailed feedback to workers. The appraisal can help determine which workers need additional training and how well past training worked (Noe et al. 1994). Furthermore, it can be used to assign workers to appropriate tasks and jobs. These functions of performance appraisals can be valuable to both firms and workers even when appraisals do not influence worker earnings. Yet, employers often do tie workers' pay to appraisals (Giardini and Kabst 2007). On the one hand, appraisals can be closely integrated into on-going compensation systems. For example, annual bonuses may be based on appraisals. On the other hand, performance appraisals may help determine long-term incentives that improve the functioning of the internal labor market of the firm (e.g., the determination of promotions to jobs with greater responsibility and greater earnings).

Workers' views of performance appraisals depend on their locus of control. At one extreme, workers may believe that they cannot influence performance appraisals as their performance is largely beyond their control. They may also view the process of appraisal itself as something that "happens" and for which the decisions are uncertain and cannot be influenced. Alternatively, workers may believe that their actions determine their performance and that higher performance is accurately reflected in appraisals. Even if workers see the appraisal process as imperfect, they may still feel that their performance is the deciding factor or that they can manipulate the appraisal process to their advantage.[4] These two extremes of randomness vs. complete efficacy represent the extremes of external and internal locus of control. Recognizing this we identify our first hypothesis.

Hypothesis 1: Workers with an internal locus of control sort into performance appraisal when that appraisal influences the earnings of workers.

This hypothesis flows from the extrinsic motive to earn more money. The locus of control influences the workers' expectations about the extent to which performance appraisal allows them to translate effort and competence into compensation. Sorting takes place because internal locus workers believe that outcomes depend on their own effort and competence so more money will be earned when pay is tied to their performance (Spector 1982). Seen this way, it is similar to other studies of labor market outcomes. When workers believe they can influence the quality of an appraisal, they seek out such an appraisal just as when they feel they can influence the flow of job arrivals, the unemployed search more intensively.

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[4] As performance appraisals reflect, in part, subjective judgments, workers may strategically engage in activities that result in positive evaluations (Acemoglu et al. 2008, Milgrom and Roberts 1988). For example, workers may conform to the opinion of their supervisors or provide flattery and private services to the supervisors (Laffont 1990, Prendergast 1993).

However, from a psychological viewpoint, workers' decisions reflect more than the extrinsic motivation to earn more money. Workers are also intrinsically motivated by the need to feel competent (Baard et al. 2004, Deci et al. 2001, Gagne and Deci 2005, McClelland et al. 1953). Workers derive feelings of pride, self-worth and self-esteem from successfully accomplishing tasks and achieving goals even if wage goals are irrelevant. This insight has also entered into recent economic modeling (Gomez-Minambres 2012, Kuhnen and Tymula 2012).

The basic point for our analysis is that locus of control should also influence how the need for feeling competent translates into labor market behavior. Workers with an internal locus should sort into jobs that allow demonstrating their competence (Judge and Bono 2001, Judge et al. 2000, Judge et al. 1998). These workers expect that they can successfully accomplish tasks and, hence, derive positive feelings of pride and self-worth.[5] Workers with an external locus of control should avoid such jobs as they feel that they cannot influence outcomes and that success is beyond their control.

This has an immediate consequence for the sorting in jobs with performance appraisals. Jobs only satisfy the need for feeling competent if workers receive information confirming that they successfully accomplished tasks and achieved goals. Performance appraisals deliver such information by routinely providing performance feedback. Thus, they can perform an important motivational function to meet the need for feeling competent (Ilgen

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[5] One may wonder why workers with an internal locus of control need positive reinforcement to boost pride and self-worth if they already have high self-esteem. Psychological self-verification theory provides the answer (Swann et al. 1992). Individuals derive utility not only from a positive self-concept, but also from verification of that self-concept. Thus, they tend to select situations that provide information reinforcing their self-concept (Judge et al. 1997). Theoretical economists model this as reinforcement of performance identity (Akerlof and Kranton 2000, Benabou and Tirole 2002, Preiss 2015). We note that some workers might simply seek reinforcement "to show the world" and that this may blur the boundary between intrinsic and extrinsic motivation. Yet, this does not change our analysis in any way.

et al. 1979). This intrinsic value of performance feedback has recently also been recognized by economists (Kuhnen and Tymula 2012, Peiss 2015). The intrinsic value may even be strengthened if the feedback involves social recognition of good performance. As Silverman (2004: p. 2) puts it, "recognition is needed to enhance intrinsic motivation." As a consequence, workers with an internal locus should sort into performance appraisal even when it is not tied to compensation. They believe that they can succeed and expect positive feedback increasing their pride and self-worth.[6] By contrast, workers with an external locus (those who do not believe in themselves) do not expect to receive positive feedback as they do not believe that they can succeed and that, if they did, they would necessarily be recognized. Thus, they tend to avoid performance appraisal jobs and the negative experiences and feelings they expect in those jobs. These considerations lead to hypothesis 2.

Hypothesis 2: Workers with an internal locus of control sort into performance appraisal jobs in which they get feedback about their performance as they expect to perform well and, hence, to get positive feedback.

This sorting can involve both performance appraisals with and without financial consequences. Sorting into performance appraisals without financial consequences should be driven by the intrinsic motivation to feel competent and receive recognition (not reward). By contrast, sorting into performance appraisals with financial consequences should be driven by a mix of extrinsic and intrinsic motivation. Economists have built on the psychological

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[6] Some may worry that workers do not have an accurate sense for how performance appraisals work before they have accepted a job. On the one hand, workers may learn about the employer's performance appraisal system during the job interview so that this information influences their job choice. On the other hand, the sorting into and out of performance appraisal may simply reflect trial and error. Workers move between jobs until they find a job that matches their preferences.

literature to argue that extrinsic incentives can crowd out intrinsic motivation (Frey and Oberholzer-Gee 1997, Gneezy et al. 2011, Kreps 1997). If extrinsic incentives interfere with intrinsic motivation, the sorting into performance appraisals with financial consequences might be less clear. However, the psychological literature provides a more nuanced view of the relationship between extrinsic and intrinsic motivation. Extrinsic incentives can be perceived by workers as controllers of their behavior or, alternatively, as indicators of their competence (Deci et al. 1999, Gagne and Deci 2005). In the first case, extrinsic incentives undermine intrinsic motivation whereas, in the latter, they enhance intrinsic motivation. Importantly, locus of control plays a critical role in workers' perceptions of extrinsic rewards (Earn 1982, Malik et al. 2015). Workers with an internal locus are more likely to perceive extrinsic rewards as indicators of their competence so those rewards strengthen their intrinsic motivation. Against this background, we expect that while workers with an internal locus of control are attracted to both performance appraisals with and without financial consequences, the link will be stronger for appraisals with financial consequences.

2.2.2 Locus of Control and Risk Attitudes

While personality traits have only recently found their way into economics, risk preferences have long played an important role in performance pay research. Performance pay brings with it various types of risk for workers (Milgrom and Roberts 1992: pp. 207-208). First, workers' performance can be stochastic reflecting markets, production technology, health or weather. Second, performance measurement itself can be stochastic as subjective performance appraisals depend on superiors' idiosyncratic perceptions (Prendergast and Topel 1996). Economic theory suggests that risk-averse workers avoid performance appraisal

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and its contingent consequences while risk-loving workers are attracted to performance appraisal (Cornelissen et al. 2011). This prediction has been confirmed by empirical research (Bandiera et al. 2015, Bellemare and Shearer 2010, Grund and Sliwka 2010). However, an interaction with locus of control has not been considered.

We argue that locus of control and preferences over risk should play an intertwined role. A higher internal locus of control means not only that a worker expects to receive more money and positive feedback when sorting into performance appraisals but also that the worker perceives performance appraisals as less random. The worker believes that the appraisals depend on his or her ability and effort more than on luck. Whether this aspect is positively or negatively valued by the worker, depends on his or her risk preference. A risk-averse worker positively values low uncertainty. Thus, a high degree of risk aversion reinforces the propensity of a worker with an internal locus of control to sort into performance appraisals. By contrast, a risk-loving worker negatively values low uncertainty. Hence, a high degree of risk love weakens the tendency of a worker with an internal locus of control to choose a job with performance appraisal.

Put differently, if workers are risk-averse, both the expectation of high earnings and positive feedback and the perception of low uncertainty work to increase utility. However, if workers are risk-loving, the two aspects work in opposite directions. While expectations of high earnings and positive feedback increase utility, the perception of low uncertainty decreases it. Thus, other things equal, the perceived benefits of a performance appraisal job to a worker with an internal locus of control may be lower if the worker is risk-loving than if the worker is risk-averse. When these benefits are weighed against the costs (e.g., an increased disutility of effort or a lower base wage), risk-loving workers with an internal locus

are less likely to sort into a performance appraisal job than the additive influence of risk love and an internal locus would suggest.[7]

Altogether, this reasoning implies a negative interaction effect of locus of control and risk tolerance. The propensity of workers with an internal locus of control to sort into performance appraisals should be stronger for those with low risk tolerance than for those with high risk tolerance. This allows us to state our final hypothesis.

Hypothesis 3: The interaction of internal locus of control and risk tolerance will decrease sorting in performance appraisal as the two influences are less than additive.

2.2.3 East and West Germany

The relationship between personality traits and performance pay may depend on the cultural context. This context differs between East and West Germany. More than two decades after unification, there remain deep behavioral differences with East Germans showing stronger preferences for state intervention and redistribution (Alesina and Fuchs-Schuendeln 2007). East and West Germans even differ *on average* in personality characteristics such as trust and honesty (Ariely et al. 2014, Ockenfels and Weimann 1999, Rainer and Siedler 2009). Most importantly, East Germans are less likely to have an internal locus of control than West Germans (Friehe et al. 2015). Clearly, 45 years of the East German regime have left deep cultural consequences.

East and West Germans may differ not only in their average personality traits, but

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[7] Thus, if a risk-loving worker with an internal locus prefers a job without performance appraisal, this does not mean that he or she is able to have more risk in that job. It just means that the perceived benefits of a performance appraisal job are not large enough for this worker to offset the costs associated with the performance appraisal job.

also in how personality traits translate into labor market behavior. The former East German coercive regime with its high degree of control and restrictions on the public sphere led people to withdraw into private relationships with friends and family and to place less value on autonomy in the public sphere (Schmelz and Ziegelmeyer 2016). Against this background, we argue that East German workers primarily live out an internal locus of control in the private sphere (e.g., in families, sports or hobbies) and less so at work. At work, they may take a more passive role regardless of their locus of control. This suggests that locus of control should have a smaller or, in the extreme, no influence on sorting into and out of jobs with performance appraisals. By contrast, West German workers' locus of control is likely to be more generalized as they have been socialized in a political system with far greater freedom in the public sphere. Thus, to the extent West German workers' locus of control applies not only to the private, but also to the public sphere, it should influence their sorting into and out of jobs with performance appraisals.

This reasoning fits research showing that specific components or domains of locus of control differ between cultures (Gaa and Shores 1979, Krampen and Weiberg 1981). Moreover, it fits Tabellini's (2008) theory that the quality of institutions influences the emergence of generalized values and attitudes. People tend to focus on local networks under low-quality institutions whereas they develop generalized values and attitudes under high-quality institutions with well-functioning legal systems.

Altogether, our reasoning suggests separate regressions for East and West German employees. These separate regressions can provide insights into whether or not our three basic hypotheses depend on the cultural and political context.

2.3 Theoretical Illustration

In what follows we present a theoretical illustration to demonstrate that our three hypotheses can be derived from a formal model. We extend Cornelissen et al.'s (2011) model of performance pay to account for workers' locus of control.

2.3.1 The Base Model

We imagine three sectors, a pure time rate sector $(j = 1)$, a pure performance appraisal sector without financial consequences $(j = 2)$, and a performance pay sector with performance appraisal with financial consequences $(j = 3)$. Workers choose between jobs in the three sectors.

A worker's output is given by $q = v + b$ where $b > 0$ is a base standard of production common to all workers and equally difficult to produce for all workers.[8] The output associated with additional effort is captured by

$$v = ae + \varepsilon. \tag{1}$$

Additional effort is denoted by e with $e \in \{0, 1\}$ and is considered a simple dichotomous decision of whether or not to exert effort. A worker decides on the effort level after choosing the job. The impact of the additional effort on output depends on ability a. Workers have heterogeneous abilities distributed over the interval $(0, \overline{a}]$. Worker output is subject to random influence ε, distributed with mean zero and variance σ^2.

Employers cannot observe a, e and ε. However, employers in sectors 2 and 3 can observe individual worker performance and provide workers individual performance feedback. Moreover, in sector 3, remuneration is based on the worker's performance.

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[8] The assumption of a common standard output, b, avoids the unrealistic result of no production in sector 1.

Building on previous sorting models of performance pay (Booth and Frank 1999, Cornelissen et al. 2011, Lazear 1986), we assume that worker remuneration equals his or her output q plus a negative fixed wage component $\bar{w}_3$: $w_3 = q + \bar{w}_3$. The negative fixed component reflects the costs of measuring worker performance and designing performance pay that are ultimately shifted to each worker. In sector 2, employers do not base remuneration on individual worker performance even though they observe individual output. In this sector, performance pay may be less effective or designing performance pay may be too costly.[9] Thus, workers are paid a fixed wage $\bar{w}_2$. This wage reflects both the average worker output in the sector and the cost of measuring individual worker performance that is shifted to each worker. Finally, as employers in sector 1 do not observe individual worker output, they provide no feedback and pay a fixed wage $\bar{w}_1$ reflecting average output in that sector.

We assume $\bar{w}_1 > \bar{w}_2 > \bar{w}_3$. The fixed wage in sector 1 is greater than that in sector 2, as there is no measurement of individual worker performance and, hence, no cost shifted to workers in sector 1.[10] The fixed wage in sector 2, in turn, is greater than the fixed wage component in sector 3. The fixed wage in sector 2 reflects both average worker output and the measurement cost whereas the fixed component in sector 3 reflects both the costs of measuring output and of designing performance pay.

We model locus of control by assuming that a worker's subjective perception of the production function can differ from the objective production function. Building from economic models on locus of control (Caliendo et al. 2015, Coleman and DeLeire 2003, McGee 2015, McGee and McGee 2016, Schurer 2017), we introduce the worker's locus as

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[9] Heywood and Jirjahn (2006) provide a discussion on the factors that limit the effectiveness of performance pay.

[10] Thus, we assume that a possible higher average output in sector 2 is dominated by the monitoring cost.

a subjective belief that his or her effort and ability have an impact on the outcome:

$$v^l = \theta a e + \varepsilon, \tag{2}$$

where the superscript l indicates a subjective belief. The locus of control is captured by θ, distributed over the interval $[\underline{\theta}, \overline{\theta}]$ with $\underline{\theta} \geq 0$. A higher value of θ reflects a stronger internal locus of control and, thus, a stronger belief that own ability and effort can increase output. Thus, locus of control influences the subjective belief regarding performance pay, but not the belief regarding fixed wages: $w_1^l = \overline{w}_1$, $w_2^l = \overline{w}_2$, and $w_3^l = q^l + \overline{w}_3$ with $q^l = v^l + b$.

The worker's perceived expected utility is expressed by a mean-variance utility function:

$$EU^l = \begin{cases} \mathrm{E}[w^l] - C(e) - 0.5r\mathrm{Var}[w^l] \text{ if no feedback,} \\ \mathrm{E}[w^l] + \psi \mathrm{E}[q^l - b] - C(e) - 0.5r(\mathrm{Var}[w^l] + \mathrm{Var}[q^l - b]) \text{ if feedback} \end{cases} \tag{3}$$

As usual, a higher expected wage is assumed to increase expected utility. Moreover, the utility function captures the idea that performance has not only an extrinsic, but also an intrinsic value to the worker. If the worker believes that his or her output will be greater than the base output, this contributes to a higher expected utility. This reflects expected feelings of pride, competence and self-esteem. The strength of this intrinsic motive is given by ψ with ψ distributed over the interval $(0, \overline{\psi}]$. The intrinsic motive can only play a role in utility if the worker has information about his or her individual output allowing the worker to compare the outcome with the base level of production. Thus, the intrinsic motive enters the expected utility only if the worker expects that he or she will receive performance feedback.

The disutility of additional effort is denoted by $C(e)$ with $C(0) = 0$, $C(1) = c, c >$

0, and $c < \bar{\psi}\bar{\theta}\bar{a}$.[11] Risk preference is captured by the coefficient r, distributed over the interval $[\underline{r}, \bar{r}]$ with $\underline{r} < 0$ and $\bar{r} > 0$. For a risk-averse worker the coefficient is positive. For a risk-neutral worker it is equal to zero, and for a risk-loving worker it is negative. We assume that the same risk attitude applies to the variation in earnings and to the variation in performance feedback.

2.3.2 Self Sorting and Effort Choice

As workers in sector 1 do not receive performance feedback or pay, they have no incentive to provide additional effort. Thus, their expected utility in sector 1 is:

$$EU_1^l = \bar{w}_1 \tag{4}$$

A worker in sector 2 decides to exert additional effort if $\psi\theta a \geq c$. Thus, to the extent the worker has a need for achievement, performance appraisals providing feedback can induce effort even if the appraisals are not coupled with pay. If the worker exerts additional effort, his or her expected utility is:

$$EU_2^l = \bar{w}_2 + \psi\theta a - c - 0.5r\sigma^2. \tag{5}$$

A worker in sector 3 decides to exert additional effort if $(1+\psi)\theta a \geq c$. Here, both performance feedback and performance pay provide incentives to exert effort. The expected utility of a worker exerting additional effort is given by:

$$EU_3^l = \bar{w}_3 + (1+\psi)\theta a - c - r\sigma^2. \tag{6}$$

The differences between the expected utilities can be shown as functions of θ and r:

$$\Delta_{31}(\theta,r) = EU_3^l - EU_1^l = \bar{w}_3 - \bar{w}_1 + (1+\psi)\theta a - c - r\sigma^2, \tag{7}$$

$$\Delta_{32}(\theta,r) = EU_3^l - EU_2^l = \bar{w}_3 - \bar{w}_2 + \theta a - 0.5r\sigma^2, \tag{8}$$

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[11] The disutility of standard effort required to produce output b is normalized to be zero.

$$\Delta_{21}(\theta, r) = EU_2^l - EU_1^l = \bar{w}_2 - \bar{w}_1 + \psi\theta a - c - 0.5r\sigma^2. \tag{9}$$

Each worker chooses the sector that yields the highest expected utility. A worker chooses the pure performance appraisal sector if $\Delta_{21}(\theta, r) \geq 0$ and $\Delta_{32}(\theta, r) < 0$. On the one hand, compared to the pure time rate sector, the expected utility from performing well and receiving a positive feedback must be sufficiently high to outweigh the disutility of additional effort and the lower wage.[12] If the worker is risk-averse, the expected intrinsic utility must also outweigh the disutility resulting from the uncertainty of the outcome. If the worker is risk-loving, he or she derives utility from that uncertainty reinforcing the tendency to sort out of the pure time rate sector. On the other hand, compared to the performance pay sector, a job in the pure performance appraisal sector involves a higher fixed wage. The higher wage must not be outweighed by the expected variable income in the performance pay sector. Furthermore, the uncertainty is lower in the performance appraisal sector than in the performance pay sector, as a job in the latter sector also entails income risk. The implication for sorting depends on risk attitude. While risk aversion reinforces the tendency to sort out of the performance pay sector, risk love implies that the higher fixed wage in the pure performance appraisal sector outweighs the lower uncertainty.

A worker prefers a job with performance pay if $\Delta_{32}(\theta, r) \geq 0$ and $\Delta_{31}(\theta, r) \geq 0$. Comparing the performance pay and pure time rate sectors, the expected intrinsic utility and the expected variable pay component must be sufficiently high to outweigh the lower fixed wage and the disutility of additional effort. Furthermore, for a risk-averse worker these must additionally compensate for the higher uncertainty in the performance pay sector, whereas

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[12] As workers receive a lower wage in the sector with performance appraisals without financial consequences, they pay an implicit price for performance feedback. This is in line with the theory of compensating differentials which suggests that workers pay for job amenities through lower wages (Krueger and Schkade 2008, Rosen 1986).

risk love contributes to higher utility in that sector. Comparing performance pay with pure performance appraisal, the expected variable pay component must be sufficiently high to compensate the lower fixed wage. Whether the higher uncertainty in the performance pay sector involves a higher utility or disutility depends on the worker's risk attitude.

Taking derivatives with respect to θ isolates the influence of locus of control:

$$\frac{\partial \Delta_{31}}{\partial \theta} = (1 + \psi)a, \tag{10}$$

$$\frac{\partial \Delta_{32}}{\partial \theta} = a, \tag{11}$$

$$\frac{\partial \Delta_{21}}{\partial \theta} = \psi a. \tag{12}$$

All three derivatives are positive. Equation (10) implies that workers with a higher internal locus of control are more likely to prefer performance pay over a pure time rate. Reflecting Hypothesis 1, these workers expect that their effort and ability result in a higher output and earnings in the performance pay sector. Moreover, reflecting Hypothesis 2, they expect to receive a higher intrinsic utility in that sector.

Equation (12) shows that workers with a higher internal locus of control also have an increased likelihood to prefer pure performance appraisals over pure time rates. Reflecting Hypothesis 2, these workers expect a higher expected intrinsic utility in the pure performance appraisal sector. However, equation (11) implies that a higher internal locus of control increases the probability to prefer performance pay over pure performance appraisals. Whether a higher internal locus of control increases or decreases the total likelihood to sort into pure performance appraisals depends on ψ. It increases that likelihood for $\psi > 1$ and decreases it for $\psi < 1$.

It is obvious from equations (10) to (12) that the influence of locus on control on

workers' self sorting does not depend on risk attitude. In what follows we present an extension that predicts an interaction of locus of control and risk attitude.

2.3.3 An Extension of the Model

So far we have assumed that locus of control influences the belief regarding the impact of ability and effort. However, psychological research suggests that locus of control also influences the belief that luck and chance impact outcomes. To take this into account, we extended the modeling:

$$v^l = \theta a e + (1 - \theta)\varepsilon, \tag{13}$$

where θ is distributed over the interval $[0, 1]$. A stronger locus of control involves a stronger belief that own ability and effort play a role and at the same time a weaker belief that random influences impact output. While this does not change the worker's expected utility in sector 1, it modifies the expected utilities in sectors 2 and 3:

$$EU_2^l = \overline{w}_2 + \psi\theta a - c - 0.5r(1 - \theta)^2\sigma^2, \tag{14}$$

$$EU_3^l = \overline{w}_3 + (1 + \psi)\theta a - c - r(1 - \theta)^2\sigma^2. \tag{15}$$

In the extended model, a higher internal locus of control is not only associated with a higher perceived expected outcome, but also with a lower perceived variance of the outcome. The differences between the expected utilities are now:

$$\Delta_{31}(\theta, r) = \overline{w}_3 - \overline{w}_1 + (1 + \psi)\theta a - c - r(1 - \theta)^2\sigma^2, \tag{16}$$

$$\Delta_{32}(\theta, r) = \overline{w}_3 - \overline{w}_2 + \theta a - 0.5r(1 - \theta)^2\sigma^2, \tag{17}$$

$$\Delta_{21}(\theta, r) = \overline{w}_2 - \overline{w}_1 + \psi\theta a - c - 0.5r(1 - \theta)^2\sigma^2. \tag{18}$$

The derivatives with respect to θ are:

$$\frac{\partial\Delta_{31}}{\partial\theta} = (1 + \psi)a + 2r(1 - \theta)\sigma^2, \tag{19}$$

$$\frac{\partial \Delta_{32}}{\partial \theta} = a + r(1 - \theta)\sigma^2, \tag{20}$$

$$\frac{\partial \Delta_{21}}{\partial \theta} = \psi a + r(1 - \theta)\sigma^2. \tag{21}$$

In contrast to our base model, the influence of locus of control on workers' self-sorting now depends on risk attitude. Let us define $r' \equiv -0.5(1 + \psi)a[(1 - \theta)\sigma^2]^{-1}$, $r'' \equiv -a[(1 - \theta)\sigma^2]^{-1}$, and $r''' \equiv -\psi a[(1 - \theta)\sigma^2]^{-1}$. If $r' < \underline{r}$, the derivative $\partial \Delta_{31}/\partial \theta$ is positive for all risk attitudes. However, if $r' > \underline{r}$, the derivative is positive for $r > r'$ and negative for very risk-loving workers with $r < r'$. A higher internal locus of control has two opposing effects on risk-loving workers' propensity to sort into the performance pay sector over the pure time rate sector. On the one hand, a higher perceived expected outcome increases the propensity. On the other hand, a smaller perceived variance of the outcome reduces the utility risk-loving workers receive in the performance pay sector and, hence, lowers their propensity to sort into that sector. For very risk-loving workers the latter effect can dominate. In a similar vein r'' and r''' apply to equations (20) and (21), respectively.

The moderating role of risk attitude is even clearer in the cross derivatives:

$$\frac{\partial^2 \Delta_{31}}{\partial r \partial \theta} = 2(1 - \theta)\sigma^2, \tag{22}$$

$$\frac{\partial^2 \Delta_{32}}{\partial r \partial \theta} = (1 - \theta)\sigma^2, \tag{23}$$

$$\frac{\partial^2 \Delta_{21}}{\partial r \partial \theta} = (1 - \theta)\sigma^2. \tag{24}$$

All three cross derivatives are positive. Reflecting Hypothesis 3, a lower r (a higher risk tolerance) is associated with a smaller influence of locus of control on self-sorting into pure performance appraisals and performance pay. A higher locus of control implies a reduced

perceived variance of the output. For a risk-averse worker, this implies a lower disutility of an uncertain outcome making it more likely that the expected intrinsic utility and the expected variable pay dominate in his or her decision to sort into pure performance appraisals or performance pay. This aspect plays a smaller role in the worker's decision if he or she has a low degree of risk aversion. For a risk-loving worker a lower perceived variance reduces the utility from sorting into pure performance appraisals or performance pay. The reduction in utility is higher if the worker has a high degree of risk love.

2.4 Data and Variables

2.4.1 The Data Set

Our empirical analysis uses data from the SOEP (Wagner et al. 2007). The SOEP is a large representative longitudinal survey of private households in Germany. Based on face-to-face interviews, routine socio-economic and demographic questions are asked annually. Different 'special' topic questions appear in specific waves.

Measures of locus of control appear in 2010 and indicators of performance appraisal appear in 2011. Thus, our key variables are closely consecutive in time.[13] We focus on private sector employees aged 18 to 59 years. This reflects the typical working age population and our concern that the private sector is more likely to have the competitive markets associated with economic sorting models. We exclude worker representatives as they are often released from work and we exclude marginally employed individuals (monthly earnings of below 450 Euros) who are unlikely to face a choice of sorting into performance appraisal. After retaining

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[13] The waves 2004 and 2008 also contain information on performance appraisal while the 2005 wave is a further wave with information on locus of control. As a clear temporal mapping of the key variables is not possible, we do not use these waves.

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observations for which full information is available, the analysis uses data from 3,521 employees.[14]

2.4.2 Performance Appraisal

Our dependent variable is built up from a two stage question asking first if the employee is subject to regular and formalized performance appraisals by a superior. The underlying question is: "Is your own performance regularly assessed by a superior as part of a formalized procedure?" Second, if the employee answers in affirmative, he or she is asked whether the performance appraisal has consequences for his or her earnings.[15] Table 2.1 provides the relative frequencies with 68 percent of the employees not subject to performance appraisal, 6 percent subject to performance appraisal without financial consequences and 26 percent subject to performance appraisal with financial consequences.

For those with financial consequences, the survey asks if the performance appraisals have consequences for monthly gross wage, annual bonus, future wage growth or potential promotion. Multiple answers are possible. Table 2.2 presents the descriptive statistics and shows that 45 percent have consequences for monthly gross wage, 66 percent have consequences for annual bonus, 65 percent have consequences for future wage growth and 59 percent have consequences for potential promotion. We will use these categories to distinguish between shorter and longer term financial consequences in a robustness check.

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[14] The 2011 SOEP wave comprises information on 24,218 persons. Our age restriction reduces that number by 8,098 with the excluded mostly older retirees. Excluding those self-employed, marginally employed, unemployed or out of the labor force further reduces the sample by 7,764 observations. Moreover, the private sector focus causes a reduction by 2,503 persons. Finally, we lose 1,755 observations due to missing variable values and 579 observations from excluding worker representatives.

[15] The SOEP provides no information on how performance appraisals are conducted. We share this limitation with other studies on the determinants of performance appraisal (Addison and Belfield 2008, Grund and Sliwka 2010, Heywood and Brown 2005, Heywood and Jirjahn 2014, Jirjahn and Poutsma 2013).

Table 2.1: Distribution of employees with and without performance appraisal

Performance appraisal	*Percent*
No performance appraisal	67.8
Performance appraisal without financial consequences	5.9
Performance appraisal with financial consequences	26.3

N=3,521

Table 2.2: Distribution of consequences of performance appraisal

Consequences of performance appraisal	*Percent*
Monthly gross wage	44.9
Annual bonus	66.0
Future wage growth	65.1
Potential promotion	58.5

N=768. The descriptive statistics are calculated for employees subject to performance appraisal with financial consequences. Multiple answers are possible.

2.4.3 Locus of Control

Our measure of locus of control follows from the nine separate items in the Rotter scale. Table 2.3 provides the underlying statements and the descriptive statistics.[16] Interviewees responded to each of the statements on a seven-point Likert scale ranging from 1 "disagree completely" to 7 "agree completely". Higher scale points of items 1 to 3 reflect a more internal locus of control while higher scale points of items 4 to 9 reflect a more external locus of control.

Building on the literature (e.g., Caliendo et al. 2015), we construct an overall index of locus of control by adding up the nine survey items with items 4 to 9 being recoded in

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[16] Caliendo et al. (2015) use factor analysis to show that items 1 to 3 in Table 2.3 load on a factor interpretable as internal while factors 4 to 9 load on a second factor interpretable as external. The survey provides a tenth item: 'If a person is socially or politically active, he or she can have an influence on social conditions.' Caliendo et al. show that this item does not load onto either factor. We follow their approach and drop the item from the analysis.

inverse order before adding up. The sum is divided by 9 so that the overall index ranges from 1 to 7. Higher values of the index correspond to a more internal locus of control. The index holds together with a Cronbach's alpha of 0.67 suggesting a sensible amount of co-variation. Table 2.4 provides the definitions and descriptive statistics for the index and for the other explanatory variables.

Table 2.3: Components of locus of control

Item	Questionnaire wording and descriptive statistics (mean, std.dev.)
Item1	How my life takes course is dependent on me (5.481, 1.220).
Item2	Success is gained through hard work (5.964, 1.085).
Item3	Inborn abilities are more important than any efforts one can make (4.707, 1.322).
Item4	Compared to others, I have not achieved what I deserve (3.270, 1.736).
Item5	What one achieves in life is in the first instance a question of destiny or luck (3.378, 1.598).
Item6	I often experience that others have a controlling influence over my life (3.183, 1.616).
Item7	When I encounter difficulties in my life, I often doubt my own abilities (3.133, 1.594).
Item8	The opportunities that I have in life are determined by the social conditions (4.442, 1.420).
Item9	I have little control over things that happen in my life (2.594, 1.399).

N=3,521. The introduction to the statements was: „The following statements apply to different attitudes towards life and the future. To what degree to you personally agree with the following statements?" Interviewees respond to each statement on a seven-point Likert scale ranging from 1 "disagree completely" to 7 "agree completely".

2.4.4 Risk Attitude

The SOEP also contains a unique measure of risk attitude. The underlying question is: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" Interviewees respond to the question on an eleven-point Likert scale ranging from 0 "not at all willing to take risks" to 10 "very willing to take risks". This measure has been validated by Dohmen et al. (2011) who demonstrate that it is highly correlated with actual risk taking in lottery experiments.

