How Germans Use Their Time: Essays on the Reconciliation of Work and Social Life

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Abstract

This thesis consists of four essays that contribute to the empirical literature of the allocation of market work. The first essay studies the interrelation between working schedules and social life of couples by investigating the synchronization of schedules. A novel approach is proposed that allows for a determination of the average impact of working conditions of the German population on the allocation of leisure. From these findings, couple-specific conclusions concerning the active synchronization of schedules can be drawn. The second essay is devoted to empirically testing the assumption of compensating wage differentials predicting that work at non-standard hours shall be compensated by higher wage rates. The results suggest 9–10 percent higher hourly wage rates. Wage premia are U-shaped across the earnings distribution for shift workers. Since the focus on monetary compensation of such working condition neglects potential adverse consequences on the worker's social life and individual health, the third essay explores such non-pecuniary aspects. Such jobs entail significantly higher levels of solitary leisure which is likely to adversely affect the worker's well-being by reducing the marginal utility of leisure. The more severe consequence of work at undesirable hours is the augmented risk to physical and mental health which arises from the significantly lower allocation of time to sleep. In particular older workers who are potentially exposed to such working conditions over a longer time horizon bear the highest risks. Finally, the fourth essay studies the causal gain from temporal work flexibility on parental time with children. Flexitime arrangements allow mothers to spend 30 percent more of their disposable time on childcare. The results are generalizable to Germany as a whole. The paper provides empirical support for the importance of temporal work flexibility on mitigating adverse effects of maternal employment on the child's cognitive development.

Zusammenfassung

Diese Dissertation besteht aus vier Aufsätzen, die zur empirischen Literatur der Allokation der Arbeitszeit beitragen. Der erste Artikel untersucht die Wechselbeziehung zwischen Arbeit und Sozialleben von Paaren und untersucht die Synchronisation der Arbeitszeiten. Ein neuer Analyseansatz wird vorgeschlagen, der es ermöglicht, den durchschnittlichen Einfluss der Arbeitsbedingungen der deutschen Bevölkerung auf die Allokation der Freizeit zu bestimmen. Der zweite Aufsatz untersucht, ob Arbeit zu unüblichen Bedingungen gemäß der Theorie kompensierender Lohndifferentiale durch höhere Löhne entlohnt wird. Die Ergebnisse zeigen, dass solche Arbeiter 9–10 Prozent höhere Stundenlöhne erhalten. Diese Zuschläge haben einen u-förmigen Verlauf über die Einkommensverteilung für Schichtarbeiter. Die Ausrichtung der Analyse auf monetäre Kompensation solcher Arbeitsbedingungen, vernachlässigt mögliche adverse Auswirkungen auf das Sozialleben und die Gesundheit. Der dritte Artikel untersucht daher nicht-pekuniäre Aspekte. Freizeit wird in solchen Jobs zu einem höheren Anteil allein verbracht, was sich negativ auf das Wohlbefinden auswirken kann, da der Grenznutzen der Freizeit sinkt. Die drastischen Auswirkungen dieser Arbeit zieht ein erhöhtes Risiko auf den mentalen und physischen Gesundheitszustand mit sich, der sich aus einer signifikant niedrigeren Schlafallokation ergibt. Besonders betroffen sind ältere Arbeitnehmer, die eine höhere Wahrscheinlichkeit haben, diesen Arbeitsbedingungen schon über einen längeren Zeitraum ausgesetzt zu sein. Abschließend untersucht der vierte Aufsatz den kausalen Zugewinn auf die elterliche Zeit mit Kindern, den Arbeitnehmer durch mehr zeitliche Arbeitsflexibilität erreichen. Gleitzeitregelungen erlauben es Müttern somit, etwa 30 Prozent mehr ihrer verfügbaren Zeit mit ihren Kindern zu verbringen. Zeitliche Flexibilität kann somit die adversen Effekte der Beschäftigung von Müttern auf die kognitive Entwicklung ihrer Kinder abmildert.

Schlagwörter:

Arbeitsmarktökonomik, Zeitverwendung, Arbeitsbedingungen, Arbeitszeit, Flexibilität, Sozialleben, Kinderbetreuung, Schichtarbeit

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Contents

List of Figures

List of Tables

1 Introduction

1.1 Family Economics: A Political Dimension

The integration of national economies into a world economy drastically expanded the demand for goods, intensified international trade and thus raised the competitive pressure in particular in developed economies and high-wage and export-oriented countries. The ongoing transition towards more knowledge-based and service oriented economies strongly augments the demand for well qualified workers. The simultaneous demographic change in many highly developed countries towards an aging population, a declining share of people in working-age relative to the overall population, falling birth rates which will further reduce the number of potential employees in the future uncover a more severe problem, namely the impending shortage of skilled labor. These new challenges force the economy, society and hence policy-makers to develop new concepts to mobilize all available resources. The fastest way is to exploit the underutilized potential of skilled females and older workers in a better and more comprehensive way. Various debates within national governments as well as with employer and employee associations over the configuration of employment policies and work arrangements were triggered as to how to achieve this aim. In the focus of these debates is the question of how to enhance opportunities for workers and in particular for parents to enable them to reconcile work and family as it is one major prerequisite for female labor force participation.

For policy makers and economists likewise, the drastic increase of female employment and also the intensified demand for female workers was one of the major achievements of the past decades. However, this development is also critically debated. Becker (1981) notes that the "large increase in female labor force participation of married women, including mothers with young children, has reduced the contact between children and their mothers and contributed to the conflict between the sexes in employment as well as in marriage." The fear is that the positive aggregate employment effects are outweighed to some extent by potential adverse social consequences on the individual or household level. The new challenge for policy-makers nowadays is hence to deal with such social consequences while simultaneously further encouraging female labor force participation. Additionally, the combination of an ageing workforce, the drop in birth-rates and the shortage of skilled labor of recent years requires countries to emphasize their endeavors

to activate their female population. To retain employees and also to attract new skilled labor, firms must offer family-oriented work arrangements and national government should further promote such measures. A possible step in this context is the intensification of measures granting flexibility of working schedules and thus to strengthen incentives for women to enter the labor market and to re-enter after child birth.

Family politics is thus a highly important area of research as it defines the framework as well as the incentives for current and future economic activities and consequently for growth. Modern family oriented employment policy balances incentives to work with support for togetherness of parents and children that caters the needs and development possibilities of dependent children to a significant extent. In this context, parents support every form of reconciliation of family and work which they deem to be worthy, necessary and achievable.

Today's orientation of current family politics in Germany is better understood after highlighting some important historical trends. Traditional gender roles are still wide-spread nowadays and can be traced back to family politics during the Weimar Republic and the Third Reich. Family related policies were first integrated into the constitution of the Weimar Republic in 1919 (Gerlach, 2008). Articles 119 to 121 protected the marriage and the equality of both genders directly. Accordingly, the paramount duty of the family was the education of children. Under the Nazi reign, the family received even greater attention but was also instrumented for the population and race related intentions of the regime. A general family policy which was accessible to everybody was not yet achieved.

The demographic and economic situation after World War II required the usage of the total available labor potential to rebuild the destroyed country (Schröder, 1998). Both parts of post-war Germany approached this task differently and consequently, the orientation of their family policies diverged drastically. In the former GDR, it was recognized already during the 1950s that the integration of women into the domestic labor market is essential. In addition to the difficult demographic situation after World War II, the country had to deal with a massive outflow of qualified labor to the Federal Republic of Germany during the 1950s. To offer work environments that allow women to work full-time but to also have children, the expansion of childcare facilities was one of the main objectives of family policies in the GDR. The peak was reached in 1989, when almost every child had access to formal childcare facilities. According to Schröder (1998), family policies were primarily based on economic and demographic principles, yet achieving an equalization of household tasks between the spouses was not an issue. Consequently, traditional roles persisted which enforced a double burden on these women who had to simultaneously juggle work and family without receiving much support from their husbands.

In contrast, the Federal Republic of Germany approached the demographic situation after World War II in a different way. The main goal of family policies during the 1950s was to improve the situation of post-war families in particular of those being affected by missing family members, expulsion or the lack of housing and workplaces (Gerlach, 2008). The traditional family consisting of a husband who was working in the labor market and a housewife who cared for household and children was strongly promoted by policy makers. West Germany was additionally strongly influenced by the Catholic Social Teaching which further shaped the role models. The law of equal opportunities that was enacted in 1957 postulated that women should have the same opportunities than men to earn income and that both fathers and mothers are equally responsible for the education of their children. I reality, however, women were supposed to ask their husbands for permission to work and until 1977 he even had to additionally sign the work contract. This situation was not changed until June 1976 with the reform of marital and divorce laws. During the years of the economic miracle, the role of women being housewives was further advocated as a promise of men towards their wives to not have the need to work in the labor market. Public incentives based on tax advantages for married couples ("Ehegattensplitting") intensified traditional gender roles and the traditional division of labor and still continue to do so.[1] The aim of the joint taxation of married couples is to mitigate the burden of progressive taxes. The tax advantages of joint taxation increase with a widening of the income gap between the spouses so that one earner households benefit most.

Nowadays, firms play an ever increasing role among the non-governmental actors to shape and apply family policies. In the face of the demographic change towards an aging population as well as an increasing shortage of skilled labor in many firms, a family-oriented company policy is now indispensable in order to use the underutilized potential of females and older workers. Since 1994, many OECD countries have enacted reforms to expand the options of workers and employers to make use of flexible working-time arrangements. The objective of these reforms (OECD, 2006) are to allow for a greater deal of variability of working schedules over time (e.g. annualization of working hours), but also for a more flexible recourse to work outside of the conventional workweek (e.g. evening/night, weekend work and shift work).

According to the *Unternehmensmonitor 2010* by the Bundesministerium für Familie, Senioren, Frauen und Jugend (2010), more than 70 percent of all interviewed firms offered either individually agreed or flexible working hours within some predefined range in 2006 and in 2010. Among these firms, about 69 percent indicate that family-friendliness of employment policies is important to experts, managers and executives and even 80 percent recognize its importance for other employees but

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[1]See also Juster and Stafford (1991) who find that countries in which couples are taxed by a single marginal tax have weaker tendencies towards an equalized division of labor among spouses.

also the firm itself. Between 2003 and 2009, the share of respondents recognizing the importance for the firm itself doubled reflecting the rising awareness of flexibility measures for a reconciliation of family and work which additionally benefits the firm. More than 90 percent of all interviewed firms report to offer such measures in order to keep or even to attract qualified workers and to improve their workplace satisfaction. The reconciliation of family and work is not only important for German firms. According to the *Europäischer Unternehmensmonitor 2010* by the Bundesministerium für Familie, Senioren, Frauen und Jugend (2010) more than 80 percent of firms in Poland, France and Italy agree. Swedish employers even indicate it to be the main priority in about 95 percent of all interviewed firms. The UK is bottom of the league with only half of all firms considering the reconciliation of family and work as important determinant of a firm's employment policy. However, more than 70 percent of all British firms already offer flexible or even individually agreed working hours. The percentage is significantly lower in the other countries and ranges between 46 and 57 percent in France, Poland and Italy.

For a long time it was no objective of policy makers to intervene into the personal sphere of families. The division of labor within German households was viewed as being the result of a bargaining process within the household in which the responsibilities of earning earning and rearing children are determined only between the partners (Becker, 1985). Yet, the family as institution is important to society as a whole in that it offers services for its preservation and social cohesion. In this respect, it is a powerful institution for the socialization of the current but also of all future generations. It is responsible for the formation of fundamental attitudes. Developmental psychologists as well as neuro-scientists further emphasize the importance of close relationships between children and parents in particular during the first years of a child's life for the cognitive and social development (Hartup, 1989; Maccoby, 1992; Thompson, 2001; Landry et al., 2003). It is therefore essential to better understand the interaction between economic and social activities in order to draw better informed policy implications.

1.2 Family Economics: Empirical Facts

The drastic expansion of product demand induced by increased competitive pressure as a result of an intensification of economic globalization requires countries to adapt strategies and to launch labor market policies to use their total employment potential more efficiently.

Recent trends of selected labor market indicators are depicted in figure 1.1. It describes average changes in percentage points of work arrangements among all OECD countries between 1995 and 2005 (OECD, 2009). Panel A shows that annual working hours declined on average by more than 3 percentage points in

all OECD countries over these years. Simultaneously, the incidence of temporary jobs increased. Such jobs are relatively flexible but rather from an employer's perspective. Yet, the strong increase over time across OECD countries corroborates the growing importance of firms to be able to flexibly adjust to changes in demand.

Figure 1.1: Percentage-Point Changes, 1995 – 2006, Unweighted Averages of All OECD Countries.

A. **Type of contract, working hours**[b] **and job tenure**

B. **Unsocial working hour arrangements**

C. **Long hours and intense work**[c]

D. **Work atmosphere**[d]
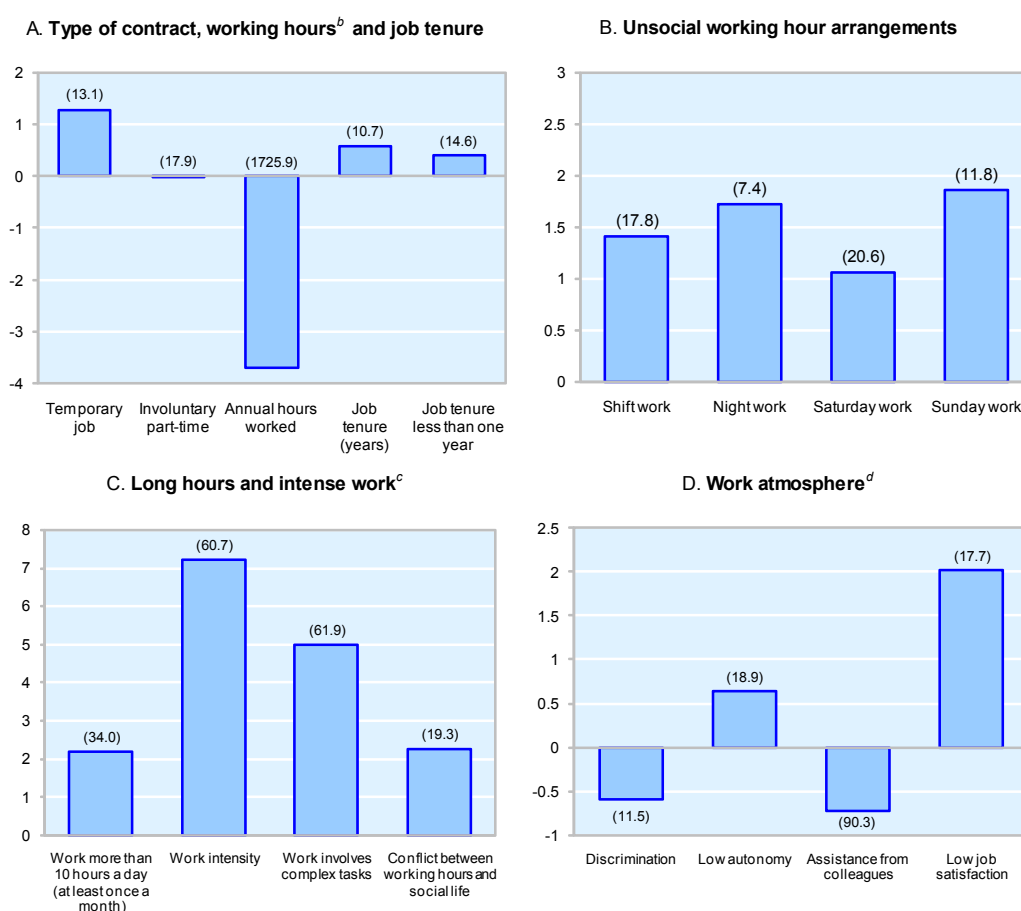
a) Values within parenthesis are the OECD average in the last year.
b) Percentage change for average annual hours worked.
c) 2000-2005 for the share of employees working more than 10 hours a day (at least once a month) and for those experiencing difficulties in reconciling working hours and family or social commitments outside work; 1990-2005 for work intensity; and 1995-2005 for work involves complex tasks.
d) 1995-2005 instead of 1995-2006.