Table 2.4: Variable definitions and descriptive statistics of the explanatory variables

Variable	*Definition and descriptive statistics (mean, std.dev.)*
Locus of control	Score of adding up items 1 to 9 shown in Table 3. Items 4 to 9 are recoded in inverse order before adding up. The sum of items is divided by 9. (4.906, 0.737)
Above-average locus of control	Dummy equals 1 if the employee's score of locus of control is equal or greater than the average score of 4.906 in the sample (0.549, 0.498)
Risk tolerance	Score of risk tolerance. The interviewee answers the question „How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" on an eleven-point Likert scale. The scale ranges from 0 "not at all willing to take risks" to 10 "very willing to take risks". (4.765, 2.089)
Above-average risk tolerance	Dummy equals 1 if the employee's risk tolerance is equal or greater than the average risk tolerance of 4.765 in the sample (0.591, 0.492).
Patience	Score of patience. The interviewee answers the question "How would you describe yourself: Are you generally an impatient person, or someone who always shows great patience?" on an eleven-point Likert. The scale ranges from 0 "very impatient" to 10 "very patient". (6.271, 2.293)
Positive reciprocity	Score of positive reciprocity constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of the three items is divided by 3. The items are "If someone does me a favor, I am prepared to return it", "I go out of my way to help somebody who has been kind to me before", "I am ready to undergo personal costs to help somebody who helped me before". (5.843, 0.843)
Negative reciprocity	Score of negative reciprocity constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of the three items is divided by 3. The items are "If I suffer a serious wrong, I will take revenge as soon as possible, no matter what the cost", "If somebody puts me in a difficult position, I will do the same to him/her", "If somebody offends me, I will offend him/her back". (3.175, 1.398)
Trust in others	Score of trust in others constructed from adding up three survey items measured on a four-point Likert scale ranging from 1 "agree completely" to 4 "disagree completely". The sum of items is divided by 3. The items are "On the whole one can trust people", "Nowadays one can't trust people", "One has to be careful, when dealing with strangers". The first item was recoded in inverse order before adding up. (2.372, 0.523)
Conscientiousness	Score of conscientiousness constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of items is divided by 3. The items are: I see myself as someone who… "does a thorough job", "does things effectively and efficiently", "tends to be lazy". The last item was recoded in inverse order before adding up. (5.892, 0.862)
Extraversion	Score of extraversion constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of items is divided by 3. The items are: I see myself as someone who… "is communicative", "is sociable",

	"is reserved". The last item was recoded in inverse order before adding up. (4.797, 1.141)
Agreeableness	Score of agreeableness constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of items is divided by 3. The items are: I see myself as someone who… "is sometimes somewhat rude to others", "has a forgiving nature", "is considerate and kind to others". The first item was recoded in inverse order before adding up. (5.260, 0.986)
Openness	Score of openness constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of items is divided by 3. The items are: I see myself as someone who… "is original", values artistic experiences", "has an active imagination". (4.320, 1.146)
Neuroticism	Score of neuroticism constructed from adding up three survey items measured on a seven-point Likert scale ranging from 1 "does not apply to me at all" to 7 "applies to me perfectly". The sum of items is divided by 3. The items are: I see myself as someone who… "worries a lot", "gets nervous easily", "deals well with stress". The last item was recoded in inverse order before adding up. (3.723, 1.188)
Job autonomy	Jobs are ranked on a five-point scale according to occupational autonomy and the degree of responsibility with higher scores reflecting greater autonomy and responsibility. Variable constructed by the SOEP survey team. (2.679, 1.038)
Work council	Dummy equals 1 if the employee works for a firm that has a work council. (0.470, 0.499)
Firm size 20-199	Dummy equals 1 if the worker is employed in a firm with 20-199 employees. (0.303, 0.460)
Firm size 200-1,999	Dummy equals 1 if the worker is employed in a firm with 200-1,999 employees. (0.193, 0.395)
Firm size $\geq$ 2,000	Dummy equals 1 if the worker is employed in a firm with more than 1,999 employees. (0.222, 0.416)
Part-time	Dummy equals 1 if the employee works part-time. (0.217, 0.412)
Tenure	The worker's tenure with the firm in years. (10.670, 9.462)
Blue-collar	Dummy equals 1 if the worker has a blue-collar job. (0.348, 0.476)
Work experience	The worker's work experience in years. (19.220, 10.267)
Skilled	Dummy equals 1 if the worker's highest educational attainment is a completed apprenticeship training. (0.628, 0.483)
University degree	Dummy equals 1 if the worker has a university degree. (0.298, 0.457).
Age	The worker's age in years. (42.562, 10.049)
Male employee	Dummy equals 1 if the worker is a man. (0.550, 0.498)
Migration background	Dummy equals 1 if the worker is a first-generation or second-generation immigrant (0.178, 0.382)
East Germany	Dummy equals 1 if the worker resides in a federal state located in East Germany (Berlin, Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony Anhalt, Thuringia). (0.253, 0.435)
Southern West Germany	Dummy equals 1 if the worker resides in a Southern federal state of West Germany (Bavaria, Baden-Wuerttemberg). (0.286, 0.452)

Northern West Germany	Dummy equals 1 if the worker resides in a Northern federal state of West Germany (Schleswig-Holstein, Hamburg, Lower Saxony, Bremen). (0.135, 0.342)
Industry dummies	14 detailed industry dummies.

N=3,521. The reference group of the firm size dummies (education dummies, region dummies) consists of firms with less than 20 employees (unskilled workers, workers residing in the West German federal states North Rhine-Westphalia, Hesse, Rhineland-Palatinate or Saarland). For the personality traits patience, positive reciprocity, negative reciprocity, trust in others, conscientiousness, extraversion, agreeableness, openness and neuroticism, the number of observations is equal to 2,633.

2.4.5 Other Personality Traits

Information on other personality traits comes from different SOEP waves. As a robustness check, we include variables for patience, reciprocity, trusting behavior, and the Big Five (conscientiousness, extraversion, agreeableness, openness, and neuroticism). This tests whether the influence of locus of control simply reflects the effects of other personality traits. As including these variables reduces the number of observations to 2,633, estimates with and without these controls are provided.

Patience, in particular, plays an important role in some recent examinations of performance pay and we recognize that there could be opposing effects of patience on workers' propensity to sort into jobs with performance appraisal. On the one hand, if good performance is not rewarded immediately, impatient workers may be less interested in performance appraisal (Graham et al. 2013). On the other hand, impatience may be associated with problems of self-control. Workers with self-control problems do not exert as much effort as they would like. Performance pay can help mitigate such problems (Jain 2012, Kaur et al. 2010, 2015, O'Donoghue and Rabin 1999b). To the extent that rewards depend on meeting specific deadlines and performance targets, workers with self-control problems are encouraged to work harder. Thus, they may prefer such arrangements as a self-commitment

device to control their impatience.[17]

2.4.6 Job Complexity

Other things equal, performance appraisals may depend on the complexity of the job. Previous research suggests a positive link between task complexity and performance appraisals (Brown and Heywood 2005, Jirjahn and Poutsma 2011). If a job involves simple tasks, workers often have limited scope to vary effort. They follow narrow instructions and are easily monitored. As jobs become more multifaceted, workers have greater scope to vary their effort and to allocate their effort across various tasks such as increasing output, striving for quality, maintaining equipment, helping colleagues or cultivating customer goodwill (Holmstrom and Milgrom 1991). In order to provide appropriate incentives, employers can use subjective performance appraisals by supervisors for a more comprehensive measurement of performance (Gibbons 1998, Prendergast 1999).

We capture job complexity by a series of variables. First, assuming that education is associated with job complexity, we include dummies for a completed apprenticeship training and for a university degree. Second, we use a variable for blue-collar jobs as an inverse indicator of job complexity (Berman et al. 1998). Third, we include a variable constructed by the SOEP staff that ranks jobs on a five-point Likert scale according to occupational autonomy and the degree of responsibility (Hoffmeyer-Zlotnik and Geis 2003). Fourth, 14 detailed industry dummies take into account that the nature of production varies across industries.

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[17] Workers with self-control problems also under-save and delayed payment helps mitigate under-saving (Parson and van Wesep 2013). To the extent rewards are delayed, this may be a further reason why workers with self-control problems sort into performance pay.

By including these variables we hold task complexity constant. Controlling for task complexity may be important if workers with an internal locus of control prefer more complex and challenging jobs and these jobs more likely require performance appraisals. Without the variables for job complexity, sorting into challenging jobs and sorting into jobs with performance appraisal could be confounded. However, by including these variables, we hold job complexity constant in order to isolate the effect of locus of control on the sorting into performance appraisal.

2.4.7 Further Explanatory Variables

We include a series of firm size dummies, as workers in larger firms should be more likely to receive performance appraisal. Larger firms typically make more use of performance appraisals (Brown and Heywood 2005, Jirjahn and Poutsma 2011). Implementing an appraisal system involves a fixed cost and the fixed cost per employee diminishes with number of employees subject to performance appraisal. This, in turn, increases the net benefits of the appraisal system to the employer.

Industrial relations are captured by a dummy for the presence of a works council. Works councils provide a highly developed mechanism for codetermination at the firm level. They foster performance-related management practices including performance appraisal (Heywood et al. 1998, Heywood and Jirjahn 2002, 2014). A council ensures that workers' interests are taken into account and, hence, increases their cooperativeness when the employer implements a performance appraisal system. Thus, such systems are more widespread among codetermined firms and workers in these firms should have a higher probability of receiving performance appraisal.

Regional differences in the likelihood of receiving performance appraisal are taken into account by dummy variables for residing in East Germany, Southern West Germany or Northern West Germany. Finally, we control for employee characteristics by including variables for migration background, age, gender, work experience, part-time work and the employee's tenure with the employer.

2.5 Empirical Results

2.5.1 Initial Estimates

Table 2.5 presents the initial regression results for the combined sample of East and West German employees. It shows the multinomial probit with the categories of appraisal with and without financial consequences measured relative to the base of no performance appraisal. In regression (1), we do not account for the additional personality characteristics, but include the full set of other controls. It confirms the role of many of the explanatory variables in the anticipated direction. Full-time work, firm size and works council presence are positively associated with the probability of being subject to appraisal. Furthermore, our indicators for complex tasks (job autonomy, white-collar jobs, and having a university degree) suggest that employees performing multifaceted jobs are more likely to receive appraisals with financial consequences. Regional differences also play a role with workers in Southern West Germany having a higher probability of being subject to appraisal. Moreover, risk tolerance is a positive determinant of receiving performance appraisals as anticipated. The initial estimation provides no evidence that locus of control is associated with workers' sorting into jobs which provide appraisal without financial consequences. In contrast, it suggests that locus of control plays a significant role when sorting into jobs which provide appraisals with

Table 2.5: Determinants of receiving performance appraisal (East and West Germany)

	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	-0.019 [-0.0043] (0.30)	0.099 [0.0181] (1.91)*	-0.008 [-0.0045] (0.10)	0.141 [0.0251] (2.17)**
Risk tolerance	0.002 [-0.0012] (0.09)	0.051 [0.0089] (2.77)***	0.005 [0.0004] (0.18)	0.032 [0.0055] (1.44)
Patience	---	---	-0.031 (1.09)	-0.047 (2.45)**
Positive reciprocity	---	---	0.002 (0.04)	0.008 (0.15)
Negative reciprocity	---	---	-0.122 (2.77)***	-0.004 (0.13)
Trust in others	---	---	-0.080 (0.70)	0.077 (0.88)
Conscientiousness	---	---	-0.011 (0.15)	-0.009 (0.17)
Extraversion	---	---	0.073 (1.34)	0.011 (0.29)
Agreeableness	---	---	0.025 (0.35)	-0.039 (0.85)
Openness	---	---	0.053 (1.00)	0.005 (0.11)
Neuroticism	---	---	0.034 (0.64)	-0.029 (0.74)
Job autonomy	-0.148 (1.90)*	0.261 (4.63)***	-0.173 (1.91)*	0.216 (3.27)***
Work council	0.402 (2.98)***	0.372(3.69)***	0.446 (2.84)***	0.396 (3.42)***
Firm size 20-199	0.628 (3.98)***	0.561 (4.59)***	0.762 (4.10)***	0.662 (4.63)***
Firm size 200-1,999	0.901 (4.74)***	1.183 (8.36)***	1.022 (4.56)***	1.285 (7.79)***
Firm size ≥ 2000	1.279 (6.46)***	1.959 (13.5)***	1.352 (5.83)***	2.031 (12.10)***
Part-time	-0.152 (1.09)	-0.274 (2.36)**	0.018 (0.11)	-0.190 (1.40)
Tenure	-0.026 (1.62)	-0.039 (2.97)***	-0.024 (1.29)	-0.032 (2.10)**
Tenure squared	0.001 (1.08)	0.001 (2.54)**	0.001 (0.92)	0.001 (1.99)**
Blue-collar	-0.329 (2.04)**	-0.260 (2.09)**	-0.302 (1.63)	-0.228 (1.57)
Work experience	-0.036 (1.08)	0.047 (1.63)	0.006 (0.16)	0.041 (1.17)
Work experience squared	0.001 (1.02)	-0.001 (1.23)	-4.20e-04 (0.34)	0.001 (2.40)**
Skilled	-0.135 (0.76)	0.236 (1.46)	-0.327 (1.59)	0.205 (1.06)
University degree	-0.159 (0.76)	0.442 (2.41)**	-0.399 (1.66)*	0.283 (1.31)
Age	0.183 (2.74)***	0.021 (0.40)	0.128 (1.58)	0.044 (0.67)
Age squared	-0.002 (2.52)**	-4.9e-04 (0.81)	-0.001 (1.39)	-0.001 (1.12)
Male employee	-0.226 (1.84)*	-0.091 (0.98)	-0.054 (0.35)	-0.061 (0.55)
Migration background	-0.049 (0.37)	-0.143 (1.39)	-0.147 (0.97)	-0.200 (1.67)*
East Germany	0.195 (1.48)	0.041 (0.39)	0.292 (1.93)*	0.086 (0.71)
Southern West Germany	0.037 (0.29)	0.431 (4.71)***	0.059 (0.38)	0.400 (3.75)***
Northern West Germany	0.093 (0.61)	-0.013 (0.10)	0.045 (0.25)	-0.078 (0.55)
Constant	-5.684 (4.32)***	-3.731 (3.67)***	-5.000 (2.81)***	-3.877 (2.83)***
Industry dummies	Included	Included	Included	Included
Log-likelihood		-2139.680		-1583.768
N		3,521		2,633

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. Average marginal effects are in square brackets. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

financial consequences. As workers have a more internal locus of control they are increasingly likely to receive a performance appraisal with consequences. The magnitude of this association is meaningful. An additional point on the one to seven scale of the internal locus is associated with a marginal increase in the probability of being in a job with a performance appraisal of 1.8 percentage points. This is supportive of the notion that workers who feel they can control their work environment want to be in job in which they are rewarded for good performance.

As shown by estimation (2), the relationship between locus of control and performance appraisals with financial consequences persists even when controlling for other personality traits. Indeed, the coefficient has increased in magnitude and level of statistical significance. The marginal effect is now 2.5 percentage points for a one unit increase in the locus scale. As the original share of workers in appraisal with consequences was about 26 percent, this would represent a 10 percent increase on that base. The evidence of sorting by risk attitude that was evident in the estimate without the personality traits fades when adding those traits. Yet, most of the additional traits do not emerge with significant coefficients. Patience, however, emerges as a negative covariate of receiving performance appraisals with financial consequences. This may suggest that less patient workers do sort into performance pay as a self-commitment device to control their impatience. Furthermore, negative reciprocity is a negative determinant of receiving performance appraisals without financial consequences.

Our background discussion suggests that the relationship between locus of control and performance appraisal may differ between West and East Germans. Thus, we divide the sample by residence in West or East Germany. Table 2.6 presents results for West Germany.

Table 2.6: Determinants of receiving performance appraisal (West Germany)

	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	-0.015 [-0.0044] (0.21)	0.119 [0.0218] (2.00)**	0.005 [-0.0036] (0.05)	0.154 [0.0271] (2.01)**
Risk tolerance	-0.009 [-0.0025] (0.31)	0.068 [0.0124] (3.22)***	-0.006 [-0.0016] (0.18)	0.045 [0.0080] (1.75)*
Patience	---	---	-0.051 (1.56)	-0.051 (2.35)**
Positive reciprocity	---	---	-0.024 (0.29)	-0.047 (0.76)
Negative reciprocity	---	---	-0.113 (2.18)**	0.002 (0.06)
Trust in others	---	---	0.018 (0.13)	0.065 (0.64)
Conscientiousness	---	---	-0.010 (0.12)	-0.023 (0.39)
Extraversion	---	---	0.097 (1.46)	0.037 (0.79)
Agreeableness	---	---	0.069 (0.83)	-0.072 (1.36)
Openness	---	---	-0.027 (0.44)	0.014 (0.30)
Neuroticism	---	---	0.065 (1.03)	-0.050 (1.05)
Job autonomy	-0.183 (1.94)*	0.190 (2.90)***	-0.259 (2.48)**	0.119 (1.50)
Work council	0.352 (2.34)**	0.330 (2.73)***	0.448 (2.56)**	0.359 (2.58)***
Firm size 20-199	0.761 (3.99)***	0.609 (4.12)***	0.872 (3.88)***	0.827 (4.65)***
Firm size 200-1,999	1.034 (4.75)***	1.365 (8.01)***	1.144 (4.53)***	1.501 (7.31)***
Firm size ≥ 2000	1.360 (6.00)***	2.107 (12.15)***	1.456 (5.60)***	2.242 (10.76)***
Part-time	-0.365 (2.12)**	-0.343 (2.56)**	-0.159 (0.79)	-0.261 (1.66)*
Tenure	-0.019 (1.01)	-0.029 (1.90)*	-0.015 (0.65)	-0.024 (1.36)
Tenure squared	0.001 (0.96)	0.001 (1.63)	4.81e-04 (0.70)	0.001 (1.32)
Blue-collar	-0.395 (1.99)**	-0.417 (2.84)***	-0.436 (1.94)*	-0.404 (2.34)**
Work experience	-0.038 (0.93)	0.021 (0.64)	0.023 (0.45)	0.010 (0.26)
Work experience squared	4.06e-04 (0.48)	-3.24e-04 (0.46)	-0.001 (0.98)	1.03e-04 (0.12)
Skilled	-0.170 (0.90)	0.362 (2.09)**	-0.357 (1.63)	0.369 (1.82)*
University degree	-0.301 (1.31)	0.566 (2.87)***	-0.455 (1.76)*	0.511 (2.22)**
Age	0.197 (2.45)**	0.087 (1.40)	0.132 (1.34)	0.129 (1.68)*
Age squared	-0.002 (2.20)**	-0.001 (1.72)*	-0.001 (1.12)	-0.002 (2.04)**
Male employee	-0.217 (1.45)	-0.022 (0.21)	0.039 (0.21)	0.025 (0.19)
Migration background	-0.060 (0.42)	-0.145 (1.31)	-0.210 (1.25)	-0.207 (1.59)
Southern West Germany	0.026 (0.20)	0.453 (4.83)***	0.067 (0.43)	0.435 (3.96)***
Northern West Germany	0.064 (0.41)	-0.023 (0.18)	0.019 (0.10)	-0.077 (0.52)
Constant	-5.866 (3.74)***	-5.099 (4.30)***	-5.253 (2.44)**	-5.102 (3.12)***
Industry dummies	Included	Included	Included	Included
Log-likelihood		-1577.068		-1144.767
N		2,630		1,941

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. Average marginal effects are in square brackets. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

The estimation without the additional personality traits continues to show no role for locus of control in sorting into appraisals without consequences. It also continues to reveal that those with a greater internal locus of control sort into appraisal with consequences. These results persist in the estimates that add the additional personality traits. The coefficient on locus of control implies a 2.7 percentage point increase in the likelihood of receiving appraisals with consequences for a one point increase in the index. Unlike the sample for the entire country, the measure of risk tolerance now remains statistically significant and supports the notion that those with greater risk tolerance sort into performance appraisal with consequences as do those with a more internal locus of control.

The East German subsample in Table 2.7 reveals far less. Sample size is smaller which influences precision yet the coefficients also imply smaller marginal effects. There is no significant association between locus of control and either type of appraisal. The coefficients on risk tolerance are also insignificant and even take paradoxical negative signs for the appraisals with consequences. Moreover, one can reject the hypothesis that the estimates in Table 7 are identical to those in Table 8. Altogether, this fits the contention that there remain deep behavioral differences between East and West Germans. Personality traits do not translate into the same sorting pattern as in West Germany. Thus, the remainder of our estimates focuses on West Germany but we summarize results for East Germany in the Online Appendix.

The initial estimates support Hypothesis 1 (an association between internal locus and appraisal with consequences) in the full sample and West Germany. They fail to provide support for Hypothesis 2 (an association between internal locus and all appraisals that provide feedback both those with and without consequences). However, the full pattern of sorting

Table 2.7: Determinants of receiving performance appraisal (East Germany)

	(1)		(2)	
	Appraisal without financial consequences	Appraisal with financial consequences	Appraisal without financial consequences	Appraisal with financial consequences
Locus of control	-0.013 [-0.0039] (0.10)	0.095 [0.0156] (0.86)	0.005 [-0.0027] (0.03)	0.124 [0.0193] (0.95)
Risk tolerance	0.042 [-0.0044] (0.86)	-0.018 [-0.0040] (0.44)	0.041 [0.0043] (0.72)	-0.026 [-0.0051] (0.52)
Patience	---	---	0.010 (0.19)	-0.052 (1.21)
Positive reciprocity	---	---	0.060 (0.52)	0.208 (2.13)**
Negative reciprocity	---	---	-0.139 (1.75)*	-0.022 (0.31)
Trust in others	---	---	-0.262 (1.31)	0.214 (1.21)
Conscientiousness	---	---	-0.096 (0.73)	-0.007 (0.07)
Extraversion	---	---	0.035 (0.34)	-0.044 (0.53)
Agreeableness	---	---	-0.049 (0.35)	0.106 (0.99)
Openness	---	---	0.279 (2.65)***	-0.055 (0.62)
Neuroticism	---	---	-0.057 (0.56)	0.036 (0.45)
Job autonomy	-0.069 (0.47)	0.426 (3.75)***	-0.046 (0.27)	0.420 (3.32)***
Work council	0.567 (2.02)**	0.526 (2.77)***	0.538 (1.69)*	0.555 (2.63)***
Firm size 20-199	0.420 (1.46)	0.473 (2.15)**	0.634 (1.83)*	0.298 (1.21)
Firm size 200-1,999	0.668 (1.75)*	0.740 (2.79)***	0.846 (1.86)*	0.862 (2.92)***
Firm size $\geq$ 2000	1.288 (3.18)***	1.617 (5.56)***	1.196 (2.52)**	1.738 (5.53)***
Part-time	0.324 (1.29)	-0.173 (0.72)	0.314 (1.11)	-0.195 (0.70)
Tenure	-0.040 (1.26)	-0.081 (2.90)***	-0.047 (1.41)	-0.065 (2.06)**
Tenure squared	3.32e-04 (0.35)	0.002 (2.74)***	0.001 (0.79)	0.002 (2.09)**
Blue-collar	-0.086 (0.30)	0.106 (0.42)	-0.036 (0.11)	0.041 (0.14)
Work experience	-0.055 (0.86)	0.130 (2.10)**	-0.050 (0.73)	0.109 (1.47)
Work experience squared	0.002 (1.39)	-0.002 (1.59)	0.002 (1.13)	-0.001 (0.94)
Skilled	0.351 (0.52)	-0.525 (1.15)	0.009 (0.01)	-0.520 (0.91)
University degree	0.551 (0.78)	-0.318 (0.64)	-0.031 (0.04)	-0.664 (1.08)
Age	0.224 (1.77)*	-0.127 (1.13)	0.214 (1.51)	-0.148 (1.10)
Age squared	-0.003 (1.74)*	0.001 (0.81)	-0.002 (1.46)	0.001 (0.79)
Male employee	-0.319 (1.39)	-0.298 (1.60)	-0.347 (1.24)	-0.215 (0.97)
Migration background	-0.165 (0.41)	-0.080 (0.23)	0.142 (0.34)	0.104 (0.26)
Constant	-7.024 (2.85)***	-0.342 (0.16)	-6.427 (2.05)**	-1.320 (0.50)
Industry dummies	Included	Included	Included	Included
Log-likelihood	-527.351		-402.964	
N	891		692	

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. Average marginal effects are in square brackets. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

may remain obscured until the interaction effect with risk attitude is taken into account. Hence, we now turn to an examination of Hypothesis 3, a negative interaction of locus of control and risk tolerance.

2.5.2 The Interaction of Locus of Control and Risk Attitude

Table 2.8 presents the West German results with the interaction. As before, the first estimation is the multinomial probit without the additional personality traits. For the first time, the estimate on appraisal without consequences shows statistically significant coefficients for locus of control and risk tolerance. This more complete pattern of sorting is only revealed when accounting for the interaction of these two variables. The pattern that emerges for the appraisals without consequences is broadly matched by that for the appraisals with consequences. In both cases, locus of control takes a significantly positive coefficient. Thus, this estimation provides evidence supporting Hypothesis 2. Workers with an internal locus of control sort into performance appraisal not only because they earn more money but also because they expect to receive positive feedback yielding feelings of pride and self-worth. Risk tolerance now emerges with significantly positive coefficients for the two types of performance appraisal. Furthermore, the coefficient on the interaction of the locus and risk tolerance is significantly negative for appraisals both with and without financial consequences supporting Hypothesis 3. While an internal locus of control and risk tolerance are each associated with increased sorting into performance appraisals, their influence is not additive.

The inclusion of the other personality traits does not change the pattern of key results. This pattern suggests that locus of control influences both sorting into appraisal without

Table 2.8: Determinants of receiving performance appraisal; interaction of locus of control with risk tolerance (West Germany)

	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	0.331 (2.11)**	0.391 (2.88)***	0.349 (1.97)**	0.547 (3.46)***
Risk tolerance	0.377 (2.30)**	0.360 (2.71)***	0.374 (2.04)**	0.472 (3.03)***
Locus of control x risk tolerance	-0.080 (2.43)**	-0.059 (2.25)**	-0.077 (2.13)**	-0.087 (2.79)***
Patience	---	---	-0.051 (1.55)	-0.051 (2.32)**
Positive reciprocity	---	---	-0.032 (0.39)	-0.056 (0.92)
Negative reciprocity	---	---	-0.114 (2.19)**	0.002 (0.05)
Trust in others	---	---	0.016 (0.11)	0.061 (0.59)
Conscientiousness	---	---	0.004 (0.04)	-0.005 (0.08)
Extraversion	---	---	0.098 (1.47)	0.039 (0.83)
Agreeableness	---	---	0.071 (0.84)	-0.073 (1.39)
Openness	---	---	-0.029 (0.47)	0.014 (0.29)
Neuroticism	---	---	0.065 (1.03)	-0.052 (1.09)
Job autonomy	-0.175 (1.84)*	0.197 (3.00)***	-0.256 (2.44)**	0.127 (1.61)
Work council	0.359 (2.38)**	0.332 (2.76)***	0.457 (2.62)***	0.365 (2.63)***
Firm size 20-199	0.749 (3.92)***	0.604 (4.09)***	0.866 (3.84)***	0.825 (4.64)***
Firm size 200-1,999	1.010 (4.63)***	1.351 (7.92)***	1.127 (4.46)***	1.483 (7.24)***
Firm size ≥ 2000	1.353 (5.98)***	2.108 (12.2)***	1.460 (5.62)***	2.252 (10.8)***
Part-time	-0.381 (2.20)**	-0.353 (2.64)***	-0.178 (0.88)	-0.280 (1.77)*
Tenure	-0.019 (0.97)	-0.029 (1.87)*	-0.014 (0.60)	-0.023 (1.29)
Tenure squared	0.001 (0.93)	0.001 (1.61)	4.59e-04 (0.67)	0.001 (1.26)
Blue-collar	-0.397 (1.99)**	-0.419 (2.84)***	-0.448 (1.98)**	-0.416 (2.40)**
Work experience	-0.038 (0.93)	0.020 (0.61)	0.022 (0.43)	0.007 (0.17)
Work experience squared	-4.30e-04 (0.51)	-3.01e-04 (0.42)	-0.001 (0.95)	1.85e-04 (0.21)
Skilled	-0.183 (0.97)	0.352 (2.02)**	-0.370 (1.69)*	0.360 (1.75)*
University degree	-0.313 (1.36)	0.551 (2.79)***	-0.464 (1.79)*	0.494 (2.13)**
Age	0.198 (2.45)**	0.090 (1.45)	0.134 (1.36)	0.136 (1.76)*
Age squared	-0.002 (2.22)**	-0.001 (1.77)*	-0.001 (1.16)	-0.002 (2.14)**
Male employee	-0.236 (1.58)	-0.033 (0.30)	0.023 (0.12)	0.013 (0.10)
Migration background	-0.072 (0.51)	-0.157 (1.41)	-0.226 (1.35)	-0.228 (1.74)*
Southern West Germany	0.017 (0.13)	0.444 (4.74)***	0.063 (0.40)	0.427 (3.88)***
Northern West Germany	0.054 (0.35)	-0.034 (0.27)	0.014 (0.07)	-0.093 (0.63)
Constant	-7.521 (4.34)***	-6.469 (4.84)***	-6.957 (3.00)***	-7.138 (4.09)***
Industry dummies	Included	Included	Included	Included
Log-likelihood	-1573.121		-1140.329	
N	2,630		1,941	

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

consequences and into appraisal with consequences. The role of this influence is most dramatic when risk tolerance is low. At the extreme when the risk tolerance score takes a value of zero the influence is entirely given by the coefficient on locus of control alone. As the degree of risk tolerance increases, the influence includes the partially offsetting effect of the interaction.

Figure 2.1: Average marginal effects of locus of control on the probability of receiving performance appraisal
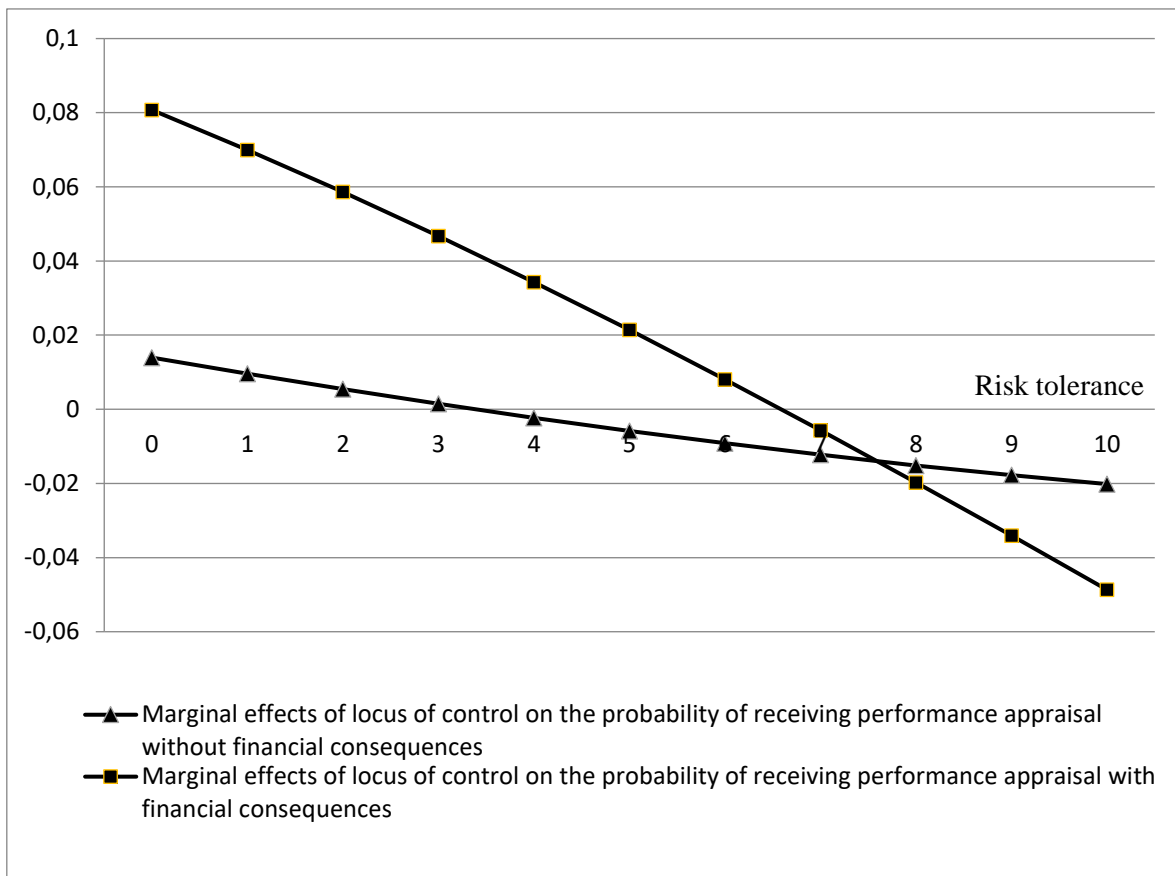
Note: Calculation of marginal effects is based on regression (2) in Table 2.8.

This point is made explicit in Figure 2.1 which plots the average marginal effects of the locus

of control on the probability of receiving performance appraisals.[18] If risk tolerance equals zero, a one point increase in the locus scale involves a 1.4 percentage point increase in the probability of receiving performance appraisal without financial consequences and an 8.1 percentage point increase in the probability of receiving performance appraisal with financial consequences. Taking into account that the shares of workers in appraisals without and with financial consequences are 6 and 26 percent, this implies increases in the respective probabilities of 23 and 31 percent. These marginal effects make clear that the sorting into performance appraisals is stronger when the appraisals are coupled with extrinsic rewards than when they only provide feedback. Due to the negative interaction, the marginal effects decrease as risk tolerance increases. For appraisals without financial consequences, the negative interaction dominates for risk tolerance scores greater than 3 causing the marginal effects to turn negative. For appraisals with financial consequences, the negative interaction dominates for risk tolerance scores greater than 6. In summary, Figure 2.1 illustrates the supportive evidence on all three hypotheses.

Further insight comes from dividing the financial consequences. We identify long term consequences as those on future earnings growth and promotion. We identify short term consequences as those on the annual bonus or monthly gross wage. Recalling that respondents choose any of the four underlying consequences, we identify three mutually exclusive categories: appraisals with only short-term consequences, appraisals with only long-term consequences and appraisals with both short- and long-term consequences.

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[18] Note that interaction effects in nonlinear models such as multinomial probits require particular care. We follow Greene's (2010) suggestion by presenting the estimated coefficients in the table and additionally providing numeric calculations of the average marginal effects of a change in locus of control for different values of risk tolerance in the figure. We stress that these are not naïve marginal effects that ignore the calculated interaction coefficients, but are the first derivative of the conditional mean with respect to the locus of control evaluated at different values of the risk tolerance variable.

Table 2.9: Determinants of the financial consequences of performance appraisals (West Germany)

	No financial consequences	*Short-term consequences*	*Long-term consequences*	*Short-term & long-term consequences*
Locus of control	0.330 (1.84)*	0.318 (1.39)	0.651 (3.17)***	0.503 (2.92)***
Risk tolerance	0.375 (2.02)**	0.418 (1.96)**	0.603 (2.95)***	0.390 (2.34)**
Locus of control x risk tolerance	-0.077 (2.07)**	-0.075 (1.72)*	-0.112 (2.69)***	-0.070 (2.12)**
Patience	-0.050 (1.56)	0.002 (0.06)	-0.072 (2.45)**	-0.056 (2.32)**
Positive reciprocity	-0.024 (0.30)	0.001 (0.02)	-0.079 (0.93)	-0.040 (0.59)
Negative reciprocity	-0.115 (2.21)**	-0.030 (0.55)	-0.024 (0.43)	0.005 (0.13)
Trust in others	0.023 (0.16)	0.036 (0.24)	0.239 (1.79)*	0.034 (0.31)
Conscientiousness	0.011 (0.13)	-0.097 (1.23)	0.079 (0.93)	0.016 (0.24)
Extraversion	0.101 (1.56)	-0.019 (0.28)	0.006 (0.08)	0.095 (1.85)*
Agreeableness	0.062 (0.76)	-0.067 (0.95)	-0.012 (0.16)	-0.074 (1.26)
Openness	-0.026 (0.43)	0.001 (0.02)	0.048 (0.79)	0.028 (0.52)
Neuroticism	0.065 (1.04)	-0.023 (0.35)	-0.057 (0.87)	-0.055 (1.06)
Job autonomy	-0.266 (2.51)**	0.167 (1.53)	-0.096 (0.78)	0.201 (2.34)**
Work council	0.401 (2.38)**	0.645 (3.04)***	0.111 (0.55)	0.324 (2.04)**
Firm size 20-199	0.830 (3.69)***	0.795 (2.59)***	0.688 (2.53)**	0.900 (4.28)***
Firm size 200-1,999	1.076 (4.28)***	1.362 (4.04)***	1.453 (4.81)***	1.396 (5.83)***
Firm size ≥ 2000	1.449 (5.64)***	1.864 (5.38)***	2.155 (6.88)***	2.194 (9.11)***
Part-time	-0.211 (1.05)	0.204 (0.95)	-0.684 (2.89)***	-0.353 (1.95)*
Tenure	-0.012 (0.52)	-0.007 (0.28)	-0.012 (0.49)	-0.027 (1.40)
Tenure squared	0.000 (0.53)	0.000 (0.56)	-0.000 (0.15)	0.001 (1.67)*
Blue-collar	-0.515 (2.22)**	-0.281 (1.20)	-0.478 (1.91)*	-0.357 (1.94)*
Work experience	0.021 (0.43)	-0.006 (0.12)	0.039 (0.76)	0.021 (0.46)
Work experience squared	-0.001 (0.97)	0.001 (0.46)	-1.75e-04 (0.16)	-3.95e-04 (0.40)
Skilled	-0.393 (1.80)*	0.185 (0.72)	0.430 (1.41)	0.266 (1.09)
University degree	-0.493 (1.88)*	0.092 (0.31)	0.396 (1.11)	0.520 (1.93)*
Age	0.134 (1.35)	0.199 (2.06)**	0.051 (0.52)	0.132 (1.48)
Age squared	-0.001 (1.14)	-0.002 (2.17)**	-0.001 (0.82)	-0.002 (1.81)*
Male employee	0.028 (0.15)	0.128 (0.74)	-0.099 (0.53)	0.101 (0.73)
Migration background	-0.225 (1.36)	-0.199 (1.09)	-0.172 (0.95)	-0.183 (1.25)
Southern West Germany	0.047 (0.30)	0.373 (2.52)**	0.068 (0.43)	0.523 (4.28)***
Northern West Germany	-0.004 (0.02)	-0.244 (1.09)	-0.005 (0.02)	-0.014 (0.09)
Constant	-6.726 (2.91)***	-8.707 (3.87)***	-7.486 (3.26)***	-8.009 (4.16)***
Industry dummies	Included	Included	Included	Included
Log-likelihood		-1529.234		
N		1,898		

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Together with the category of no financial consequences and the base no performance appraisal, we have five categories used in a multinominal probit estimation. In addition to dividing short- and long-term consequences, we again test all three hypotheses and so include the interaction.

Table 2.9 presents the multinomial probit across the five categories. The first critical point is the continued support for the locus of control as a determinant of sorting. In all four categories of performance appraisal, the locus of control takes a positive coefficient. It is significant for appraisals with no financial consequences and for appraisals that have long-term or short- and long-term consequences. Risk tolerance is routinely significant and positive. The interaction is always negative and statistically significant. In sum, the new five-way split broadly supports the earlier estimation. As the locus alone is insignificant for the short-term consequences category, we delete it from our presentation of the associated magnitudes.

The marginal effects of the estimates from column 2 of Table 2.9 are shown in Figure 2.2. The lowest curve is that for appraisals without consequences. The estimated effect is positive for the first four risk tolerance categories and is then dominated by the negative interaction effect. The middle curve is that for appraisals with only long-term consequences. The estimated effect is positive for the first six risk tolerance categories. Finally, the highest curve is that for appraisals with both long and short-term consequences. It is positive with the exception of the highest risk tolerance category. Thus, the appraisals that have the greatest influence on sorting are those with both long and short term financial consequences.

We emphasize that the estimation supports the third hypothesis for all categories of appraisal. The influence of an internal locus of control is at its strongest when workers have

low risk tolerance and it shrinks as their risk tolerance grows. We also note that the role of risk tolerance itself is not in doubt. It plays a positive role in sorting toward performance appraisals and this role is strongest for those with an external locus of control. Thus, all in all, the division between long- and short-term consequences continues to support for all three hypotheses. The refinement found is that sorting is strongest on appraisals with both short and long-term consequences.

Figure 2.2: Average marginal effects of locus of control on the probability of receiving performance appraisal for different types of financial consequences
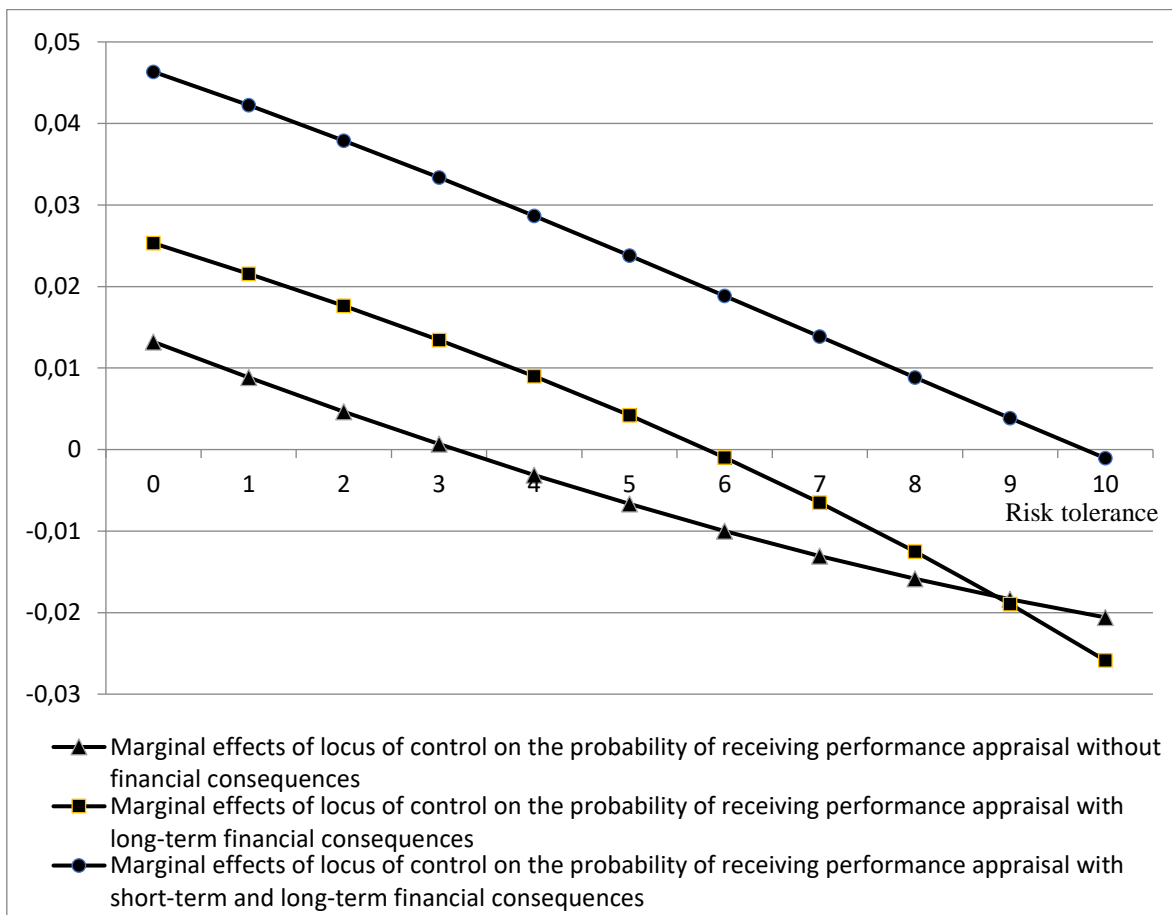
Note: Calculation of marginal effects is based on the regression presented in Table 2.9.

Finally, we perform the regressions with the interaction variable for the East German sample. Tables 2.10 and 2.11 in the Appendix show that the estimates differ sharply from

those for West Germany. Most coefficients are insignificant and there appears to be no coherent pattern. This again confirms the contention that there remain still deep behavioral differences between East and West Germans.

2.5.3 Robustness Checks

Finally, we present a series of tests that increase confidence in the basic pattern of results. The corresponding tables can be found in the Appendix. In Table 2.12, we relax the linearity assumptions regarding our two key explanatory variables and replace the indices for locus of control and risk tolerance with dummy variables for an above-average locus of control and an above-average risk tolerance. This exercise confirms our results. For West Germany, the two dummy variables take significantly positive coefficients while their interaction emerges with a significantly negative coefficient. No consistent pattern is evident for East Germany.

As stressed in section 2.4.6, we examine the sorting into performance appraisal along personality traits by controlling for the complexity of jobs. This approach requires job complexity not be perfectly correlated with either locus of control or performance appraisals. Table 2.13 provides descriptive statistics on our key variables separately for each of the five categories of the job autonomy variable (one crucial proxy for complexity of tasks). Reflecting Table 2.5, the share of workers receiving performance appraisals with financial consequences is more pronounced among the higher autonomy categories while the share of workers receiving performance appraisals without financial consequences is somewhat larger in the lower categories. Importantly, Table 2.13 shows that performance appraisals exist across all autonomy categories and are not perfectly correlated with those categories.

Furthermore, Table 2.13 provides the distribution of workers with an above-average locus of control and an above-average risk tolerance across the five autonomy categories.

While the share with an above-average locus of control increases in job autonomy, the share with an above-average risk tolerance is largest in the lowest and in the highest autonomy category. Again, above-average locus of control and above-average risk tolerance are clearly distributed across all autonomy categories.

As a further check, Table 2.14 provides the distribution of the key variables for five broadly defined industries. That table shows workers receiving performance appraisals, having an above-average locus of control and an above-average risk tolerance exist in each industry.

Finally, we recognize that our five-scale variable for job autonomy might capture the complexity of tasks only imperfectly. Thus, as our final robustness check, we replace the autonomy variable with 23 detailed occupation dummies. As shown in Table 2.15, this robustness check also confirms our results.

2.6 Conclusions

Recognizing basic personality traits as drivers of economic choices has been hailed as an important addition to the perspective of labor economists and others interested in worker behavior. Among these traits, seen as largely fixed in grown adults, the locus of control seems central for understanding the sorting of workers across jobs. We focus on performance appraisals systems arguing that workers who think they control outcomes will see such systems as a method for accomplishing their objectives while workers who don't think they control outcomes will view them as random noise at best. Thus, our fundamental assertion has been that workers with an internal locus of control will sort into jobs with performance appraisals. The evidence on this association is very clear for West Germany. The association is strongest for appraisals with financial consequences. This confirms the hypothesis that

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extrinsic rewards play an important role in the sorting of workers with an internal locus of control. However, the estimates also suggest that intrinsic motivation plays a role as an association, albeit weaker, even emerges with performance appraisals without financial consequences. This supports the hypothesis that workers with an internal locus also sort into performance appraisal because they expect positive feedback reinforcing their feeling of competence and self-esteem.

Finally, the results on the interaction routinely support the anticipated tension between the locus of control and risk tolerance. Locus of control plays a larger role in sorting into appraisals when workers have a low risk tolerance. As risk tolerance grows, workers are more likely to be in a job with performance appraisal but the influence of the locus of control on that sorting diminishes. Thus, while both risk tolerance and an internal locus make a job with performance appraisal more likely, the combined influence is smaller than the addition of the two individual influences.

The estimates for East Germany show no association between locus of control and performance appraisal. This fits the notion that there remain deep behavioral differences between East and West Germans. One explanation could be that East and West Germans differ in the domains in which they live out their personality traits. The former coercive regime of East Germany may have led people to primarily live out an internal locus of control in the private sphere, but not at work. By contrast, West German workers may have developed a more generalized locus of control as they have grown up in a political system permitting much more freedom in the public sphere. This implies that locus of control plays a role in their labor market behavior. Future research could fruitfully examine this explanation in more detail.

Also, left for future work is whether there are other differences across jobs that the locus of control may influence. We have consciously limited our attention to the private sector as the nature of performance appraisals is more homogenous. Yet, we recognize that appraisals are increasingly common in the public sector and this may provide a valuable avenue for future research.

2.7 Appendix

Table 2.10: Determinants of receiving performance appraisal; interaction of locus of control with risk tolerance (East Germany)

	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	0.394	0.122	0.532	0.227
	(1.31)	(0.48)	(1.45)	(0.83)
Risk tolerance	0.464	0.014	0.604	0.087
	(1.58)	(0.06)	(1.65)*	(0.32)
Locus of control x risk tolerance	-0.087	-0.006	-0.115	-0.023
	(1.47)	(0.13)	(1.57)	(0.42)
Personality Traits	---	---	Included	Included
Log-likelihood	-526.374		-401.806	
N	891		692	

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. * Statistically significant at the 10% level. Control variables are included in the regressions, but are suppressed to save space. In addition to the basic control variables, regression (2) also includes the variables for patience, reciprocity, trust, and the Big Five.

Table 2.11: Determinants of the financial consequences of performance appraisals (East Germany)

	No financial consequences	*Short-term consequences*	*Long-term consequences*	*Short-term & long-term consequences*
Locus of control	0.477	0.687	-0.921	0.142
	(1.33)	(1.84)*	(1.56)	(0.49)
Risk tolerance	0.589	0.503	-0.821	0.018
	(1.67)*	(1.28)	(1.52)	(0.07)
Locus of control x risk tolerance	-0.112	-0.099	0.195	-0.019
	(1.55)	(1.30)	(1.74)*	(0.35)
Log-likelihood	-433.624			
N	669			

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. * Statistically significant at the 10% level. Control variables are included in the regressions, but are suppressed to save space. In addition to the basic control variables, regression (2) also includes the variables for patience, reciprocity, trust, and the Big Five.

Table 2.12: Determinants of receiving performance appraisal; dummy variables for locus of control and risk tolerance

	West Germany			
	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Above-average locus of control	0.282	0.285	0.380	0.338
	(1.65)*	(2.13)**	(1.82)*	(2.11)**
Above-average risk tolerance	0.312	0.460	0.484	0.461
	(1.81)*	(3.38)***	(2.35)**	(2.80)***
Above-average locus of control x above-average risk love	-0.450	-0.311	-0.596	-0.450
	(1.94)*	(1.76)*	(2.17)**	(2.16)**
Log-likelihood	-1577.206		-1143.098	
N	2,630		1,941	

	East Germany			
	(3)		(4)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Above-average locus of control	0.272	-0.033	0.235	0.055
	(0.933)	(0.13)	(0.73)	(0.19)
Above-average risk love	0.554	0.123	0.420	0.080
	(2.08)**	(0.52)	(1.41)	(0.29)
Above-average locus of control x above-average risk love	-0.766	-0.052	-0.831	-0.051
	(2.02)**	(0.16)	(1.87)*	(0.29)
Log-likelihood	-525.508		-401.746	
N	891		692	

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Control variables are included in the regressions, but are suppressed to save space. In addition to the basic control variables, regressions (2) and (4) also include the variables for patience, reciprocity, trust, and the Big Five.

Table 2.13: Relative frequencies of key variables by job autonomy

Job autonomy score	Appraisal without financial consequences	Appraisal with financial consequences	Above-average locus of control	Above-average risk tolerance
1	0.074	0.117	0.423	0.610
2	0.064	0.156	0.436	0.594
3	0.068	0.266	0.510	0.567
4	0.034	0.505	0.593	0.590
5	0.011	0.319	0.702	0.734

The table shows the relative frequency of the respective key variable for each score of the job autonomy variable.

Table 2.14: Relative frequencies of key variables by industry

Industry	Appraisal without financial consequences	Appraisal with financial consequences	Above-average locus of control	Above-average risk tolerance
Construction	0.024	0.121	0.514	0.652
Agriculture	0.034	0.103	0.431	0.638
Manufacturing	0.044	0.347	0.511	0.605
Retail & tourism	0.070	0.174	0.472	0.599
Services	0.075	0.281	0.502	0.554

The table shows the relative frequency of the respective key variable for each of the five broadly defined industries.

Table 2.15: Determinants of receiving performance appraisal; detailed control variables for occupations

	West Germany			
	(1)		(2)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	0.319	0.409	0.307	0.571
	(2.03)**	(2.93)***	(1.74)*	(3.55)***
Risk tolerance	0.386	0.376	0.371	0.491
	(2.33)**	(2.79)***	(1.99)**	(3.11)***
Locus of control x risk tolerance	-0.081	-0.061	-0.077	-0.089
	(2.46)**	(2.28)**	(2.09)**	(2.84)***
Log-likelihood	-1549.682		-1116.252	
N	2,629		1,940	

	East Germany			
	(3)		(4)	
	Appraisal without financial consequences	*Appraisal with financial consequences*	*Appraisal without financial consequences*	*Appraisal with financial consequences*
Locus of control	0.386	0.114	0.558	0.298
	(1.24)	(0.44)	(1.46)	(1.04)
Risk tolerance	0.465	-0.014	0.608	0.116
	(1.58)	(0.06)	(1.63)	(0.42)
Locus of control x risk tolerance	-0.087	-0.003	-0.114	-0.028
	(1.48)	(0.07)	(1.55)	(0.50)
Log-likelihood	-519.858		-389.638	
N	891		692	

Method: Multinomial probit. Base category: No performance appraisal. The table shows the estimated coefficients. Z-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Control variables are included in the regressions, but are suppressed to save space. In addition to the basic control variables, regressions (2) and (4) also include the variables for patience, reciprocity, trust, and the Big Five. In all regressions, the variable for job autonomy is replaced by 23 detailed occupation dummies.

3. Too Stressed to Sleep? Job Insecurity and Sleep Behavior

Abstract: This study uses German data to investigate the impact of perceived job insecurity on quality and quantity of sleep. To address the potential endogeneity of job insecurity, media coverage on downsizing serves as instrument. Using this strategy, I show that perceived job insecurity decreases satisfaction with sleep by 6.9 percent. Moreover, job insecurity leads to a decrease in sleep duration by roughly 4 minutes per day. The study further investigates the role of work stress as a potential mechanism. Based on the IV approach, I find evidence that job insecurity strongly affects workers' perceived capability to cope with work stress. The results show that insecure workers think more intensively about work problems before and after bedtime which likely results in sleep difficulties.

3.1 Introduction

Insufficient sleep has become a public health problem in Germany and many other industrialized countries. According to the National Sleep Foundation (2013), 36 percent of the German adults sleep less than 7 hours on a workday.[19] Moreover, the study reports that 63 percent of the German respondents state they are not getting enough sleep on a regular basis. These numbers should be alarming, as a large body of medical literature suggests that sleep deprivation is strongly associated with physical and mental illness and even higher risk of mortality (see Cappuccio et al. 2010 for a review). Inadequate sleep, however, is also of economic importance. Hafner et al. (2016) estimates that 200,000 working days are lost each year in Germany due to sickness absence and presenteeism caused by a lack of sleep. Furthermore, a growing number of economic studies based on quasi-random experiments and instrumental variable approaches points out the benefits of longer sleep duration. More sleep increases health (Giuntella et al. 2017, Jin and Ziebarth 2015), academic performance (Heissel and Norris 2017), cognitive skills (Giuntella et al. 2017), and income (Gibson and Shrader 2018). Sufficient sleep also lowers the probability of having a fatal crash (Smith 2016) and a work accident (Lombardi et al. 2012).

Given its far-reaching consequences, economists have paid remarkably little attention to the determinants of sleep deprivation.[20] This is surprising as economic conditions and particularly workplace characteristics play an important role in explaining health status. The U.S. Centers for Disease Control and Prevention (1999) state "Problems at work are more

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[19] The recommended amount of sleep for an adult is 7 to 9 hours per night (Watson et al. 2015).

[20] The economic analysis of sleep began in the 1970s with a short paper by El-Hodiri (1973), which was discussed and continued by Bergstrom (1976) and Hoffman (1977). The authors developed a simple demand for sleep model. The first formal economic analysis of the sleeping decision was conducted by Biddle and Hamermesh (1990). The authors show theoretically and empirically that sleep time is not fixed but responds to economic incentives.

strongly associated with health complaints than are any other life stressor". The goal of this paper is to investigate the consequences of a major life stressor – namely job insecurity – on quality and quantity of sleep.

Job insecurity is likely to be a key determinant of insufficient sleep, as previous studies underline its relevance for workers' health and well-being. Perceived job insecurity has a strong negative impact on life satisfaction (Green 2011, Knabe and Rätzel 2011) and mental health (Bünnings et al. 2017, Cottini and Ghinetti 2018, Reichert and Tauchmann 2017). Moreover, job insecurity has been found to be negatively associated with general health (Caroli and Godard 2016, Ferrie et al. 2005, Otterbach and Sousa-Poza 2016).

Nonetheless, the relationship between job insecurity and sleep has been neglected so far. A few studies have investigated the effect of local unemployment on sleep duration. Using data from the American Time Use Survey (ATUS), Antillon et al. (2014) find a positive association between regional unemployment and sleep duration within the population at large. Brochu et al. (2012) use Canadian time use data and also show that people sleep more if the regional unemployment rate is high. If higher regional unemployment increases job insecurity, the findings of those studies may suggest that job insecurity also has a positive effect on sleep duration. However, Brochu et al. further show that the effect of regional unemployment on sleep fades away for females and decreases substantially in magnitude for males, when they reduce the sample to working respondents. The authors conclude that the positive impact of local unemployment on sleep is mainly driven by unemployed individuals moving in and out of employment. Those individuals sleep more when being unemployed during bad times (high unemployment) but reduce sleeping when being back in employment during good times (low unemployment). This is in line with results

presented by Asgeirsdottir and Olafsson (2015). Using ATUS data, the authors find no relationship between local unemployment and sleep duration for working respondents.

While macroeconomic factors seem to be less relevant for workers' sleep, working conditions at the micro level are important determinants. A small but growing economic literature suggests that difficulties at work are primarily negatively associated with sleep duration. The studies show that sleep time is lower if workers commute to work and work irregular hours (Hafner et al. 2016), cannot adjust working hours for personal matters (Haley and Miller 2015), and feel unfairly paid (Pfeifer 2015). Moreover, Knudsen et al. (2007) find significant negative effects of work overload and role conflict on sleep duration.

While economists are predominant silent on what drives the effects of working conditions on sleep, psychologists have demonstrated the relevance of stress to sleep behavior. The strand of research shows that stress is an important determinant of poor sleep, as stress responses raise hormonal levels (such as cortisol) that make it difficult to come to rest (e.g., Espie 2002, Morin et al. 2002). In particular, preoccupation with stress and worries at bedtime results in lower sleep efficiency and higher percent wake (Akerstedt et al. 2007). Work stress plays a particularly important role in this context, as it is one of the most frequently cited causes of sleeping difficulties by workers themselves (Henry et al. 2008, Linton 2004). Several studies, mostly psychological or biomedical in nature, have examined work factors resulting in stress and their implications for the development of sleep problems. They find that work stress, typically measured as indices consisting of items reflecting job demands, job control, job social support, and effort-reward imbalance, is significantly related to insufficient sleep (e.g., Kalimo et al. 2000, Lallukka et al. 2010, Linton et al. 2015, Ota et

al. 2005).[21] Much of this reasoning, however, is based on cross-sectional data and neglects the issue of causality. Moreover, they do not consider the relationship between job insecurity and sleep behavior.

A second channel through which a potential relation between job insecurity and sleep may operate is the allocation of time. Many adults spend about one-third of most days on the job, a third for leisure activities, and another third sleeping. If individuals decide to spend more time in employment, they obviously have to reduce leisure time or sleeping. Biddle and Hamermesh (1990) show in their pioneering work that sleep time is not fixed but the result of a conscious choice. They show that economic incentives not only affect workers labor-leisure choice but also the choice about time spent sleeping. Biddle and Hamermesh demonstrate that higher wages lead to a decrease in sleep time among men. Furthermore, the authors show that higher working hours reduce time spent sleeping. Accordingly, if decisions about sleep time cannot be separated from decisions about labor supply, one may expect that job insecurity also induces workers to reallocate their time use. Workers suffering from job insecurity likely want to improve their employment prospects with the current firm. Hence, they may invest more time in the labor market (e.g., working overtime) to signal high effort and thereby increase the chances of keeping their job. As spending more time on the job may demand spending less time sleeping, higher effort can also explain a potential negative effect of job insecurity on sleep time.

In this study I test the hypothesis that job insecurity has a negative impact on quality and quantity of sleep. While previous evidence on job characteristics and sleep comes

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[21] The studies employ two work stress models which are widely-used in psychology. The demand-control-support model (Karasek 1979, Johnson and Hall 1988) evaluates work stress by measuring the imbalance between job demands, job control, and job social support. The effort-reward model (Siegrist 1996) proposes that an imbalance between effort and reward exerts stress on workers.

primarily from correlations, this study addresses potential endogeneity in an attempt to identify a causal link. To this end, I exploit exogenous variation in perceived job insecurity by using media coverage on downsizing as an instrument. I assume that workers tend to report higher job insecurity if they receive information on layoffs before the survey interviews take place. Hence, job insecurity is instrumented by the number of media reports covering downsizing on the days prior to the interview. Besides establishing a link between job insecurity and sleep, the present study also tries to shed light on potential mechanisms underlying the relationship. For this purpose, I test if work stress and effort serve as transmission channels.

The results show that job insecurity strongly affects sleep behavior. Initial fixed effects estimations suggest that job insecurity significantly decreases satisfaction with sleep and sleep duration. To allow for endogeneity, I estimate treatment effects models. The instrumental variable approach confirms the results. Suffering from job insecurity lowers satisfaction with sleep by 6.9 percent and decreases sleep duration by 4 minutes per day. I further identify a link between job insecurity and individuals' perceived capability to cope with work stress. The results show that job insecurity increases the probability that workers cannot stop thinking about their job in the evening and after waking up. Furthermore, they exhibit more often sleep problems due to work issues. I find no evidence that workers decrease sleep time to increase work effort.

I contribute to the literature by providing the comprehensive analysis investigating the impact of perceived job insecurity on satisfaction with sleep and sleep duration. The two outcomes are particularly suitable for analysis, as I believe that they respond more quickly to changes in sleep behavior than objective indicators (e.g., sleep disorders diagnosed by a

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doctor). Therefore, sleep duration and sleep satisfaction may be more likely to capture short- and long-term effects of job insecurity. Furthermore, I extend previous literature by considering individuals' difficulties to cope with work stress during leisure time as additional outcomes. By doing so, I not only identify a potential mechanism that helps to understand the effects of job insecurity on sleep behavior but also shed light on the role of job insecurity for the quality of waking leisure time.

In what follows, the next section presents the data, variables, and methodology. Section 3.3 provides the results and the last section concludes.

3.2 Empirical Framework

3.2.1 The Data Set

The present study is based on data from the German Socio-Economic Panel (SOEP), a representative longitudinal panel of private households in Germany. Annually, the SOEP conducts interviews with more than 20,000 individuals in over 11,000 households on living conditions in Germany (Wagner et al. 2007). The interviews are carried out between January and November, where primarily face-to-face interviews are used. In practice, interviewers conduct their interviews over a pre-defined period of a couple of months. Within that period, interviewers arrange the interview independently with the respondent by offering interview dates. If the respondent rejects the suggested dates, the interviewer offers new dates. The interviews are usually scheduled several days in advance.

The main empirical analysis is restricted to the years 2008 to 2012, as information on the key variables is not available before this period. The sample consists of workers between 18 and 65 years of age. I exclude civil servants and workers who work less than 15 hours per

week. Job insecurity may be less relevant for the two groups, as civil servants enjoy a stricter dismissal protection and workers with a low number of weekly working hours are likely to have a different source of income. Nonetheless, I include both groups in a robustness check.

3.2.2 Variables

The study uses two outcome variables in the main analysis. The first dependent variable is *satisfaction with sleep*. In the SOEP, respondents are asked to evaluate their sleep on an eleven-point scale ranging from 0 (completely dissatisfied) to 10 (completely satisfied). For the second outcome I consider *sleep duration* measured in hours. The variable is based on the question "How many hours do you sleep on average on a working day?". Information on the two outcome variables is available from 2008 onwards. Table 3.1 reports definitions and descriptive statistics of the variables used in this study.

Table 3.1: Variable definitions and descriptive statistics

Variable	Description	Mean (Std. dev.)
Satisfaction with sleep	Score of satisfaction with sleep on an eleven-point Likert scale that ranges from 0 "completely dissatisfied" to 10 "completely satisfied".	6.960 (2.151)
Sleep duration	The worker's average sleep duration on a working day in full hours.	6.857 (0.995)
Thinking of work all evening[a]	Workers respond on a four-point scale how strongly they agree with the statement "Work seldom lets go of me, it stays in my head all evening".	2.166 (0.906)
Finding it hard to unwind from work[a]	Workers respond on a four-point scale how strongly they agree with the statement "When I come home, it is very easy for me to unwind from work". The scale is recoded in reverse order.	2.277 (0.929)
Sleep problems due to work[a]	Workers respond on a four-point scale how strongly they agree with the statement "If I put off something that needs to be done that day, I cannot sleep at night".	1.946 (0.872)
Thinking of work when waking up[a]	Workers respond on a four-point scale how strongly they agree with the statement "I am often already thinking about work-related problems when I wake up".	2.170 (0.944)
Actual working hours[a]	Actual working hours per week including overtime.	39.913 (10.200)
Overtime last month[a]	Incidence of overtime last month.	0.735 (0.441)

Overtime hours[a]	Number of overtime hours worked last month.	19.177 (17.180)
Overcommitment[a]	Workers respond on a four-point scale how strongly they agree with the statement "Those closest to me say I sacrifice myself too much for my career".	2.261 (0.941)
Job insecurity	Dummy equals 1 if the worker is very concerned about job insecurity.	0.134 (0.341)
Female	Dummy equals 1 if the worker is female.	0.474 (0.499)
Migration background	Dummy equals 1 if the worker has migration background.	0.176 (0.381)
Age	The worker's age in years.	42.758 (11.352)
Skilled	Dummy equals 1 if the worker's highest educational attainment is a completed vocational training.	0.590 (0.492)
University degree	Dummy equals 1 if the worker holds a university degree.	0.316 (0.465)
Married	Dummy equals 1 if the worker is married.	0.584 (0.493)
Number of children	Number of children under age 16 in the household.	0.552 (0.868)
Unemployment experience	The worker's unemployment experience in years.	0.624 (1.569)
Log(income)	Log of labor income.	7.231 (0.663)
Blue-collar	Dummy equals 1 if the worker is a blue-collar worker.	0.282 (0.450)
Self-employed	Dummy equals 1 if the worker is self-employed.	0.018 (0.131)
In education	Dummy equals 1 if the worker is in education.	0.041 (0.199)
Part-time	Dummy equals 1 if the worker is a part-time worker.	0.209 (0.407)
No agreed working hours	Dummy equals 1 if the worker has no contractually agreed working hours.	0.091 (0.287)
Fixed-term	Dummy equals 1 if the worker holds a fixed-term contract.	0.134 (0.341)
Tenure	The worker's tenure in years.	11.171 (10.045)
Firm size dummies	4 firm size dummies (less than 20 employees; 20 to 199 employees; 200 to 1999 employees; 2000 or more employees).	---
Sector dummies	6 sector dummies (construction; manufacturing; finance; services; retail, tourism and transport; agriculture).	---
Media coverage	Detrended sum of media reports covering downsizing on the date of the SOEP interview and the six days prior to the interview.	8.522 (62.883)

The table shows means, with standard deviations in parentheses. The reference group of the education dummies (occupational status dummies, working time dummies) consists of unskilled workers (white-collar workers, full-time workers). Note that the regressions also include state fixed effects and month-year dummies. N=35,866.
[a] Descriptive statistics are based on the samples of the respective regressions.