Source: OECD calculations based on the *OECD database on Labour Force Statistics* for panel A; the European Labour Force Survey (EULFS) for panel B; and the European Working Conditions Survey (EWCS) for panels C and D. For further details on variables and definitions, see OECD (2008), *Employment Outlook*, Chapter 4.

Panel B of figure 1.1 further illustrates that the incidence of shift work grew on average by about 1.5 percentage points and accounted for about 17.8 percent of all employment relations on average. As a result from the intensification of global trade and the expansion of world demand, many firms widened their production capacities and operating hours which in turn increased the importance of shift

work.[2] During the 1970s, shift work was most prominent among manufacturing workers yet the composition changed over time. Longer shop opening hours, to name just one example, shifted the mix of occupations over the decades to also include service sector occupations to a growing extent. Longer production schedules are further reflected by an increasing incidence of weekend work. Saturday work increased by about 1 percentage point and work during Sundays by even 1.8 percentage points.[3]

Panel C of figure 1.1 shows that despite the decrease in aggregate working hours, average work intensity, complexity and length of a workday among OECD countries expanded over time. The percentage of people who worked more than 10 hours per day even increased by more than 2 percentage points. Work intensity increased by more than 7 percentage points and in addition, workers reported to a growing extent that their work involves complex tasks.

Panel D further demonstrates that overall job satisfaction is generally quite low and is even declining. Being just one determinant of overall life satisfaction, it is nevertheless an important proxy for a worker's well-being. The combination of higher workloads and low job satisfaction are potential indicators for adverse consequences on social lives of workers which poses a challenge to employment policies. Many OECD countries have therefore focused their employment policies on measures providing work environments and work arrangements that allow employees to better reconcile their careers and personal lives. Such policies aim at working conditions that ensure productive as well as mentally and physically healthy workers and to create incentives for all workers and in particular women to participate in the labor market. The developments of figure 1.1 therefore show that rising demands at the workplace are not yet compensated by increasing support to achieve a balance with social life.

Figure 1.2: Difference in Satisfaction with Work-Life Balance, 2007.
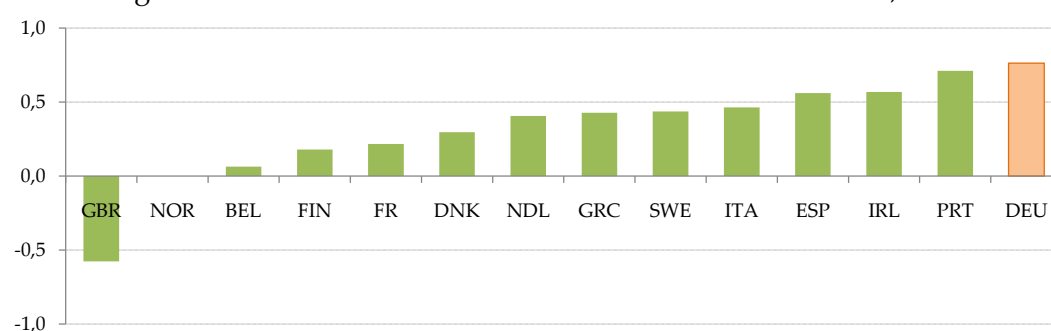
Source: European Quality of Life Survey, 2007.

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[2]This stands in some contrast with the developments observed for the US for the last 4 decades where evening and night work declined (Hamermesh, 1999a,b).

[3]These developments are in line with the findings of Hamermesh (1999a) for the US.

To get a better impression about the differences in the levels of satisfaction with the work-life balance for selected European countries, figure 1.2 reports average levels for 2008.[4] It shows a great dispersion across the countries. Respondents in Great Britain indicate on average higher levels of dissatisfaction with the balance between work and life than of general life satisfaction. German workers, in contrast, indicate to be most satisfied with their lives and the balance between work and family. Also Southern European workers and those living in Ireland are generally quite satisfied.

The reconciliation of work and family can be facilitated if workers are given some influence over their working schedules. It allows individuals to react more flexibly to unforeseen events or daily changes of personal schedules which is of particular importance for employed mothers. They are often said to work double shifts by working in the household and having a job. Flexible working schedules could be one important device to reduce the stress from juggling household and work.

Figure 1.3: How Working Time Arrangements are Set, 2005.
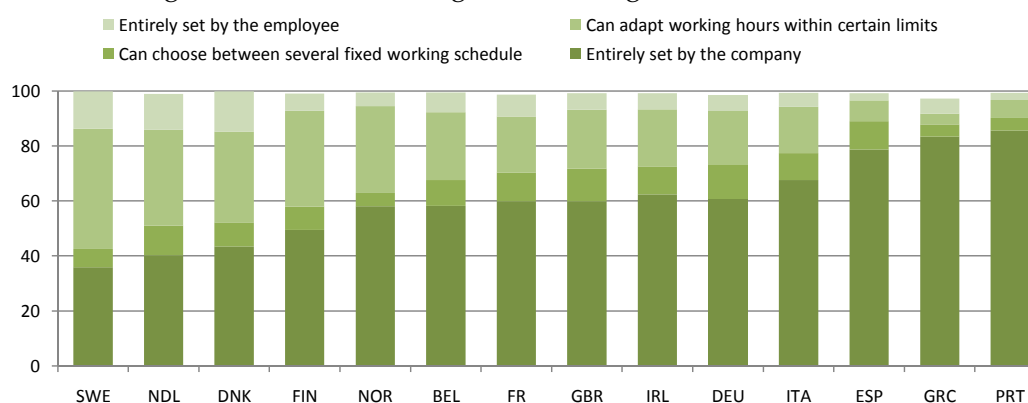
Source: Fourth European Survey on Working Conditions, 2005.

Figure 1.3 illustrates differences in the setting of working arrangements within firms in 2005 as reported by the OECD Family Database. In most European countries, working arrangements are predominantly determined by the firm. In about 61 percent of all German firms, workers cannot directly influence their working schedules. Only in some Southern countries (Italy, Spain, Greece and Portugal) is this share higher. In contrast, temporal work flexibility is most pronounced in the Nordic countries and the Netherlands. Sweden takes the lead by allowing 44 percent of all employees to adapt their working hours within certain limits. In

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[4]According to the OECD Family Database, respondents of the European Quality of Life Survey in 2007 were directly asked about their levels of satisfaction with life. In addition, a person is classified as *dis*satisfied with the balance between work and private life if he reports to spend either too much or too little time on his job/paid work. Differences between the answers to these questions are reported by the figure.

14 percent of the Swedish firms, workers can set their working hours entirely by themselves compared to only 6 percent of the German workers.

Figure 1.4: Gender Gaps in Possibilities to Change Working Hours, 2005.
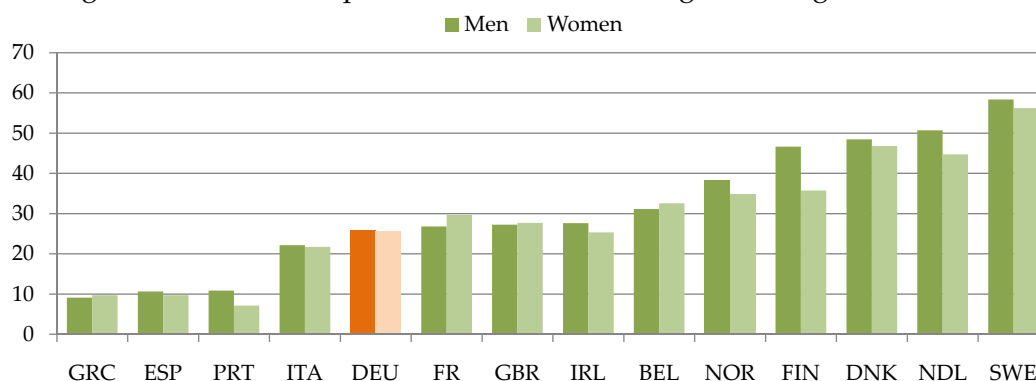
Source: Fourth European Survey on Working Conditions, 2005.

Moreover, figure 1.4 depicts the ability of men and women to directly influence their working schedules in 2005. In most of the represented European countries, this possibility is slightly higher for men. Only in Greece, France and Belgium were women more likely to be granted flexible working schedules than men. As noted before, the incidence of flexible working hours in Germany was among the lowest of the European countries yet without showing significant differences between men and women.

The importance of general labor market policies and the respective shift in focus over the last decades is further illustrated in figure 1.5. It shows the correlation between total fertility rates and female employment rates in selected European countries and the US for 1980 and 2009. While in 1980 countries with higher female employment rates had lower fertility rates ($r = -0.410$), the opposite correlation was observed in 2009 ($r = 0.414$).

In 1980, the countries depicted in figure 1.5 differed a lot with respect to female employment rates.[5] In the countries with the lowest female employment rates (Spain, Italy and Greece but also Ireland, Belgium and the Netherlands) only about $25 - 35$ percent of all women were employed in this year. In contrast, all Nordic countries are clustered at the upper end with elevated female employment rates of $60 - 73$ percent. 30 years later, in 2009, the overall variation among the European countries has shrunk considerably. In addition to the highest female employment rates, the Nordic countries also have high rates of total fertility. In virtue of the extraordinarily high rate of female part-time employment in the Netherlands, the Dutch government was able to strongly expand female employment over time yet not at the expense of fertility (Bosch et al., 2008). At the lower end, Italy and Greece have the lowest rates of female employment and fertility.

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[5]See also d'Addio and d'Ercole (2005).

Figure 1.5: Cross-Country Relationship between Female Employment Rates and
Total Fertility Rates (TFR)
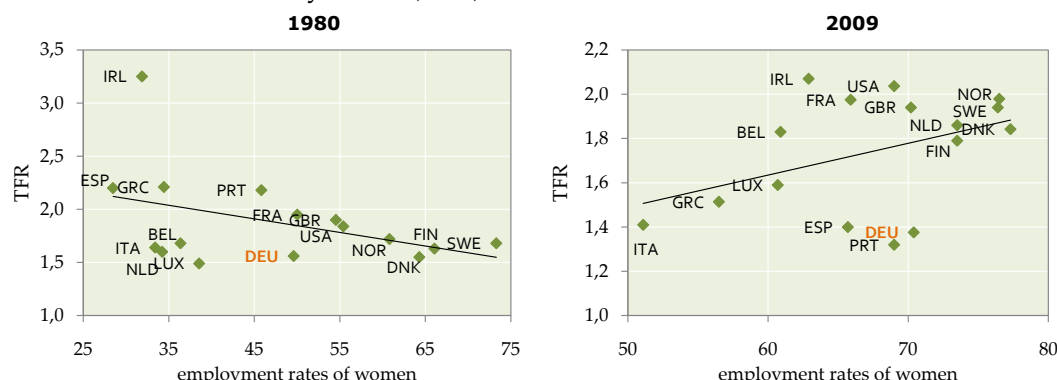
So far, the simple correlations depicted in figure 1.5 suggest that in countries
with more family friendly work environments such as the Northern European
countries and the Netherlands the balance between professional and private lives
for women is easier to arrange. In Germany, both participation and fertility rates in
1980 were lower compared to other European states. Over time, the fertility rate
remained low with participation increasing in 2009. The combination between the
two indicators in 2009 is comparable only with Spain and Portugal.

Figure 1.6: Maternal Employment Rates by Age of the Youngest Child in 2008
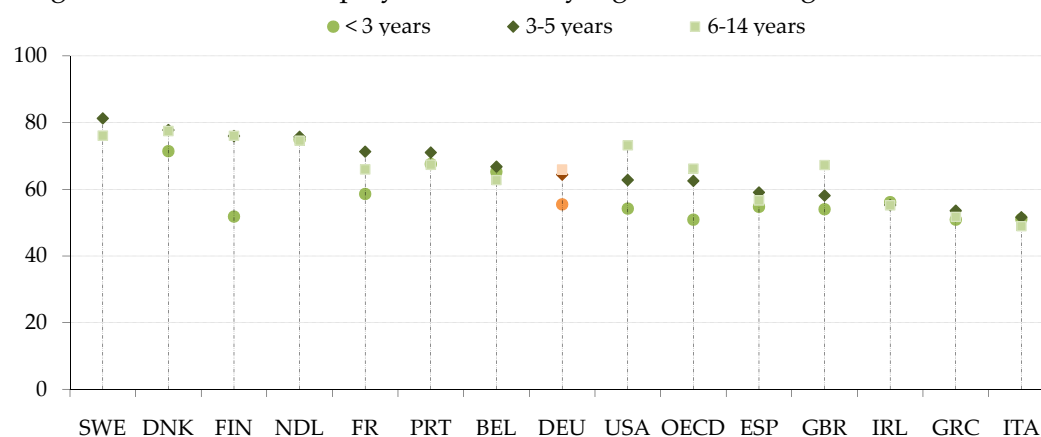
Figure 1.6 depicts maternal employment rates by age of the youngest child for
European countries, the US and for the OECD average for 2008. It shows that once
women chose to have children, labor market participation is strongly determined
by the age of the youngest child. The high female employment rates of the Nordic

countries are also reflected in very high maternal employment rates. Maternal employment rates are exceptionally high in Sweden and Denmark independent of the age of the youngest child. Among all women in these countries, those with children under the age of 14 have employment rates of 71 and 81 percent. Although overall employment rates are generally high for women in Finland, the graph reveals comparatively low rates for mothers with children under the age of 3. Maternal employment rates are lowest in the Southern European countries as well as in Ireland and Great Britain independent of the age of the youngest child and lie between 48 and 55 percent. In Germany, maternal employment rates are comparable to the OECD average. The employment rate of mothers with children under the age of 3 amounts to 55.5 percent and is 10 percentage points higher when the youngest child is in school age (6 – 14 years).