Descriptive statistics provide first evidence that insufficient sleep may be an issue. Average sleep duration on a working day amounts to 6.86 hours and, hence, is lower than the recommended 7 to 9 hours (Watson et al. 2015). Satisfaction with sleep has a mean value of 6.96.

In the subsequent analysis I examine if work stress and effort serve as transmission channels. For this purpose, I consider individuals' perceived difficulties to cope with job-related stress after work as additional outcomes. In the waves 2006 and 2011 individuals were asked on a four-point scale how strongly they agree with the following statements: "Work seldom lets go of me, it stays in my head all evening", "When I come home, it is very easy for me to unwind from work", "If I put off something that needs to be done that day, I cannot sleep at night", and "I am often already thinking about work-related problems when I wake up". For the second statement I change the order of the scale, so that for all four outcomes higher values indicate bigger problems to recover from work-related stress. To investigate the role of effort, the study employs *actual working hours* per week, incidence of *overtime last month*, and the number of *overtime hours* worked last month as outcome variables. Information on the variables is available for the entire period under investigation. The last outcome variable measures perceived effort (*overcommitment*). In the waves 2006 and 2011 workers were asked how strongly they agree with the statement: "Those closest to me say I sacrifice myself too much for my career". Workers responded on a four-point scale where higher values indicate stronger approval.

The explanatory variable of primary interest is perceived job insecurity. In the SOEP, respondents are asked whether they are very concerned, somewhat concerned or not concerned at all about job security. Based on this information, I construct a dummy variable

for job insecurity which is equal to 1 if an employee is very concerned about job security. Although perceived job insecurity is subjective, it can be considered as an adequate measure for actual job insecurity, as Dickerson and Green (2012) have demonstrated the predictive power of self-reported job insecurity for actual future unemployment. Descriptive statistics show that 13.4 percent of the workers in the sample report job insecurity.

I add control variables for gender, migration background, age, educational attainment, marital status, number of children, and unemployment experience. The estimations also include contractual working hours, labor income, occupational status, tenure, firm size, and sector dummies as job-related characteristics. Finally, I add state fixed effects and a large set of month-year dummies.

3.2.3 Methodology

For the initial analysis I estimate pooled OLS models:

$$Y_{it} = \alpha J_{it} + \beta' \boldsymbol{v}_{it} + \epsilon_{it}, \tag{1}$$

where Y_{it} is one of the outcomes of interest for individual i at year t and J_{it} is a dummy variable for job insecurity. $\boldsymbol{v}_{it}$ is a vector of control variables and ϵ_{it} is the error term.

However, the precise nature of the causal link between job insecurity and sleep is not clear. On the one hand, this study hypothesizes that suffering from job insecurity leads to insufficient sleep. On the other hand, there are good reasons to believe that causality may run in the reverse direction. Workers who do not get enough sleep on a regular basis are less productive and more often on sick leave (Hafner et al. 2016), which likely results in higher job insecurity. Ahammer (2018) shows in this context that sickness-related absence increases the probability to become unemployed. One also needs to consider unobserved factors which

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influence both job insecurity and sleep, such as health-conscious behavior. A health-conscious individual may be more prone to practice a healthy lifestyle by getting more hours of sleep and sort into a job that provides lower job insecurity. In this case the bias due to omitted variables is likely to be negative. Source of a positive bias could be the economic situation of a worker's firm. In a profitable firm where overtime is well-paid, workers may decrease sleep time to work additional hours. Moreover, a thriving firm that does not dismiss but rather increases the workforce likely provides higher job security. Overall, job insecurity is likely to be endogenous and ignoring unobservable heterogeneity or reverse causality can bias the results.

Controlling for individual fixed effects eliminates endogeneity originating from time-invariant unobserved heterogeneity. Thus, I estimate linear fixed effects regressions of the following form:

$$Y_{it} = \gamma J_{it} + \delta' x_{it} + \varepsilon_{it} + \vartheta_i, \tag{2}$$

where x_{it} is a vector of time-varying control variables, ε_{it} is the error term, and ϑ_i is an individual-level fixed effect.

As fixed effects models only address endogeneity stemming from time-invariant unobserved heterogeneity, I additionally apply an instrumental variable approach. More precisely, I estimate treatment effects models (Greene 2003, 787-789). Treatment effects regressions, in contrast to standard instrumental variable estimators, do not treat binary endogenous variables as continuous. Instead, they specifically take into account the binary nature of the treatment and, hence, are as least as efficient as standard IV estimators (Vella and Verbeek 1999). In practice, the treatment effects model estimates the probability of receiving a treatment with a probit model, while the treatment in turn is included in a linear

regression. As the potentially endogenous variable job insecurity is a dummy variable, the treatment effects model seems a suitable estimator. Thus, I estimate the following linear regression augmented with the endogenous binary-treatment variable J_{it}:

$$Y_{it} = \theta J_{it} + \rho' \boldsymbol{v}_{it} + \omega_{it}, \tag{3}$$

where ω_{it} is the error term. Based on a latent variable approach, the treatment effects model assumes that the treatment J_{it} depends on a latent variable J_{it}^*:

$$J_{it} = \begin{cases} 1, & J_{it}^* = \varphi' \boldsymbol{v}_{it} + \mu Z_{it} + \tau_{it} > 0 \\ 0, & J_{it}^* = \varphi' \boldsymbol{v}_{it} + \mu Z_{it} + \tau_{it} \leq 0 \end{cases} \tag{4}$$

where Z_{it} is an instrumental variable. The coefficients of equations (3) and (4) are estimated simultaneously by full information maximum likelihood. To estimate the model, one has to make an (untestable) distributional assumption regarding the error terms, namely that ω_{it} and τ_{it} follow a bivariate normal distribution.[22] While some may consider the assumption as too strong, Vella and Verbeek (1999) provide convincing evidence that this is more of a minor issue. Using Monte Carlo simulations, the authors show that treatment effects models and standard IV models yield similar results, even in the absence of normality. Moreover, if the assumption holds, the treatment effects model tends to be more efficient than standard IV frameworks. However, as standard IV models require less assumptions, I estimate Two-Stage-Least-Squares (2SLS) models as a check of robustness.

3.2.4 Instrument

The instrumental variable used in this study is the number of media reports covering downsizing. The instrument is based on the assumption that a high quantity of press releases

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[22] By assuming that τ_{it} is normally distributed, equation (4) becomes a probit model. If one assumes that τ_{it} follows a logistic distribution, it generates a logit model.

on downsizing directly affects an individual's perceived job security. Previous empirical evidence supports this contention by showing a strong relationship between media coverage and peoples' perceptions (Chadi 2015, Lamla and Lein 2015).[23] Garz (2012) links news reports of labor market policy to subjective job insecurity and shows that job insecurity increases in years with greater quantity of news coverage.

To investigate the effect of news of layoffs on perceived job insecurity, I exploit the fact that companies intending to downsize usually provide an amount of forewarning to the employees. Hence, employers notify workers and authorities some time in advance of an upcoming mass layoff. These announcements, in turn, are taken up by the media and are widely publicized.[24] This procedure commonly adopted by companies and media provides an interesting time delay in which the workers have received the news of the layoff event, but the event itself has not yet taken place. More precisely, this approach allows to analyze the effect of news of job losses on workers' perceived job insecurity while being able to mitigate the direct consequences of job loss.

Media reports on downsizing may affect perceived job insecurity in several ways. In a few cases the media reports on downsizing refer to the worker's company. The worker is directly affected and will lose his job in the near future. Consequently, the worker suffers from real job insecurity. In most cases, however, the worker is not directly affected, as the media refer to another company. Nevertheless, the worker can still report higher job insecurity after consuming press releases on downsizing, even if he does not lose employment. This could be the case if the worker considers the layoffs "contagious" and

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[23] Chadi (2015) links media coverage on the euro crisis to concerns about the euro currency. Lamla and Lein (2015) investigate the effect of news reports on the euro cash changeover on inflation perceptions.
[24] See Friebel and Heinz (2014) for a discussion on the temporal structure of media coverage of downsizing.

expects the job cuts to extend to other companies. Goins and Gruca (2008) provide evidence on contagion effects of layoff announcements for the US oil and gas industry. The authors show that shareholders respond negatively to layoff announcements and that the negative effects spillover to non-announcing firms.

Information on quantity of media reports is provided by the database *LexisNexis*, a database that is commonly used for media-based analysis (e.g., Chadi 2015, Groseclose and Milyo 2005, Lamla and Lein 2015). The databank contains press releases from most of German print and online media, such as *Der Spiegel*, *Die Welt*, or *Die Zeit*. To obtain the number of media reports, I run *LexisNexis*' search tool with the term 'downsizing'. The database computes the number of media reports that contain the word 'downsizing' for each day of the period under investigation. A day's total number of reports covering downsizing is then matched with the exact dates of the SOEP interviews. For the instrument, I use the sum of media reports on the day of the interview and the six days prior to the interview. As Friebel and Heinz (2014) point out the issue of time trends in the analysis of news reports on downsizing, the present study includes a rich set of month-year dummies to control for seasonal differences and temporal effects. Moreover, I clean the instrument from its trend before it enters the analysis. For this purpose, I regress the sum of media reports on a linear and a quadratic time trend and a constant. The residuals of such a regression form the detrended variable used as instrument.[25]

A day's number of press releases on downsizing varies between 0 and 95, where a higher number indicates the extent of downsizing on that particular day. The extent of downsizing can either refer to a single company's behavior or to several events. For example,

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[25] Note, however, that this is not a major issue, as the results do not change qualitatively or quantitatively, if I do not detrend the instrument. The results are available from the author upon request.

on June 22nd 2006 the company *Allianz*, one of the world's largest insurance companies headquartered in Munich, Germany, announced to cut 7,500 jobs. The announcement was covered by 95 media reports. Searching for the term 'downsizing' in the *LexisNexis*' database on July 18th 2012 leads to 93 media reports. On that day three retail companies announced to lay off 4,230 employees in total.

Media coverage is used as an instrument under the assumption that individuals report higher job insecurity if they receive information on downsizing prior to the SOEP interview. If individuals read media reports on mass layoffs before the interviews take place, it is likely that they are more concerned about current job security. Since interview dates are not chosen in anticipation of downsizing events, media coverage on downsizing is considered as an exogenous source of variation in job insecurity.

3.3 Results

3.3.1 Main Results

Table 3.2 reports estimates from pooled OLS models and linear fixed effects regressions. The main finding is that job insecurity is negative and significant across all four regressions. In the pooled OLS models, workers suffering from job insecurity are by -0.681 points less satisfied with sleep. As satisfaction with sleep has a mean value of 6.96, the coefficient implies a decrease from the mean by 9.8 percent. Job insecurity and sleep duration are also significantly negatively associated. The coefficient of -0.113 indicates a decrease in sleep duration by 6.5 minutes per day. When looking at the fixed effects estimates, the coefficients decrease in magnitude in absolute terms but remain statistically significant. Suffering from job insecurity decreases satisfaction with sleep by 2 percent with respect to the mean of the

Table 3.2: The effects of job insecurity on satisfaction with sleep and sleep duration

	Pooled OLS		Fixed effects	
	(1) Satisfaction with sleep	(2) Sleep duration	(3) Satisfaction with sleep	(4) Sleep duration
Job insecurity	-0.681***	-0.113***	-0.156***	-0.040**
	(0.046)	(0.021)	(0.037)	(0.018)
Female	-0.124***	0.096***		
	(0.043)	(0.020)	-	-
Migration background	0.094**	0.007		
	(0.048)	(0.022)	-	-
Age	-0.056***	-0.033***	0.020	-0.314
	(0.013)	(0.006)	(0.418)	(0.228)
Age squared	0.0004***	0.0003***	-0.0004	0.0003*
	(0.0002)	(0.0001)	(0.0004)	(0.0002)
Skilled	0.099	0.049	0.192	0.025
	(0.068)	(0.032)	(0.167)	(0.089)
University degree	0.168**	0.121***	0.116	0.117
	(0.078)	(0.035)	(0.220)	(0.115)
Married	-0.045	0.086***	-0.086	0.050
	(0.043)	(0.019)	(0.072)	(0.034)
Number of children	0.035	-0.037***	-0.025	-0.006
	(0.022)	(0.010)	(0.035)	(0.019)
Unemployment experience	-0.041***	-0.009	0.066	-0.005
	(0.012)	(0.006)	(0.105)	(0.050)
Log(income)	0.107***	-0.028*	0.049	-0.070***
	(0.036)	(0.017)	(0.051)	(0.025)
Blue-collar	-0.188***	-0.097***	-0.047	-0.019
	(0.046)	(0.021)	(0.055)	(0.027)
Self-employed	0.028	0.100*	-0.074	-0.105
	(0.123)	(0.053)	(0.169)	(0.071)
In education	0.042	-0.043	0.186	-0.136**
	(0.092)	(0.046)	(0.117)	(0.061)
Part-time	0.064	0.089***	0.077	0.050*
	(0.050)	(0.023)	(0.057)	(0.026)
No agreed working time	-0.105*	0.021	0.053	0.051*
	(0.060)	(0.028)	(0.055)	(0.027)
Fixed-term	0.108**	-0.002	0.119**	0.017
	(0.051)	(0.024)	(0.053)	(0.026)
Tenure	0.003	0.002	-0.015	-0.006
	(0.006)	(0.003)	(0.010)	(0.004)
Tenure squared	-0.0002	-1-5e-05	0.0004	0.0001
	(0.0002)	(7.5e-05)	(0.0004)	(0.0001)
Constant	8.867***	7.630***	6.489	20.380**
	(0.585)	(0.278)	(17.684)	(9.628)
R^2	0.042	0.032	0.013	0.010
N	35,866	35,866	31,825	31,825

Years 2008 to 2012. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include firm size dummies, sector dummies, state fixed effects, and month-year dummies. Singleton observations are dropped in the fixed effects estimations. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

dependent variable. The negative effect on sleep duration amounts to roughly 2.5 minutes per day. Although the coefficients produced by the fixed effects models decline in magnitude and, hence, suggest that the pooled OLS results are partly driven by time-invariant unobservables, both estimation methods show that job insecurity is significantly negatively associated with quality and quantity of sleep.

To take into account potential endogeneity originating from reverse causality or time-variant unobserved heterogeneity, I estimate treatment effects models. Table 3.3 reports the results. The estimates of the job insecurity equation in column (1) show that the instrument has a significant effect with the expected sign. Media coverage on downsizing positively affects job insecurity.[26] As the job insecurity equation is a probit model, one cannot directly assess the magnitude of the effect. However, marginal effects show that a one standard deviation increase in media reports results in a 0.6 percentage point higher probability of suffering from job insecurity.[27] Taking into account that the mean of the variable is equal to 13.4 percent, this is an increase in the probability of job insecurity by 5.5 percent.

The treatment effects model confirms the negative influence of job insecurity on satisfaction with sleep. Perceived job insecurity decreases satisfaction with sleep by almost half a score point on an eleven-point satisfaction scale. This is equivalent to a decline of 6.9 percent with respect to the mean of the dependent variable and therefore substantial in magnitude. When looking at the second outcome of interest, I find a significant negative impact of job insecurity on sleep duration. Job insecurity decreases sleep duration by roughly

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[26] The 2SLS models I estimate as a robustness check in chapter 3.3.3 provide a test of weak instrumentation, namely the Sanderson-Windmeijer test. In the first-stage regression the test checks the correlation of the instrument with the endogenous regressor. The test underlines the relevance of the instrument. The F-statistic exceeds the critical rule of thumb value of 10 and emphasizes that the selected instrument is sufficiently strong (Staiger and Stock 1997).

[27] The results are available from the author upon request.

Table 3.3: The effects of job insecurity on satisfaction with sleep and sleep duration; treatment effects regressions

	(1) Job insecurity	(2) Satisfaction with sleep	(3) Sleep duration
Job insecurity	-	-0.483***	-0.069**
		(0.077)	(0.034)
Media coverage	0.001***	-	-
	(0.0002)		
Female	0.101***	-0.131***	0.097***
	(0.029)	(0.043)	(0.020)
Migration background	0.145***	0.091*	0.005
	(0.030)	(0.048)	(0.021)
Age	0.037***	-0.058***	-0.033***
	(0.009)	(0.013)	(0.006)
Age squared	-0.0004***	0.001***	0.0003***
	(0.0004)	(0.0002)	(0.0001)
Skilled	-0.055	0.099	0.050
	(0.039)	(0.068)	(0.032)
University degree	-0.209***	0.169**	0.123***
	(0.048)	(0.078)	(0.035)
Married	-0.006	-0.047	0.084***
	(0.028)	(0.043)	(0.019)
Number of children	0.002	0.036	-0.036***
	(0.015)	(0.022)	(0.010)
Unemployment experience	0.030***	-0.043***	-0.010
	(0.007)	(0.012)	(0.006)
Log(income)	-0.098***	0.112***	-0.027
	(0.023)	(0.036)	(0.017)
Blue-collar	0.243***	-0.203***	-0.099***
	(0.029)	(0.046)	(0.021)
Self-employed	0.035	0.027	0.099*
	(0.090)	(0.123)	(0.053)
In education	-0.228***	0.053	-0.043
	(0.065)	(0.092)	(0.046)
Part-time	-0.143***	0.076	0.089***
	(0.034)	(0.050)	(0.023)
No agreed working time	-0.217***	-0.093	0.023
	(0.046)	(0.060)	(0.028)
Fixed-term	0.533***	0.085*	-0.009
	(0.035)	(0.052)	(0.024)
Tenure	0.001	0.003	0.001
	(0.004)	(0.006)	(0.003)
Tenure squared	-0.0001	-0.0002	-1.4e-05
	(0.0001)	(0.0002)	(7.5e-05)
Constant	-1.159***	7.860***	7.805***
	(0.234)	(0.358)	(0.167)
Rho		-0.052	-0.025
P-value of test of Rho=0		0.001	0.093
N	35,866	35,866	35,866

Method: Treatment effects regression. Years 2008 to 2012. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include firm size dummies, sector dummies, state fixed effects, and month-year dummies. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

4 minutes per day. The correlation coefficients (Rhos) among the error terms of the job insecurity equation and the two outcome equations are negative and significantly different from zero. This indicates that pooled OLS and fixed effects estimations likely suffer from endogeneity. Moreover, the negative correlation between the error terms implies that there are unobservable characteristics which negatively affect job insecurity and positively affect sleep behavior. The finding may confirm a self-selection process. Health-conscious individuals are more prone to get a sufficient amount of sleep and to sort into jobs that provide higher job security. Overall, the results suggest that it is important to take endogeneity into account, as done by the treatment effects models. However, given that the results from the treatment effects models only differ in magnitude but not in sign or significance from the estimates I obtained from the pooled OLS and fixed effects estimations, the bias does not seem to be tremendous.

3.3.2 Work Stress and Effort

To better understand the negative influence of job insecurity on sleep behavior, this section tries to shed light on potential mechanisms. The first mechanism I investigate is work stress. More precisely, I examine how job insecurity affects workers' perceived capability to cope with work stress before they go to bed and after they wake up. Based on psychological evidence outlined in section 3.1, I expect that job insecurity leads to preoccupation with work stress at bedtime which likely results in sleep difficulties. For this purpose, the outcome variables used measure how strongly an individual agrees with four statements indicating problems to recover from work-related stress. Table 3.4 reports estimates from all three estimation methods. In the pooled OLS regressions job insecurity is highly significant and is

Table 3.4: The effect of job insecurity on perceived work stress

	Pooled OLS				
	(1) Thinking of work all evening	(2) Hard to unwind from work	(3) Sleep problems due to work	(4) Thinking of work when waking up	
Job insecurity	0.285*** (0.023)	0.192*** (0.023)	0.228*** (0.022)	0.312*** (0.024)	
R^2	0.074	0.041	0.038	0.071	
N	15,454	15,454	15,454	15,454	
	Fixed effects				
	(1) Thinking of work all evening	(2) Hard to unwind from work	(3) Sleep problems due to work	(4) Thinking of work when waking up	
Job insecurity	0.107*** (0.038)	0.056 (0.046)	0.004 (0.039)	0.131*** (0.043)	
R^2	0.022	0.018	0.021	0.031	
N	7,724	7,724	7,724	7,724	
	Treatment effects				
	(1) Job insecurity	(2) Thinking of work all evening	(3) Hard to unwind from work	(4) Sleep problems due to work	(5) Thinking of work when waking up
Job insecurity	-	0.215*** (0.065)	0.093 (0.063)	0.223*** (0.072)	0.215*** (0.071)
Media coverage	0.002*** (0.0002)	-	-	-	-
Rho		0.046	0.060	0.005	0.060
P-value of test of Rho=0		0.234	0.091	0.905	0.140
N	15,454	15,454	15,454	15,454	15,454

Years 2006 and 2011. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. Singleton observations are dropped in the fixed effects estimations. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

positively associated with all four outcomes. Insecure workers are by 13.1 percent more likely to be thinking of work all evening with respect to the mean of the dependent variable. Respectively, the increase amounts to 8.4 percent in finding it hard to unwind from work, to 11.7 percent in having sleep problems due to work, and to 14.4 percent in thinking of work

when waking up. In the fixed effects regressions job insecurity becomes insignificant for two of the four outcomes. Job insecurity does not affect difficulties to unwind from work or sleep problems due to work anymore. However, I still find that workers suffering from job insecurity are by 4.9 percent more likely to be thinking of work all evening and by 5.9 percent to be thinking of work when waking up.

As endogeneity may also be an issue in these regressions, I additionally estimate treatment effects models. When instrumenting job insecurity, the coefficient remains positive and highly significant for three of the four outcomes. Insecure workers are by 9.7 percent more likely to be thinking of work all evening, by 11.4 percent to have sleep problems due to work, and by 9.9 percent to be thinking of work when waking up. In contrast to the OLS results, finding it hard to unwind from work does not respond to job insecurity. The results may indicate that it is important for a successful recovery from work stress that individuals actively try to release stress. For example, if individuals do sports or meet friends, it is easier for them to recover from work, while workers who do not engage in activities may find it more difficult to cope with job-related problems after work. Hence, if individuals actively try to unwind from work, job insecurity is likely less relevant. This may explain why I do not find a significant influence of job insecurity on this outcome but on the remaining three outcomes. Akerstedt et al. (2007) provide supportive evidence for this contention. The authors show that stress does not affect sleep unless there is a certain degree of preoccupation with stress at bedtime.

The second mechanism considered is effort. To improve their employment prospects with the current firm, workers suffering from job insecurity may increase effort by reallocating their time use. To test the channel, I employ actual working hours per week and

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overtime last month as outcomes. Unfortunately, one cannot estimate treatment effects

regressions. The instrumental variable used in the treatment effects models is based on

information collected in the days prior to the survey interview. Accordingly, the instrument

leads to a variation in perceived job insecurity in the days before the interview and, thus, is

not appropriate for outcomes providing information on the previous months, such as overtime

hours worked in the last month. To investigate the mechanism, I rely on fixed effects

estimations. Table 3.5 presents the results. Perceived job insecurity has a significant negative

Table 3.5: The effect of job insecurity on working time

	(1) Actual working hours	(2) Overtime last month	(3) Overtime hours
Job insecurity	-0.319***	-0.023*	-0.152
	(0.108)	(0.012)	(0.514)
R^2	0.171	0.020	0.025
N	32,499	22,929	15,367

Method: Fixed effects OLS. Years 2008 to 2012. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

impact on actual working hours. Workers reporting job insecurity work roughly 20 minutes

less per week. They are also by 2.3 percentage points less likely to have worked overtime

last month. Job insecurity has no effect on overtime hours once I reduce the sample to

workers who actually worked overtime last month. The results suggest that insecure workers

do not increase effort by working more hours. Individuals, however, can also increase work

effort without working additional hours. For example, a worker can increase effort by

refusing to take breaks while working. Working without breaks throughout the day is likely

to result in severe fatigue, which is hard to compensate for with sufficient sleep. Thus, for a

final check, I run additional regressions where I look at perceived overcommitment by considering agreement with the statement "Those closest to me say I sacrifice myself too much for my career". Table 3.6 reports the estimates. Job insecurity does not have an effect on overcommitment, once I account for endogeneity. The coefficient is insignificant in the

Table 3.6: The effect of job insecurity on overcommitment

	(1) Pooled OLS	(2) Fixed effects	(3) Treatment effects
Job insecurity	0.181*** (0.023)	0.007 (0.040)	0.199 (0.122)
R^2	0.053	0.023	
Rho			-0.009
P-value of test of Rho=0			0.906
N	15,480	7,770	15,480

Years 2006 and 2011. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. Singleton observations are dropped in the fixed effects estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

fixed effects regression and in the treatment effects model. Overall, the results do not indicate that effort plays a role in explaining the relationship between job insecurity and sleep behavior. On the contrary, I find evidence that workers suffering from job insecurity have problems to recover from work stress. Dealing with work problems just before sleep time likely explains why insecure workers sleep less and are less satisfied with sleep. In addition, the results suggest that job insecurity has a substantial impact on individuals' daily lives, as it not only affects sleep time but also their waking leisure time in the morning and evening.

3.3.3 Robustness Checks

I run several checks to test the robustness of the main results. First, I try to increase confidence in the validity of the instrument. For this purpose, I estimate additional

regressions where I (a) lag the instrument by one year and (b) employ placebo outcomes. In the first case, media reports on downsizing in the previous year should have no effect on job insecurity in the actual year. Hence, the coefficient on the lagged instrument should be insignificant. For the second case, I use concerns about the environment and concerns about peace as placebo outcomes. Both outcomes should not respond to media coverage on downsizing if the instrument is valid. Table 3.7 in the Appendix presents the results. The lagged instrument does not emerge with a significant coefficient in column (1). Moreover, the instrument itself remains positive and significant. In columns (2) and (3) media coverage on downsizing is insignificant and thus has no effect on the placebo outcomes. Overall, the results suggest that the instrument is both valid and relevant.

To tackle endogeneity, I estimated treatment effects models in Table 3.3. Treatment effects models, however, rest on an untestable distributional assumption regarding the error terms. As standard IV models require less assumptions, I estimate 2SLS models as a second check of robustness. Table 3.8 in the Appendix reports the estimates. The results are very similar to the ones obtained by the treatment effects regressions, although the estimates increase in magnitude. Job insecurity decreases satisfaction with sleep by 11.1 percent with respect to the mean of the dependent variable, while duration of sleep decreases by 29 minutes per day.

For a final set of robustness checks, I test if the results are driven by specific subgroups. To this end, I include and exclude groups of workers. First, I include civil servants and workers who work less than 15 hours per week again. Second, I exclude workers who are more likely to face job insecurity, namely (a) workers holding fixed-term contracts, (b) workers who do not have a contractually agreed working time, and (c) workers reporting

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tenure of six months or less. Tenure of six months or less may play a role, as new employees of a company are often placed on probationary status which lasts about six months in Germany. During the probationary period, the employer can terminate the employee's contract more easily. The results are reported in Table 3.9 in the Appendix. Overall, the results prove to be robust to all of these changes.

3.4 Conclusions

The consequences of poor sleep are tremendous and well documented. Nevertheless, research on the causes of insufficient sleep is surprisingly limited. In this study, I investigate the influence of perceived job insecurity on sleep behavior. To circumvent the endogeneity of job insecurity, I rely on media coverage on downsizing as instrument. Using this IV strategy, the study shows that job insecurity significantly affects quality and quantity of sleep. Job insecurity decreases satisfaction with sleep by 6.9 percent. As this is equivalent to a decline of almost half a score point on the satisfaction scale, the effect is substantial in magnitude. The results further show that job insecurity decreases sleep duration by roughly 4 minutes per day.

To better understand the influence of job insecurity on sleep, the present study examines the roles of work stress and effort. Based on the IV approach, I provide evidence that job insecurity strongly affects workers' perceived capability to cope with work stress. The estimates show that insecure workers have problems to stop thinking about their job before and after bedtime which likely results in lower quality and quantity of sleep. In contrast, I find no evidence that workers sleep less to increase effort (e.g., increase working hours).

The present analysis, however, also faces some limitations. The effect of job

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insecurity on sleep duration amounts to 4 minutes per day and thus is rather small in magnitude. One reason for the minor effect might be that the variable I use is not very precise, as the SOEP provides information on sleep duration only in full hours. Sleep duration measured in minutes may be better suited to capture the effect of job insecurity and therefore make a more adequate measure. A second caveat is that the variable for sleep duration might not necessarily capture actual sleep time but rather time spent in bed. As time spent in bed also includes time lying in bed but not sleeping, it is important to differentiate between the two. The data at hand does not provide this information, hence, one should view the results for sleep duration as lower bounds (in absolute terms) for true effects. Analyzing a more precise effect of job insecurity on sleep duration is left for future work.

In conclusion, the present study provides evidence for the negative influence of job insecurity on sleep. As insufficient sleep deteriorates health and increases health care costs, the results suggest to take a closer look at the sources of job insecurity. The impacts of flexicurity policies, for instance, could be weighed more carefully. Flexicurity policies aim at increasing efficiency of the labor market by, on the one hand, lowering dismissal protection and, on the other hand, improving support for the unemployed by increasing their job-finding probability. The present analysis may suggest that policymakers take a more differentiated view on flexicurity policies as a tool of efficiency gains. The costs of poor sleep, however, are not only borne by workers. Hafner et al. (2016) estimates that 200,000 working days are lost each year in Germany due to sickness absence and presenteeism caused by insufficient sleep. Accordingly, employers should be equally motivated to decrease job insecurity among employees.

3.5 Appendix

Table 3.7: Robustness check; lagged instrument and placebo outcomes

	(1) Job insecurity	(2) Concerns about the environment	(3) Concerns about peace
Media coverage	0.001** (0.0002)	0.0002 (0.0002)	0.0001 (0.0002)
Media coverage in t-1	0.0002 (0.0002)	-	-
Pseudo R^2	0.065	0.016	0.021
N	35,866	35,456	35,430

Method: Pooled Probit. Years 2008 to 2012. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 3.8: Robustness check; alternative method

	(1) Job insecurity	(2) Satisfaction with sleep	(3) Sleep duration
Job insecurity	-	-0.771** (0.383)	-0.478*** (0.174)
Media coverage	0.0003*** (0.0001)	-	-
Sanderson-Windmeijer F-statistic	35,81		
N	35,866	35,866	35,866

Method: 2SLS. Years 2008 to 2012. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 3.9: Robustness check; inclusion and exclusion of subgroups

	Pooled OLS		Fixed effects		Treatment effects		
	(1)	(2)	(3)	(4)	(5)	(6)	
	Satisfaction with sleep	Sleep duration	Satisfaction with sleep	Sleep duration	Satisfaction with sleep	Sleep duration	# of obs.
Including civil servants & working hours < 15	-0.678*** (0.045)	-0.112*** (0.020)	-0.137*** (0.036)	-0.039** (0.018)	-0.448*** (0.077)	-0.098*** (0.032)	40,660
Excluding fixed-term workers	-0.728*** (0.053)	-0.123*** (0.024)	-0.223*** (0.040)	-0.045** (0.020)	-0.572*** (0.090)	-0.092** (0.038)	31,052
Excluding workers with no agreed working time	-0.679*** (0.048)	-0.112*** (0.022)	-0.160*** (0.038)	-0.039** (0.019)	-0.477*** (0.081)	-0.057* (0.031)	32,625
Excluding workers with tenure ≤ 6 months	-0.690*** (0.048)	-0.114*** (0.022)	-0.178*** (0.038)	-0.045** (0.019)	-0.505*** (0.082)	-0.076** (0.036)	33,286

Years 2008 to 2012. The table shows the estimated coefficients of job insecurity, where each cell represents a separate regression. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

4. Smoking Bans, Leisure Time, and Subjective Well-being

Abstract: During 2007 and 2008 smoking bans were gradually implemented in all of Germany's sixteen federal states to prohibit smoking in bars, restaurants, and dance clubs. Aimed at reducing smoking and improving health, tobacco control policies are often controversially discussed as they entail potential side effects. This study exploits regional variation to identify effects of smoking bans on life satisfaction and leisure time satisfaction. Difference-in-differences estimates reveal that predicted smokers who used to visit bars regularly are less satisfied with life and leisure time, following the enforcement of a smoking ban. I show that changes in use of leisure time likely explain these findings. On the contrary, predicted non-smokers who did not visit bars and restaurants frequently benefit from the smoking bans, as their satisfaction with leisure time increases. They show an increase in hours spent on free-time activities and are more likely to go out with smoking bans in effect.

4.1 Introduction

How do public smoking bans affect individual well-being? The answer to this question is important, as smoking bans constrain individuals' behavior and interfere with personal choice. Nevertheless, many European countries have implemented smoking bans in public places and the European Union is calling for the adoption of complementary tobacco control policies to increase the number of smoke-free environments (European Commission 2013). Policymakers motivate the introduction of anti-smoking policies by protecting citizens from the exposure to second-hand smoke, as not only active smoking but also passive smoking can increase the risk of cardiovascular diseases, asthma, and cancer. Numbers provided by the World Health Organization (2009) confirm the need for smoke-free environments. According to the organization 8.7 percent of the world's deaths can be attributed to the risk factor tobacco use. However, to what extent tobacco control policies actually have a positive impact on smoking behavior and health is controversial, as previous research provides ambiguous findings. In particular, empirical evidence on the influence of smoke-free laws on health and well-being is mixed (e.g., Adda and Cornaglia 2006, 2010, Gruber and Mullainathan 2005, Kuehnle and Wunder 2017, Odermatt and Stutzer 2015, Origo and Lucifora 2013).