Table 1.1: Share of All Children under the Age of 6 in Child Day-Care Facilities by Federal State in 2008.

| | total | aged between ... | | | |
| | | under 3 | | 3 – 6 | |
	number	number	percent	number	percent
Baden-Wuerttemberg	310484	32289	11.5	278195	93.7
Bavaria	339201	37757	11.7	301444	88.6
Berlin	109122	32732	36.8	76390	92.2
Brandenburg	75506	21623	38.9	53883	93.9
Bremen	15202	1723	10.6	13479	85.7
Hamburg[1]	43814	8723	18.1	35091	77.9
Hesse	167228	18297	11.6	148931	91.4
Mecklenburg-Western Pomerania	48088	12939	34.4	35149	92.2
Lower Saxony	201564	15140	7.6	186424	85.6
North Rhine-Westphalia	465594	32203	7.1	433391	89.9
Rhineland-Palatinate	113184	13467	13.8	99717	95.3
Saarland	24522	2899	13.2	21623	92.5
Saxony	123778	32644	33.0	91134	94.4
Saxony-Anhalt	74469	26722	52.1	47747	93.6
Schleswig-Holstein	68557	5133	7.3	63424	83.2
Thuringa	67433	18823	37.5	48610	95.9
Germany	2247746	313114	15.3	1934632	90.3
former Federal Republic (excl. Berlin)	1749350	167631	10.0	1581719	89.6
new länder (excl. Berlin)	389274	112751	38.4	276523	94.1

[1] In additon, 8.6 percent of all children in these age groups attended pre-school institutions.
Source: Statistisches Bundesamt (2009).

An important prerequisite for mothers to participate in the labor market is the provision of formal child care facilities. As reported in table 1.1, crèche placements were provided in 2008 only for about 7 percent of all children under the age of 3 (Statistisches Bundesamt, 2009) in some of the bigger territorial states in the Western part of Germany, such as Lower Saxony, North Rhine-Westphalia or Schleswig-

Holstein which constitutes a serious hurdle to maternal employment. East German federal states provide a significantly better placement ratio of almost 40 percent for children under the age of 3. The day-care rate even exceeded 50 percent in Saxony-Anhalt.

In addition to the very low rate of day-care facilities for young children in Germany, short opening hours are an additional problem to employment in particular for full-time employed mothers. If these women want to participate in the labor market, other forms of childcare must be arranged. Figure 1.7 shows the rate of children by age group without any childcare arrangements in 2008 for selected European countries that are either formally provided by day-care centers or informally by family or friends.

Figure 1.7: Children with no Usual Childcare Arrangements by Children's Age, 2008.
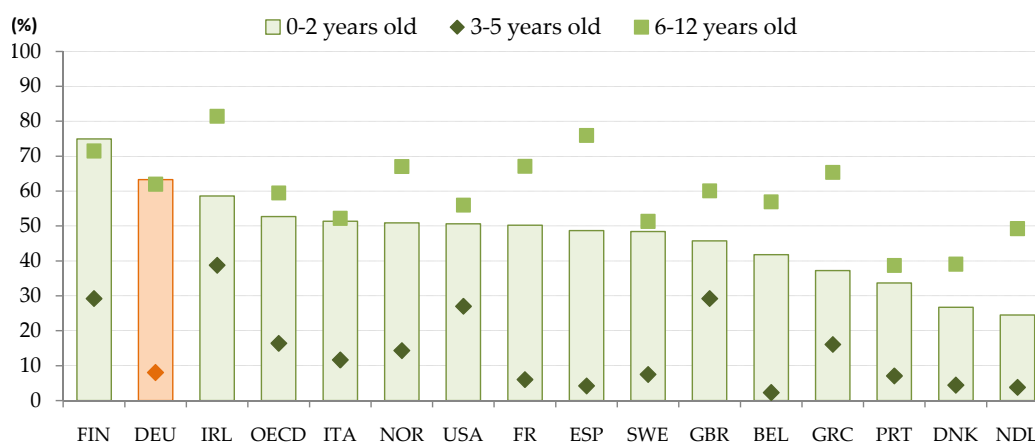
Notes: 1) Data for France concern 2007 2) Data for the US concern 2005 and includes grandparents only
Sources: EU: EU- SILC (2008); USA: National Household Education Surveys Program (2005)

With more than 60 percent, Germany is among the countries with the highest share of children under the age of 2 without any formal or informal childcare arrangements. This percentage is only exceeded by Finland which explains the low levels of employment for mothers with very young children in both countries as illustrated in figure 1.6. In Southern countries, such as Portugal and Greece but also the Netherlands only a small proportion of all kids under the age of 2 are without any childcare arrangements. Social networks are traditionally denser in Southern countries and strong family ties are possible explanations that guarantee a high degree of informal childcare arrangements. Hence, family-friendly employment policies and the availability of childcare facilities are crucial determinants for a reconciliation of family and work.

1.3 Outline of the Thesis

The objective of this dissertation is the empirical investigation of working conditions which should contribute to inform the political debate by investigating social consequences of working conditions and more precisely of measures that grant *temporal* flexibility. Such measures might be viewed as boon but also as bane. Shift work, in particular work in rotating teams, but also work at unusual hours grants some degree of flexibility to employers. The exposure to unusual or changing working schedules might have strong adverse consequences on the individual's physical and mental health and on his well-being. Consequently, there is a high risk that it will also become a societal problem in particular if an already disadvantaged group of workers is most strongly affected. Such relationships can be investigated very well by means of time use data.

Chapter 2 will be devoted to a brief summary of the most influential academic studies in the growing field of the economics of time use. The subsequent chapter will describe the major features and definitions of the main data source of this dissertation, the German Time Use Data, in more detail as it builds the foundation of the later empirical analyses. In addition, some key aspects about the general allocation of time of Germans will be presented.

The starting point of the empirical analysis is Chapter 4. Before examining particular aspects of flexibility and of an individual's working schedules in more detail, it is important to understand how working conditions in general interact with a person's private and social life. In this chapter, I therefore explore the consequences of working schedules on the potential of married or cohabiting couples to synchronize their leisure time.

Since working schedules are chosen given individual preferences, endogeneity is the major issue addressed in Chapter 4. It is crucial to disentangle the influence of working conditions per se from individual choices. To solve this issue and to be able to identify the impact of working conditions on potential time that couples spend with each other, the chapter proposes a novel approach. By repeatedly assigning individuals to other so-called pseudo partners in the sample to form random pseudo couples and by investigating the resulting simultaneous leisure time, the average impact of working conditions on the potential allocation of leisure can be inferred. This approach builds on an idea about the creation of pseudo couples by Hallberg (2003) and improves upon earlier studies that investigate the synchronization of spouses' time but which lack direct information on whether or not leisure is indeed spent with the partner (Hamermesh, 2000; Lesnard, 2004; van Klaveren et al., 2006; van Klaveren and Maassen van den Brink, 2007).

Once it is clear how different job and workplace attributes affect the social life of couples, I investigate some of the working conditions in more detail. Chapters 5 and 6 analyze the consequences of unusual working schedules and shift work.

Such working schedules allow employers to expand their production capacities and machine operating hours and thus to increase output. Nowadays, such work arrangement gain more importance also in service sector occupations such as in retail and are prevalent also among medical occupations.

Work during evening or nights but also with changing working schedules entails higher levels of stress, lack of sleep and longer-run health related problems that might even harm the individual's well-being. The theory of compensating wage differentials which dates back to Smith (1776) and Rosen (1987) predicts that such working conditions must be compensated by higher hourly wage rates. Empirical evidence is however scarce and yields mixed conclusions. The size of the wage premium strongly depends on the distribution of underlying taste for such working schedules. Workers who would like to avoid them would rather use their earnings potential by accepting lower hourly wage rates for daytime work (Hamermesh, 1996). To attract workers to jobs with unusual working schedules, significant wage premia must be paid as compensation for the additional burden. Other workers, in contrast, might yet prefer to work during non-standard hours. In such a case no or a relatively low wage premia need to be paid as work incentive.

Chapter 5 builds on the study by Kostiuk (1990) was the first to study wage differentials of shift work for male manufacturing workers in the US and a follow-up study by Lanfranchi et al. (2002) for French full-time blue collar private sector workers. Using German Time Use data, I find that male shift workers are generally negatively selected workers who choose to work in such jobs to reap the benefits from the wage premia. A poolability test suggests that wage determinants for shift and daytime workers differ considerably so that a separate estimation of wage equations is more appropriate. This approach reveals that while daytime workers tend to have more favorable characteristics, shift workers are not found to be a systematically selected group of workers. In contrast, men who work during non-standard hours are not found to differ systematically from the respective reference group.

In general, shift premia of 9 − 10 percent are estimated which are slightly higher than for manufacturing workers in the US but lower than for blue-collar workers in France. In addition, I find that wage differentials across the earnings distribution tend to be U-shaped and are highest for workers at the lowest or highest quartile.

However, higher levels of solitary leisure cannot be demonized per se. Some workers, in particular younger ones who are about to embark on their professional careers, accept solitary leisure as part of their career paths and view it as investment. In this chapter, I find evidence to support this hypothesis as it is mainly younger workers with above median earnings who experience higher levels of solitary leisure. In addition, younger workers tend to substitute sleep for accompanied leisure time so that the influences on solitary time are strongly mitigated. However,

the long-run costs of being alone on the one hand and the disruptive consequences on the circadian cycle resulting from the changes in working schedules are immense. Significantly lower minutes of sleep in particular for older workers can be interpreted as evidence in support of the higher long-run risks to mental health for workers who are exposed to such working schedules over a longer horizon.

However, higher levels of solitary leisure cannot be demonized per se. Some workers, in particular younger ones who are about to embark on their professional careers, accept solitary leisure as part of their career paths and view it as investment. In this chapter, I find evidence to support this hypothesis as it is mainly younger workers with above median earnings who experience higher levels of solitary leisure. In addition, younger workers tend to substitute sleep for accompanied leisure time so that the influences on solitary time are strongly mitigated. However, the long-run costs of being alone are immense. Significantly lower minutes of sleep in particular for older workers can be interpreted as evidence in support of the higher long-run risks to mental health for workers who are exposed to such working schedules.

The combination of a selection of workers with more unfavorable characteristics to accept such jobs due to the higher wage premia and the higher adverse consequences on social coordination and even sleep suggests that this already disadvantaged group of workers is disproportionately affected by the working schedules. Given these strong influences on a particular group of workers raises the question whether the wage premia are high enough to compensate for the adverse consequences on short- and long-run well-being and mental health.

Finally, Chapter 7 is devoted to the investigation of temporal flexibility and the resulting consequences on the balance between work and family. In this chapter, I investigate whether temporal work flexibility granted to the *worker* in the form of flexitime arrangements allows parents to spend more time with their children. The major aim is to clearly identify and quantify the effect. To do so, I use information from the first survey year (1991/92) of the German Time Use Data and focus on East German parents only. The particularity of the East German labor market in combination with a similar legal system as in West Germany allows me to identify the causal link. Becker (1965) already noted that children not only need financial resources from their parents but that time investments are equally important for their cognitive development. Recent studies find that maternal employment in particular during the first year of a child's life has a detrimental impact on the cognitive development in later years (Baum, 2003; Ruhm, 2004, 2008; Hill et al., 2005; Bernal, 2008). Results in Chapter 7 suggest that mothers who are granted some degree of temporal work flexibility spend about 30 percent more time with their children compared to mothers with fixed schedules. It can hence be argued that the adverse effect of maternal employment on a child's cognitive development

in early years can be alleviated. The effect is found to be greatest for parents and especially for women with kids under the age of 3.

As East German parents in 1991/92 are a particular group of workers, I further test whether the results can be generalized to all German parents. I therefore use data from the German Socio-Economic Panel for the years 2002 – 2008. Estimation results based on an instrumental variable approach strongly support the positive and sizeable effect of temporal work flexibility on parental time with children.

2 The Use of Time in the Academic Literature

In this chapter, I will present the relevant literature concerning the allocation of time from a theoretical and an empirical point of view. I will structure this chapter by first presenting an overview about those articles that explore the allocation of activities. In a first step, I will present papers that analyze market versus non-market work and the resulting implications. Non-market work is a very broad concept that encompasses leisure and household work which are inherently different so that the next part of this chapter is devoted to a presentation of studies that further explore these differences and the implications of these time aggregates. A second important strand of the literature that is introduced in section 2.2 of this chapter, comprises articles dealing with aspects of social interaction as well as social capital. Finally, section 2.3 presents the relevant articles regarding the allocation of activities in conjunction with the intra-household allocation of activities.

2.1 Timing of activities

In his seminal paper, Becker (1965) first introduced the importance of time investments as well as the amount of time devoted to different activities into a standard labor supply model. He argues that a person's decisions are restricted by financial resources but also by time. The main idea of this theory is that households are not only consumers but also producers of home-made commodities. For the production of such goods, inputs of market goods and time are combined. Higher incomes imply increased opportunity costs of time. If home-made commodities are normal goods, workers will consequently allocate less of their total time to household activities and buy market substitutes instead. This theory can also be used to explain the secular decline in working hours with rising real incomes in that it suggests that time-intensive goods have been luxuries in the past. In addition, relative prices of goods used for the production of time-intensive commodities declined over the last decades which further spurred this development. Thus, Becker (1965) points out that the importance of forgone earnings that arise from the allocation of time must be taken more seriously in theoretical models. This seminal contribution stimulated first collections of time use data and lead to a high number of follow-up studies on the efficiency and allocation of time.

2.1.1 Allocation of Market versus Non-Market Work

Weiss (1996) models the timing of work as being the result of an equilibrium process of welfare gains from joint production. Accordingly, working schedules do not arise by accident but rather satisfy some basic economic needs. The main driving force of his analysis is communication which results in a synchronization of working hours even among workers with different tastes.

The emergence and dissemination of time diary surveys over the last decades allowed researchers to further examine the instantaneous use of time empirically. Hamermesh (1999b) argues that such investigations can yield important insights into individual behavior that cannot be inferred from any other data source. Aggregate annual working hours declined between the 1970s and the 1990s in the US, though the distribution of working hours across a workday widened. This development cannot be explained by changes in the demographic structure or by industrial shifts and there is also no evidence for a non-neutral technology-based explanation. The best fitting approach is the model of compensating wage differentials according to which work during unusual hours and more specifically work during evenings or nights is viewed as a disamenity. With rising real earnings workers will make use of their earnings potential to shift away from work during evenings and nights and to rather work at the marginal hours of the standard workday. It follows that work during these undesired hours is performed to a greater extent by workers with lower wages.

The timing of activities also affects the worker's effort and well-being and consequently firms' profitability. Since the temporal component of work is part of the overall reward package, wage premia must be high enough to attract workers to accept more undesirable jobs. However, Hamermesh (1999b) does not find the expected positive wage premia which suggests that the returns to non-measurable skills must have risen over the observation period. The combination of rising real earnings and a sharp decline in the incidence of evening and night work over the investigation period further supports the inferiority of these working hours. This hypothesis is further emphasized by the fact that workers in the upper part of the wage earnings distribution shift to a much higher extent away from work during these hours. Workers with less favorable characteristics, in contrast, are more likely to accept such jobs due to the associated wage premium.

Hamermesh (1999b) finds that the rising earnings inequality over the last decades in the US cannot be attributed to increases in the returns to measurable skills. Consequently, Hamermesh (1999a) investigates potential other reasons. He uses time diary data for the US covering three decades for his analysis. While traditional studies focus merely on pecuniary returns to work, he explores changes in inequality of the *overall* returns to work (which is the sum of pecuniary and non-pecuniary returns). Accounting for the fact that along with an increase in income inequality

also the burden of work at less desirable times has intensified for already disadvan-taged groups of workers, conventional inequality estimates are strongly downward biased. Since only cross-sectional data are available and no causal inference is possible, Hamermesh (1999a) performs a step-by-step investigation of various non-wage aspects of returns to work to explore their influences on the changing inequality over time from various angles.

In addition to the allocation of activities within a day, also their variation between days might affect an individual's welfare. Hamermesh (2005) argues that routine in economic activities is useful because it enables people to reduce set-up costs[1] but it is also undesirable at the margin as it limits the worker's ability to enjoy temporal variety. Based on four different countries, the author finds that the timing of market activities has important implications in that the implied increase of temporal variety on individual well-being is greater in absolute terms for households with higher incomes than what conventional income measures would predict.

Cardoso et al. (2008) analyze the implications of non-standard working hours from a labor demand perspective for Portugal. The authors find that legislated or collectively-bargained penalties mandated on those employers who have a greater demand for work at irregular hours, induce firms to alter their operating schedules such that they can substitute between workers who work at different times of the day. The findings are in line with the theoretical results of Weiss (1996) in that the large amount of work outside daytime hours in the US can be attributed to a lack of government policy, weak trade unions and the fact that bargained union policies cannot expanded to the non-unionized sector.

In general, the time that individuals allocate to market work differs consider-ably between the US and Europe. The fewer hours worked in Europe are partly explained by different labor market institutions. Freeman and Schettkat (2005) ana-lyze the so-called *marketization hypothesis* according to which these differences arise because households in the US shift a higher proportion of traditional household activities to the market than European households. Instead of producing certain commodities at home, individuals in the US therefore purchase market substitutes: time intensive goods are substituted by income intensive goods. This explanation would suggest a perfect substitutability between goods produced at home. Hamer-mesh and Donald (2007) however show that market and household work are rather complements at the margin with respect to the individual allocation of time which undermines the assumption of perfect substitutability. Since household production is traditionally taken over by women, Freeman and Schettkat (2005) attribute the major share of the EU – US gap in aggregate working hours to differences in the allocation of household work devoted by women in the EU and the US.

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[1]This is in line with the model implications of Weiss (1996).

2.1.2 Allocation of Household Work versus Leisure

The productive nature of household work is long recognized. Gronau (1977) formally included this concept into the model of individual labor supply. He augments the theory of Becker (1965) by a production function for household work. Gronau (1977) argues that a clear distinction of non-market time into productive home production and leisure is crucial for the analysis of fertility, marriage, child-care programs, labor-force participation as well as for the evaluation of output of the non-market sector. In addition, leisure and household work react differently to changes in socio-economic variables which further underlines the need for a clear distinction. Kooreman and Kapteyn (1987) confirm the validity of this model empirically. Moreover, Gronau (1980) attempts to estimate the value of home production for the first time. He finds estimates that amount to two-thirds of the total money income of average (white) families. The value even exceeds 80 percent in the case of families with pre-school kids. Yet, given that the data are not perfect, the true contribution of family members to home production might even be underestimated.

Although Becker (1965) and Gronau (1977) note that leisure and household time should not be combined into a single index of non-market time, most researchers in this field do so for lack of suitable data. Since the extent of household production strongly changed over the course of time, leisure is only poorly approximated by non-market time. Aguiar and Hurst (2007) therefore explore changes in the allocation of household work and leisure in the US over the last four decades to gain a better understanding about the elasticity of substitution between time and goods. This is particularly interesting if the elasticity of substitution changes across the production function for different commodities. The authors find that the allocation of leisure increased by 4 – 8 hours per week over the observation period with a significant simultaneous decline in time devoted to household production for women. They additionally estimate that the market value of the increased time devoted to leisure is non-negligible. The estimates range from $ 5000 to $ 5500 for the US in 2003 and roughly represent 13 to 14 percent of the annual sample income.

Also variations in time spent sleeping might explain the shifting patterns of time allocation. Biddle and Hamermesh (1990) explore whether sleep is endogenous and can be controlled by the individual. The authors find that variations in the allocation of sleep respond to economic incentives so that sleep is slightly reduced when wages increase. Since sleep is a choice variable, it is affected by the same economic variables that also influence the allocation of other activities. In contrast, lack of sleep in particular if induced by the timing of market work adversely affects individual productivity and well-being and has therefore also implications on firms' output as will be investigated more closely in Chapter 6.

Traditionally, men are more likely to engage in market work and women to care for household and children. An aggregation of the amount of time devoted to all

work related activities performed with the household or in the labor market into a single measure reveals that gender differences disappear. Burda et al. (2008) call it the iso-work fact since the relationship is surprisingly stable across countries, time and specific groups of workers. The hours spent on total work further restrict the available time for enjoyable activities. This result suggests first that leisure and all work related activities are substitutes which in fact opposes the assumption of Freeman and Schettkat (2005) and secondly, market work and household production are complements.

2.2 Social Interaction and Social Capital

The ability of people to interact with other either at work or during non-market time is an important determinant of well-being. The importance was acknowledged by the sociological and anthropological literature already during the 1970s.[2] Becker (1974) was the first to introduce this concept into economic models. The theory is based on the assumption that not only individual characteristics but also those of others as well as their interactions need to be considered in economic modeling. Becker calls the central concept of his model "social income" and defines it as the sum of a person's own income and the monetary valuation of the other people's personal characteristics. Each term in an individual's utility function has therefore a given or innate and an acquired component. He incorporates the concept into a so-called "family utility function" for the head of household who altruistically combines his own welfare concerns with those of all other family members. As a consequence, a redistribution of income within the family does not affect the consumption and welfare of any household member because transfers from the head of household offset these differences. Becker (1974) shows that the introduction of social income can explain the high observed income elasticities of demand for the quality of childcare.

In this dissertation, I adopt a broader definition of social interaction that is less oriented towards monetary equivalents. I interpret it instead as interaction with any friend or family member in terms of time investments and I view it as enhancing an individual's utility (Sullivan, 1996). The timing of market work is central in this context as it strongly restricts the individual's ability to interact with others. Yet, social interaction is not only restricted by the individual's own allocation of time but it is also contingent on other people's schedules (Jenkins and Osberg, 2005). Therefore, one requirement for social interaction is that the mutual schedules of both parties overlap to some degree. Work outside the usual working hours, however, strongly hampers this possibility. Further implications of this concept will be explored in more detail in Chapter 5.

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[2]See for example Larson (1978); McLanahan et al. (1981); Thoits (1982); Berkman (1984)

The amount of time devoted to total work (Burda et al., 2008) strongly restricts the individual's available time for enjoyable activities. Hamermesh (2002) finds additional evidence that couples seem to actively coordinate their working schedules as to be able to jointly consume leisure. In combination with the results of Sullivan (1996) who finds that social leisure enhances a person's utility and in particular when it is spent with the spouse, it can be argued that leisure time coordination positively affects well-being and is therefore societally desirable. In addition, joint leisure increases with income which Hamermesh (2002) interprets as evidence that it is not an inferior good. On the contrary, the strong decline in working hours over the past decades in combination with an increase in leisure further emphasize the argumentation of Becker (1965) that time-intensive goods have been luxuries in former times.

To identify the influencing factors, Hamermesh et al. (2008) examine how schedules as well as the individual's coordination of activities respond to various cues. Their results suggest that the circadian cycle[3] but to an even greater extent the timing of television programs have the largest effects on the coordination of economic activities in the US. Chapter 4 proposes a novel approach to studying the implications of working schedules on joint leisure.

As mentioned before, the allocation of market work is the most important determinant of social interaction. Hamermesh (1999b) proposes its usage as indicator for the degree of integration of the members of a society. Narrower working hour distributions raise the possibility of workers to interact with others during their non-market time. Since social interaction is utility enhancing (Sullivan, 1996; Jenkins and Osberg, 2005), a higher degree of social integration within a society thus reflects, ceteris paribus, higher levels of overall well-being of its members. In addition, the possibility of social interaction is affected by changes in the value of time. With rising wages, also the value of time and the opportunity costs of leisure increase, generating an income and a substitution effect. As a consequence, the allocation of activities as well as their mix over the day is changed depending on which of the effects is stronger (Hamermesh, 1998).

In general, social interaction is one important aspect of *social capital*. The definition of this term is however very heterogeneous in the literature. Durlauf (2002) presents some of the different concepts and definitions of "social capital". In this thesis, I adopt the view of Putnam (2000) who refers to it as "connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them. [...] A society of many virtuous but isolated individuals is not necessarily rich in social capital." Therefore, societies with larger social networks are typically societies with more social norms and also with higher levels of trust. Coleman (1994) further notes, that social capital is not a single entity but

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[3]The circadian cylce denotes the daily recurrent rhythm of biological activity and rest in cycles of approximately 24 hours. See for example Culpepper (2010).

is defined by its function in that it facilitates certain actions of individuals within a social structure. Related to this definition, Glaeser et al. (2002) use this term to describe a person's social characteristics that enable him to benefit from market and non-market returns arising from interactions with others. In this context, social capital can be understood as the social component of human capital. The authors build a theoretical model on investments in social capital and test its implications empirically. The model is consistent with standard economic investment models and the results suggest that individuals tend to accumulate more social capital when private incentives are high. An aggregation of these individual-based views is in line with the concept of Knack and Keefer (1997) who define social capital as trust, norms or associations within groups. The authors analyze its influence on economic growth and conclude that the erosion of trust is of greater concern to economic performance in the US than the decline in associational life as emphasized by Putnam (1995). Yet long-term consequences are hard to measure. Neglecting them might strongly understate the overall consequences.

The binding element of the different views of social capital as used in this chapter is that trust and norms are essential to the functioning of civic societies, to economic progress and to existence of stable social networks. The argument that individuals living in societies with higher levels of trust need to spend less financial resource to protect themselves from being exploited in economic transactions can thus be related to the view of more integrated social networks according to Putnam (1995, 2000).

2.3 Division of Labor, Children and Household Time

Increases in female labor supply have long been regarded by economists as the major achievement of the past decades. A vast body of the literature has thus been devoted to the analysis of female labor supply decisions, in particular of married women.[4] This question itself is not a primary topic of this dissertation but the strong increase in female labor supply has consequences on social life and the individual's ability to reconcile family and work.

Historical developments as described in Chapter 1 explain the emergence of one-earner families in Western Germany. Becker (1985) gives a theoretical explanation of the evolution of the traditional division of labor within households. Accordingly, specialization among identical individuals on specific activities determines the resulting investments into human capital and consequently the returns to specialized human capital. In addition, economies of scale from investments in activity-specific human capital further encourage a specialization of women and thus foster the division of labor among spouses. Such a specialization in household and childcare,

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[4]See Killingsworth and Heckman (1986); Blundell and MaCurdy (1999) for extensive surveys of the existing literature.

typically by women, prevents incomes from rapid growth even among identical individuals. Intrinsic initial productivity differences additionally emphasize the sexual bias in the division of labor and the resulting accumulation of specific human capital. Juster and Stafford (1991) note that the existence of joint taxation of couples with a single marginal tax rate further contributes to the weaker tendencies within a household to equalize the gender roles.

However, traditional gender roles have weakened over the past decades in reality. The expansion of the service sector provides new job opportunities to a high proportion of female workers and thus enables them to participate in the labor market. This development increased the earnings power and the employment opportunities of (married) women which raised the forgone value of household activities and – more importantly to this dissertation – of parental time spent with kids (Becker, 1985). Against all concerns Bianchi (2000) finds that maternal time and parental attention towards their children has been more constant over the past decades than expected. No significant substitution away from time spent with children has occurred as consequence of the drastic increase of maternal employment. The combination of improved earnings potentials over the past decades and augmented female employment opportunities further intensified the incentives of women to invest in market-oriented human capital. In turn, their earnings power and labor supply rose even further.

To better understand the development of human fertility over time, Becker and Lewis (1973) note that the trade-off between quantity and quality of children is crucial and even intensified over the course of time. The authors sketch a model which is grounded on the assumption that the shadow price of the number of children increases with quality and vice versa. The authors use this relationship to explain the high income inequality of the demand for quality of children and also the low and even negative elasticity of quantity. Becker and Tomes (1976) augment the model of Becker (1974) by social interaction. The authors show that the observed elasticities of demand for quantity and quality of children largely depend on the degree of intergenerational mobility and the intertemporal income growth rate. The stronger focus on the quality of children over the past decades can be viewed as possible explanation why the amount of maternal time with kids remained relatively constant over time even if maternal employment increases.

Becker and Murphy (1988) examine why the state intervenes in family matters at all. The authors argue that such interventions improve the efficiency of family activities if families themselves are not able to achieve an efficient arrangement. Hence, the welfare of children and parents is raised at the same time. Yet, the well-being of children is the central issue of the analysis. Regulations that introduce and further strengthen flexible working schedules of workers are one possible example for such a state intervention. Such flexibility of working schedules might

help to mitigate potential adverse effects of parental employment on the cognitive development of children in particular during the first years of a child' life. Such a policy increases not only the well-being of children who can spend more quality time with their parents, it also helps to alleviate stress from parents who must juggle work and family simultaneously. Consequently, also the well-being of parents is positively affected which is again returned to their children. Chapter 7 identifies and quantifies the positive effect of flexible working schedules on parental time.

Another interesting aspect is the influence of demographic variables on consumption patterns within households. Gronau (1991) studies the intra-household allocation of resources and shows that the assumption of separable utilities generated by the consumption of parents and children provides an empirical method to separate the two components of consumption. The author finds that families with up to 3 children allocate 20 – 30 percent of their total consumption on their children. His analysis shows that mothers with longer working hours divert more pecuniary resources to the consumption of their children and he interprets it as evidence that they compensate their children for the lower time investments due to maternal employment.

In conjunction with the substantial increase in female labor force participation, many researcher are preoccupied with the association between maternal employment and the cognitive development of children yet, empirical evidence is very mixed. Blau and Grossberg (1992) explore this question for young US mothers aged between 21 and 29 for the year 1986 with pre-school kids. By addressing the potential non-random selection of mothers into employment and by applying an instrumental variable approach, the authors find that maternal full-time employment during the first year of a child's life, significantly reduces standardized test scores of three to four year old children.[5] Maternal full-time employment after the second year of a child's life significantly improved test results. The authors argue that the higher financial investments of working mothers are mainly driving this result. In sum, both effects offset each other so that maternal employment during the first three years of a child's life has no significant influence on the child's cognitive development. However, the specific group of mothers of this study shall be kept in mind so that the results obtained must be regarded with caution. Bianchi (2000) wonders that only relatively few studies find that the strong increase in labor force participation over the past decades had such a little effect on the cognitive development of children. The author reviews many studies to explore potential reasons and finds that, in contrast to conventional wisdom, mothers' time and attention to children has been more constant over these years than expected, so that employed mothers seem to add a second shift to care for their children in addition to the work performed at the job.

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[5]The standardized test used to assess a child's cognitive development is the Peabody Picture Vocabulary Test.

3 German Time Use Data

3.1 The Survey

Time is a scarce resource and its natural limit restricts economic activities. Over the past decades, the statistical offices of many countries started to collect time budget data on a representative level. The availability of these new data sources allows researchers to study the impact and consequences of the allocation of time on an individual level and within a household in more detail. The empirical analyses of this dissertation are mainly based on German Time Use Data (*Zeitbudgeterhebung*) which shall hence be presented in more detail in this chapter.