To analyze the relationship between smoking bans and subjective well-being is the purpose of this paper. I thereby go beyond existing research by extensively examining individuals' leisure time. This seems to be a promising approach, as smoking bans in public places such as bars and restaurants particularly affect individuals in their leisure time. Thus, the strength of the impact of smoking bans may depend crucially on how often someone actually visits bars and restaurants. To investigate the link between smoking bans, leisure

time, and subjective well-being, I use the implementation of smoking bans in Germany.

In Germany, smoke-free laws regulating the exposure to second-hand smoke in the hospitality sector did not exist until 2007. Following a nonbinding agreement between the federal ministry of health and the German hospitality union which did not have the desired effect, the state health ministers agreed in February 2007 to implement smoking bans in all of Germany's sixteen federal states. Although the smoke-free laws differ to some extent in their strictness across states, they broadly prohibit smoking in bars, restaurants, and dance clubs, unless the owners can provide a separate room for non-smokers. In August 2008 smoking bans were in force in all sixteen federal states. Following previous studies (Anger et al. 2011, Kuehnle and Wunder 2017), I exploit the fact that the smoking bans were enforced on different dates across states. More precisely, I use the regional variation in the implementation of the bans as a quasi-random experiment to estimate difference-in-differences models.

The results show that being exposed to a smoking ban strongly influences well-being. Individuals who used to be regular guests in bars and restaurants are less satisfied with life and leisure time, following the ban. The estimates are particularly strong in magnitude for predicted smokers. This is supportive of the notion that smoking bans in the hospitality sector interfere with individuals' leisure pursuits. Moreover, the results suggest that restricting individuals' habits decreases well-being. I further show that changes in use of leisure time likely explain these findings by providing evidence that smoking bans displace smokers from public to private places. Exploiting time use data reveals that likely smokers spend less time with friends and are less likely to go to night clubs and dancing, when covered by a smoking ban. On the contrary, they spend more time at home engaging in housework and child care.

I provide additional evidence that predicted non-smokers who did not visit bars frequently prior to the bans are more satisfied with leisure time. This may suggest that smoke-free laws raise non-smokers' options for free-time activities. If non-smokers did not go out very often due to smoking, they would notably benefit from the lower exposure to second-hand smoke in bars and restaurants. Examining time use supports this contention. When covered by a smoking ban, likely non-smokers spend more time on leisure time activities and are more likely to go out. Furthermore, they spend less time at home dealing with child care and garden work. I run several robustness checks to increase confidence in the basic pattern of results.

This study provides several contributions to the literature. First, to the best of my knowledge I provide the first study that analyzes the consequences of smoking bans on well-being for Germany. Second, while previous articles have only considered overall well-being and life satisfaction, this study also investigates the influence of smoking bans on satisfaction with leisure time. As I analyze smoking bans in bars and restaurants that primarily affect individuals in their free-time, I assume that satisfaction with leisure time responds more quickly to the bans than overall life satisfaction. Third, I extend previous research by examining individuals' leisure time activities. This approach not only allows to consider groups who are particularly affected by the bans but also to better understand the influence of smoking bans on well-being. Finally, as I use panel data from the German Socio-Economic Panel (SOEP), I am able to take individual fixed effects into account.

In what follows, the next section reviews the related literature. Section 4.3 presents the data and variables and section 4.4 describes the empirical approach. Section 4.5 provides the results and the final section concludes.

4.2 Previous Literature

Tobacco control policies aim to reduce smoking and improve health. However, the actual effectiveness of those policies is not clear, as neither empirical studies nor theoretical models provide conclusive evidence. From a theoretical perspective, one of the first models on the effects of smoking regulations was contributed by Becker and Murphy (1988). Their theory of rational addiction predicts that price changes of addictive goods decrease consumption in the long-run but only have a limited effect on consumption in the short-run. Moreover, as regulations of addictive goods constrain individuals' behavior, Becker and Murphy conclude that individuals' well-being is likely to decrease. An extension of the model is provided by Adda and Cornaglia (2006). The authors not only consider the number of cigarettes but also the intensity of smoking in their model. They show that smokers can compensate tax increases by extracting more nicotine per cigarette. As inhaling cigarette smoke more intensively is detrimental to health, the usefulness of cigarette taxes is questionable according to the authors. On the contrary, theoretical models of O'Donoghue and Rabin (1999a) and Gruber and Köszegi (2004) predict that smoking regulations can increase the cost of smoking and thus serve as self-control device for smokers who want to reduce or quit smoking. Smokers do not need to solely rely on willpower with smoking bans in force, as bans decrease smokers' temptation to smoke in public places. Hence, if smokers desire to reduce or quit smoking, smoke-free laws can help to decrease consumption and increase well-being.

Empirical studies on the effects of tobacco control policies on smoking also present conflicting results. While earlier studies show that smoking regulations can be an important tool in reducing cigarette consumption (e.g., Chaloupka and Warner 2000, Tauras 2006), more recent economic studies report no effect (Adda and Cornaglia 2010, Carpenter et al.

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2011) or only a limited effect on specific subgroups (Anger et al 2011, Jones et al. 2015). Nonetheless, as anti-smoking policies primarily focus on protecting non-smokers from passive smoking, these policies can still play an important role. And indeed, smoking bans decrease exposure to second-hand smoke in public places, particularly in bars and restaurants (Carpenter et al. 2011). Furthermore, the lower exposure to tobacco smoke likely results in health benefits, as non-smokers' health improves after the introduction of smoking bans in public places (Meyers at al. 2009, Kuehnle and Wunder 2017, Wildman and Hollingsworth 2013). Analyzing smoking bans in European workplaces, Origo and Lucifora (2013) show that bans reduce exposure to second-hand smoke and decrease work-related respiratory problems. However, the authors also find that restricting individuals in their smoking habits causes mental distress among smokers. Further unintended effects of smoking bans are highlighted by Adda and Cornaglia (2010). Using data on cotinine levels, a biological marker for nicotine intake, the authors find that tobacco control policies can also entail negative health effects. Smoking bans displace smokers from public to private places, where particularly non-smokers and children of smoking families suffer from the higher exposure to second-hand smoke.

Considering those previous studies suggests that not only smoking status but also individuals' time use is an important channel when analyzing the effects of public-place smoking laws on health, as the strength of the impact depends on how much time individuals spend in public buildings. While so far ignored by previous research on smoking laws and well-being, leisure time use may also play a significant role in explaining well-being effects. Smoking bans in bars and restaurants directly affect leisure time, since individuals primarily visit bars and restaurants in their leisure time and thus, face the consequences of the policy

mainly during that part of the day. If smokers dislike being constrained in their smoking habits during free-time, their well-being is likely to decrease. Furthermore, if smokers spend less time in bars and restaurants due to smoking bans, they may be less satisfied with leisure time. In contrast, non-smokers benefit from the smoking bans. On the one hand, non-smokers who often visit bars and restaurants are less exposed to second-hand smoke which may increase well-being. On the other hand, non-smokers who did not go to bars and restaurants frequently because of the smoking may be more likely to go out with smoking bans in force. Thus, the effect on non-smokers' well-being may be positive.

The fact that one should not ignore smoking status or leisure time use when analyzing well-being, is also highlighted when considering the perception of the smoke-free laws in the German public. The implementation of the smoking bans led to a strong opposition from the beginning. Several groups and clubs emerged, which collected signatures for petitions and organized protests in every major city. Particularly smokers rejected the tobacco control policy, as they perceived the bans were interfering excessively with personal choice. However, not only smokers but also non-smokers expressed concerns. Regular customers of bars and restaurants worried about the bar and restaurant culture and the survival of their local pub. As non-smokers who frequently visit bars are the main beneficiaries of the lower exposure to second-hand smoke, this potential negative impact of smoking bans seems an important aspect to consider. Hence, the effect on non-smokers well-being may also be negative. Overall, I argue that it is not only crucial to take into account smoking status but also how much time is spent in bars and restaurants, when examining the consequences of smoking bans on individual well-being.

Empirical knowledge about the influence of smoking laws on well-being is very

limited. The prominent study by Gruber and Mullainathan (2005) shows for Canada and the US that higher cigarette taxes make individuals with a high propensity to smoke happier. In contrast, Brodeur (2013) uses more recent US data and shows that higher cigarette taxes have no effect on smokers' life satisfaction. Studies for the UK (Leicester and Levell 2015) and the Netherlands (Weinhold and Chaloupka 2017) also find no evidence for smoking bans affecting well-being. Using data from 40 European countries and regions, Odermatt and Stutzer (2015) identify effects of smoking bans and cigarette prices on life satisfaction. As the authors can exploit detailed information on smokers' intentions to stop smoking, they are able to differentiate between smokers who have no intention to quit and smokers who would like to stop smoking. They find that smokers who intent to stop smoking report an increase in life satisfaction, following the introduction of a smoking ban. Higher cigarette prices instead decrease life satisfaction of smokers who would like to quit.

Overall, previous empirical evidence is mixed and predominantly focuses on smokers and their smoking habits. Moreover, none of the studies examining well-being considers the role of leisure time use. Investigating the link between smoking bans, leisure time, and well-being is a unique aspect of this study.

4.3 Data and Variables

4.3.1 The Data Set

The data used in this study are obtained from the German Socio-Economic Panel (SOEP), a representative longitudinal panel of private households in Germany. Annually, the SOEP conducts interviews with more than 20,000 individuals in over 11,000 households on living conditions in Germany (Wagner et al. 2007). The empirical analysis is restricted to the years

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2003 to 2008, as information on the key variables is only available for this period.

Table 4.1: Implementation of smoking bans in German bars and restaurants

Federal state	Date of enforcement
Baden-Wurttemberg	August 2007
Bavaria	January 2008
Berlin	July 2008
Brandenburg	July 2008
Bremen	July 2008
Hamburg	January 2008
Hesse	October 2007
Lower Saxony	November 2007
Mecklenburg West Pomerania	August 2008
North Rhine-Westphalia	July 2008
Rhineland-Palatinate	February 2008
Saarland	June 2008
Saxony	February 2008
Saxony-Anhalt	July 2008
Schleswig-Holstein	January 2008
Thuringia	July 2008

Information on enforcement of smoking bans was compiled from original law texts. With the exception of Rhineland-Palatinate and Saarland, which enforced the smoking bans on February 15th, the bans were enforced in all states at the first of the month.

4.3.2 Key Explanatory Variable

Variable of primary interest is the implementation of state-level public smoking bans in German bars and restaurants. The German federal states enforced smoking bans on different dates during 2007 and 2008 (see Table 4.1). Starting in August 2007, Baden-Wurttemberg was the first state covered by a smoking ban. During the next twelve months the remaining fifteen states followed with Mecklenburg West Pomerania being the last one in August 2008. The indicator *ban* is a dichotomous variable which is coded as one if the individual resides in a federal state that was covered by a smoking ban at time of interview. The variable equals zero if the individual lives in a state where a smoking ban was not in force yet. This implicates that the dummy is always equal to zero in the years prior to the smoking bans (2003 to 2006).

Table 4.2 provides definitions and descriptive statistics of the variables used in this study.

Table 4.2: Variable definitions and descriptive statistics

Variable	Description	Mean (Std.dev.)
Life satisfaction	Score of life satisfaction on an eleven-point Likert scale that ranges from 0 "completely dissatisfied" to 10 "completely satisfied".	6.872 (1.793)
Leisure time satisfaction	Score of leisure time satisfaction on an eleven-point Likert scale that ranges from 0 "completely dissatisfied" to 10 "completely satisfied".	6.971 (2.201)
Leisure time activities[a]	Average time spend on leisure time activities on a weekday in hours.	2.314 (2.054)
Spending time with friends[b]	Spending time with friends coded as 1 "never", 2 "less than once a month", 3 "monthly", and 4 "weekly".	3.145 (0.835)
Going to clubs and dancing[b]	Going to clubs, concerts, movies, and dancing coded as 1 "never", 2 "less than once a month", 3 "monthly", and 4 "weekly".	1.883 (0.815)
Ban	Dummy equals 1 if the individual resides in a federal state that was covered by a smoking ban at time of interview and 0 otherwise. Dummy is always coded as 0 in the years prior to the smoking bans (2003-2006).	0.083 (0.276)
Likely smoker	Dummy variable coded as 0 "likely non-smoker" (below median) and 1 "likely smoker" (above median) based on the individual's estimated propensity to smoke.	0.473 (0.499)
Weekly bar and restaurant visits	Dummy equals 1 if the individual visits bars and restaurants weekly in 2003. Dummy is coded as 0 if the individual visits bars and restaurants monthly, less than once a month, or never.	0.229 (0.420)
Age 30-44	Dummy equals 1 if the individual is 30 to 44 years of age.	0.282 (0.450)
Age 45-59	Dummy equals 1 if the individual is 45 to 59 years of age.	0.286 (0.452)
Age ≥60	Dummy equals 1 if the individual is 60 years or older.	0.304 (0.460)
Skilled	Dummy equals 1 if the individual's highest educational attainment is a completed apprenticeship training.	0.543 (0.498)
University degree	Dummy equals 1 if the individual has a university degree.	0.286 (0.452)
Doctor visits	Number of doctor visits in the last three months.	2.511 (3.930)
Married	Dummy equals 1 if the individual is married.	0.645 (0.479)
Number of children	Number of children under age 16 in the household.	0.506 (0.888)
Log(household income)	Log of deflated household income.	7.928 (0.586)
Living in an urban area	Dummy equals 1 if the individual lives in an urban area.	0.668 (0.471)
Work experience	The individual's work experience in years.	21.13 (13.48)

Full-time	Dummy equals 1 if the individual works full-time.	0.404 (0.491)
Part-time	Dummy equals 1 if the individual works part-time.	0.110 (0.313)
Out of labor force	Dummy equals 1 if the individual is out of labor force.	0.363 (0.481)
Unemployed	Dummy equals 1 if the individual is unemployed.	0.061 (0.239)
Log(unemployment rate)	Log of unemployment rate (state-level).	2.286 (0.409)
Log(share of foreigners)	Log of share of foreigners (state-level).	1.953 (0.639)
Log(share of students)	Log of share of students (state-level).	3.146 (0.213)
Average age	Average age (state-level).	38.88 (1.012)

Descriptive statistics for the dependent variables are based on the full samples of the respective regressions. Descriptive statistics for the explanatory variables are based on the full sample of the life satisfaction analysis. The regressions also include state fixed effects, month-year dummies, and a linear and a quadratic time trend.
[a] Information obtained from the waves 2004 to 2008.
[b] Information obtained from the waves 2005, 2007, and 2008.

4.3.3 Outcome Variables

This study uses two outcome variables in the main analysis. In the SOEP, respondents are asked to evaluate their life and certain life domains on an eleven-point scale ranging from 0 (completely dissatisfied) to 10 (completely satisfied). For the analysis I use the variable *life satisfaction* which is based on the question "How satisfied are you with your life, all things considered?". For the second outcome I consider the life domain leisure time and use *satisfaction with leisure time* as dependent variable. In the subsequent analysis I examine leisure time activities. As the SOEP provides data on individuals' time use, I employ *average leisure time on a weekday in hours*. The last two outcomes are measures for *spending time with friends* and *going to night clubs, dancing, and concerts.* Respondents are asked whether they never, rarely, monthly, or weekly engage in those leisure time activities.

4.3.4 Control Variables

Control variables for age, educational attainment, number of doctor visits[28], number of children under age 16, marital status, household income, residential area, work experience, and employment status are included.[29] Explanatory variables of special interest are frequency of bar and restaurant visits prior to the bans and smoking status. The SOEP provides information on smoking behavior in the even-numbered years, but as smoking behavior likely has changed due to the enforcement of smoking bans, I cannot add current smoking status directly as a control variable. Instead I follow the strategy by Gruber and Mullainathan (2005) and use an individual's propensity to smoke. Gruber and Mullainathan argue that cigarette taxes affect constant non-smokers and former smokers differently. To avoid mixing the two groups, the authors use predicted smoking behavior instead of actual smoking behavior. Hence, I also include an individual's propensity to smoke. Based on information on smoking status in the even-numbered years, I calculate an individual's probability to smoke given their personal characteristics. Thereupon, I generate a dummy variable that is equal to 1 if an individual has an above median predicted propensity to smoke.[30]

To control for the number of bar and restaurant visits prior to the bans, I follow Anger et al. (2011) and rely on information from 2003. I define a dummy variable which is coded as one if the individual visited bars and restaurants weekly and zero otherwise. Finally, I add time-varying state characteristics (unemployment rate, share of foreigners, share of students,

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[28] As smoking bans may influence doctor visits, I use the number of doctor visits in 2006 for the waves 2006 to 2008.

[29] Note that I do not include time-invariant variables such as gender or migration background as I estimate fixed effects models.

[30] The estimated smoking propensity in 2002 is used for the wave 2003. Respectively, smoking propensity in 2004 (2006) is used for the years 2004 and 2005 (2006 to 2008). Note that the shares of potential smokers and non-smokers are not exactly 50 percent, as all available observations were used for the smoking propensity estimations and not only the estimation samples of the satisfaction analysis. Table 4.13 in the Appendix reports the results of the smoking propensity estimations.

average age), state fixed effects, a linear and a quadratic time trend, and month-year dummies. Adding a dummy for each month of each observed year to the specification allows to capture common time trends across states in subjective well-being. More precisely, the time effects control for policy changes and shocks that coincided with the implementation of the smoking bans and may have influenced well-being.

4.4 Empirical Methodology

The present study uses the implementation of state-level public smoking bans as a quasi-random experiment to estimate the effects of smoking bans on well-being and leisure time activities. Fortunately, the enforcement of the smoke-free laws not only provides variation across federal states but also variation within federal states. The SOEP conducts interviews each year from January to November which allows to observe individuals who were surveyed before the smoking bans were in force and individuals who were interviewed after the smoke-free laws were in effect within the same state. To exploit the regional variation in the exposure to smoking bans, I apply a difference-in-differences approach (see Angrist and Pischke 2009: 234-235). The estimation strategy considers a group who received treatment and a group who did not receive treatment in the period before the treatment and in the period after the treatment. The federal states enforced smoking bans on different dates during 2007 and 2008, which provides a treatment group (covered by a smoking ban) and a control group (not covered by a smoking ban). To identify the effects of smoking bans on the outcomes, I estimate fixed effects linear probability models of the following form:

$$Y_{ist} = \alpha Ban_{ist} + \beta \boldsymbol{x}_{ist} + \varepsilon_{ist} + \vartheta_i, \tag{1}$$

where Y_{ist} is one of the outcomes of interest for individual i in federal state s at time t. Ban_{ist}

is a dummy variable that is equal to one if the individual i resides in a federal state s that was exposed to a smoking ban at survey time t, and zero otherwise. The coefficient alpha identifies the effect of smoking bans on the outcomes. x_{ist} is a vector of time-varying control variables, ε_{ist} is the error term, and ϑ_i is an individual-level fixed effect.

The key assumption for a difference-in-differences approach is that the outcomes for treatment and control group would follow the same trend in absence of the smoking bans.

Figure 4.1: Average well-being and leisure time activities over time by exposure to smoking bans
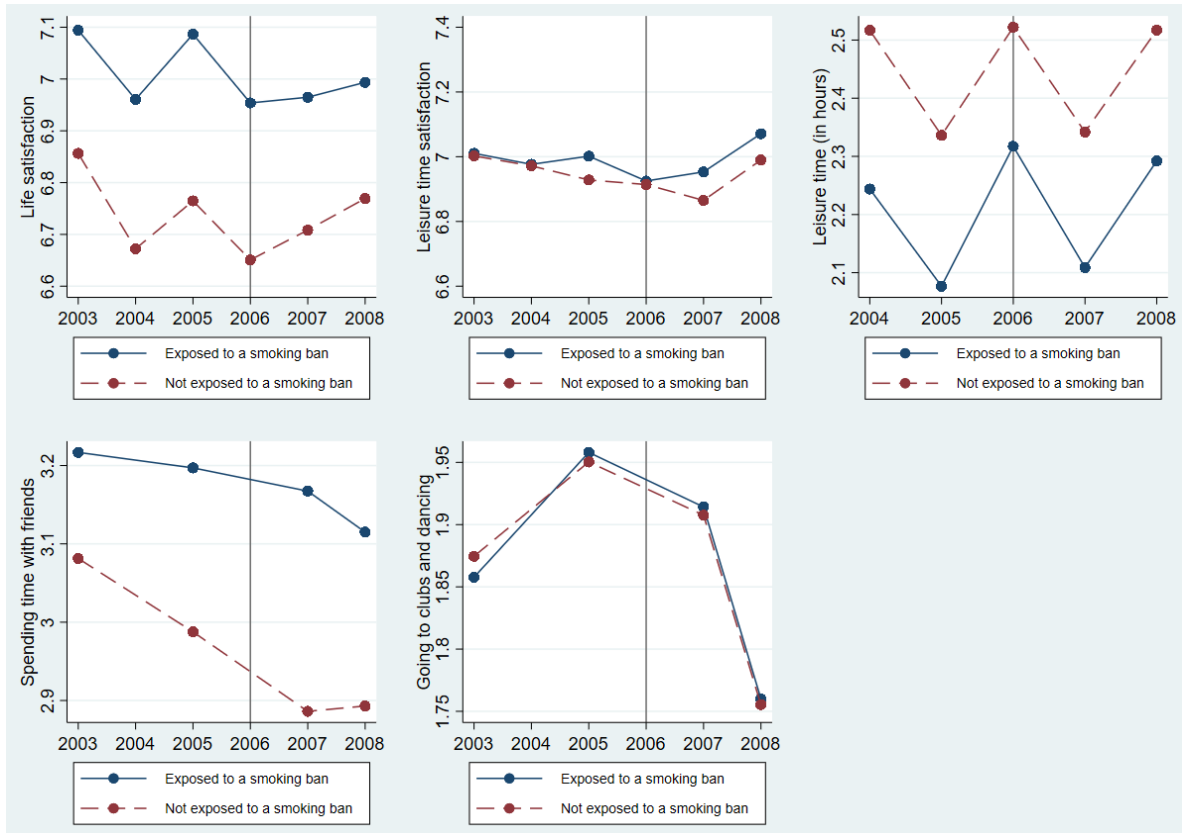
Smoking bans were gradually enforced in all German states between 2007 and 2008. Pre-treatment data is obtained from the years 2003 to 2006, indicated by the vertical line.

Figure 4.1 provides descriptive evidence for the common trend assumption using pre-treatment data from 2003 to 2006. For each of the outcomes I compare the trends for individuals exposed to a smoking ban in 2008 and individuals who did not live in a state

covered by a smoking ban at time of their interview in 2008. The pre-treatment data shows that the trends are very similar for both groups. The only exception is satisfaction with leisure time where the average satisfaction slightly increases for the treatment group between 2004 and 2005 but decreases for the control group. However, given that the difference in trends can be considered as marginal, I conclude that the common trend assumption holds for all five outcomes.

4.5 Results

4.5.1 Main Analysis

Table 4.3 reports estimates from the difference-in-differences models for individuals with an above median predicted propensity to smoke (likely smokers) and individuals with a smoking propensity below the median (likely non-smokers).[31] For completeness I also include results for the full sample. In the full sample smoking bans have a significant negative effect on life satisfaction. As life satisfaction has a mean value of 6.872, the coefficient of -0.058 implies a decrease from the mean value by 0.8 percent. While the influence of smoking bans on life satisfaction is negative, the coefficient on ban in column (2) has the opposite sign. Being exposed to a smoking ban increases leisure time satisfaction by 1 percent. Separate regressions by smoking status show that likely smokers and likely non-smokers are less satisfied with life after a smoking ban is in force. The decrease amounts to 0.8 percent for predicted smokers and to 0.9 percent for predicted non-smokers. The negative effect on life satisfaction, however, is for non-smokers only significantly different from zero. For smokers, the coefficient on ban just misses to be statistically significant at conventional levels

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[31] Table 4.10 in the Appendix reports the full results of the difference-in-differences models.

(*p=0.15*). The positive influence of bans on leisure time satisfaction found for the full sample is driven by individuals with a low propensity to smoke. When covered by a smoking ban, likely non-smokers are by 1.3 percent more satisfied with leisure time.

Table 4.3: The effects of smoking bans on life satisfaction and leisure time satisfaction

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: FULL SAMPLE		
Ban	-0.058**	0.066**
	(0.024)	(0.030)
N	101,391	100,180
PANEL B: LIKELY SMOKERS		
Ban	-0.054	0.031
	(0.038)	(0.048)
N	47,998	47,920
PANEL C: LIKELY NON-SMOKERS		
Ban	-0.064**	0.094**
	(0.032)	(0.039)
N	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. Table A1 in the Appendix reports the full results of the regressions. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

First regressions show ambiguous findings for non-smokers, as their leisure time satisfaction increases and their life satisfaction decreases. To better understand how smoking bans impact individuals' well-being further analysis is necessary. As the background discussion strongly suggests that smoking bans in the hospitality sector particularly affect individuals who often go to bars and restaurants, I consider a moderating role of bar and restaurant visits. Table 4.4 presents the results of an interaction of weekly bar and restaurant visits and exposure to smoking bans.

Table 4.4: The effects of smoking bans on life satisfaction and leisure time satisfaction; interaction of smoking ban and weekly bar and restaurant visits (prior to the ban)

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	-0.020	0.061
	(0.040)	(0.051)
Ban*weekly bar and restaurant visits	-0.125**	-0.126**
	(0.052)	(0.062)
N	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.030	0.102**
	(0.034)	(0.041)
Ban*weekly bar and restaurant visits	-0.115**	-0.106**
	(0.045)	(0.054)
N	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

The estimates show that the important patterns of results are revealed only when taking into account the interaction. Likely smokers who went to bars and restaurants weekly prior to the implementation of the smoke-free policy are by roughly 2 percent less satisfied with life and leisure time after smoking bans are in force. The interpretation is straightforward, as smokers who often go out are mostly affected by smoking bans in the hospitality sector and the resulting changes in the pub culture. Moreover, the estimates support the notion that restricting smokers' habits decreases smokers' well-being.

To set a benchmark, I compare the estimated effects against the effects of involuntary job loss on life satisfaction. Fixed effects regressions suggest that involuntary job loss decreases life satisfaction by about 3.9 percent in the short-run. Thus, the negative impact of smoking bans on life satisfaction is almost half the size of the effect of involuntary job loss

and therefore quite substantial.

For likely non-smokers the effects of smoking bans on satisfaction are more diverse. Predicted non-smokers who did not visit bars and restaurants regularly prior to the bans are by 1.4 percent more satisfied with leisure time after smoking bans are enforced. This supports the contention that smoking bans increase non-smokers leisure options. Non-smokers who did not go to bars and restaurants because of second-hand smoke may be more likely to go out with smoking bans in force. Hence, they benefit from the smoking bans and, accordingly, are more satisfied with leisure time. On the contrary, predicted non-smokers who previously often went out suffer from lower life satisfaction, when covered by a smoking ban. The decrease in life satisfaction amounts to 1.6 percent. In column (2) the interaction is also negative and significant, implying a slightly overall negative effect on leisure time satisfaction for predicted non-smokers who used to be regular guests in bars. The effects may be surprising at first sight, as non-smokers who frequently visit bars should be the main beneficiaries of the smoking bans. At second glance, however, they are in line with anecdotal evidence. Considering the perception of the smoke-free laws in the German public shows that not only smokers but also non-smokers opposed the smoking bans. Media reports suggest that both smokers and non-smokers who used to be regular guests in bars and restaurants participated in protests, signed petitions, and were members in groups and clubs that rejected the smoking bans. One of the main reasons for the strong opposition by regular guests (regardless of smoking status) was concerns about the bar and restaurant culture. People worried about the pub experience and the survival of their local pub. This likely explains the negative well-being effects I find for smokers and non-smokers who often visit bars and restaurants, as the smoking bans not only affect the bar and restaurant culture but also

interfere with both groups' leisure pursuits.

The estimates suggest that use of leisure time plays an important role when explaining the impact of smoking bans on well-being. I investigate the role of time use further in the next subsection. More specifically, I check for displacement of individuals from public buildings to private places and vice versa.

4.5.2 Smoking Bans and Use of Leisure Time

In this chapter I analyze the effects of smoking bans on leisure time activities. The first outcome variables used are the number of hours spent per day on free-time activities, spending time with friends, and going to night clubs, dancing, and concerts. The results are presented in Table 4.5.

Table 4.5: The effects of smoking bans on use of leisure time

	(1) Leisure time activities[a]	(2) Spending time with friends[b]	(3) Going to clubs and dancing[b]
PANEL A: LIKELY SMOKERS			
Ban	-0.017	-0.059**	-0.007
	(0.043)	(0.025)	(0.021)
Ban*weekly bar and restaurant visits	-0.089*	-0.070**	-0.070***
	(0.054)	(0.030)	(0.027)
N	37,978	21,157	21,160
PANEL B: LIKELY NON-SMOKERS			
Ban	0.130***	-0.055**	0.034**
	(0.040)	(0.023)	(0.016)
Ban*weekly bar and restaurant visits	0.013	0.001	-0.106***
	(0.058)	(0.028)	(0.023)
N	44,384	25,097	25,094

Method: Fixed effects OLS. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.
[a] Regressions based on the years 2004 to 2008.
[b] Regressions based on the years 2005, 2007, and 2008.

Likely smokers who previously often went to bars and restaurants spend significantly less time on leisure time activities, when covered by a smoking ban. The decrease amounts to 4.3 percent in hours spent on free-time activities, to 4 percent in spending time with friends, and to 3.4 percent in going to clubs or dancing. Likely non-smokers who used to go to bars a lot also show a reduction in going to clubs or dancing by 4.2 percent. The results suggest that smoking bans lead former regular guests of bars and restaurants to go out less and to spend less time with friends which, consequently, negatively impacts their leisure time satisfaction and life satisfaction. Finally, the estimates show that likely non-smokers who previously did not visit bars and restaurants weekly also report a change in use of leisure time. When covered by a ban, they spend more time on free-time activities (increase by 4.9 percent) and exhibit an increase in going to clubs, concerts, or dancing by 2 percent. Hence, the results support the notion that smoking bans increase this groups' leisure options which likely explains the higher leisure time satisfaction.

Adda and Cornaglia (2010) point out the importance of displacement for health consequences. The authors show that smoking bans lead smokers to spend more time at home where they contaminate non-smokers. As a potential displacement from bars and restaurants to private places may also be relevant to explain the well-being effects found in the previous subsection, I investigate individuals' time use at home in Table 4.6. For that purpose, I consider three variables that measure time spent on household duties. More precisely, I employ as outcomes the average number of hours spent on a weekday on housework, on garden work and repairs around the house, and on child care.

Table 4.6: Displacement effects of smoking bans

	(1) Housework	(2) Garden work/repairs around the house	(3) Child care
PANEL A: LIKELY SMOKERS			
Ban	0.013	0.022	0.040
	(0.026)	(0.024)	(0.064)
Ban*weekly bar and restaurant visits	0.070**	0.019	0.135*
	(0.029)	(0.028)	(0.074)
N	38,010	37,972	38,046
PANEL B: LIKELY NON-SMOKERS			
Ban	0.019	-0.052**	-0.076*
	(0.026)	(0.022)	(0.046)
Ban*weekly bar and restaurant visits	-0.005	0.019	0.099
	(0.031)	(0.027)	(0.069)
N	44,374	44,378	44,412

Method: Fixed effects OLS. Years 2004 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Likely smokers who used to be regular guests in bars exhibit an increase in time spent on housework (5.2 percent) and child care (11.4 percent). The results confirm the findings by Adda and Cornaglia (2010). Smokers spend less time in public buildings and more time at home. Finally, I find that likely non-smokers spend significantly less time on garden work/repairs around the house (5.4 percent) and child care (6.9 percent). Hence, non-smokers who did not visit bars frequently spend less time on household duties and spend more time going out after bans are enforced.

4.5.3 Robustness Checks

In this subsection, I provide robustness checks of the main findings (Table 4.4) to increase confidence in the basic pattern of results. To validate the findings, I (a) use an alternative

definition of smoking status, (b) run a placebo check, (c) extend the observation period by two years, (d) add state-specific time trends, and (e) apply a different method. In Table 4.7 I use a stricter definition of smoking status. I only consider an individual to be a likely smoker if the person is in the top tertile of the distribution of the estimated individual propensity to smoke. The results shown in Table 4.7 are very similar in magnitude and significance to the

Table 4.7: Robustness check; alternative definition of smoking status

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	0.038	0.062
	(0.053)	(0.067)
Ban*weekly bar and restaurant visits	-0.143**	-0.132*
	(0.068)	(0.079)
N	31,608	31,551
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.036	0.090**
	(0.030)	(0.037)
Ban*weekly bar and restaurant visits	-0.095**	-0.100**
	(0.039)	(0.047)
N	69,783	69,629

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. Only individuals in the top tertile of the distribution of the estimated individual propensity to smoke are considered as likely smokers. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

ones reported in Table 4.4. For likely smokers, the estimates even slightly increase in magnitude. Hence, the main results are robust to the definition of smoking status. In a second robustness check I follow Kuehnle and Wunder (2017) and apply a placebo ban where I pretend the smoking bans were implemented in 2005 and 2006. Table 4.8 presents the results. The placebo ban does not emerge with a significant coefficient in any of the regressions.