The data were collected by the German Federal Statistical Office with financial support of the German Ministry for Family Affairs and Senior Citizens (Statistisches Bundesamt, 2003). Up until today, the data are available for two waves, namely for the years 1991/92 and 2001/02. Both waves are comparable and the design of the survey as well as the coding of activities are based on international recommendations issued by the International Association of Time Use Research (IATUR).[1] This assures the comparability with time use surveys of other EU-member states. The German Time Use data are particularly suited for answering the questions of this dissertation as they allow me to study individual choices about the allocation of time to different activities as well as the interaction with other household members.

3.1.1 Survey Year 1991/92

The German Time Use data were first collected during the years 1991 and 1992. The interviews were conducted in four survey periods. The collection started in October 1991 and ended in July 1992 to obtain representative information about the allocation of time across the whole year and for methodological reasons. To allow for comparability with other German data sources, demographic variables are harmonized with the largest German household survey, the microcensus. The target population comprises private households with a German household head, covering all household members older than 11 years. In total, approximately 32000 diaries were gathered of about 7200 households. The results of this survey are representative at the national level as well as at the level of old and new federal states. The data are based on three personal questionnaires namely i) the

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[1]See also Kraus (2001); Ehling (1998).

introductory interview, ii) the diary and iii) the final interview and a household questionnaire.

In the introductory interview, each household member above the age of 11 reports basic socio-economic characteristics, his current education, all educational attainments, the type of labor force status as well as net earnings. The household questionnaire covers additional information about the composition of the household, its endowment with a list of consumer durables and also about its housing situation and residential surroundings. The final interview contains topics about the need for care, help provided to other households or help received, voluntary and community work, as well as childcare provided by each respondent.

To gain information about the allocation of activities over a day, each person additionally reports all first and secondary activities he engaged in during each 5 minute time interval in his own words for two consecutive days. These diary days were proportionally selected to cover the entire week. Moreover, each respondent indicates for every time slot who the primary activity was spent with as well as the whereabouts. After the completion of the interviews, the open diaries were centrally coded at the Federal Statistical Office into a 3-digit classification with more than 200 activities encompassing ten main fields: i) household work, ii) handicraft activities, iii) paid market work or job search, iv) unpaid voluntary and community service, v) qualification and education, vi) personal sphere and physiological regeneration, vii) contacts, communication, social life, viii) media usage and leisure activities, ix) care and support of others, x) and a residual category of all unclassified activities.

3.1.2 Survey Year 2001/02

The second survey wave of the German Time Use survey was carried out between April 2001 and March 2002. As for the previous wave, the German microcensus built the the basis for the explanatory variables as well as for population weights. In contrast to the first wave, also households with a foreign household head were included if they had a good command of the German language. The total sample consists of approximately 5400 households covering about 12600 persons and about 37700 diaries.

Each person above the age limit of 10 had to provide information about the socio-demographic and socio-economic background which is comparable to the first survey wave. According to the Federal Statistical Office (Statistisches Bundesamt, 2005), the prevailing type and extent of paid and unpaid work but also of voluntary employment, life-long learning, education and vocational training, the division of labor within a household, leisure activities, the use of time of families, kids, adolescents and elderly people are covered. Moreover, information on professional formation and vocational training, health and questions on the subjective assessment about the allocation of time was gathered. Like for the previous wave,

also information about assistance obtained from others or given to others, as well as about the accessibility of infrastructure facilities are collected. The additional household questionnaire comprises questions about the composition of the household, its endowment with consumer durables as well as its housing situation and residential surroundings which are broadly comparable to the previous wave.

In addition, each respondent filled in open time diaries for three days of which two were consecutive workweek days and one day had to be a weekend day. Time slots of the diaries were widened to include all activities undertaken during each 10 minutes. Respondents indicated again all primary and secondary activities of each time slot as well as with who it was spent with and its whereabouts. Similarly to the previous wave, all activities were centrally coded by the Federal Statistical Office into 3 digit classifications. The main topics are comparable to those for the 1991/92 survey wave.

3.1.3 Definition of Main Activity Aggregates

The more than 200 single activities that were coded into 3 digit classifications by the Federal Statistical Office will be aggregated in this dissertation into four main activity aggregates. Such an aggregation is inherently arbitrary but necessary. I use the following activity groups following Burda et al. (2007): paid market work (MW), household work (HP), pure leisure (L) and tertiary time (T).[2]

Market work (MW) is defined as all directly job related activities of primary and second jobs. Moreover, those time intervals devoted to internships, qualification and education on or for the job, job search, breaks during the workday and travel time related to work are also defined as market work.

Household production (HP) captures all those activities for which market substitutes can be purchased. It follows that somebody can be paid to take these activities over instead. Hence, household work satisfied the third-party rule by Reid (1934) according to which a substitution between market goods and services for household time is possible (Burda and Hamermesh, 2010). Some household activities such as cooking or gardening are however enjoyable and utility enhancing to some extent and can hence be partially viewed as leisure. These additional benefits are also termed "process benefits" (Juster, 1985), "joint production" (Graham and Green, 1984; Kerkhofs and Kooreman, 2003) or "activity benefits" (Gørtz, 2006) in the literature. Yet, for the marginal consumer, these activities are rather associated with work and are therefore defined as such. Furthermore, some other household activities such as childcare may provide extra benefits beyond their consumption value (Gørtz, 2006, Kerkhofs and Kooreman, 2003).

Moreover, pure leisure (L) comprises those activities that nobody can be paid for to do them and that nobody has to engage in at all. Hence, they are purely

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[2]Commuting or traveling time is added to the respective activity aggregate for which it is needed.

enjoyable activities from which people derive utility. Activities such as organized leisure, sports, reading and writing, watching TV as well as listening to the radio are included in this aggregate

Finally, tertiary time (*T*) is defined as those activities that nobody else can do for us because they are essential such as sleeping or personal hygiene. In the reminder of this chapter, I will use an additional activity group termed as total work. This index measures the sum of all work related activities at the job or in the household being either paid or unpaid.

3.2 How Do Germans Use Their Time?

In this section, I will present how Germans generally use their time in order to get a better understanding about the allocation of these activity aggregates. Figure 3.1 depicts broad unconditional averages for both survey waves for all respondents of the German time use surveys.

Figure 3.1: Allocation of Time of All Respondents Older than 10.

Source: German Time Use Surveys for 1991/92 and 2001/02; own calculations.

In 1991/92 (2001/02), the average respondent spends about 35 (36) percent of their total available time sleeping which corresponds to an average of more than 8 hours per day. Over the years, time devoted to eating and personal hygiene increases from 2 hours in 1991/92 to about 2.5 hours 10 years later. In contrast, respondents devote on average an hour less to market work between 1991/92 and 2001/02. Over the survey waves, time spent on unpaid work or on volunteer work declined while the importance of leisure intensified. In 1991/92, the average person

Figure 3.2: Female-Male Ratios of the Allocation of (Un)Paid Work for People Aged 15 − 64.
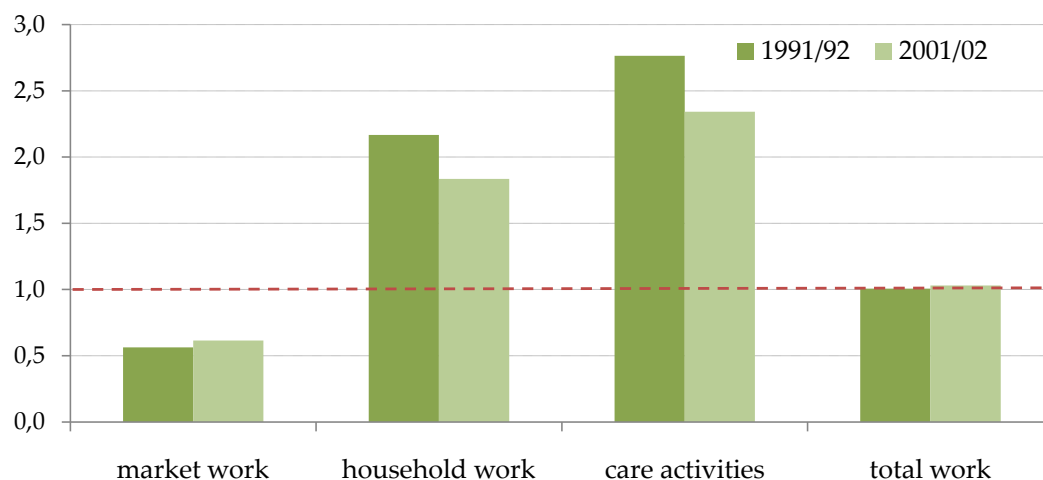
allocated almost one fourth of the disposable time to pure leisure activities. Ten years later, people additionally report to spend about an hour more on sports, hobbies or other entertainment related activities compared to the previous wave. In summary, people allocate on average more of their available time in 2001/02 to sleep and leisure activities at the expense of total hours of paid and unpaid work.

The increase in the time used for leisure between 1991/92 and 2001/02 went along with a decline in unpaid household work for the working age population but to a greater extent with a reduction in market work. This observation corroborates the findings by Hamermesh and Donald (2007) that paid and unpaid work are complements and that leisure is rather a substitute for any total work related activity.

Figure 3.2 represents the female-male activity ratios for both survey years. In the case that men and women allocate similar amounts of time to a specific activity aggregate, the ratio equals one. Ratios smaller than one suggest that men devote more time to this activity than women and vice versa. The figure shows that the division of tasks within German households is traditional so that women in the working age population spend about half as much time per day on market work than men. Regarding household work or even care activities, the female-male ratio shows a significantly higher female involvement with women spending on average about twice the time on household work than men. The multiplier is even higher for childcare activities. Over the years, these ratios diminished slightly but remained pronounced suggesting that gender roles did not weaken considerably. The figure additionally shows the ratios of time spent on total work and reveals no big differences between the sexes. As mentioned above, this very stable relationship is also known as the iso-work fact (Burda et al., 2008).

Figure 3.3: Differences in Female-Male Ratios of the Allocation of (Un)Paid Work between West and East Germany for People Aged 15 – 64.
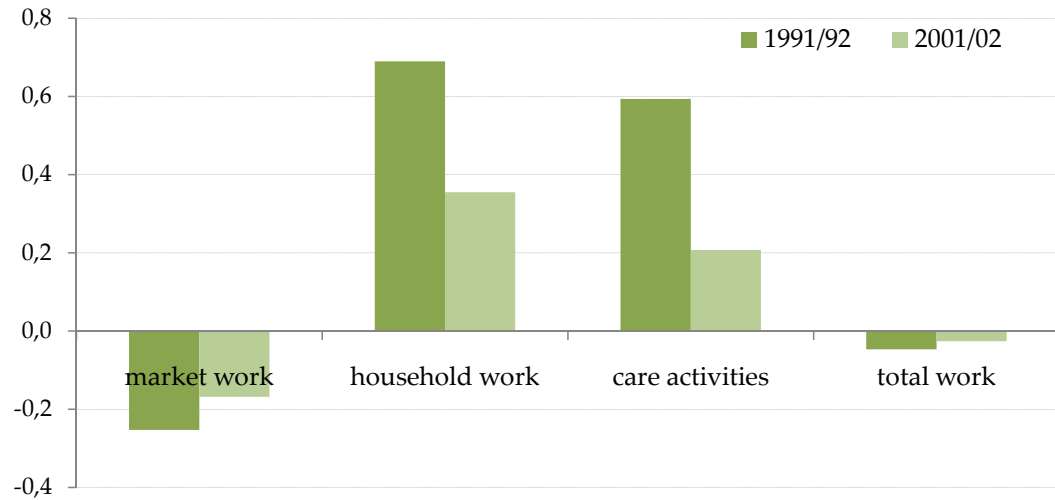
Source: German Time Use Surveys for 1991/92 and 2001/02; own calculations.

In addition to the general ratios, figure 3.3 shows differences in the female-male ratios between West and East Germans. Zero values indicate no differences in the activity ratios while negative values suggest that female-male ratios are lower in West Germany and vice versa. The figure reveals that market work in East Germany is more equally allocated between the sexes so that the ratio is about 0.2 percentage points lower than in West Germany. Also the female-male ratio in household production is significantly lower in East Germany: while West German women devote about twice as much time to unpaid work in the household, East German women allocate only 1.5 times more. A similar difference is obtained for care related activities. One possible reason could be the different gender roles resulting from different employment and family policies between the former GDR and the Federal Republic of Germany. The exposure of all Germans to the same family values and policies after reunification might further explain the strong convergence of these activity ratios over time. Chapter 7 exploits the particularities of the labor market in the former GDR before reunification as identification strategy.

Moreover, table 3.1 presents the minutes of time devoted to specific activity aggregates in West and East Germany by gender for both survey waves to make the distinction even clearer. Only people in the working age population are considered here. In 1991/92, women in West Germany spent on average about an hour less on total work than women in East Germany. While women in East Germany devoted more of their total time to market work, they also spent a lot of their remaining time on household production without neglecting childcare. This emphasizes the double burden for these women (Hochschild and Machung, 1989 and also Bianchi,

Table 3.1: Average Minutes of (Un)Paid Work for West and East Germany in 1991/92 and 2001/02.

	1991/92			2001/02		
	male	female	ratio	male	female	ratio
West Germany:						
market work	371	185	0.50	280	163	0.58
household work	133	316	2.37	140	267	1.91
care activities	16	47	2.92	13	32	2.38
total work	504	501	0.99	419	430	1.03
East Germany:						
market work	372	280	0.75	268	201	0.75
household work	167	281	1.68	159	248	1.56
care activities	17	39	2.33	10	22	2.17
total work	539	561	1.04	427	449	1.05

2000). In addition, East German men spent half an hour more time on total work activities which results from the 30 minutes more time allocated on average to household work. In 2001/02, the difference in total work related time between East and West German women shrank. In contrast, the total work gap between East German men and women widened in 2001/02. According to the average allocation, women in East Germany devote about 20 minutes more time to all work related tasks than men.

When only the allocation of time during waking hours is regarded, about 40 – 50 percent of the this time is devoted to market work. The active day is therefore restricted by and is organized around work. If individuals work at unusual hours, the possibility of social interaction and therefore social life is limited and also the reconciliation of family and work is challenged. This is an important aspect, since social interaction is an important determinant of an individual's well-being.

Figure 3.4 shows the composition of leisure across a standard day. The shares are very similar in both survey years. On average, almost 50 percent of total leisure time is devoted to mass media and mostly to TV watching. Men allocate 5 percentage points more of their total leisure to mass media than women. In contrast, only little time is generally spent on sports and hobbies by men and women likewise. About 37 percent of the total free time consists of activities associated with entertainment and social life which shows that social interaction is of major importance. In addition, women enjoy higher average fractions of their total leisure time with interactive activities as compared to men.