Table 4.8: Robustness check; placebo ban

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Placebo ban	0.130	0.140
	(0.084)	(0.098)
Placebo ban*weekly bar and restaurant visits	-0.012	-0.044
	(0.038)	(0.050)
N	35,173	35,100
PANEL B: LIKELY NON-SMOKERS		
Placebo ban	0.050	-0.023
	(0.061)	(0.082)
Placebo ban*weekly bar and restaurant visits	0.021	-0.043
	(0.037)	(0.047)
N	37,210	37,121

Method: Fixed effects OLS. Years 2003 to 2006. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Third, I extend the observation period from 2008 to 2010. On the one hand, with the addition of two more years, one can ensure that all individuals in the sample were exposed to a smoking ban during the observation period. On the other hand, extending the observation period allows me to not only consider short-term effects but also a more persistent influence of smoking bans on well-being. The estimates are reported in Table 4.9. In comparison to the short-term effects, the medium-term effects are equally statistically significant but somewhat less pronounced. Likely smokers (likely non-smokers) who often visited bars and restaurants are by 1.7 percent (1.1 percent) less satisfied with life and by 1.2 percent (0.6 percent) less satisfied with leisure time. On the contrary, predicted non-smokers who previously did not go out frequently are by 1 percent more satisfied with leisure time. Overall, adding two more years to the observation period does not change the basic pattern of results. Moreover, the

estimates indicate that the effects of smoking bans on well-being continue in the medium-term.

Table 4.9: Robustness check; extension of the observation period until 2010

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	-0.005	0.025
	(0.036)	(0.046)
Ban*weekly bar and restaurant visits	-0.114***	-0.081**
	(0.032)	(0.041)
N	58,791	58,709
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.024	0.076**
	(0.031)	(0.035)
Ban*weekly bar and restaurant visits	-0.076***	-0.121***
	(0.029)	(0.036)
N	65,802	65,640

Method: Fixed effects OLS. Years 2003 to 2010. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Next, I address the specification of time effects and add state-specific time trends in addition to the month-year dummies. State-specific time trends capture unobserved changes over time that may be correlated with well-being and the timing of the implementation of the smoking bans in the federal states. Note, however, that this is likely not a major issue as Anger et al. (2011) provide convincing evidence that the timing of the adoption is not correlated with state characteristics but rather random. The results of the estimations are presented in Table 4.11 in the Appendix. Finally, I apply an alternative method to validate the results. For the ease of interpretation, I so far ignored the ordinal nature of the dependent variables and treated them as if they are cardinal. To take the ordinal scale of the outcomes into account, I apply fixed effects ordered logit models. More specifically, I use the BUC

estimator proposed by Baetschmann et al. (2015). The regressions are reported in Table 4.12 in the Appendix. The results are robust to the specification of time effects and the choice of method.

4.6 Conclusions

During 2007 and 2008 all of Germany's sixteen federal states enforced smoking bans which prohibit smoking in bars, restaurants, and night clubs. This study exploits the variation across states in the implementation of smoking bans to investigate the influence of state-level smoking bans on subjective well-being. I extend previous research by extensively examining the role of leisure time use.

The implementation of smoking bans had a strong impact on well-being, although the important patterns of results are revealed only when taking into account how intense individuals are exposed to the changes imposed by smoking bans. More specifically, the results show that it is crucial to consider how often an individual actually visits bars and restaurants when analyzing well-being effects. Overall, I find that individuals who used to go out a lot are less satisfied with life and leisure time after a smoking ban is enforced. The decline in satisfaction is particularly strong for predicted smokers. This is supportive of the notion that restricting individuals' habits and interfering with leisure pursuits decreases subjective well-being. To provide further evidence for this contention, I examine time use data. The estimates show that the same individuals spend less time with friends and are less likely to go to clubs or dancing with smoking bans in force. Hence, the decrease in well-being is likely induced by a change in leisure time activities. Checking for displacement effects reveals that likely smokers who visited bars and restaurants often prior to the bans are

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now more likely to stay at home dealing with housework and child care. The findings are in line with results provided by Adda and Cornaglia (2010). The authors use US data to show that smoking bans displace smokers from public to private places. Adda and Cornaglia, however, focus on health and not satisfaction. Nevertheless, my results on changes in smokers' time use suggest that the negative health consequences resulting from displacement of smokers to private places found for the US may also be relevant in the German case. Future research analyzing health effects of smoking bans in Germany, thus, could benefit from considering these findings.

Smoking bans aim at reducing second-hand smoke for non-smokers. And indeed, the estimates provide evidence that likely non-smokers who previously did not visit bars often are the beneficiaries of the tobacco control policy. The results show that smoking bans increase this group's satisfaction with leisure time. The examination of time use suggests that changes in use of leisure time likely explain this finding. Predicted non-smokers spend more time on free-time activities and are more likely to go out after bans are in force. On the contrary, they spend less time at home engaging in home duties. This supports the notion that smoking bans make it more appealing to non-smokers to go out, which accordingly increases satisfaction with leisure time.

For further insight into the relationship between smoking bans and subjective well-being, future research could link the findings of this study with smokers' intentions to quit smoking. As Odermatt and Stutzer (2015) point out the importance of smokers' intentions, this seems a promising approach. Unfortunately, the SOEP data does not provide information on smokers' desire to quit, hence analyzing this mechanism is left for future work. Furthermore, it would be interesting to investigate the long-run effects of smoking bans on

subjective well-being in more detail. As regular customers of bars and restaurants slowly get used to the new situation, they may benefit from the lower exposure to second-hand smoke and their well-being improves.

Overall, the results suggest that the implementation of smoking bans not only influenced individuals' health and smoking behavior but also other life domains. Hence, it is important to take potential side effects into account when evaluating the economic effects of smoking bans. Policymakers need to consider consequences on leisure pursuits and well-being, when enforcing policy changes intended to constrain individuals' behavior.

4.7 Appendix

Table 4.10: The effects of smoking bans on life satisfaction and leisure time satisfaction; full results

	Full sample		Likely smokers		Likely non-smokers	
	(1) Life satisfaction	(2) Leisure time satisfaction	(1) Life satisfaction	(2) Leisure time satisfaction	(1) Life satisfaction	(2) Leisure time satisfaction
Ban	-0.058**	0.066**	-0.054	0.031	-0.064**	0.094**
	(0.024)	(0.030)	(0.038)	(0.048)	(0.032)	(0.039)
Likely smoker	0.025	0.001	-	-	-	-
	(0.022)	(0.029)				
Age 30-44	0.036	-0.066	0.084*	-0.044	-0.096	-0.134
	(0.040)	(0.058)	(0.048)	(0.070)	(0.082)	(0.123)
Age 45-50	0.075	-0.039	0.134**	-0.027	-0.096	-0.088
	(0.051)	(0.071)	(0.065)	(0.089)	(0.096)	(0.142)
Age ≥60	0.204***	0.148*	0.251***	0.128	0.033	0.118
	(0.064)	(0.086)	(0.096)	(0.118)	(0.106)	(0.156)
Skilled	-0.025	-0.032	-0.198***	-0.143	0.132	0.018
	(0.059)	(0.081)	(0.070)	(0.094)	(0.149)	(0.198)
University degree	-0.136	0.231*	-0.458***	0.001	0.244	0.562*
	(0.088)	(0.124)	(0.112)	(0.154)	(0.225)	(0.294)
Doctor visits	-0.024***	-0.006***	-0.023***	-0.008**	-0.023***	-0.004
	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)
Married	0.223***	-0.122**	0.228***	-0.029	0.303***	-0.245***
	(0.039)	(0.048)	(0.051)	(0.065)	(0.076)	(0.089)
Number of children	0.032**	-0.178***	0.040*	-0.130***	0.011	-0.239***
	(0.016)	(0.022)	(0.023)	(0.029)	(0.026)	(0.038)
Log(household income)	0.209***	-0.013	0.249***	0.050	0.155***	-0.083**
	(0.021)	(0.026)	(0.029)	(0.035)	(0.032)	(0.040)
Living in an urban area	-0.102	-0.034	-0.106	-0.099	0.023	0.107
	(0.077)	(0.096)	(0.104)	(0.123)	(0.140)	(0.189)
Work experience	0.029***	0.002	0.003	-0.017	-0.047**	0.031
	(0.010)	(0.012)	(0.016)	(0.020)	(0.021)	(0.022)
Work experience squared	0.0001	0.0005**	0.0001	0.0004	0.001***	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0004)
Full-time	0.169***	-0.574***	0.257***	-0.441***	0.073	-0.822***
	(0.032)	(0.042)	(0.041)	(0.054)	(0.052)	(0.075)
Part-time	0.044	-0.110***	0.099**	0.030	-0.007	-0.283***
	(0.031)	(0.041)	(0.044)	(0.057)	(0.045)	(0.064)
Out of labor force	-0.024	0.234***	-0.078*	0.299***	0.005	0.115**
	(0.029)	(0.037)	(0.044)	(0.055)	(0.043)	(0.055)
Unemployed	-0.488***	0.512***	-0.492***	0.643***	-0.273***	0.235**
	(0.038)	(0.045)	(0.045)	(0.055)	(0.082)	(0.097)
Log(unemployment rate)	-0.172*	0.110	-0.218	0.119	-0.107	0.152
	(0.102)	(0.134)	(0.160)	(0.213)	(0.142)	(0.177)
Log(share of foreigners)	-0.056	0.316	-0.159	0.454	-0.475	0.258
	(0.142)	(0.320)	(0.271)	(0.451)	(0.310)	(0.539)
Log(share of students)	0.080	0.381**	-0.018	0.271	0.207	0.343*
	(0.114)	(0.149)	(0.176)	(0.233)	(0.171)	(0.204)
Average age (state-level)	-0.147***	0.088	-0.119	0.284**	-0.108	0.005
	(0.051)	(0.066)	(0.088)	(0.112)	(0.068)	(0.086)
Constant	11.667***	1.902	10.610***	-6.170	11.306***	5.275
	(2.154)	(2.851)	(3.536)	(4.826)	(2.862)	(3.770)
R^2	0.022	0.021	0.033	0.027	0.017	0.017
N	101,391	100,180	47,998	47,920	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include state fixed effects, month-year dummies, a linear and a quadratic time trend. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4.11: Robustness check; models include state-specific time trends

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	0.031	0.008
	(0.046)	(0.060)
Ban*weekly bar and restaurant visits	-0.118**	-0.124**
	(0.053)	(0.063)
N	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.002	0.091**
	(0.039)	(0.046)
Ban*weekly bar and restaurant visits	-0.108**	-0.102*
	(0.045)	(0.054)
N	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. State-specific time trends are added to the specification. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4.12: Robustness check; alternative method

	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	-0.024	0.081
	(0.069)	(0.065)
Ban*weekly bar and restaurant visits	-0.206**	-0.176**
	(0.094)	(0.083)
N	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.046	0.155**
	(0.065)	(0.064)
Ban*weekly bar and restaurant visits	-0.243***	-0.160*
	(0.090)	(0.083)
N	53,393	53,260

Method: Fixed effects ordered logit (BUC estimator). Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4.13: Determinants of smoking

	(1) Smoking in 2002	(2) Smoking in 2004	(3) Smoking in 2006
Female	-0.096***	-0.085***	-0.082***
	(0.007)	(0.007)	(0.007)
Migration background	0.0002	-0.004	0.006
	(0.008)	(0.009)	(0.009)
Age 30-44	0.020	0.010	0.005
	(0.014)	(0.014)	(0.014)
Age 45-50	-0.036**	-0.038**	-0.033**
	(0.015)	(0.016)	(0.016)
Age $\geq$60	-0.169***	-0.180***	-0.175***
	(0.016)	(0.017)	(0.017)
Skilled	-0.018**	-0.011	-0.023***
	(0.008)	(0.009)	(0.009)
University degree	-0.134***	-0.109***	-0.124***
	(0.010)	(0.010)	(0.010)
Doctor visits	-0.0003	-0.002***	-0.003***
	(0.001)	(0.001)	(0.001)
Married	-0.078***	-0.083***	-0.064***
	(0.008)	(0.008)	(0.008)
Number of children	0.011***	0.002	-0.008*
	(0.004)	(0.004)	(0.004)
Log(household income)	-0.033***	-0.044***	-0.058***
	(0.006)	(0.006)	(0.006)
Living in an urban area	0.009	0.008	0.013
	(0.008)	(0.008)	(0.008)
Work experience	0.005***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)
Work experience squared	-0.0001***	-0.0001***	-0.0001***
	(0.00002)	(0.00002)	(0.00002)
Full-time	0.008	-0.010	0.005
	(0.014)	(0.015)	(0.014)
Part-time	-0.001	-0.009	0.024
	(0.017)	(0.017)	(0.016)
Out of labor force	-0.064***	-0.076***	-0.064***
	(0.014)	(0.015)	(0.014)
Unemployed	0.119***	0.113***	0.131***
	(0.019)	(0.019)	(0.018)
Constant	0.671***	0.812***	0.715***
	(0.071)	(0.111)	(0.157)
R^2	0.094	0.095	0.098
N	21,225	19,932	19,879

Method: OLS. The table shows the estimated coefficients. Robust standard errors are in parentheses. All regressions include state fixed effects and a linear time trend. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

5. A Note on Risk Attitude and Nonmarital Birth*

Abstract: Using data of adult women from the German Socio-Economic Panel (SOEP), we demonstrate that it is important to distinguish between single women and cohabiting women when examining the influence of risk attitude on nonmarital birth. We find that risk tolerance is associated with a higher probability of an out-of-partnership birth. In contrast, we find no association between risk tolerance and the probability of a cohabiting birth.

JEL: D10, J12, J13.

Keywords: Risk attitude, out-of-partnership birth, cohabiting birth, nonmarital birth.

5.1 Introduction

Since the emergence of the economics of the family, economists have been increasingly interested in the determinants of nonmarital birth (e.g., Akerlof et al. 1996, An et al. 1993, Burdett and Ermisch 2002, Ekert-Jaffe and Grossbard 2008, Kearney and Levine 2014, Lundberg and Plotnick 1995, Lundberg et al. 2016, Willis 1999, Wolfe et al. 2001). Economic studies have examined factors such as welfare benefits, income, educational achievement, labor market conditions, religiosity, race, and price and effectiveness of birth control. The role of risk attitudes has been largely neglected. One notable exception is a study by Schmidt (2008) showing a significant influence of risk attitude on nonmarital births for teenagers, but not for adults in the United States.

Our study provides an examination for adults in Germany. We stress that the influence of risk attitudes may differ between out-of-partnership births and cohabiting births. We hypothesize that risk tolerance should be particularly associated with a higher probability of out-of-partnership birth. On the one hand, risk tolerance can involve a higher willingness to take the risk of an unwanted pregnancy. Even if a single woman does not wish to have children, a high degree of risk tolerance may induce her to contracept less effectively when engaging in casual sex. On the other hand, risk tolerance can increase a single woman's propensity for a planned pregnancy. If the woman wishes to have a child and does not find a suitable partner, a high degree of risk tolerance may increase her willingness to take the risks associated with single motherhood. These risks involve financial insecurity, future disadvantages in the marriage market, and potentially adverse consequences for the child's health status and school achievement.

By contrast, the relationship between risk attitude and the probability of cohabiting

birth is less clear from a theoretical viewpoint. To the extent cohabitation is an unstable form of union, women with a higher degree of risk tolerance should be more likely to give birth to a child during cohabitation. However, cohabitation is often a precursor of marriage. A child can even stimulate the transition from cohabitation to marriage. Thus, there may be no or possibly even a negative association between risk tolerance and cohabiting birth.

5.2 Data and Variables

Our empirical analysis uses the SOEP to examine the influence of risk attitude on nonmarital birth. The SOEP is a representative longitudinal survey of private households. It is administered by the German Economic Institute (DIW). Infratest Sozialforschung, a professional survey and opinion institute, conducts the face-to-face interviews. A nucleus of socio-economic and demographic questions is asked annually. Different 'special' topics are sampled in specific waves.

Our empirical analysis focuses on women aged 18–42.[32] As the share of women with a nonmarital birth is very low among immigrants, women with migration background are excluded from the analysis.[33] The analysis is based on dummy dependent variables for an out-of-partnership birth and a cohabiting birth. The respective dummy equals one if a woman gives birth to a child in the actual year and equals zero otherwise. For the analysis of out-of-partnership births, we focus on women who are singles in the previous and in the actual year. For the examination of cohabiting births, we consider women who are in a cohabiting relationship in the previous and in the actual year. Taking into account the availability of all

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[32] Note that the data provide no information whether women younger than 18 years gave birth to a child.
[33] The low share of immigrants with a nonmarital birth is likely to reflect the fact that a large proportion of immigrants in Germany are from Muslim countries.

variables used for the analysis, the regressions are based on an unbalanced panel for the years 2007, 2009, 2010, 2011, 2012, 2013, 2014, and 2015.

The explanatory variables, including our key explanatory variable, are measured one year prior to the actual year. This contrasts with the data used by Schmidt. In her data, the question on risk tolerance was asked after most women in the underlying sample had made their fertility decisions (Schmidt 2008: p. 444).

Our key explanatory variable is a unique measure of risk attitude. The underlying question is: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" Interviewees respond to the question on an eleven-point Likert scale ranging from 0 "not at all willing to take risks" to 10 "very willing to take risks". This measure has been validated by Dohmen et al. (2011) who demonstrate that it is highly correlated with actual risk taking in lottery experiments.

We control for age and its square, education, health, religiosity, economic worries, labor market status, actual working hours, income, and the number of children already living in the woman's household. Furthermore, we include seven year dummies, three broad region dummies, and variables for residence in an urban area, child care availability, and male unemployment rate at the federal-state level.

In the estimates on the determinants of cohabiting birth, we additionally account for the partner's age, education, labor market status, and income. We also account for differences in age, education, and income between the partners. As the partner variables have a larger number of missing values, both estimates with and without these variables are provided.

5.3 Estimation Methods

Our estimations are based on random effects (RE) and correlated random effects (CRE) probit models. The RE probit accounts for a random error component that is associated with each individual but invariant over time. The CRE probit is a parametric fixed effects approach that accounts for time-invariant unobserved factors by additionally including the individual-specific means of the time-varying explanatory variables (Mundlak 1978). Finally, we also apply the Firth logit approach which is a penalized likelihood method taking into account low prevalence of the outcome (Firth 1993).

5.4 Empirical Analysis

5.4.1 Risk Attitude and Out-of-Partnership Birth

Table 5.1 provides the estimates on risk attitude and out-of-partnership birth. The RE probit, the CRE probit and the Firth logit yield qualitatively the same result. A greater risk tolerance is significantly associated with a higher probability of out-of-partnership birth. Comparing the CRE model with the RE model, it can be seen that the estimated coefficient on risk tolerance and the resulting marginal effect double when fixed effects are taken into account.

Table 5.1: Determinants of out-of-partnership birth

	Mean, SD	RE Probit	CRE Probit	Firth Logit
Out-of-partnership birth	0.01, 0.10	---	---	---
Risk tolerance	4.84, 2.18	0.059 [0.001] (2.74)**	0.101 [0.002] (2.20)*	0.143 (2.45)*
Pseudo R^2	---	0.085	0.247	0.113

Number of observations = 6,723. Number of women = 2,247. Results on the control variables are suppressed to save space. Marginal effects are in square brackets and z-statistics are in parentheses. Marginal effects for the Firth logit are not available. ** Statistically significant at the 1% level; * at the 5% level.

For a quantitative assessment of the results, let us consider a two point increase in risk

tolerance. This is roughly an increase by one standard deviation. Considering the CRE model, the one standard deviation increase in risk tolerance results in a 0.4 percentage point higher probability of out-of-partnership birth. Taking into account that the mean of the dependent variable is equal to 1 percent, this is an increase in the probability of out-of-partnership birth by 40 percent.

5.4.2 Risk Attitude and Cohabiting Birth

Table 5.2 shows the estimations on risk attitude and cohabiting birth. The variable for risk attitude does not emerge with a significant coefficient in any of these estimations. This result holds regardless of whether or not we control for the characteristics of the partner. Thus, while our analysis provides evidence of a strong positive association between risk tolerance and out-of-partnership birth, it shows no evidence of a link between risk tolerance and cohabiting birth.

Table 5.2: Determinants of cohabiting birth

	Mean, SD	RE Probit	CRE Probit	Firth Logit
	Without partner controls			
Cohabiting birth	0.05, 0.21	---	---	---
Risk tolerance	4.53, 2.11	-0.015 [-0.001]	-0.041 [-0.003]	-0.035
		(0.82)	(1.12)	(0.87)
Pseudo R^2	---	0.053	0.245	0.020
	With partner controls			
Cohabiting birth	0.06, 0.23	---	---	---
Risk tolerance	4.45, 2.08	0.007 [0.001]	0.017 [0.001]	0.013
		(0.28)	(0.35)	(0.28)
Pseudo R^2	---	0.072	0.270	0.086

Without partner controls: Number of observations = 3,336. Number of women = 1,326. With partner controls: Number of observations = 2,056. Number of women = 818. Results on the control variables are suppressed to save space. Marginal effects are in square brackets and z-statistics are in parentheses. Marginal effects for the Firth logit are not available.

5.4.3 Determinants of Nonmarital Birth

In order to compare our results with Schmidt's (2008) study, we combine the sample of single women and the sample of cohabiting women to estimate the determinants of nonmarital birth. The estimates also include a dummy for single women. The reference group consists of cohabiting women.

Table 5.3: Determinants of nonmarital birth

	Mean, SD	RE Probit	CRE Probit	Firth Logit
		Without interaction variable		
Nonmarital birth	0.02, 0.15	---	---	---
Single woman	0.67, 0.47	-0.579 [-0.027]	-0.590 [-0.025]	-1.321
		(9.62)**	(8.19)**	(8.75)**
Risk tolerance	4.74, 2.16	0.013 [0.001]	0.022 [0.001]	0.022
		(0.89)	(0.88)	(0.67)
Pseudo R^2	---	0.099	0.246	0.112
		With interaction variable		
Nonmarital birth	0.02, 0.15	---	---	---
Single woman	0.67, 0.47	-0.955 [-0.029]	-1.118 [-0.026]	-2.278
		(6.32)**	(6.21)**	(5.92)**
Risk tolerance	4.74, 2.16	-0.019 [0.001]	-0.020 [0.001]	-0.042
		(1.04)	(0.73)	(1.05)
Single woman x risk tolerance	3.24, 2.89	0.077 [0.003]	0.107 [0.004]	0.194
		(2.82)**	(3.29)**	(2.81)**
Pseudo R^2	---	0.102	0.251	0.116

Number of observations = 10,059. Number of women = 3,028. Results on the control variables are suppressed to save space. Marginal effects are in square brackets and z-statistics are in parentheses. The calculation of the marginal effect on the interaction variable is based on Ai and Norton (2003). Marginal effects for the Firth logit are not available. ** Statistically significant at the 1% level.

Table 5.3 provides the key results. In the first set of estimations we do not account for an interaction of risk attitude and single woman status. The dummy variable for single women takes a significantly negative coefficient. Thus, single women are less likely to give birth to a child than cohabiting women. Most importantly the variable for woman's risk attitude does not emerge as a significant determinant of nonmarital birth. This is in line with

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Schmidt's (2008) study finding no influence of risk attitude on nonmarital birth for adult women in the United States.

However, the combined sample of single women and cohabiting women hides a far richer pattern of results. In the second set of estimations, we additionally include an interaction of the dummy for a single woman with the risk attitude variable. The interaction term takes a significantly positive coefficient while the coefficient on the risk attitude is insignificant. This corroborates the findings of Tables 1 and 2. A higher risk tolerance has a positive influence on the probability that a single woman gives birth to a child. By contrast, there is no evidence that risk tolerance influences the probability that a cohabiting woman gives birth to a child. Altogether, our estimates show that the role of risk attitude is only revealed if one distinguishes between out-of-partnership births and cohabiting births.

5.4.4 Further Robustness Checks

We performed a series of robustness checks that increased confidence in the pattern of results. First, in order to ensure that our key results are not solely driven by very young women, we also performed regressions without women younger than 20. This robustness check confirmed the key results.

Second, we included an interaction term of the risk tolerance variable and a dummy variable for women older than 30 to examine if the influence of risk attitude differs between age groups. The interaction term did not emerge with a significant coefficient. Most importantly, the coefficient on risk tolerance remained significantly positive in the regressions on out-of-partnership birth and insignificant in the regressions on cohabiting birth.

Third, we interacted risk attitude with the woman's education to examine if education plays a moderating role. This interaction term was also not significant and its inclusion did not change our key results.

5.5 Conclusions

This study demonstrates that it is important to distinguish between single women and cohabiting women when analyzing the determinants of nonmarital birth. Using data of adults from the SOEP, it finds that single women with a higher degree of risk tolerance are more likely to give birth to a child. This conforms to the notion that out-of-partnership birth reflects underlying risk taking behavior, i.e. engaging in casual sex without effective contraception and taking the risks associated with single motherhood. In contrast, our study finds no evidence that the risk attitudes of cohabiting women have an influence on their decision to give birth to a child. This may indicate that cohabitation is perceived as relatively stable, specifically when a child is borne to the cohabiting parents. The birth of a child may even stimulate a subsequent transition from cohabitation to marriage.

We recognize the need for further research within this theme. In particular, it would be interesting to examine if risk tolerance also has an influence on subsequent outcomes of an out-of-partnership birth for both the mother and her child.

6. Out-of-Partnership Births in East and West Germany*

Abstract: Using data from the German Socio-Economic Panel (SOEP), we show that single women in East Germany are significantly more likely to give birth to a child than single women in West Germany. This applies to both planned and unplanned births. Our analysis provides no evidence that the difference between East and West Germany can be explained by economic factors or the higher availability of child care in East Germany. This suggests that the difference in out-of-partnership births is rather driven by behavioral and cultural differences. However, these behavioral and cultural differences do not only reflect different gender role models that evolved under the former communist regime in East Germany and the democratic one in West Germany. Partly, they also reflect a long historical divide that predates the 1945 separation of Germany.

JEL: J12, J13, P20.

Keywords: Unpartnered birth, gender role models, culture, East Germany, West Germany, politico-economic systems.

6.1 Introduction

Two decades after reunification there are still large differences between East and West Germany. This does not only hold for economic circumstances but also for various dimensions of social life including family structure and fertility. Official statistics show that single-parent households are more common among East Germans than among West Germans (Statistisches Bundesamt 2010). In the year 2009, 27 percent of East German families were single-parent families. The share of single-parent families in West Germany amounted to only 17 percent. Closely related to this, nonmarital births are much more common in East Germany (Goldstein et al. 2010). In the year 2009, the share of nonmarital births among all births was 61 percent in East Germany which was more than twice the share of 27 percent in West Germany. The share of nonmarital births in East Germany is one of the highest in the EU (Mühling and Schreyer 2012).

This gives rise to the question as to what factors drive the differences between East and West Germany. We address this question by examining the determinants of out-of-partnership birth. Using data from the SOEP, our multivariate analysis shows that, even when accounting for a broad set of control variables, single women in East Germany are significantly more likely to give birth to a child than single women in West Germany. In particular, our estimates provide no evidence that the differences between East and West Germany can be explained by economic factors or by the higher availability of child care in East Germany. This holds for both planned and unplanned out-of-partnership births.

Our results conform to the notion that behavioral and cultural differences – i.e. different preferences and social customs in matters of love, partnership and family – play a crucial role in the differences in out-of-partnership births. People in East and West Germany

lived under completely different political regimes – a communist and a democratic one – for 45 years. This may have resulted in the emergence of different gender role models in the two parts of Germany. East Germany appears to be characterized by more equal gender roles implying that women are less dependent on a male partner. Thus, their wish to have a child should be less likely to depend on the presence of a stable partner or spouse. Moreover, as stressed by sex researchers and cultural historians, the more equal gender roles imply that women's sexuality is more emancipated in East Germany. To the extent this involves a higher frequency of casual sex, it can lead to a higher likelihood of unwanted pregnancies.

However, while the separation of Germany after World War II is often viewed as a natural experiment, behavioral differences between East and West Germans may have historical origins that predate the 1945 separation. Indeed, historical descriptive statistics show that, already in the early 20th century, the eastern part of Germany had substantially higher nonmarital fertility rates than the western part (Klüsener and Goldstein 2016). When taking this long historical divide into account, we do no longer find a significant East-West difference in unplanned births whereas the difference in planned births still remains. This suggests that the differences in out-of-partnership births are due to both historical factors predating the separation of Germany and different gender role models that have evolved under the two political regimes during the separation. The higher probability of unplanned births in East Germany appears to reflect long historical factors that might have contributed to East-West differences in casual sexual behavior. By contrast, the higher probability of planned births in East Germany appears to reflect a more emancipated gender role model that has evolved under the former communist regime.

The more emancipated gender role model implies that East German women to a lesser

degree define themselves through a partner. Thus, their decision to give birth to a child should be less likely to depend on the presence of a stable partner or spouse. In order to examine this explanation in more detail, we also analyze if single women in East and West Germany differ in their life goals. Our estimates show that single women in East Germany place a higher value on having children than single women in West Germany. This result provides further support for the hypothesis that women in East Germany are less dependent on a male partner.

In a final step, we estimate the determinants of birth with an expanded sample that additionally includes cohabiting and married women. While cohabiting women in East Germany are also more likely to give birth to a child than their West German counterparts, we find no significant differences between married women in East and West Germany. Thus, the differences between East and West Germany only hold true for nonmarital, but not for marital births. This finding also supports the view that the East-West differences are due to different gender role models rather than due to a generally higher propensity of having children.

Our study contributes in several ways to the economic literature. Since the emergence of the economics of the family, economists have been increasingly interested in the determinants of nonmarital births (Akerlof et al. 1996, An et al. 1993, Burdett and Ermisch 2002, Ekert-Jaffe and Grossbard 2008, Lundberg and Plotnick 1995, Lundberg et al. 2016, Kearney and Levine 2014, Willis 1999, Wolfe et al. 2001). Economic studies have examined factors such as welfare benefits, income, educational achievement, labor market conditions, religiosity, race, and price and effectiveness of birth control. We examine the long-lasting effects of historical factors and different political regimes. Moreover, our paper is one of the few papers distinguishing between planned and unplanned births.

Our study also adds to the literature on gender identity (Akerlof and Kranton 2010, Alesina et al. 2013, Bertrand et al. 2015, Booth and Nolen 2012, Cardenas et al. 2012, Gneezy et al. 2009). That literature has examined the influence of gender role models on income distribution, labor force participation, risk taking, and competitive behavior. Our results suggest that gender role models also have an influence on out-of-partnership births.

Furthermore, our study is related to the literature on institutions and cultural attitudes (Bowles 1998, Alesina and Giuliano 2015). Specifically, it contributes to the literature on the behavioral consequences of communism. A series of econometric examinations have shown that the exposure to 45 years of communism in East Germany has had substantial long-term influences on solidarity and cooperation, social distrust, personality traits, and preferences for state intervention (Alesina and Fuchs-Schündeln 2007, Ariely et al. 2014, Brosig-Koch et al. 2011, Friehe et al. 2015, Heywood et al. 2017, Ockenfels and Weimann 1999, Rainer and Siedler 2009). These studies assume that the separation of Germany after World War II is a natural experiment. However, due to the non-availability of suitable data, East-West differences predating the separation are usually not taken into account. Examining the long-lasting influence on fertility, our study demonstrates that such historical differences can play an important role.

Finally, we note that some exploratory studies have examined the determinants of nonmarital births in East and West Germany (Huinink 1998, Kreyenfeld et al. 2011, Vatterrott 2012). However, those studies do not have a specific focus on out-of-partnership births and do not distinguish between planned and unplanned births. Moreover, they use a rather small set of control variables.

The rest of the paper is organized as follows. In the next section, we provide our

background discussion. Section 6.3 presents the data and variables while section 6.4 provides the estimation results. The final section concludes.

6.2 Background Discussion

6.2.1 Different Gender Role Models in East and West Germany

Germany was separated in 1945 at the end of World War II. The separation was the result of the positions of the occupying forces and negotiations between the Allies. In 1949, the Federal Republic of Germany (FRG) and the German Democratic Republic (GDR) were officially founded in the West and in the East. The GDR was an authoritarian communist regime while the FRG embraced democracy and capitalism. After the fall of the Berlin Wall, reunification of East and West Germany took place in 1990.

During the years of separation, the two parts of Germany differed substantially in their family policies (Engelhardt et al. 2002, Pfau-Effinger and Geissler 2002, Rosenfeld et al. 2004). In West Germany, family policy was dominated for a long time by the traditional male breadwinner model with continuously employed men and only partially employed women. Women worked full-time until they had children and returned to part-time work after longer career interruptions. Lack of public child care and inconvenient opening times of many day care facilities made it difficult for women to combine work and family. Instead of facilitating women's employment opportunities, the government focused on parental leave policies allowing mothers to stay at home with their young children. While being on parental leave, women's entitlements were largely derived from their husbands' rights. Moreover, the tax system provided incentives for mothers to stay at home as it heavily weighted in favor of married and single income couples. Support for single-parent households was modest and

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there were no specific measures to foster single mothers' employment.

The family policy in East Germany promoted more equal gender roles. The main goals of the family policy were to integrate women into full-time employment and to encourage childbearing. The communist regime built up a comprehensive child care system that allowed women to stay in the labor force even during childbearing years.[34] Furthermore, measures such as child-illness leave or reductions in working hours for full-time employed mothers enabled women to reconcile work and family. East Germany also provided parental leave. However, parental leave was coupled with far reaching rights to job return. Furthermore, in contrast to West Germany, the East German tax system provided no specific incentive for women to stay at home. The earnings of spouses were taxed individually. Finally, while marriage was seen as the foundation of the family, some family policies privileged unmarried mothers (Hiekel et al. 2015). For unmarried women, the government permitted a 1-year paid maternity leave already for their first child. For married women, this maternity leave was granted for the second child only. Unmarried mothers were also preferentially treated in the allocation of child care slots.

After reunification the West German family and marriage law was adopted by the whole of Germany. However, to the extent people in East and West Germany have internalized the respective gender role model, one should still find behavioral differences even after reunification. The experience of a new politico-economic regime is unlikely to make East Germans completely abandon the family and moral values they have acquired

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[34] A further reason for building up the comprehensive child care system was that the communist regime tried to control the socialization and education of its citizens from the very start of their lives.

through socialization.[35] Available evidence suggests that the process of cultural transmission, if any, takes a long period of time.

A series of studies show that East Germans are still much more likely to hold egalitarian sex-role attitudes than West Germans (Bauernschuster and Rainer 2012, Kreyenfeld and Geisler 2006, Lee et al. 2007, Scott 1999, Treas and Widmer 2000). East Germans are less likely to be concerned about adverse effects of maternal employment on the well-being of children. Accordingly, they are more likely to disagree with the view that women have to stay home in order to take care of the household and the children. East Germans also more often tend to refuse the view that a woman has to support the husband's career instead of making her own. Most interestingly in our context, East Germans more often share the opinion that single women's wish to have a child should be respected and that one parent can raise children as effectively as two parents can do (Dorbritz and Ruckdeschel 2009).

Remarkably, the attitudinal studies do not provide evidence of a convergence. Considering the time span between the years 1991 and 2004, Lee et al. (2007) find that the differences in sex-role attitudes between East and West Germans have even increased. Bauernschuster and Rainer (2012) analyze the time span between 1991 and 2008 and obtain a similar result.

Labor supply studies show that the attitudinal differences are matched by behavioral differences. Considering the years 1999 to 2002, Haan (2005) finds that married women in the East have a higher labor market participation rate than those in the West. Relatedly,

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[35] Giavazzi et al. (20014) show that a process of cultural transmission can indeed take a long time. They examine the speed of evolution of a series of cultural attitudes for different generations of European immigrants to the US. Specifically, they identify family and moral values, general political views, and religious values as being relatively persistent.

analyzing data from married and cohabiting couples in the period 2000 to 2007, Haan and Wrohlich (2011) find higher employment rates among East German than among West German women. Finally, Kreyenfeld and Geisler (2006) show for 2002 that mothers in East Germany are much more likely to work full-time than mothers in West Germany. Moreover, they find that married and unmarried mothers in East Germany have similar employment patterns whereas in West Germany married mothers are less likely to work full-time than unmarried mothers.

All in all, the available evidence suggests that there still exist more equal gender roles in East Germany even though the former political regime is no longer in place. People in East Germany have been usually grown up with mothers employed full-time. This is the model on which they base their own lives. The more equal gender roles imply that women are both emotionally and economically less dependent on a male partner. They are less likely to define themselves through a partner and the stronger labor force attachment enables them to earn their living. Thus, their wish to have a child should be less likely to depend on the presence of a stable partner or spouse. This wish is reinforced by the widespread social acceptance of single motherhood. Against this background, we hypothesize that East German women have a higher probability of out-of-partnership birth than West German women.

One may even take this one step further and argue that the more equal gender roles not only contribute to a higher probability of wanted pregnancies, but also to a higher likelihood of unwanted pregnancies. Sex researchers and cultural historians stress that sexuality in East Germany is more emancipated (Beutel et al. 2007, Herzog 2008, Lautmann et al. 2004, Mühlberg 1995, Starke 1995). Sexuality in East Germany is characterized by higher levels of sexual activity and mobility and is more frequently to be perceived as

gratifying and enjoyable. Long-term material cost-benefit considerations appear to play a less important role in the relationships between East German men and women. Thus, to the extent single women in East Germany have a higher frequency of casual sex, we should also observe a higher probability of unplanned out-of-partnership births.

6.2.2 Alternative Explanations

We recognize that East and West Germany still differ in a series of further circumstances that may be potentially relevant for out-of-partnership births. After German reunification, East Germany's comprehensive child care system has, to a larger extent, survived so that availability of child care is higher in the East than in the West (Schober and Stahl 2014, Wrohlich 2008). As child care allows women to combine family and work, it lowers their financial dependence on a male partner (Bauernschuster and Borck 2012). This in turn may increase women's incentive to give birth to a child even if they do not have a stable partner. However, it is an open question whether higher availability of child care alone can explain the differences between East and West Germany. The availability of child care facilities must be matched by a corresponding demand. The demand is higher if women have a stronger labor force attachment. Other things equal, such labor force attachment depends on more equal gender roles.

A second alternative explanation may be that East Germany is still characterized by relatively poor labor market outcomes. In the year 2009, the unemployment rate amounted to 13 percent in East Germany compared to 7 percent in West Germany.[36] The average gross monthly wage of a full-time employee was 2486 Euro in East Germany compared to 3248

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[36] See *www.destatis.de/DE/ZahlenFakten/Indikatoren/LangeReihen/Arbeitsmarkt/lrarb001.html*.

Euro in West Germany.[37] Building on the 'marriageable men' hypothesis (Willis 1999, Wilson 1987), one could argue that there is a low share of men with a high earnings capacity in East Germany. If women have a smaller chance to find a partner who brings resources to the partnership, they may decide to have a child without a partner. However, from a theoretical point of view the influence of a low share of marriageable men is ambiguous. Single women may rather prefer to have no child if they do not find a suitable partner. Only single women guided by relatively egalitarian gender roles may decide to give birth to a child.

One may argue that women's own economic situation could play a role, too. However, the influence of this factor is also not clear-cut from a theoretical viewpoint. On the one hand, feelings of economic hopelessness may lead single women to view themselves as having little to lose by having a baby (Kearney and Levine 2014). On the other hand, single women may only give birth to a child when they have sufficient income to support a family on their own (Willis 1999).

We recognize that even if the East-West difference in out-of-partnership births is due to behaviorial and cultural factors, this does not necessarily mean that these factors evolved under the two political regimes during Germany's separation. This brings us to the third alternative explanation. Klüsener and Goldstein (2016) provide descriptive statistics showing that already in the early 20th century the eastern part of Germany on average had substantially higher nonmarital fertility rates than the western part. The authors argue that civil legislation and population policies in the eastern parts of the German Empire facilitated non-marital births. Moreover, a larger share of the East German population worked as seasonal workers. They had itinerant employment and lived far from home in mass dormitories. In these

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[37] See *www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/VerdiensteArbeitskosten/ VerdiensteVerdienstunterschiede/Tabellen/Bruttomonatsverdienste.html*.

seasonal communities, the workers were less subject to social control and pressure. This is likely to have supported the spread of deviant behavior. One may hypothesize that specifically the latter factor has contributed to long-lasting East-West differences in casual sexual behavior.

In our empirical analysis, we will test these alternative explanations by running regressions with and without control variables for the economic situation, the availability of child care and the long historical divide. If the economic situation, the availability of child care or the historical divide plays the primary role, the difference in out-of-partnership births between East and West Germany should diminish or even vanish when including the respective control variables. Yet, if the difference is primarily driven by behavioral and cultural factors tracing back to the separation of Germany after World War II, we should still find a significantly higher probability of out-of-partnership birth in East Germany regardless of whether or not we account for the economic situation, the availability of child care and the long historical factors.

6.3 Data and Variables

6.3.1 The Data Set

Our study uses data from the SOEP (Wagner et al. 2007). The SOEP is a large representative longitudinal survey of private households in Germany. It is administered by the German Economic Institute (DIW). Infratest Sozialforschung, a professional survey and opinion institute, conducts the face-to-face interviews. A nucleus of socio-economic and demographic questions is asked annually. Different 'special' topics are sampled in specific waves. In our empirical analysis, we consider single women, i.e. women without a partner or

spouse. We focus on single women aged 18–42.[38]

6.3.2 Dependent Variables

Table 6.1 shows the definitions of the dependent variables and their descriptive statistics. Our main dependent variable is a dummy for out-of-partnership birth. The respective dummy equals one if a single woman gives birth to a child in the actual year and equals zero otherwise. For the analysis of out-of-partnership birth, we focus on women who are singles in the previous and in the actual year. The variable for out-of-partnership birth is available for the years 1999–2014.

Table 6.1: Variable definitions and descriptive statistics of the dependent variables

Variable	Description	Years	Mean	N
Out-of-partnership birth	Dummy equals 1 if a single woman gives birth in the actual year.	1999-2014	0.011	17,289
Planned out-of-partnership birth	Dummy equals 1 if a single woman gives birth in the actual year and states that the pregnancy was planned.	2004-2014	0.002	12,121
Unplanned out-of-partnership birth	Dummy equals 1 if a single woman gives birth in the actual year and states that the pregnancy was unplanned.	2004-2014	0.006	12,121
Importance of children	Dummy equals 1 if a single woman states that having children is an important or very important goal in her life.	2004, 2008, 2012	0.687	3,861

In a further step, we distinguish between unplanned and planned out-of-partnership births. This helps examine possible transmission channels in more detail. As stressed by our background discussion, the higher degree of gender equality should imply that East German women's wish to have a child is less dependent on the presence of a stable partner or spouse.

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[38] Note that the data provide no information whether women younger than 18 years gave birth to a child.

This should result in a higher probability of planned out-of-partnership birth. Single women in East and West Germany may even differ in their sexuality. If single women in East Germany have a higher frequency of casual sex, we should also observe a higher probability of unplanned out-of-partnership birth. The variables for planned and unplanned out-of-partnership birth are available for the years 2004–2014.

Moreover, we examine if single women in East and West Germany differ in the value they place on having children. The dependent variable is a dummy equal to 1 if a single woman states that having children is an important or very import goal in her life. To the extent East Germany is characterized by more equal gender roles, a woman's wish to have a child should be less likely to depend on the presence of a stable partner or spouse. Thus, East German single women should place a higher value on having children than their West German counterparts. The variable for the personal importance of having children is available for the years 2004, 2008 and 2012.

6.3.3 Explanatory Variables

Table 6.2 provides the definitions and descriptive statistics of the explanatory variables. The explanatory variables are measured one year prior to the actual year. Our explanatory variable of primary interest is a dummy equal to 1 if the woman resides in East Germany. The dummy is equal to 0 if the woman resides in West Germany. We exclude women who have migrated from East to West Germany or from West to East Germany. For our analysis, we focus on East German women who have lived in East Germany before the fall of the Berlin Wall. Accordingly, we focus on West German women who have lived in West Germany before the fall of the Wall. This helps capture the potential influence of long-term cultural factors.

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Table 6.2: Variable definitions and descriptive statistics of the explanatory variables

Variable	Description	Mean
East Germany	Dummy equals 1 if the single woman resides in East Germany.	0.263
Risk tolerance	Score of risk tolerance on an eleven-point Likert scale. The scale ranges from 0 "not at all willing to take risks" to 10 "very willing to take risks".	4.789
Ln(child care availability)	Log of number of daycare facilities per children under age 3 at the county level.	-3.690
Age	The single woman's age in years.	26.870
Skilled	Dummy equals 1 if the single woman's highest educational attainment is a completed apprenticeship training.	0.535
University degree	Dummy equals 1 if the single woman has a university degree.	0.160
Migration background	Dummy equals 1 if the single woman is a first-generation or second-generation immigrant.	0.194
Health	Dummy equals 1 if the woman reports good or very good health.	0.697
Number of children	Number of children under age 16 in the household.	0.595
Actual working hours	Actual working hours per week including overtime. The variable is set equal to 0 if the woman does not work.	21.635
Labor income	Monthly gross labor income of the single woman. The variable is set equal to 0 if the woman does not work.	911.88
Unemployed	Dummy equals 1 if the single woman is unemployed.	0.104
Out of labor force	Dummy equals 1 if the single woman is out of labor force.	0.235
Economic worries	Score of own economic concerns on a three-point Likert scale coded as 1 "no concerns", 2 "somewhat concerned", and 3 "very concerned".	2.071
Ln(unemployment rate)	Log of unemployment rate (in %) at the county level.	2.181
Catholic	Dummy equals 1 if the woman is catholic.	0.285
Protestant	Dummy equals 1 if the woman is protestant.	0.374
Other religious affiliation	Dummy equals 1 if the woman has another religious affiliation.	0.034
Ln(historical nonmarital birth rate)	Log of historical nonmarital birth rate (in %) at the federal state level. The rate is averaged over the years 1900-1929.	2.238
Year dummies	Sixteen year dummies.	---

N = 17,289. The reference group of the education dummies (labor force status dummies, religion dummies) consists of unskilled single women (employed single women, single women with no religious affiliation). For risk tolerance and childcare availability the number of observations is equal to 6,540.

The economic situation is captured by a series of variables. We include a variable for the

unemployment rate at the county level. Furthermore, we account for the woman's labor force status, working hours and income. Subjective expectations are captured by a variable for economic worries.

Information on the availability of child care is not provided by the SOEP, but can be obtained from official German statistics (Bundesinstitut für Bau-, Stadt- und Raumforschung 2016). Our measure of child care availability is the number of day care facilities divided by the number children under age 3 in the county the woman lives in.

Data on historical nonmarital birth rates are also obtained from official German statistics (Statistisches Reichsamt 1900–1929). For our analysis, we average nonmarital birth rates at the federal state level over the years 1900–1929. By including the historical nonmarital birth rate, we can examine if possible East-West differences in out-of-partnership births are due to Germany's separation or due to factors predating the separation (see Lichter et al. 2015 for a related approach with respect to the influence of mass surveillance on social capital in the former GDR).

Socio-demographic characteristics are taken into account by variables for education, age, health and the number of children under age 16 in the single woman's household. We also control for risk tolerance. Risk tolerance has been shown to be positively associated with out-of-partnership birth (Jirjahn and Struewing 2016). The SOEP provides a measure of risk tolerance on an eleven-point Likert scale. This measure has been experimentally validated by Dohmen et al. (2011).

Furthermore, we include variables for religious affiliation to capture differences in religiosity between East and West Germany. East Germans are, on average, less religious than West Germans (Meulemann 2016). One may argue that this reflects cultural differences

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between the eastern and the western part of Germany. However, even though gender role models may be related to religion, they play a more general and fundamental societal role beyond religion. Moreover, the influence of religion on out-of-partnership births is ambiguous from a theoretical point of view. Lower religiosity could explain the higher rate of out-of-partnership births in East Germany only if religiosity had a negative influence on the likelihood that single women give birth to a child. This would be the case if religiosity were associated with reduced sexual activity of single women. Yet, there are at least two other potential effects of religiosity working in the opposite direction. First, religious women may have a lower probability to abort a child. Second, religious women may have a higher degree of altruism implying a stronger wish to have a child even when there is no stable partner or spouse. Thus, the inclusion of the religion variables may weaken or strengthen the estimated East-West difference in out-of-partnership births.

Note that the variables for child care and risk tolerance are not available for all waves of our sample. Thus, we provide two sets of regressions. The first set of regressions use the full sample of observations, but do not account for child care and risk tolerance. The second set of regressions include these variables and use only those waves of the survey that contain information on child care and risk tolerance.

6.4 Empirical Analysis

6.4.1 Determinants of Out-of-Partnership Births

Table 6.3 provides the initial estimations on the determinants of out-of-partnership birth. The estimations are based on an unbalanced panel of single women for the years 1999–2014. In

Table 6.3: Determinants of out-of-partnership birth; years 1999-2014

	Random Effects Probit				Firth Logit
	(1)	(2)	(3)	(4)	(5)
East Germany	0.437 [0.010]	0.472 [0.019]	0.391 [0.014]	0.400 [0.015]	0.961
	(6.86)***	(6.87)***	(4.09)***	(3.39)***	(3.39)***
Age	---	0.291 [0.005]	0.257 [0.004]	0.256 [0.004]	0.634
		(5.94)***	(5.13)***	(5.11)***	(5.15)***
Age squared	---	-0.005 [-0.0001]	-0.004 [-0.0001]	-0.004 [-0.0001]	-0.011
		(5.87)***	(5.15)***	(5.12)***	(5.14)***
Skilled	---	-0.254 [-0.008]	-0.201 [-0.006]	-0.202 [-0.006]	-0.487
		(3.09)***	(2.43)**	(2.44)**	(2.54)**
University degree	---	-0.143 [-0.005]	0.006 [0.0002]	0.006 [0.0002]	0.010
		(1.31)	(0.05)	(0.05)	(0.04)
Migration background	---	0.118 [0.004]	0.127 [0.004]	0.097 [0.003]	0.227
		(1.39)	(1.49)	(1.06)	(1.02)
Health	---	-0.101 [-0.003]	-0.065 [-0.002]	-0.067 [-0.002]	-0.156
		(1.55)	(0.97)	(1.01)	(0.97)
Number of children	---	-0.004 [-0.0001]	-0.040 [-0.001]	-0.041 [-0.001]	-0.038
		(0.11)	(0.92)	(0.95)	(0.42)
Actual working hours	---	---	0.003 [0.0001]	0.003 [0.0001]	0.010
			(0.87)	(0.83)	(1.27)
Labor income	---	---	-4.1e-06 [-6.4e-07]	-3.4e-05 [-5.5e-07]	-3.0e-04
			(0.31)	(0.26)	(1.26)
Labor income squared	---	---	-9.8e-09 [-1.5e-05]	-1.1e-08 [-1.8e-10]	3.5e-08
			(0.32)	(0.37)	(0.94)
Unemployed	---	---	0.464 [0.020]	0.468 [0.021]	1.076
			(3.90)***	(3.93)***	(3.77)***
Out of labor force	---	---	0.117 [0.004]	0.112 [0.003]	0.301
			(0.94)	(0.91)	(0.97)
Economic worries	---	---	0.025 [0.001]	0.026 [0.001]	0.063
			(0.51)	(0.52)	(0.52)
Ln(unemployment rate)	---	---	0.015 [4.4e-04]	0.031 [0.001]	0.068
			(0.16)	(0.31)	(0.27)
Catholic	---	---	---	0.099 [0.003]	0.228
				(1.01)	(0.96)
Protestant	---	---	---	0.079 [0.002]	0.209
				(0.97)	(1.09)
Other religious affiliation	---	---	---	0.241 [0.008]	0.592
				(1.38)	(1.49)
Ln(historical nonmarital birth rate)	---	---	---	0.049 [0.001]	0.125
				(0.53)	(0.54)
Constant	-2.614	-6.429	-6.143	-6.325	-14.216
	(31.68)***	(9.38)***	(8.42)***	(8.15)***	(7.56)***
Year dummies	---	Included	Included	Included	Included
Pseudo R^2	0.023	0.050	0.066	0.067	0.076
N	17,289	17,289	17,289	17,289	17,289

The table shows the estimated coefficients. Z-statistics are in parentheses. Marginal effects are in square brackets. Marginal effects of dummy variables are evaluated for a discrete change from 0 to 1. Marginal effects of the education dummies, labor force status dummies and religion dummies are changes in probability compared to the respective reference group. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

random effects probit regression (1), we include only a constant and the dummy variable for residing in East Germany. The variable takes a significantly positive coefficient. The corresponding marginal effect implies that a single woman in East Germany has a 1 percentage point higher probability of giving birth to a child. Taking into account that this probability is 0.5 percent for West Germany, the difference between the two parts of Germany is substantial. Single women in East Germany have twice the probability of giving birth to a child than single women in West Germany.

In regression (2), we add basic control variables for age, education, health, number of children and year of observation. Age takes a significantly positive and its square a significantly negative coefficient. This suggests an inverse U-shaped relationship between age and out-of-partnership birth with a maximum at roughly 30 years. The variable for a completed apprenticeship training emerges with a significantly positive coefficient while the variable for a university degree is not significant. Taking into account that the reference group consists of the unskilled, the results suggest a U-shaped influence of education with medium educated women having the lowest probability of out-of-partnership birth. Most importantly, including the basic control variables does not change the result on our key explanatory variable. Single women in East Germany are more likely to give birth to a child than single women in West Germany.

In regression (3), we expand the specification by additionally including the variables for the economic situation. With one exception these variables do not emerge with significant coefficients. Only the variable for own unemployment takes a significant coefficient. The coefficient is positive suggesting that single women are more likely to give birth to a child if they are unemployed. Residing in East Germany remains a significantly positive determinant

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of out-of-partnership birth. Thus, the estimation provides no evidence that the East-West differences in out-of-partnership birth can be explained by economic factors.

In regression (4), we also include variables for the woman's religious affiliation and for the historical nonmarital birth rate. The coefficients on these variables are insignificant while the coefficient on the dummy for East Germany still remains significant. Compared to the initial regression without control variables, the size of the estimated coefficient and the marginal effect are even higher when taking control variables into account. According to regression (4), single women in East Germany have a 1.5 percentage point higher probability of out-of-partnership birth than single women in West Germany.

Finally in regression (5), we apply Firth's (1993) penalized likelihood approach to take into account that the share of observations with an out-of-partnership birth is rather small in our sample.[39] The results of the penalized likelihood approach are very similar to those obtained by using the probit procedure. Importantly, this approach also confirms a significant East-West difference in out-of-partnership births.

The estimations in Table 6.3 do not control for child care availability and risk tolerance. In order to take child care availability and risk tolerance into account, we limit our estimation sample to the years for which information on these variables is available. Table 6.4 presents the estimations based on an unbalanced panel for the years 2008–2014. For the purpose of comparison, regression (1) uses the same specification as regression (4) in Table 6.3. The regression confirms the inverted U-shaped relationship between age and out-of-partnership birth. For the first time, the variable for the historical nonmarital birth rate takes a significant coefficient. Single women in federal states with a higher 1920s nonmarital birth

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[39] Note that STATA provides only coefficients, but no marginal effects for Firth's model.

Table 6.4: Determinants of out-of-partnership birth; years 2008-2014

	Random Effects Probit			Firth Logit
	(1)	(2)	(3)	(4)
East Germany	0.495 [0.014]	0.431 [0.012]	0.429 [0.011]	1.123
	(2.64)***	(2.26)**	(2.22)**	(2.43)**
Ln(historical nonmarital birth rate)	0.313 [0.006]	0.313 [0.006]	0.319 [0.006]	0.811
	(1.82)*	(1.78)*	(1.78)*	(1.81)*
Risk tolerance	---	---	0.053 [0.001]	0.127
			(2.02)**	(2.10)**
Ln(child care availability)	---	0.451 [0.009]	0.465 [0.009]	1.041
		(1.88)*	(1.91)*	(1.90)*
Age	0.283 [0.003]	0.289 [0.003]	0.295 [0.003]	0.728
	(3.00)***	(3.05)***	(3.07)***	(3.17)***
Age squared	-0.005 [-0.0001]	-0.005 [-0.0001]	-0.005 [-0.0001]	-0.013
	(3.09)***	(3.15)***	(3.15)***	(3.22)***
Skilled	-0.186 [-0.004]	-0.186 [-0.004]	-0.170 [-0.003]	-0.503
	(1.29)	(1.29)	(1.16)	(1.52)
University degree	0.057 [0.002]	0.068 [0.002]	0.086 [0.002]	0.099
	(0.28)	(0.34)	(0.43)	(0.22)
Migration background	0.262 [0.007]	0.282 [0.007]	0.283 [0.007]	0.749
	(1.66)*	(1.78)*	(1.76)*	(2.04)**
Health	-0.042 [-0.001]	-0.036 [-0.001]	-0.044 [-0.001]	-0.087
	(0.36)	(0.31)	(0.38)	(0.32)
Number of children	0.003 [0.0001]	-0.002 [-3.6e-05]	-0.006 [-0.0001]	0.026
	(0.05)	(0.03)	(0.09)	(0.19)
Actual working hours	-0.002 [-3.8e-05]	-0.002 [-4.1e-05]	-0.002 [-4.2e-05]	-0.003
	(0.29)	(0.31)	(0.33)	(0.18)
Labor income	-0.0001 [-1.3e-06]	-0.0001 [-1.6e-06]	-0.0001 [-1.2e-06]	-0.0004
	(0.69)	(0.67)	(0.69)	(1.22)
Labor income squared	1.6e-08 [1.8e-10]	1.6e-08 [1.8e-10]	1.8e-08 [1.8e-10]	7.7e-08
	(0.61)	(0.63)	(0.68)	(1.95)*
Unemployed	0.340 [0.010]	0.361 [0.010]	0.359 [0.010]	0.705
	(1.48)	(1.56)	(1.53)	(1.28)
Out of labor force	-0.026 [-0.001]	-0.019 [-0.0003]	-0.018 [-0.0003]	-0.095
	(0.11)	(0.08)	(0.08)	(0.17)
Economic worries	-0.092 [-0.002]	-0.097 [-0.002]	-0.091 [-0.002]	-0.219
	(1.08)	(1.14)	(1.06)	(1.07)
Ln(unemployment rate)	0.057 [0.001]	0.117 [0.002]	0.107 [0.002]	0.192
	(0.36)	(0.71)	(0.64)	(0.47)
Catholic	0.089 [0.002]	0.113 [0.002]	0.103 [0.002]	0.268
	(0.49)	(0.62)	(0.56)	(0.62)
Protestant	0.154 [0.003]	0.170 [0.003]	0.173 [0.003]	0.431
	(1.13)	(1.23)	(1.24)	(1.36)
Other religious affiliation	0.587 [0.020]	0.597 [0.020]	0.615 [0.020]	1.465
	(2.14)**	(2.18)**	(2.21)**	(2.53)**
Constant	-7.045	-5.569	-6.049	-13.408
	(4.81)***	(3.44)***	(3.63)***	(3.43)***
Year dummies	Included	Included	Included	Included
Pseudo R^2	0.170	0.175	0.180	0.074
N	6,540	6,540	6,540	6,540

The table shows the estimated coefficients. Z-statistics are in parentheses. Marginal effects are in square brackets. Marginal effects of dummy variables are evaluated for a discrete change from 0 to 1. Marginal effects of the education dummies, labor force status dummies and religion dummies are changes in probability compared to the respective reference group. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

rate have an increased probability of giving birth to a child. This suggests that historical factors can indeed have a very long-lasting influence on fertility behavior. However most importantly, the East-West difference in out-of-partnership births is also confirmed when using the smaller estimation sample.

In regression (2), we add the variable for child care availability to the specification. This variable takes a significantly positive coefficient. Single women in counties with a greater availability of child care are more likely to give birth to a child. While this role of child care availability conforms to expectations, it cannot explain the East-West differences in the fertility of single women. Single women in East Germany remain significantly more likely to give birth to a child.

In regression (3), we also control for risk attitude. The regression shows a significantly positive association between risk tolerance and out-of-partnership birth. The result on the East-West difference remains also in this regression unchanged. Finally, regression (4) applies Firth's penalized likelihood approach. That regression confirms our pattern of results, too.

Altogether, the result of a significant East-West difference in out-of-partnership births persists even when taking a broad set of control variables into account. Specifically, our estimates do not provide evidence that the higher likelihood of out-of-partnership births in East Germany can be explained by the higher availability of child care or the poor economic situation. This suggests that other factors should play a role. As discussed, different norms of love, partnership and family have developed in East and West Germany. People in East Germany are more likely to have non-traditional sex role attitudes. As a consequence, single women in East Germany appear to be more willing to give birth to a child.

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So far we also have not found evidence that the different norms of love, partnership and family can be explained by historical factors predating the 1945 separation of Germany. The estimated East-West difference in the likelihood of out-of-partnership birth remains statistically significant and quantitatively largely unchanged in regressions that account for the 1920s nonmarital birth rate. This could suggest that the different gender role models evolved under the two political regimes during the separation. However, the role of historical factors may differ between planned and unplanned births. Hence, we now turn to an examination of the determinants of planned and unplanned out-of-partnership births.

6.4.2 Planned and Unplanned Out-of-Partnership Births

The determinants of planned and unplanned out-of-partnership births are estimated by using the multinomial probit model. Planned and unplanned births are measured relative to the base of no birth. Table 6.5 presents the results. Regressions (1) and (2) are based on an unbalanced sample for the years 2004–2014.

In regression (1), we do not control for the historical nonmarital birth rate. The regression shows that age has an inverted U-shaped relationship with both planned and unplanned births. The single woman's own unemployment increases both the probability of a planned and the probability of an unplanned birth. Education plays only a role in unplanned births. Single women with a medium education level are less likely to have an unplanned birth. Religion emerges as a significantly positive determinant of planned births whereas it plays no significant role in unplanned births. Compared to single women without religious affiliation, those with a Catholic, Protestant or other religious affiliation are more likely to

Table 6.5: Determinants of planned and unplanned out-of-partnership births

	(1) Years 2004-2014		(2) Years 2004-2014		(3) Years 2008-2014		(4) Years 2008-2014	
	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned
East Germany	1.092 [0.006]	0.447 [0.005]	1.102 [0.006]	0.258 [0.002]	2.035 [0.016]	0.537 [0.005]	2.011 [0.016]	0.138 [0.001]
	(5.20)***	(2.28)**	(4.40)***	(1.17)	(5.97)***	(1.99)**	(5.03)***	(0.46)
Ln(historical nonmarital birth rate)	---	---	-0.007 [-0.0001]	0.345 [0.004]	---	---	0.042 [1.5e-05]	0.834 [0.008]
			(0.02)	(2.08)**			(0.08)	(2.65)***
Risk tolerance	---	---	---	---	-0.042 [-0.0002]	0.085 [0.001]	-0.043 [-0.0002]	0.085 [0.001]
					(0.59)	(2.13)**	(0.63)	(2.09)**
Ln(child care availability)	---	---	---	---	-0.868 [-0.003]	0.579 [0.006]	-0.865 [-0.003]	0.621 [0.006]
					(1.52)	(1.72)*	(1.52)	(1.77)*
Age	0.580 [0.002]	0.452 [0.004]	0.580 [0.002]	0.452 [0.005]	0.815 [0.003]	0.360 [0.003]	0.812 [0.003]	0.358 [0.003]
	(3.89)***	(4.61)***	(3.91)***	(4.60)***	(2.69)***	(2.30)**	(2.68)***	(2.16)**
Age squared	-0.009 [-4.0e-05]	-0.008 [-0.0001]	-0.009 [-4.0e-05]	-0.008 [-0.0001]	-0.014 [-4.7e-05]	-0.006 [-0.0001]	-0.014 [-4.7e-05]	-0.006 [-0.0001]
	(3.90)***	(4.62)***	(3.92)***	(4.60)***	(2.86)***	(2.32)**	(2.86)***	(2.19)**
Skilled	-0.050 [-0.0001]	-0.300 [-0.003]	0.052 [-0.0001]	-0.306 [-0.003]	0.443 [0.001]	-0.356 [-0.004]	0.437 [0.001]	-0.386 [-0.004]
	(0.20)	(1.65)*	(0.21)	(1.71)*	(0.89)	(1.59)	(0.86)	(1.73)*
University degree	0.368 [0.002]	0.005 [-0.0001]	0.365 [0.002]	-0.015 [-3.7e-04]	0.943 [0.003]	-0.006 [-2.6e-04]	0.933 [0.003]	-0.065 [-0.001]
	(1.22)	(0.03)	(1.20)	(0.07)	(1.60)	(0.02)	(1.50)	(0.22)
Migration background	0.269 [0.002]	-0.206 [-0.002]	0.269 [0.002]	-0.203 [-0.002]	0.842 [0.004]	-0.043 [-0.001]	0.845 [0.004]	-0.011 [-0.0002]
	(1.05)	(1.12)	(1.05)	(1.11)	(2.14)**	(0.17)	(2.14)**	(0.04)
Health	0.169 [0.001]	-0.134 [-0.002]	0.169 [0.001]	-0.140 [-0.002]	0.213 [0.001]	-0.117 [-0.001]	0.214 [0.001]	-0.134 [-0.001]
	(0.83)	(1.00)	(0.82)	(1.04)	(0.71)	(0.61)	(0.72)	(0.68)
Number of children	0.191 [0.001]	0.124 [0.001]	0.191 [0.001]	0.128 [0.001]	0.223 [0.001]	0.092 [0.001]	0.223 [0.001]	0.093 [0.001]
	(3.42)***	(1.89)*	(3.40)***	(1.94)*	(2.65)***	(1.06)	(2.65)***	(1.06)
Actual working hours	0.002 [8.2e-06]	0.002 [1.9-05]	0.002 [8.2e-06]	0.002 [1.5e-06]	-0.010 [-3.3e-05]	-0.001 [-1.3e-05]	-0.010 [-3.3e-05]	-0.002 [-2.1e-05]
	(0.16)	(0.23)	(0.16)	(0.18)	(0.42)	(0.13)	(0.43)	(0.20)
Labor income	2.7e-05 [1.6e-07]	-0.0001 [-1.3e-06]	2.8e-05 [1.7e-07]	-0.0001 [-1.3e-06]	1.2e-05 [4.1e-07]	-0.0001 [-1.4e-06]	1.1e-05 [4.2e-07]	-1.7e-04 [-1.6e-06]
	(0.10)	(0.55)	(0.11)	(0.52)	(0.27)	(0.51)	(0.27)	(0.58)
Labor income squared	-6.9e-09 [-3.4e-11]	7.8e-09 [8.3e-11]	-7.0e-09 [-3.4e-11]	8.1e-09 [8.7e-11]	3.0e-09 [7.8e-12]	1.5e-08 [1.5e-10]	2.9e-09 [6.6e-12]	2.2e-08 [2.1e-10]
	(0.21)	(0.28)	(0.22)	(0.27)	(0.07)	(0.52)	(0.07)	(0.70)
Unemployed	0.666 [0.004]	0.596 [0.008]	0.663 [0.004]	0.582 [0.008]	0.598 [0.002]	0.411 [0.005]	0.591 [0.002]	0.368 [0.004]
	(1.72)*	(2.18)**	(1.72)*	(2.12)**	(0.94)	(1.14)	(0.94)	(0.99)
Out of labor force	0.277 [0.001]	0.005 [0.0001]	0.276 [0.001]	-0.014 [-0.0002]	0.004 [3.6e-05]	-0.146 [-0.001]	-0.001 [-2.6e-05]	-0.201 [-0.002]
	(0.62)	(0.02)	(0.62)	(0.05)	(0.01)	(0.36)	(0.01)	(0.48)
Economic worries	0.223 [0.001]	-0.068 [-0.001]	0.221 [0.001]	-0.067 [-0.001]	0.314 [0.001]	-0.174 [-0.002]	0.313 [0.001]	-0.169 [-0.002]
	(1.39)	(0.80)	(1.38)	(0.77)	(1.35)	(1.52)	(1.35)	(1.42)

Ln(unemployment rate)	0.185 [0.001]	0.249 [0.003]	0.182 [0.001]	0.294 [0.003]	-0.670 [-0.002]	0.465 [0.005]	-0.662 [-0.002]	0.554 [0.006]
	(0.70)	(1.44)	(0.69)	(1.71)*	(1.49)	(1.49)	(1.37)	(2.00)**
Catholic	0.633 [0.003]	0.113 [0.001]	0.636 [0.003]	0.146 [0.001]	0.935 [0.002]	0.284 [0.003]	0.940 [0.002]	0.321 [0.004]
	(2.50)**	(0.56)	(2.50)**	(0.71)	(2.09)**	(1.06)	(2.14)**	(1.20)
Protestant	0.495 [0.002]	-0.023 [-0.0004]	0.496 [0.002]	0.014 [-2.5e-05]	1.103 [0.003]	-0.063 [-0.001]	1.105 [0.003]	-0.003 [-0.0002]
	(2.61)***	(0.13)	(2.64)***	(0.08)	(3.05)***	(0.29)	(3.09)***	(0.01)
Other religious affiliation	0.811 [0.004]	0.398 [0.005]	0.816 [0.004]	0.466 [0.006]	1.233 [0.004]	0.143 [0.001]	1.237 [0.004]	0.298 [0.003]
	(1.91)*	(1.08)	(1.91)*	(1.28)	(1.79)*	(0.26)	(1.80)*	(0.56)
Constant	-15.010	-10.416	-14.992	-11.262	-21.423	-7.530	-21.473	-9.315
	(6.75)***	(6.97)***	(6.17)***	(7.52)***	(4.11)***	(2.86)***	(3.85)***	(3.31)***
Year dummies	Included	Included	Included	Included	Included	Included	Included	Included
Log pseudolikelihood		-576.549		-532.095		-254.349		-250.495
N		12,121		12,121		6,525		6,525

Method: Multinomial probit. Base category: No birth. The table shows the estimated coefficients. Z-statistics are in parentheses. Standard errors are clustered by the county level. Marginal effects are in square brackets. Marginal effects of dummy variables are evaluated for a discrete change from 0 to 1. Marginal effects of the education dummies, labor force status dummies and religion dummies are changes in probability compared to the respective reference group. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

have a planned birth. This conforms to the notion that religiosity is associated with an increased wish to have a child. Turning to our variable of primary interest, single women in East Germany have both a significantly higher probability of a planned birth and a significantly higher probability of an unplanned birth. Thus, the East-West difference in the fertility of single women holds true for both planned and unplanned births.