As mentioned earlier, social interaction is restricted by a person's working schedules and consequently also the composition of leisure activities is affected. Figure 3.5 shows this composition by survey wave and shift status for employed

Figure 3.4: How is Leisure Spent by People in the Working Age Population in 2001/02?
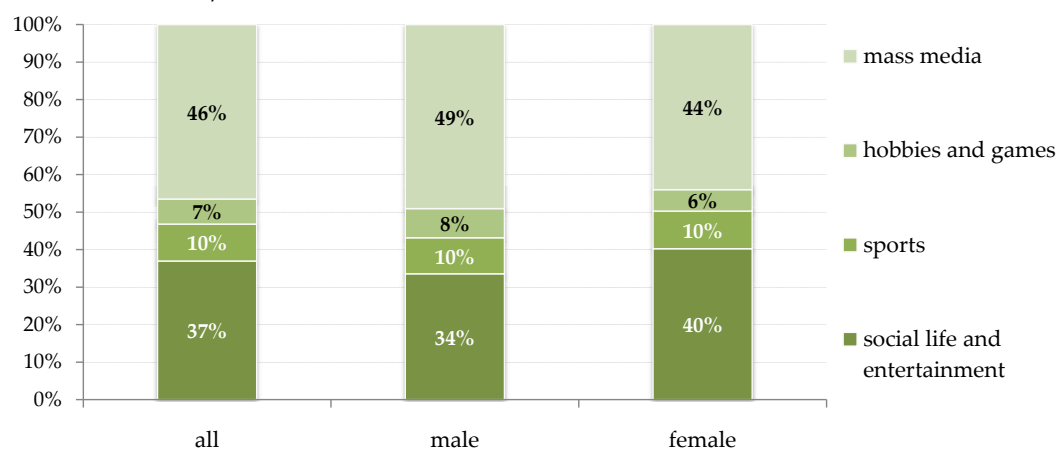
Source: German Time Use Surveys for 1991/92 and 2001/02; own calculations.

Figure 3.5: Allocation of Leisure Depending on Working Schedules.
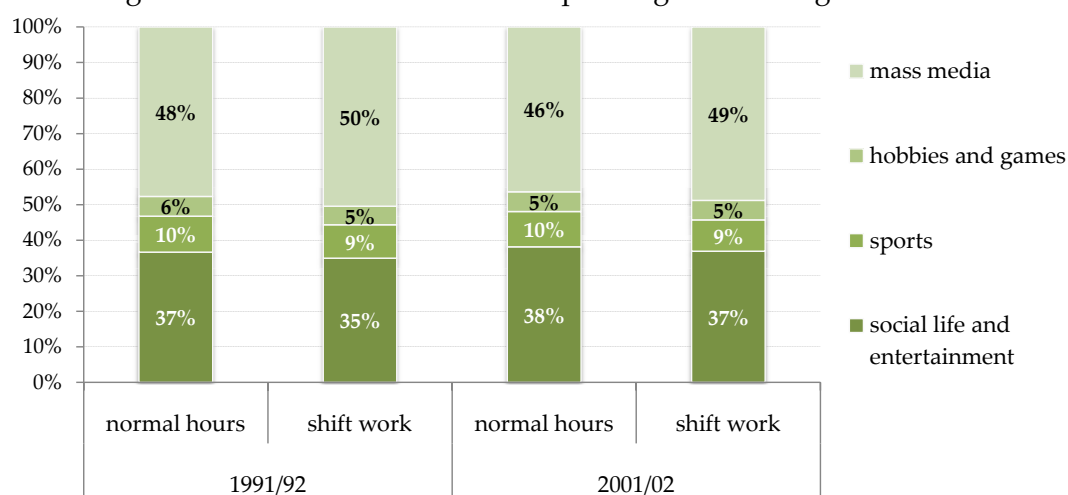
Source: German Time Use Surveys for 1991/92 and 2001/02; own calculations.

individuals in the working age population. Compared to all people in the working age population, those individuals who are employed allocate on average slightly more of their total available leisure time to mass media. In addition, shift workers devote even 2 to 3 percentage points more time to mass media. In contrast to that, they spend slightly less of their free time on entertainment and social life. Over time, the composition of leisure activities for shift and daytime workers converges, but it has to be kept in mind that simultaneously the incidence of evening and night shifts declined drastically. While on average about 14 percent of all employees worked in such shifts in 1991/92, the fraction more than halved and reached 6

percent in 2001/02. The highest fraction of shift workers work in rotating teams. While in 1991/92, about 61 percent of all shift workers reported to work in rotating teams, this share increased by 20 percentage points in 2001/02. This compositional change in shift work is important for the analysis of adverse social consequences induced by these jobs. I account for it by exploring not only shift workers but additionally also people who work during unusual hours in Chapter 6.

Figure 3.6: Allocation of Leisure of All Respondents with Children Younger than 7 by Sex.
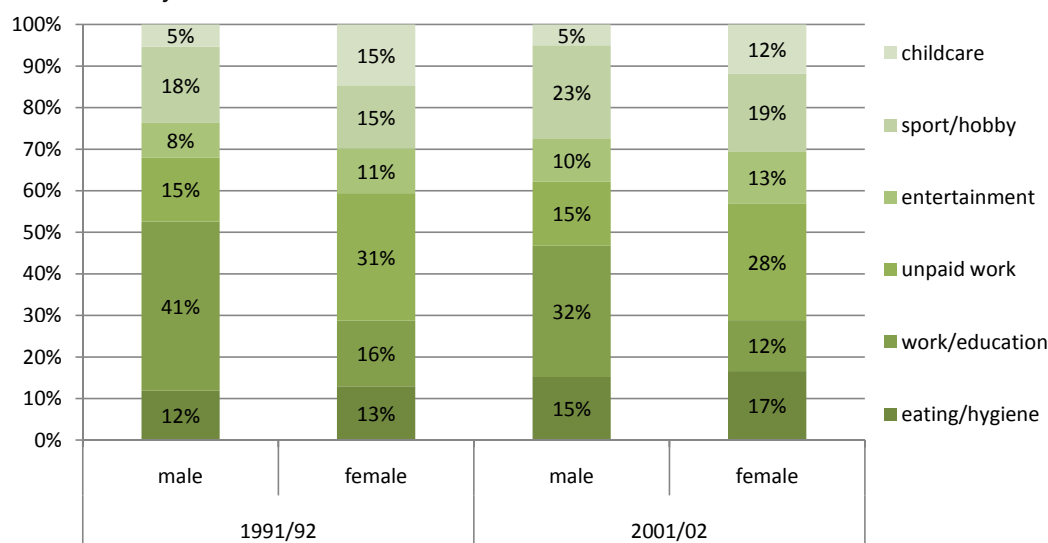
Source: German Time Use Surveys for 1991/92 and 2001/02; own calculations.

The reconciliation of family and work is especially important for parents with young children. To gain a better understanding about the allocation of time of families with young children, figure 3.6 reports the average allocation of time by gender for both survey waves for parents with kids under the age of 7. Again, only activities during non-sleeping hours are depicted in this graph.

Traditional gender roles among parents with young children that are reflected by the allocation of time are illustrated in figure 3.6. While fathers allocate most of their time to market work, mothers devote the highest fraction to household work. On average, working hours of mothers account for 12 – 16 percent while fathers devoted between 32 and 41 percent to market work. In contrast, fathers with young kids spent only about half as much non-sleep time to household work as mothers. Childcare related activities are mainly overtaken by mothers who allocated between 12 – 15 percent of their available time to primary childcare related activities. Men, in contrast, spent only about 5 percent to primary childcare time.

Over time, the average unconditional fraction that mothers spent on primary childcare activities declined from 15 percent in 1991/92 to 12 percent in 2001/02.

The time that parents devoted to pleasurable activities such as sports, hobby and entertainment has increased over the same time span from a total of 26 to 32 percent and over. It must be noted, however, that only primary activities are evaluated here. In general, people are involved in more than one activity at the same time so that it is probable that parents enjoy social activities together with their kids but do not define it as childcare related time. Consequently, parental time with kids is underreported. However, primary time which is directly devoted to childcare activities is most important to the cognitive development of children. This is the reason why I will merely focus on these activities in this thesis when referring to parental time.

Figure 3.7: Composition of Whereabout for 2001/02.
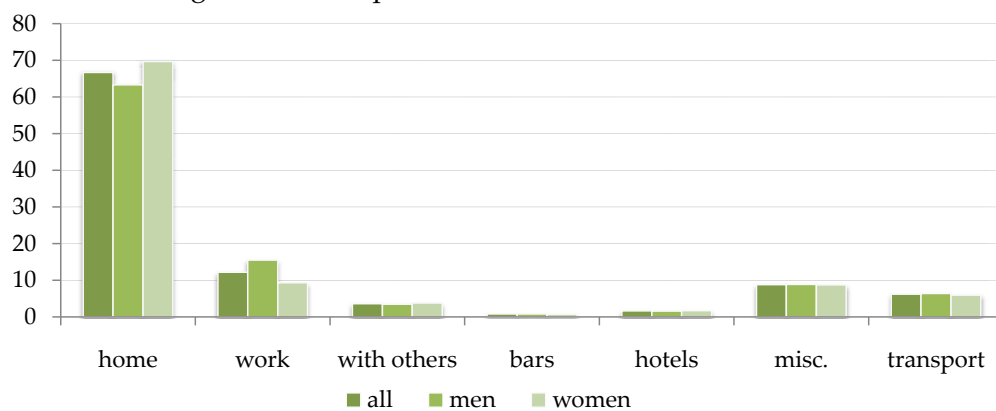
Source: German Time Use Surveys for 2001/02; own calculations.

The German Time Use data additionally provides information about where people spend their time. Table 3.7 reports the whereabouts for 2001/02 for people under the age of 65. Unsurprisingly, more than 60 percent of the time is spent at home. Of the available 24 hours per day, men are about 15.5 percent at the workplace and more than 6 percent in public or private transport. Women, in contrast, are about 7 percentage points more at home during a standard day. Furthermore, they spend about 9 percent of their time at the workplace. Compared to men, women additionally tend to have a slightly higher probability to visit others in their apartments.

3.3 When Is Time Spent?

The distinguishing feature of time use surveys with respect to other individual and household data is that not only time aggregates can be explored but also the exact *timing* of events. The time diary information allows me to study the interrelations between work and social life of household members and makes these data a perfect source for this dissertation.

Figure 3.8 shows the average distribution of market work, unpaid household work and of leisure over an average day for the year 2001/02. Accordingly, work in the labor market is most likely between 6 am and 8 pm. Due to the high proportion of female part-time employment market work is most common before noon. In the afternoon, the average work probability decreases steadily but remains pronounced also in the evening hours. Correspondingly, unpaid household work is most common between noon and 6 pm. The fact that daytime hours are predominantly devoted to either paid or unpaid work restricts the disposable time for leisure to the evening hours. Since people derive additional utility from spending leisure with others (Sullivan, 1996), it is not only the own working schedules but also the schedules of potential social companions that limit the allocation of time (Jenkins and Osberg, 2005). Hence, leisure is most likely to be enjoyed in the evening hours when the probability is highest to enjoy it with others.

As mentioned before, men and women spend different amounts of time to the major activities aggregates but also the allocation of these activities across a workday differs. The difference in the average use of time by gender is presented in figure 3.9 for every time interval t. Market work is more likely for men than for women during every time interval of the day. The difference is highest during the standard working hours and in particular between 1 pm and 5 pm. During evenings and nights, work in 2001/02 is mainly provided by men. Due to the traditional division of labor, unpaid work within the household is more likely to be performed by women throughout an average day. The difference for men and women is a mirror image of the allocation of working hours. This finding is in line with the iso-work fact (Burda et al., 2007), according to which men and women devote the same total amount of time to paid and unpaid work. In addition, also the timing of these activities of both sexes overlaps across a day which might be an indication for the existence of strong social norms that lead to a synchronization of working schedules (Weiss, 1996). The timing of leisure activities is similarly distributed for men and women over the day. Only during noon and after 6 pm men are slightly more likely to enjoy such activities than women.

Finally, figure 3.10 depicts differences in the average allocation of activities between the survey years for all respondents aged between 15 and 64. Positive values indicate a higher incidence of the respective activity during the t-th time interval in 1991/92. On average, work during the day was more concentrated in 1991/02. However, between 6 and 10 pm the work probability was slightly higher for the later wave. This finding is in line with the trends reported in section 1.2 regarding the widening of the working hours distribution. A similar trend was observed for the US by Hamermesh (1999b). Moreover, household work was more common during the afternoon in the first wave of the German Time Use survey. Technical progress in conjunction with a fall in prices for household

equipment and an increase in real incomes are often associated as driving forces for the reduction in hours of household production over time and an increased female labor supply (Coen-Pirani et al., 2010). The additionally available time is substituted by more market work on the one hand but also by the enjoyment of more pleasurable activities. This is emphasized by the fact that the allocation of leisure strongly increased during daytime hours between 1991/92 and 2001/02. This further corroborates the assumption that leisure and household work are rather substitutes than complements (Greenwood and Hercowitz, 1991; Hamermesh and Donald, 2007).

Figure 3.8: Timing of Activity Aggregates for all Germans Aged 15 – 64 in 2001/02.
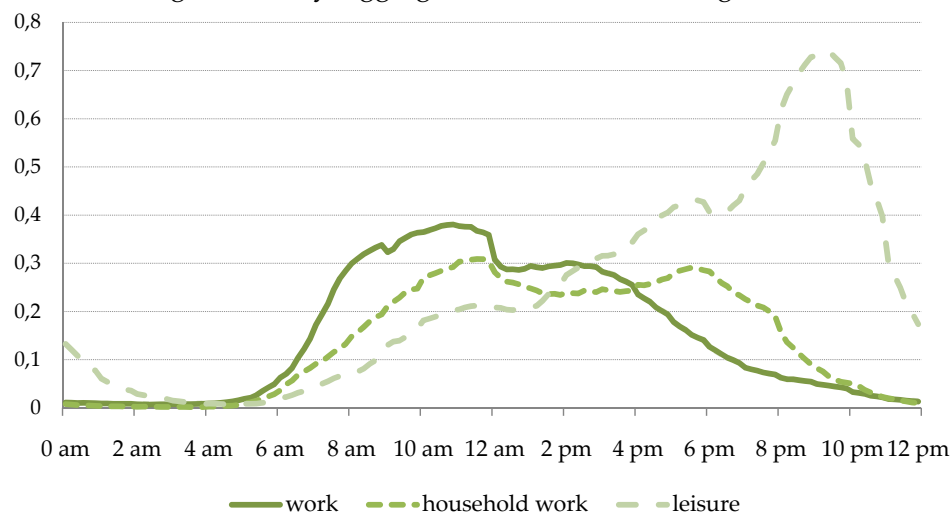
Figure 3.9: Difference in the Average Daily Use of Time between Men and Women aged 15 – 64 in Germany in 2001/02.
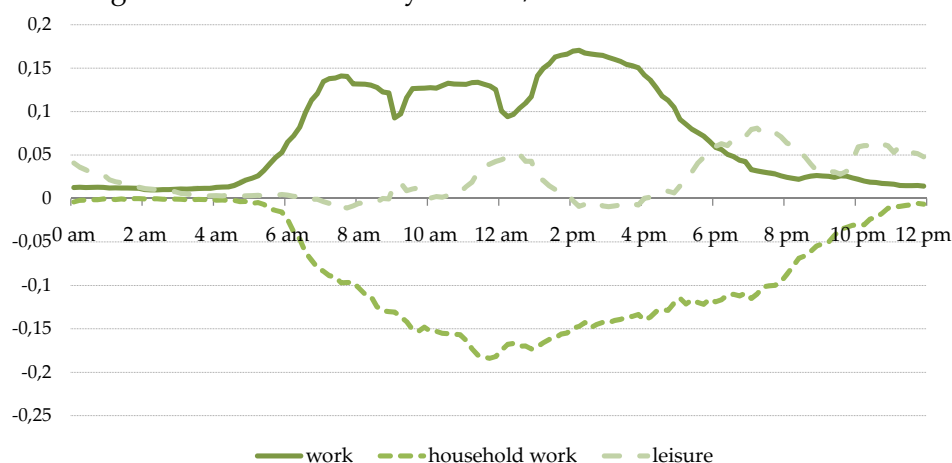
Figure 3.10: Difference in the Use of Time between 1991/92 and 2001/02 for All Germans Aged 15 – 64.
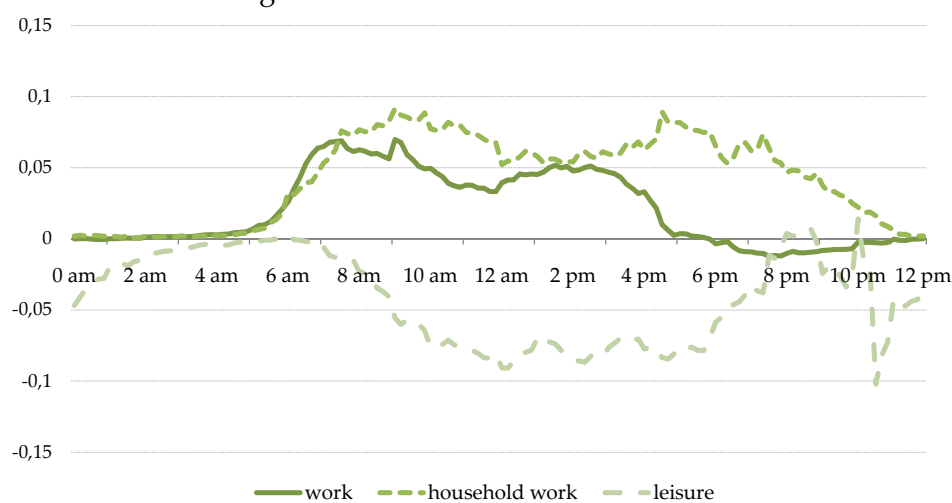
4 Honey, I'll Be Working Late Tonight. The Effect of Individual Work Routines on Leisure Time Synchronization of Couples

German time use data for 2001/02 are used to assess the impact of workplace characteristics on the private life of couples. The major aim is to solve the endogeneity resulting from individual preferences for work and leisure to identify the pure effects of the workplace independent from other diluting personal influences in a cross-sectional setting when no appropriate instruments are available. I propose a repeated random assignment of people into pseudo couples as a solution. By this approach, I am able to uncover additional marriage inherent mechanisms that result in a (de-)synchronization of joint time but are still family friendly.

4.1 Introduction

Annual hours per worker have drastically fallen over the past century in industrialized countries. The reduction in working hours was motivated by an improvement of health and safety or simply of the quality of life. As a consequence, more time is now available for the enjoyment of leisure. Over the same time period female labor supply increased tremendously which in turn reduced their available time for other than market work related activities. A combination of these two trends means for couples and more generally for families that it has become increasingly more difficult nowadays to enjoy leisure jointly. The progressing globalization further aggravates this problem as lower trade barriers lead to more internationally integrated product markets and thus to more competition. In order for firms to be internationally competitive, it is impossible not to react to these trends and consequently employers seek more flexibility in the labor relations within the limitations of the national legal system.

Over the past decades, the importance of flexible work arrangements grew steadily in Germany. The existing forms are manifold and comprise amongst others part-time work, flexitime or marginal employment. Especially, female part-time employment almost doubled from the beginning of the 1980s until today. In 2008,

almost every second employed woman worked part-time. In general, flexible work arrangements are promoted as a means to give workers some freedom to schedule their working hours to better reconcile family and work. Simultaneously, the percentage of shift work rose in Germany from 11% at the beginning of the 1990s to about 17% in 2008. Over the same time span, statutory shop opening hours were relaxed which means that the working schedules of the respective employees were also adjusted accordingly. Thus, the distribution of working hours across a standard workday widened considerably. Now, given these developments, the question remains to be answered in how far flexible work arrangements are indeed effective to reconcile work and family. This paper, therefore, addresses this question and investigates the effect of work arrangements and job attributes on joint leisure of married couples in Germany.

The availability of new data sources on time use has attracted the interest of many researchers in recent years to study the timing of activities within households and thus to get a better understanding of intra-household decision-making processes or more generally, of gender roles. In this context, not only paid work but also unpaid household work and the link between both is closely studied to shed more light on the labor market participation decision of women, which is of great concern to both policy makers and researchers (Becker, 1965; Gronau, 1977, 1980 Becker, 1981; Bird et al., 1984; Gershuny and Sullivan, 1998; Hersch and Stratton, 2000; Apps, 2004; Apps and Rees, 1996, 1997; van Klaveren and Maassen van den Brink, 2007). In contrast to that, other studies investigate the development of leisure time across the past decades (Bittman and Wajcman, 2000; Hallberg, 2003; Alesina et al., 2005; Jenkins and Osberg, 2005; Aguiar and Hurst, 2007). However, the new data sources not only allow for separate analyses of the time aggregates but more importantly to investigate their dependencies. To my knowledge research on the impact of work on the private life has not been addressed so far. Thus, this paper is a contribution for better understanding this link in particular to answer the question whether the highly promoted reconciliation of work and private life is indeed possible.

For an analysis of the influence of work on the private life, it is crucial to solve the endogeneity between hours worked and time enjoyed on non work related activities with the spouse. Individual preferences determine the importance attached to work and consequently to the time spent at the workplace as well as the job attributes that are accepted. This, in turn, influences the time that is left for the enjoyment of non-market activities with the spouse. In this paper, one of the major aims is to present a way to solve this endogeneity in a cross-sectional setting when no instruments are available so that the "pure" effects of work arrangements on the couple's private life can be identified. Not solving the endogeneity would lead to false conclusions of the effectiveness of measures aimed at increasing temporal flexibility. By this approach other diluting influences resulting from

marital preferences that might themselves affect free time can be excluded and thus proper statements can be made. I am therefore able to determine those workplace characteristics that significantly hamper or facilitate the reconciliation of work and private life.

By finding the pure effects, I am furthermore able to uncover mechanisms that lead to a (de-)synchronization of joint free time of the spouses that are not resulting from influences of the workplace itself but are rather inherent to the marriage. In this respect, I find that a coordination of schedules might lead to a mitigation of strong negative effects imposed by shift work but rather result in more de-synchronized schedules for couples with young children at the expense of joint time of the partners. The results of this paper further contribute to another strand of the literature analyzing whether couples actively synchronize their schedules or whether simultaneous time is rather a result from the general organization of activities across an average workday. In contrast to the data used in this paper, most of these studies, however, lack information on whether time is indeed enjoyed together with the spouse (Hamermesh, 2000; van Velzen, 2001; Hallberg, 2003; Lesnard, 2004; van Klaveren et al., 2006; van Klaveren and Maassen van den Brink, 2007).

The paper is organized as follows: A theoretical model will be presented in the next section that will provide the basis for the subsequent econometric specification. In this section, I will furthermore discuss the endogeneity issue arising in this context. The data set as well as the variables used are further described in Section 4.3. An overview of the sample analyzed as well as the distribution of the major activity aggregates across a standard workday will be shown and explained. Chapter 4.4 presents and discusses the estimation results. Finally, Section 4.5 concludes.

4.2 Theoretical Framework

4.2.1 A Model of Joint Leisure

In this section, a simple theoretical model is presented that serves as the basic framework for the empirical investigations of the effect of observable characteristics on a couple's decision for joint leisure. The model is inspired by the life-cycle model of labor supply proposed by MaCurdy (1981). I assume a two-person household consisting of a husband (m) and a wife (f). Children living in the household are included into the vector of household characteristics. Each day is divided into T equally spaced time units $t = \{1, \ldots, T\}$. To keep things simple, I assume that each person can decide at each time unit t to work (n_t) or alternatively to enjoy free time alone (ℓ_t^s, $s = \{m, f\}$) or together with the partner (ℓ_t^j). For each time unit, these variables are taking the value 1 if time is spent on the respective activity and 0 otherwise. For the whole day, each of the spouses faces the following time

constraint:

$$T = \sum_{t=1}^{T} \left\{ \ell_t^s + \ell_t^j + n_t^s \right\}, \quad s = \{m, f\}. \tag{4.1}$$

It follows from equation (4.1) that n_t^s is defined as $n_t^s = 1 - \ell_t^s - \ell_t^j$.

During each time interval t, each spouse ($s = \{m, f\}$) maximizes his utility according to the following concave utility function:

$$U_t^s = U\left(\ell_t^s, \ell_t^j; C_t^s \right) \tag{4.2}$$

where I assume for simplicity that the total consumption of the household can be decomposed as $C_t = C_t^m + C_t^f$. Apart from the utility that is derived from individual leisure and from consumption, each person derives additional utility from spending leisure time with the partner (ℓ_t^j).[1] The maximization problem of the couple for each time period t can be expressed as:

$$V_t\left(\ell_t^m, \ell_t^f, \ell_t^j; C_t \right) = \omega^m U_t^m + \omega^f U_t^f, \tag{4.3}$$

with ω^s denoting the weight of the individual's utility as part of the total household's utility. I assume that $\omega^m + \omega^f = 1$ so that these weights can be interpreted as the individual's bargaining power in the decision making process of the household. Over the whole day, each spouse chooses C_t^s, ℓ_t^s and also ℓ_t^j for each time unit so as to maximize the daily preference function:

$$G\left\{ \sum_{t=1}^{T} \left(\omega^m U_t^m \left(\ell_t^m, \ell_t^j; C_t^m \right) + \omega^f U_t^f \left(\ell_t^f, \ell_t^j; C_t^f \right) \right) \right\}. \tag{4.4}$$

$G(\cdot)$ is assumed to be a monotonically increasing function in all arguments which is strongly separable over each time unit.

The household's utility function as presented by equation (4.4) is maximized subject to the time constraint and to the household's daily budget constraint which is defined as follows:

$$\sum_{t=1}^{T} \left(C_t^m + C_t^f \right) = \sum_{t=1}^{T} \left(w_t^m n_t^m + w_t^f n_t^f \right) + V \tag{4.5}$$

where w_t^s denotes the exogenously given hourly wage rate for each spouse ($s = \{f, m\}$) and V other sources of non-labor income of the household.[2] The budget

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[1]Jenkins and Osberg (2005) find empirical evidence to support this assumption as they find that people who spend time with "suitable leisure companions" derive a higher degree of satisfaction from leisure activities as compared to spending them alone and Sullivan (1996) finds that spending leisure with the partner is most utility enhancing.

[2]In contrast to life-time models, I abstain from any considerations about capital markets where each spouse can borrow or lend at a given real interest rate as the joint leisure decision is modeled

constraint allows wages to differ across the day in order to account for i.e. overtime premia. Each individual decides to work in the labor market during the t-th time unit if the offered market wage exceeds his reservation wage, i.e. if $w_t^s > w_t^{res}$.

In optimum and under the assumption that the daily budget constraint is satisfied, the following first order conditions for each individual can easily be derived:

$$\omega^s \frac{\partial U_t^s}{\partial C_t^s} = \lambda \tag{4.6}$$

$$\omega^s \frac{\partial U_t^s}{\partial \ell_t^s} \geq \lambda \, w_t^s \tag{4.7}$$

$$\omega^m \frac{\partial U_t^m}{\partial \ell_t^j} + \omega^f \frac{\partial U_t^f}{\partial \ell_t^j} \geq \lambda \left(w_t^m + w_t^f \right) \tag{4.8}$$

for $t = 1, \ldots, T$ and $s = \{m, f\}$. λ is the Lagrange-multiplier that is associated with the budget constraint. According to the specification of the maximization problem presented here, it is assumed that the marginal utility of wealth across the whole workday is constant. This property is also known as Frisch function and implies that the shadow price of wealth, λ, is constant for every time interval. This assumption is not very restrictive in this context because the couple's joint leisure decision shall be analyzed for each time interval of an entire day. Equation (4.6) indicates that each spouse chooses the consumption level such that the weighted marginal utility of consumption equals the marginal utility of income and wealth. The conditions presented by equations (4.7) and (4.8) determine the spouse's choice of separate (ℓ_t^s) or joint leisure (ℓ_t^j) during the t-th time interval. The inequality conditions allow for corner solutions so that it is possible that a person enjoys leisure alone during every time unit per day so that he or she does not choose to supply any work or to have any joint time with the partner.

4.2.2 The Empirical Model

Based on the theoretical model determining the couple's joint leisure, the respective empirical model will now be derived. Following MaCurdy (1981) and Blundell and MaCurdy (1999), I assume that the utility of the whole household (h) during each time interval t can be expressed as

$$V_{ht} = \quad \omega^m Y_{1ht}^m \left(\ell_{ht}^m \right)^{\alpha_1} + \omega^f Y_{1ht}^f \left(\ell_{ht}^f \right)^{\alpha_2} + \left(\omega^m + \omega^f \right) Y_{1ht}^j \left(\ell_{ht}^j \right)^{\alpha_3}$$
$$+ \left(\omega^m + \omega^f \right) Y_{2ht} \left(C_{ht} \right)^{\alpha_4}, \tag{4.9}$$

with α_i being time-invariant parameters that are common for all households and that have the following properties: $\alpha_1, \alpha_2, \alpha_3 > 1$ and $0 < \alpha_4 < 1$. Moreover,

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during one day.

Y_{1ht}^m, Y_{1ht}^f, Y_{1ht}^j, $Y_{2ht} > 0$ are functions of those consumer characteristics that affect preferences of the household members. Joint leisure is scarce during a standard workday and shall be analyzed more closely. For that reason, I will concentrate on this decision for the reminder of this section. It is determined for each time interval by taking the first derivative of equation (4.9) with respect to ℓ_{ht}^j first. The resulting marginal utility of joint leisure is plugged into the theoretical first order conditions as given by equation (4.8). Taking logs of the resulting equation and solving for $\ln\left(l_{ht}^j\right)$ yields the following interior solution of the household's joint leisure:

$$\ln\left(l_{ht}^j\right) = \frac{1}{\alpha_3 - 1}\left[\ln \lambda_h + \ln\left(w_{ht}^m + w_{ht}^f\right) - \ln \alpha_3 - \ln Y_{1ht}^j\right]. \qquad (4.10)$$

If it is assumed in accordance to Blundell and MaCurdy (1999) that tastes for joint leisure (Y_{1ht}^j) are a function of consumer characteristics and can thus be expressed as $\ln Y_{1ht}^j = \exp\left(X_{ht}\rho^* + u_{ht}^*\right)$, where u_{ht}^* indicates unmeasured characteristics and ρ^* the vector of preference parameters, one can rewrite:

$$\ln\left(l_{ht}^j\right) = F_h + \rho X_{ht} + \delta \ln\left(w_{ht}^m + w_{ht}^f\right) + u_{ht}, \qquad (4.11)$$

with $\delta = \frac{1}{\alpha_3 - 1}$, $F_h = \delta\left(\ln \lambda_h - \ln \alpha_3\right)$, $\rho = \delta\rho^*$, $u_{ht} = \delta u_{ht}^*$. All relevant exogenous control variables are captured by X_t; F_h represents a couple specific time-invariant term that will be discussed in more detail in section 4.2.3.