Regression (2) shows that this difference is partly due to historical factors that predate the 1945 separation of Germany. Adding the variable for the historical nonmarital birth rate to the specification renders the coefficient on East Germany insignificant in the equation for unplanned out-of-partnership births. Moreover, the size of that coefficient drops substantially by more than 40 percent. The variable for 1920s nonmarital birth rate emerges as a significant determinant of unplanned out-of-partnership births. Single women in federal states with a higher historical nonmarital birth rate are more likely to have an unplanned birth.

However, the East-West difference in planned out-of-partnership births cannot be explained by the historical nonmarital birth rate. In the equation for planned births, the coefficient on East Germany remains statistically significant and its size even slightly increases when including the variable for the 1920s nonmarital birth rate. Moreover, the variable for the 1920s nonmarital birth rate does not emerge as a significant determinant of planned out-of-partnership births.

Regressions (3) and (4) use a smaller sample for the years 2008–2014. These regressions additionally include variables for risk tolerance and child care availability. The two variables take significant coefficients in the equation for unplanned out-of-partnership births. Risk tolerance and child care availability are positively associated with a higher probability of unplanned out-of-partnership birth. Most importantly, the two regressions

confirm our key pattern of results. When not controlling for the 1920s nonmarital birth rate, the coefficient on East Germany is statistically significant in both the equation for planned and the equation for unplanned out-of-partnership births. Adding the 1920s nonmarital birth rate to the specification renders the coefficient on East Germany insignificant in the equation for unplanned out-of-partnership births whereas the coefficient remains statistically significant and quantitatively large unchanged in the equation for planned out-of-partnership births.

Altogether, the estimations shown in Table 6.5 provide two important insights. First, the pattern of influences underlying the East-West difference in out-of-partnership births can be revealed only when distinguishing between planned and unplanned births. Second, while behavioral and cultural differences between East and West Germans are usually attributed to the different political systems during Germany's separation, our estimations show that historical factors predating the separation cannot be ignored. The estimations provide evidence that the higher likelihood of unplanned births among East German single women is due to factors dating back longer than Germany's separation. As suggested by Klüsener and Goldstein (2016), a greater extent of seasonal work in the eastern part of Germany may have historically contributed to what they call deviant behavior. Our finding indicates that East-West differences in casual sexual behavior persist to the present time.

By contrast, we do not find evidence that the higher likelihood of planned births among single women in East Germany can be explained by factors that predate the separation. This conforms to the hypothesis that the higher likelihood of planned out-of-partnership births reflects more equal gender roles that have evolved in East Germany during the separation. These more equal gender roles imply that women are less dependent on men

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such that they are more willing to raise a child even when there is no stable partner or spouse.

Furthermore, our estimations provide no evidence that the cultural and behavioral differences between East and West Germans can be reduced to differences in religiosity. East Germans are on average less religious than West Germans (Meulemann 2016). However, the East-West difference in planned out-of-partnership births holds even when controlling for religious affiliation. Moreover, religious affiliation is not associated with a lower, but with a higher probability of planned out-of-partnership births. Thus, the estimations suggest that the different gender role models in East and West Germany play a more general societal role beyond religion.

6.4.3 The Importance of Having Children

In a further step, we examine if single women in East and West Germany differ in the value they place on having children. If women are less dependent on men, their wish to have a child should depend to a lesser degree on the presence of a stable partner or spouse. Thus, single women in East Germany should place more value on having children than their West German counterparts.

Table 6.6 provides the estimations on the determinants of the personal importance of having children. Regressions (1) and (2) are based on an unbalanced panel for the years 2004, 2008 and 2012. In regression (1), we include a set of basic control variables. Several of the control variables take significant coefficients. Single women with a Catholic, Protestant or other religious affiliation are more likely to place a high or very high value on having children. This finding fits the result that religious women have a higher probability of planned out-of-partnership birth. It may indicate that religious people are characterized by a higher

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Table 6.6: Determinants of the importance of having children

	(1) Years 2004, 2008, 2012	(2) Years 2004, 2008, 2012	(3) Years 2008, 2012	(4) Years 2008, 2012
East Germany	0.373 [0.065] (3.16)***	0.381 [0.063] (2.51)**	0.453 [0.047] (2.16)**	0.454 [0.046] (2.12)**
Risk tolerance	---	---	---	-0.028 [-0.003] (1.44)
Ln(child care availability)	---	---	---	0.069 [0.008] (0.25)
Age	0.325 [0.084] (5.40)***	0.285 [0.073] (4.57)***	0.304 [0.060] (3.22)***	0.305 [0.060] (3.20)***
Age squared	-0.005 [-0.001] (5.05)***	-0.004 [-0.001] (4.26)***	-0.005 [-0.001] (3.09)***	-0.005 [-0.001] (3.10)***
Skilled	-0.059 [-0.011] (0.57)	-0.057 [-0.010] (0.54)	-0.178 [-0.019] (1.18)	-0.184 [-0.020] (1.21)
University degree	-0.434 [-0.097] (2.87)***	-0.283 [-0.057] (1.77)*	-0.420 [-0.055] (1.87)*	-0.421 [-0.054] (1.86)*
Migration background	0.157 [0.029] (1.39)	0.151 [0.026] (1.32)	0.094 [0.011] (0.60)	0.098 [0.011] (0.61)
Health	0.098 [0.019] (1.21)	0.140 [0.027] (1.69)*	0.280 [0.037] (2.33)**	0.292 [0.038] (2.40)**
Number of children	0.668 [0.130] (11.54)***	0.640 [0.118] (10.96)***	0.764 [0.094] (8.07)***	0.742 [0.089] (7.78)***
Catholic	0.308 [0.062] (2.69)***	0.344 [0.066] (2.91)***	0.467 [0.059] (2.77)***	0.479 [0.059] (2.81)***
Protestant	0.219 [0.046] (2.07)**	0.237 [0.048] (2.21)**	0.228 [0.034] (1.53)	0.240 [0.035] (1.58)
Other religious affiliation	0.653 [0.108] (2.39)**	0.705 [0.109] (2.55)**	0.799 [0.080] (1.98)**	0.828 [0.080] (2.02)**
Ln(historical nonmarital birth rate)	0.019 [0.004] (0.19)	0.007 [0.001] (0.06)	0.152 [0.018] (1.00)	0.153 [0.018] (0.99)
Actual working hours	---	-0.009 [-0.002] (2.11)**	-0.016 [-0.002] (2.49)**	-0.016 [-0.002] (2.50)**
Labor income	---	0.0001 [3.2e-05] (1.00)	0.0003 [0.0001] (1.45)	0.0003 [0.0001] (1.48)
Labor income squared	---	-5.4e-08 [-1.4e-08] (2.25)**	-7.7e-08 [-1.5e-08] (2.16)**	-7.8e-08 [-1e-08] (2.19)**
Unemployed	---	0.151 [0.026] (0.81)	0.159 [0.018] (0.61)	0.159 [0.018] (0.60)
Out of labor force	---	-0.366 [-0.073] (2.41)**	-0.519 [-0.076] (2.31)**	-0.526 [-0.076] (2.32)**
Economic worries	---	0.035 [0.006] (0.62)	0.066 [0.008] (0.80)	0.064 [0.008] (0.77)
Ln(unemployment rate)	---	-0.042 [-0.008] (0.36)	0.018 [0.002] (0.12)	0.026 [0.003] (0.17)
Constant	-4.546 (5.43)***	-3.704 (4.07)***	-4.328 (-3.15)***	-3.947 (2.34)**
Year dummies	Included	Included	Included	Included
Pseudo R^2	0.064	0.072	0.090	0.091
N	3,861	3,861	2,254	2,254

Method: Random effects probit. The table shows the estimated coefficients. Z-statistics are in parentheses. Marginal effects are in square brackets. Marginal effects of dummy variables are evaluated for a discrete change from 0 to 1. Marginal effects of the education dummies, labor force status dummies and religion dummies are changes in probability compared to the respective reference group. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

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degree of altruism. The number of children is also a positive covariate of the personal importance of having children whereas a university degree is a negative covariate. Age has an inverted U-shaped influence. Interestingly, the historical nonmarital birth rate does not emerge as a significant determinant of the personal importance of having children. This fits the results that this rate has only an influence on unplanned, but not on planned out-of-partnership births. Most importantly, single women in East Germany are more likely to place a high or very high value on having children than their West German counterparts.

In regression (2), we additionally include the variables for the economic situation. Those who are out of the labor force and those who work but have a higher number of working hours tend to place less value on having children. The health variable now also emerges as a significant determinant. Good or very good health is positively associated with the personal importance of having children. Turning to our variable of primary interest, the coefficient on the variable for East Germany remains statistically significant and quantitatively largely unchanged.

In regressions (3) and (4), we limit our estimation sample to the years 2008 and 2012. For the purpose of comparison, regression (3) is based on the same specification as estimation (2). The regression confirms the pattern of results. In regression (4), we add variables for child care availability and risk tolerance to the specification. While these variables do not take significant coefficients, the variable for East Germany remains a significant determinant of the importance of having children.

In summary, the positive association between the variable for East Germany and the variable for the personal importance of having children confirms our hypothesis. The more emancipated gender role model in East Germany implies that women's wish to have a child

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depends to a lesser degree on the presence of a stable partner or spouse. This fits the result that women in East Germany are more likely to have a planned out-of-partnership birth.

6.4.4 Marital, Cohabiting and Out-of-Partnership Births

Finally, we recognize the possibility that East German women might have in general a higher fertility rate than their West German counterparts. Thus, general differences in the propensity of having children rather than differences in gender roles might drive the East-West differences in out-of-partnership births. To examine this alternative explanation in more detail, we additionally include married women in our estimation sample. If East German women are in general characterized by a higher propensity of having children, we should find that married women in East Germany are also more likely to give birth to a child than their West German counterparts. Yet, if more emancipated gender roles in East Germany play the primary role, we should observe a higher likelihood of birth only for single women, but not for married women.

We also add cohabiting women to our estimation sample. Cohabitation is more prevalent among East Germans (Jirjahn and Struewing 2018). While cohabitation is largely viewed as an inferior substitute for marriage in West Germany, it is socially more accepted and often viewed as an alternative to marriage in East Germany (Hiekel et al. 2015). This reflects different norms of partnership and love suggesting that there may be also an East-West difference in cohabiting births. As stressed by sociologists, cohabitation involves a greater lack of normative prescriptions for role performance (Baxter 2001). This leaves space for cohabiting couples to negotiate more egalitarian relationships.

Table 6.7 provides the estimations on the determinants of birth. Regression (1) is

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based on an unbalanced panel for the years 1999–2014. The key explanatory variables are a dummy for married women in East Germany and dummies for cohabiting women and single women in East and West Germany. The reference group consists of married women in West Germany. Compared to this reference group, both single women in West and single women in East Germany have a lower probability of giving birth to a child. However, the negative relationship is stronger for single women in West Germany than for single women in East Germany. The null hypothesis of equality of the corresponding coefficients is rejected by a chi-square test at the 1 percent level ($\chi^2 = 44.25$). This confirms our result that single women in East Germany are more likely to give birth to a child than single women in West Germany.

Table 6.7: Determinants of birth

	(1) Years 1999-2014	(2) Years 2008-2014
Cohabiting woman in West Germany	-0.706 [-0.086] (16.79)***	-0.632 [-0.084] (9.48)***
Single woman in West Germany	-1.339 [-0.109] (27.21)***	-1.345 [-0.114] (15.91)***
Married woman in East Germany	-0.075 [-0.014] (1.40)	-0.111 [-0.021] (1.28)
Cohabiting woman in East Germany	-0.283 [-0.046] (4.77)***	-0.323 [-0.053] (3.50)***
Single woman in East Germany	-0.878 [-0.096] (13.58)***	-0.792 [-0.095] (8.06)***
Risk tolerance	---	0.002 [0.001] (0.21)
Ln(child care availability)	---	0.065 [0.006] (0.72)
Age	0.332 [0.016] (15.48)***	0.400 [0.018] (10.13)***
Age squared	-0.006 [-0.0003] (17.95)***	-0.007 [-0.0003] (11.33)***
Skilled	-0.047 [-0.004] (1.35)	-0.026 [-0.002] (0.41)
University degree	0.112 [0.011] (2.76)***	0.153 [0.015] (2.13)**
Migration background	0.021 [0.002] (0.67)	-0.046 [-0.004] (0.86)
Health	0.044 [0.004] (1.77)*	0.068 [0.006] (1.66)*

Number of children	-0.221 [-0.020]	-0.199 [-0.018]
	(13.01)***	(7.56)***
Actual working hours	-0.008 [-0.001]	-0.009 [-0.001]
	(5.63)***	(3.74)***
Labor income	1.2e-05 [5.8e-06]	1.2e-05 [5.4e-06]
	(3.63)***	(2.56)***
Labor income squared	-6.3e-09 [-3.1e-10]	-5.5e-09 [-2.5e-10]
	(1.38)	(0.95)
Unemployed	0.256 [0.028]	0.202 [0.021]
	(5.42)***	(2.25)**
Out of labor force	0.036 [0.003]	0.022 [0.002]
	(0.90)	(0.29)
Economic worries	-0.005 [-0.0004]	-0.024 [-0.002]
	(0.27)	(0.80)
Ln(unemployment rate)	-0.012 [-0.001]	0.002 [0.0002]
	(0.34)	(0.04)
Catholic	0.061 [0.005]	0.001 [0.0001]
	(1.83)*	(0.01)
Protestant	0.063 [0.006]	-0.041 [-0.004]
	(2.03)**	(0.82)
Other religious affiliation	0.107 [0.010]	0.143 [0.014]
	(1.87)*	(1.39)
Ln(historical nonmarital birth rate)	0.044 [0.004]	0.088 [0.008]
	(1.41)	(1.62)
Constant	-5.494	-6.497
	(15.89)***	(9.27)***
Year dummies	Included	Included
Pseudo R^2	0.146	0.150
N	51,944	18,918

Method: Random effects probit. The table shows the estimated coefficients. Z-statistics are in parentheses. Marginal effects are in square brackets. Marginal effects of dummy variables are evaluated for a discrete change from 0 to 1. Marginal effects of the marital status dummies, education dummies, labor force status dummies and religion dummies are changes in probability compared to the respective reference group. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

The variable for married women in East Germany does not take a significant coefficient. Thus, the estimation does not provide evidence that married women in East have a higher likelihood to give birth to a child than married women in West Germany. Quite the contrary, the estimated coefficient on the variable for East Germany is even negative. This supports the view that East German women do not have a general higher propensity of having children than West German women.

Compared to the reference group, both cohabiting women in East and cohabiting

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women in West Germany have a lower probability of giving birth to a child. Similar to single women, the negative relationship is more pronounced for West than for East Germany. The chi-square test rejects the null hypothesis of equal coefficients at the 1 percent level ($\chi^2 = 45.75$). Thus, cohabiting women in East Germany have a higher probability of giving birth to a child than cohabiting women in West Germany. This suggests that different norms of love and partnership also apply to cohabitation in East and West Germany.

In regression (2), we limit our estimation sample to the years 2008–2014 and add variables for child care availability and risk tolerance to the specification. Including these variables does not change our key pattern of results. Altogether, our estimations do not provide evidence that East German women have in general a higher propensity of giving birth to a child. A higher fertility in East than in West Germany can only be found for single women and cohabiting women, but not for married women. The higher nonmarital fertility in East Germany conforms to the view that nontraditional gender roles are more prevalent in East than in West Germany.

6.4.5 Further Robustness Checks

We performed a series of further robustness checks that increased the confidence in the pattern of our results. First, we used alternative measures of the availability of child care. Instead of child care facilities divided by the number of children under age 3, we considered child care facilities divided by the number of children under age 6 and the proportion of children under age 3 in child care facilities among children of the corresponding age group. The inclusion of these variables did not change the basic pattern of results. Second, we replaced the general unemployment rate by the male unemployment rate. This exercise also

confirmed our basic pattern of results. Third, we added women who have migrated between East and West Germany to the estimation sample. Again, the pattern of results remained unchanged. Fourth, we also experimented with a specification that included an explanatory variable for residing in an urbanized area. The variable did not emerge as a significant determinant. Fifth, we limited the estimation sample to single women who initially had no child in the household. This exercise also confirmed our key pattern of results.

6.5 Conclusions

Researchers have been increasingly interested in the behavioral differences between people in East and West Germany. Our study shows that such behavioral differences also hold for childbearing patterns. Single women in East Germany have a higher probability of giving birth to a child than single women in West Germany. Our findings conform to the hypothesis that East and West Germany are characterized by different preferences and social customs in matters of love, partnership and family. However, insights into the origins of these differences can only be obtained by taking a long historical divide between the eastern and the western part of Germany into account and distinguishing between planned and unplanned out-of-partnership births.

When accounting for nonmarital birth rates predating the 1945 separation of Germany, we do no longer find that East German women have a significantly higher probability of unplanned out-of-partnership births than West German women. This suggests that the East-West difference in unplanned out-of-partnership births cannot be explained by the 1945 separation, but rather by a long historical divide. Our finding complements a study by Klüsener and Goldstein (2016) who argue that a higher share of seasonal workers in the

eastern part of Germany has historically contributed to what they call deviant behaviour. Our result suggests that the resulting East-West differences in casual sexual behavior persist to the present time. On a broader scale, our study demonstrates that the separation of Germany after World War II cannot always be viewed as a natural experiment. Behavioral differences between East and West Germans can be due to historical factors predating the separation.

However, our findings also suggest that these historical factors only explain the East-West difference in unplanned, but not in planned births. Single women in East Germany have a significantly higher probability of giving birth to a child even when accounting for nonmarital fertility rates predating the 1945 separation. This suggests that the East-West difference in planned out-of-partnership births is due to a more emancipated gender role model that has evolved under the former communist regime in East Germany. The family policy in the former GDR promoted more equal gender roles while the family policy in West Germany was for a long time characterized by the traditional male breadwinner model. The more equal gender roles imply that women are both emotionally and economically less dependent on a male partner. Thus, their wish to have a child is less likely to depend on the presence of a stable partner or spouse. This view is supported by our finding that single women in East Germany are more likely to place a high value on having children than single women in West Germany.

In modern times, gender equality is the key topic in the family policy debate in many countries (European Commission 2016, United Nations Human Rights Council 2011, United Nations Office at Geneva 2016 and World Bank 2012). Our findings imply that gender equality can involve changes in childbearing patterns. More equal gender roles are associated with an increase in non-traditional childbearing. This suggests that promoting gender equality

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and providing sufficient support for single mothers are complementary policies. Single motherhood is often viewed as having a series of negative consequences for both mothers and children.[40] It is associated with lower earnings and a higher risk of poverty. For the children, it negatively affects academic achievement, health and psychological well-being. For the mothers, it reduces the likelihood to marry. Family policies such as child care provision, family allowance, paid parental leave, and equalizing the resources between single- and two-parent families may mitigate some of these negative consequences.[41]

However, we also recognize the possibility that more equal gender roles themselves may attenuate some of the negative consequences of single motherhood. Single motherhood is less a stigma in a society that accepts the independence of women. Thus, single mothers may have a higher probability of finding a partner. Moreover, their children may face less social exclusion. Examining this aspect in more detail stands as important future research.

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[40] E.g., see Brady and Burroway (2012), Corak et al. (2008), Krein and Beller (1988), Lerman (1996), Lichter and Graefe (1999), McLanahan and Sandefur (1994), and Scharte et al. (2012).
[41] E.g., see Maldonado and Nieuwenhuis (2015) and Pong et al. (2003).

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German Summary - Deutsche Zusammenfassung

Die vorliegende Dissertation umfasst fünf empirische Studien, die sich mit den Themen Arbeit, Wohlbefinden und Familienbildung, sowie deren Interaktion beschäftigen. Die einzelnen Studien untersuchen dabei separate Forschungsfragen. Arbeitscharakteristika, Maße zur Messung des Wohlbefindens und der Familienstand spielen aber eine bedeutende Rolle in allen Kapiteln und werden zur Beantwortung der jeweiligen Forschungsfrage herangezogen. Im Einzelnen untersuchen die Studien die Determinanten der beruflichen Sortierung in die Leistungsentlohnung (Kapitel 2), die Konsequenzen von Arbeitsplatzunsicherheit auf das Schlafverhalten (Kapitel 3), die Effekte eines Rauchverbotes auf die Lebens- und Freizeitzufriedenheit (Kapitel 4), den Einfluss von Risikopräferenzen auf die nichteheliche Geburt (Kapitel 5), sowie schließlich die Rolle von unterschiedlichen kulturellen Identitäten in Ost- und Westdeutschland für die außerpartnerschaftliche Geburt (Kapitel 6). Zur Untersuchung der Forschungsfragen nutzen die Studien Daten des Sozioökonomischen Panels (SOEP). Das SOEP ist eine repräsentative Wiederholungsbefragung, die seit 1984 jährlich Daten von mehr als 20.000 Personen in über 11.000 Haushalten zu den Lebensbedingungen in Deutschland erhebt (Wagner et al. 2007). Aufgrund des Paneldesigns und der großen Beobachtungszahl ermöglicht das SOEP die Analyse von demographischen Entwicklungen, gesellschaftlichen Phänomenen sowie politischen Maßnahmen, und stellt damit eine geeignete Datenbasis für die vorliegende Arbeit dar. Neben diesem umfangreichen Datensatz nutzt die Dissertation auch moderne mikroökonometrische Methoden (z.B. Multinomiales Probit, Firth Logit, Instrumentalvariable, etc.).

Kapitel 2 betrachtet den Zusammenhang zwischen der individuellen Kontrollorientierung und der Ausübung von Beschäftigungen, in denen eine Leistungsbeurteilung erfolgt.

Die Kontrollorientierung gibt dabei an, inwieweit Personen glauben, dass Ereignisse der eigenen Kontrolle unterliegen und nicht vom eigenen Verhalten unabhängig auftreten. In der Studie zeige ich gemeinsam mit John S. Heywood und Uwe Jirjahn, dass westdeutsche Arbeitnehmer mit einer eher internen Kontrollorientierung (die Personen glauben, dass sie die Ereignisse kontrollieren) sich häufiger in Jobs mit Leistungsbeurteilungen einsortieren. Wir finden weiter, dass westdeutsche Arbeitnehmer mit einer hohen Risikotoleranz ebenfalls eine höhere Wahrscheinlichkeit haben Beschäftigungen mit Leistungsbeurteilungen anzunehmen. Jedoch zeigen wir auch auf, dass die Effekte der beiden Persönlichkeitscharakteristika sich nicht verstärken; für Personen, die sowohl über eine interne Kontrollorientierung als auch eine hohe Risikotoleranz verfügen, nimmt die Wahrscheinlichkeit sich in eine Beschäftigung mit Leistungsbeurteilung einzusortieren wieder ab. Insgesamt liefern die Ergebnisse dieser Studie wertvolle Informationen über die berufliche Sortierung. Unsere Schätzungen deuten darauf hin, dass sowohl finanzielle Anreize als auch die intrinsische Motivation eine wichtige Rolle bei der Beschäftigungswahl von Arbeitnehmern mit einer internen Kontrollorientierung spielen.

Kapitel 3 untersucht den Einfluss der wahrgenommenen Arbeitsplatzunsicherheit auf das Schlafverhalten. Unter Verwendung eines Instrumentalvariablenansatzes zeigen die Ergebnisse, dass Arbeitsplatzunsicherheit die Zufriedenheit mit dem Schlaf erheblich verringert. Darüber hinaus führt Arbeitsplatzunsicherheit zu einer kleinen, aber signifikanten Verringerung der Schlafdauer. Um die zugrunde liegenden Mechanismen zu identifizieren, untersucht die Studie die Rolle von Arbeitsstress und Arbeitsanstrengung als mögliche Wirkungskanäle. Die Schätzungen ergeben, dass unsichere Arbeitnehmer es vor und nach dem Schlafen häufiger problematisch finden Arbeitsstress zu bewältigen. Im Gegensatz dazu

kann nicht ermittelt werden, dass Arbeitnehmer weniger schlafen, um ihre Arbeitsanstrengung zu erhöhen (z. B. Erhöhung der Arbeitszeit). Gegeben, dass unzureichender Schlaf zu einer Gesundheitsverschlechterung führt (Cappuccio et al. 2010, Giuntella et al. 2017) und mit höheren Fehlzeiten einhergeht (Hafner et al. 2016), legen die Ergebnisse dieser Studie nahe, dass die Ursachen von Arbeitsplatzunsicherheit genauer betrachtet und geprüft werden sollten.

Kapitel 4 nutzt regionale Unterschiede in der Einführung von Rauchverboten im Gastgewerbe, um die Auswirkungen von Rauchverboten auf die Lebens- und Freizeitzufriedenheit zu ermitteln. Die Ergebnisse zeigen, dass Personen, die vor der Einführung regelmäßig Bars und Restaurants besucht haben, eine geringere Lebens- und Freizeitzufriedenheit aufweisen, nachdem ein Rauchverbot eingeführt wurde. Die trifft in besonderem Maße auf Raucher zu. Die Analyse von Zeitverwendungsdaten deutet darauf hin, dass Änderungen in der Freizeitnutzung diese Ergebnisse erklären. Die Analyse zeigt, dass Raucher weniger Zeit mit Freunden verbringen und seltener ausgehen, wenn ein Rauchverbot in Kraft ist. Die Studie kann weiter ermitteln, dass Nichtraucher, die zuvor selten Bars und Restaurants besucht haben, von den Rauchverboten profitieren. Für diese Gruppe ist nach Einführung eines Rauchverbotes sowohl ein Anstieg in der Freizeitzufriedenheit als auch eine Zunahme im abendlichen Ausgehen zu verzeichnen. Die Ergebnisse dieser Studie legen nahe, dass politische Entscheidungsträger bei der Bewertung von Rauchverboten nicht nur beabsichtigte Auswirkungen auf das Rauchverhalten und die Gesundheit berücksichtigen sollten, sondern auch mögliche unbeabsichtigte Effekte auf das Wohlbefinden und die Freizeitverwendung.

In Kapitel 5 untersuche ich gemeinsam mit Uwe Jirjahn den Einfluss der Risikoeinstellung auf die nichteheliche Geburt. Die Risikoeinstellung kann eine entscheidende Rolle

für den Zeitpunkt der Fortpflanzung spielen, wenn Unsicherheit bezüglich der Verfügbarkeit geeigneter Partner oder der Intaktheit der eigenen Fruchtbarkeit besteht. Um die Hypothese zu überprüfen, werden Paneldaten analysiert. Die Ergebnisse zeigen, dass eine hohe Risikotoleranz die Wahrscheinlichkeit einer außerpartnerschaftlichen Geburt signifikant erhöht. Im Gegensatz dazu finden wir keinen Zusammenhang zwischen der Risikobereitschaft und der Wahrscheinlichkeit einer nichtehelichen Geburt in einer festen Partnerschaft.

Kapitel 6 erweitert die Analyse des fünften Kapitels. Die Studie berücksichtigt ausschließlich Geburten außerhalb der Partnerschaft, unterscheidet jedoch zwischen geplanten und ungeplanten Geburten. Die Ergebnisse zeigen, dass alleinstehende Frauen in Ostdeutschland signifikant häufiger ein Kind zur Welt bringen als alleinstehende Frauen in Westdeutschland. Dies gilt sowohl für geplante als auch für ungeplante Geburten. Die Analyse deutet darauf hin, dass die regionalen Unterschiede auf die verschiedenen kulturellen Hintergründe in Ost- und Westdeutschland zurückgeführt werden können. Diese werden insbesondere durch die unterschiedlichen Geschlechterrollenmodelle bestimmt, die sich in den beiden getrennten politischen Systemen in Nachkriegsdeutschland entwickelt haben. Allerdings spielen auch kulturelle Unterschiede zwischen Ost- und Westdeutschland eine wichtige Rolle, die auf historische Entwicklungen zurückgehen, die bereits lange vor 1945 existierten. Die Ergebnisse des fünften und sechsten Kapitels bieten wichtige Erkenntnisse für die Erklärung der Zunahme alleinerziehender Familien in Deutschland.

List of Publications

Chapter 2: Locus of Control and Performance Appraisal (with John S. Heywood and Uwe Jirjahn)

Other versions:
1. Locus of Control and Performance Appraisal (with John S. Heywood and Uwe Jirjahn), *Journal of Economic Behavior and Organization*, Vol. 142, 2017, pp. 205-225.
2. Locus of Control and Performance Appraisal (with John S. Heywood and Uwe Jirjahn), IZA DP, No. 10288, 2016.
3. Locus of Control and Performance Appraisal (with John S. Heywood and Uwe Jirjahn), Research Papers in Economics, No. 3/16, 2016.

Chapter 3: Too Stressed to Sleep? Job Insecurity and Sleep Behavior, *unpublished*.

Chapter 4: Smoking Bans, Leisure Time, and Subjective Well-being

Other versions:
Smoking Bans, Leisure Time, and Subjective Well-being, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2018: No. B21-V1.

Chapter 5: A Note on Risk Attitude and Nonmarital Birth (with Uwe Jirjahn)

Other versions:
Risk Attitude and Nonmarital Birth (with Uwe Jirjahn), IZA DP, No. 10316, 2016.

Chapter 6: Out-of-Partnership Births in East and West Germany (with Uwe Jirjahn), *unpublished*.