Until now, only the decision for the enjoyment of joint leisure during a particular time interval was determined. However, information for the whole day is available, so that the decision of all time intervals can be added up and the following estimation equation can be formulated:

$$\ln\left(L^J\right) = \mathbf{X}\beta_1 + \mathbf{H}\beta_2 + \mathbf{Z}\beta_3 + \delta_1 \ln\left(w^m,\right) + \delta_2 \ln\left(w^f\right) + \epsilon, \qquad (4.12)$$

where L^J denotes the household's aggregate joint leisure time,[3] and the control variables are decomposed into individual information ($\mathbf{X}$), household characteristics ($\mathbf{H}$) and information about the workplace and the job ($\mathbf{Z}$). The estimated coefficients indicate percentage changes of each person's time spent together with the spouse.[4]

4.2.3 Methodological Issues

As indicated earlier, F_h represents a couple-specific time-invariant term which cannot be treated as a random factor since it reflects the couple's preference for

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[3]To be clear, joint time comprises both activity aggregates that have been introduced and described earlier, namely joint leisure and joint non-market time.

[4]Some couples choose to not enjoy any joint time with the spouse. In order not to loose the respective information and to allow for corner solutions, I set these observations to 1 minute of joint time. The same procedure is applied to spouses who are not earning any labor income.

spending joint time. Since the shadow price (λ_h) attached to the couple's daily "wealth" is part of this term, F_h is consequently correlated with any variable that is used to predict wages or wealth. Such variables which are those that describe workplace characteristics and job attributes are exactly those of interest here. If the couple-specific term was treated as random and thus as being part of the error term, the parameter estimates would consequently be biased. Such a problem is easily solved with panel data or with suitable instruments. Yet, the data analyzed are merely cross-sectional and appropriate instruments are not readily available. It follows that the coefficient estimates obtained from simple OLS estimations are biased and other ways must be found to overcome this problem.

The non-random couple-specific term F_h is determined by each person's general preference for enjoying leisure but also for spending time together with the respective partner. Yet, the individual's preference for spending joint time with the spouse, is likely to also influence his decision to work at the intensive margin. It can thus be argued that some individuals work longer hours or are for instance more likely to accept business travels as their preference for enjoying joint time with the spouse or the family is comparatively low. As a consequence, workplace characteristics are endogenous and the parameter estimates obtained from simple OLS regressions are biased.

The major aim is to find a way to solve the endogeneity problem of the workplace and job attributes induced by preferences in a cross-sectional setting when no instruments are available. Consequently, a method is needed by which the individual's decision to enjoy free time with the partner can be separated from the decision to spend some hours of his available time at the workplace. It is important to make clear, that the endogeneity originates from the fact that some people given their job attributes and workplace characteristics want to enjoy as much time possible with their spouses and others rather want to avoid them. In other words, I will propose a way to randomize the couple-specific term and consequently reduce the endogeneity bias.

In a perfectly controlled world, experiments could be conducted in which husbands and wives could be randomly re-assigned to form new couples. The resulting joint leisure time decision of the "new" spouses could be observed and these results could be considered as counterfactuals (Angrist and Pischke, 2009). Since this is not feasible, I conduct a thought experiment instead which is inspired by Angrist and Krueger (1999). In this framework, I will randomly assign a wife from the sample to a husband. The thusly obtained so-called "pseudo" couples represent appropriate control groups for the purpose of this paper because actual and randomly re-assigned couples are facing the same constraints imposed by society (van Klaveren and Maassen van den Brink, 2007). The coefficient estimates for both specifications of workplace characteristics and job attributes on explaining

joint time are therefore easily comparable (Angrist and Krueger, 1999). Potentially omitted or unobserved variables are now uncorrelated with the variables of interest. Randomly assigned couples are by construction not able to coordinate their schedules across the workday and the determinants of time that the pseudo partners *simultaneously* spend outside the workplace can be regarded as being exogenous. The re-assignment process will be iterated 250 times in order to obtain a representative benchmark to compare real couples with that is independent from the assignment itself.

4.3 The German Time Use Data

The present analysis is based on the German Time Use Data (*Zeitbudgeterhebung*) for the year 2001/02 conducted by the German Federal Statistical Office (Statistisches Bundesamt, 2003). The dataset contains information about the activities that every household member is engaged in during every 10 minute time interval of a day. Respondents were asked to fill in time diaries for three consecutive days. In order to capture the time use pattern in the most accurate and unbiased way possible, the sample is evenly distributed across the whole year. The dataset used here has the advantage over surveys conducted in other countries that diary information is available for *all* household members which is crucial for the purpose of this paper.

Here, I restrict the attention to married or cohabiting couples aged between 25 and 55 with a full-time employed husband yet without restricting the employment status of wives.[5] Furthermore, I only consider observations during the standard workweek (Monday - Friday). These restrictions assure that time which can potentially be spent with the spouse outside the workplace is scarce during the workweek which requires the spouses to coordinate their schedules. I keep those couples that report to not be on vacation and since the aim is to analyze joint time enjoyed during an average workday, furthermore those who do not report to be at the same location for at least one time unit during the day are eliminated as spending joint time is impossible in these cases. Furthermore, one diary day will be treated as one observation so that I finally analyze 6966 observations stemming from 1812 households.

For the analysis, I aggregate the more than 200 daily activities into four broad categories, namely pure leisure (L), paid market work (MW), household work (HP) and tertiary time (T) of which only the first three will be more closely studied here.[6] More specifically, pure leisure (L) comprises all activities that nobody can be paid for to do them and that do not have to be undertaken at all. It

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[5]I exclude couples with two unemployed or two part-time employed partners. Since couples in which only the wives are working full-time are inherently different, I excluded also these.

[6]Commuting or traveling time is added to the activity for which it is used. It can be further noted that an aggregation of the activities into the broad measures is inherently arbitrary. See also Burda et al. (2007).

therefore comprises activities such as organized leisure activities, sports, reading and writing, watching TV as well as listening to the radio. Moreover, household production (*HP*) captures all those activities for which market substitutes can be purchased so that somebody could be paid for to do them and which satisfy the third-party rule by Reid (1934). Some household activities such as cooking or gardening are enjoyable to some extent so that utility can be derived. Some people might even consider these partially as leisure. These additional benefits are also termed "process benefits" (Juster, 1985), "joint production" (Graham and Green, 1984; Kerkhofs and Kooreman, 2003) or "activity benefits" (Gørtz, 2006) in the literature. Some household activities such as childcare may provide extra benefits beyond their consumption value (Gørtz, 2006, Kerkhofs and Kooreman, 2003). Thus, I attribute all those childcare activities like playing or reading with the own children to leisure and the remaining tasks like caring, cooking etc. for the child to household production. Market work (*MW*) is defined as all direct job related activities (primary and second jobs), but also of time spend on internships, qualification and education on or for the job, job search, breaks during the workday and travel time related to work. Finally, tertiary time captures those activities that nobody else can do for us because they are essential i.e. sleeping or personal hygiene. This aggregate is however left unconsidered here.

Before continuing, I want to clarify some wordings that will be used throughout the subsequent sections. I will refer to those activities that the spouses enjoy together with each other during a particular time unit as 'joint' time. The equivalent of that for randomly assigned couples will be termed 'simultaneous' time which occurs if both partners report the same activity aggregate during the same time interval.

For the analysis of determining the influence of workplace characteristics on the couple's choice of free time, I define two different dependent variables here which are (1) the minutes of the jointly or simultaneously enjoyment of leisure and (2) the minutes of joint or simultaneous non-market time. The advantage of the German Time Use Survey is that not only information about the individual activities of each person during each time unit per diary day is provided but also about who it is spent with and where. I therefore define a time unit as being spent together if both partners report to have been with the spouse and if both indicate the same location.

The determinants of the professional life are controlled for by a variety of workplace characteristics and job attributes that describe the work involvement of the person. Apart from that, I control for demographic information on age, the level of education and a dummy describing the person's general perception about time spend with the family, whether the person is generally healthy and whether she is of German citizenship, dummies indicating whether the respondent traveled during the day for more than 2 hours and one for whether he or she

reported to have had a non-ordinary day. Further household characteristics are included such as information on the number of children living in the household and dummies for the youngest child being younger or older than 6. Moreover, I include information on whether the household uses child care facilities regularly and if so how intensively. The size of the apartment in m^2 is further controlled for as well as a dummy indicating whether the household is located in the Western part of Germany. In order to account for differences in market and non-market time across the workweek resulting from factors other than those discussed here shall be analyzed, I further add workday dummies.

4.3.1 Composition of the Sample

In this section, I want to take a closer look at the composition of the sample and the distribution of workplace characteristics and job attributes. Since, the labor force participation decision on the extensive and intensive margin differs substantially for men and women which is a well-established fact in labor economics, I will describe them separately throughout this paper. While by construction all men analyzed here are full-time employed, it can be seen in table 8.1 more than half of all wives are either part-time or marginally employed and only about 20% work full-time. Traditional gender roles amongst German couples seem to still prevail with men being the major breadwinners of the family and women being the managers of the household (Bird et al., 1984). Despite the fundamental differences in the labor market attachment, women are observed to be more likely to have a second job.

When we take a closer look, table 8.1 reveals that men are very likely to be dependently employed but are self-employed in 16 percent of the cases. Their hourly wages amount to 15 EUR on average. Most of the jobs held by husbands are in the service sector while about 32 percent of them are public sector jobs. Slightly more than half of the work contracts grant flexitime and about 20 percent percent of the husbands work shifts. Less than 25 percent of all men report to not work at all during weekends, neither on a regular nor on a sporadic basis. On average, men in the sample spend about 2555 minutes during a normal workweek which corresponds to about 42.6 hours per week. In order to get to work, men need on average 52 minutes.

In contrast to that, only 20 percent of all women are full-time employed as indicated above while about one quarter of them does not work at all, so that their workplace conditions are expected to be less influential in explaining the couple's joint time. Apart from the differences in labor market status, their workplace characteristics and jobs attributes differ also in other dimensions from those of men. Self-employment is less common among wives which also holds for shift work. Women who actively participate in the labor market are predominantly employed in the service sector. Weekend work is much less likely than for men. Women

are mainly observed in social but also in health related jobs. Strongly downward biased by the high percentage of those who do not work for pay, the table shows that average earnings of women amount to about 7 EUR per hour and they spend about 960 minutes or about 16 hours on average at the workplace during a normal workweek.

The last four columns of table 8.1 show those workplace and job attributes of couples of which both partners work for pay. Compared to all couples, husbands are less likely to have a second job, they have a higher probability of being employed in the industrial sector and in private economy jobs, such men are more often self-employed but also to earn lower hourly wages as compared to all men and to work slightly longer hours during the standard workweek. Wives on the other hand, in two-earner households work in about 62 percent on a part-time basis and work almost entirely in the service sector. Shift work occurs only in 15 percent of the cases and women in such couples are less likely to be self-employed or have a second job. Sporadic or even regular weekend work is observed in 55 percent of the cases and about 40 percent of wives in two-earner households have a job in the public sector. Hourly wage rates do not differ drastically from men's while women provide on average only 29 hours of work during a normal workweek.

A further overview of the composition of the sample is given in table 8.2. Generally, it can be noted that almost all respondents have the German citizenship. Husbands are older on average than wives and are also better educated. Men and women are equally healthy and 80 percent of these households are located in the Western part of Germany. Couples have on average more than 1 child and the youngest child living in the household is more likely to be older than 6 years of age. About 23 percent of all households regularily use childcare facilities. Since men are the major breadwinners of the family, they report more often to not have enough time for their families.

Husbands and wives in two-earners households are a little older than the average. Table 8.2 further shows that women are better educated than the average wife yet not as well as men. Due to the generally higher work involvement, women in such households report a little bit more often not to have enough time with their families. Such households are less likely to be found in the Western part of Germany. Compared with the average household, less children are present and if so, the youngest child is less likely to be younger than 6 as compared with all households. Child care facilities are regularly used in only 20 percent of the households.

4.3.2 Time Dimension

Of particular interest is the time dimension so that I will now describe the distributions of market work, pure leisure and non-market time over the standard workday in more detail so as to better understand the limitations underlying the

decision for joint free time. As mentioned earlier, many factors determine the respective distributions, i.e. laws, institutions, the biological rhythm[7] but also religious beliefs just to name some. The work time occupies a large fraction of the available non-sleeping hours during a standard workday and consequently, confines the time that can potentially be spent on other activities.

Figure 4.1: Distribution of Market Work across a Standard Workday.
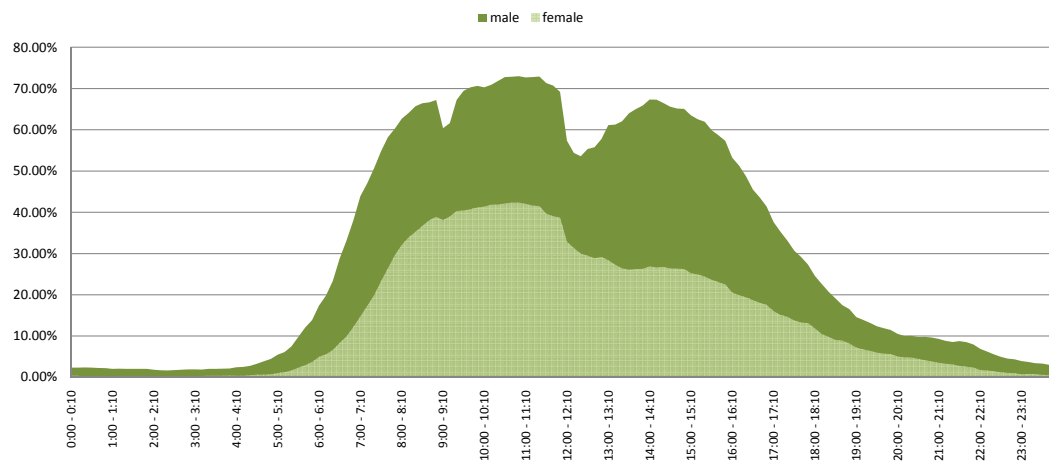
Figure 4.1 shows the distribution of market work of men and women across the workday. One can generally say that the distributions of working hours by sex are relatively wide-spread so that the average workday starts slowly at about 5 am and is likely to finish at about 7 pm with some mass in the later evening hours. Due to the high non-employment rate of the women analyzed here at the extensive margin and the very low fraction of full-time employment at the intensive margin, the distributions for men and women differ drastically. If women are employed, they are more likely to work in the morning hours before noon as during these hours it is generally easier to use childcare facilities. After noon, the distribution of work decreases evenly but it is rather low. Men, on the contrary, are by construction all full-time employed so that apart from a pronounced lunch-time slump I find a rather uniform distribution during the peak working hours which phases out slowly in the evening hours.

These distributions show, that most of the daylight hours of a standard workday in Germany are devoted to market work. The general effects on the private life are immediate and imply that joint time on other than work related activities is mainly restricted to the evening hours which is verified by figures 4.2 and 4.3. Let us first look at the distribution of the narrower aggregate, pure leisure, first. As depicted by the lightest-colored area in figure 4.2, pure leisure is in general mainly concentrated to the evening hours after work independent of gender and

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[7]The most important rhythm in chronobiology is the circadian rhythm which lasts for about 24 hours and shows physiological processes in all organisms.

Figure 4.2: Distribution of Pure Leisure.
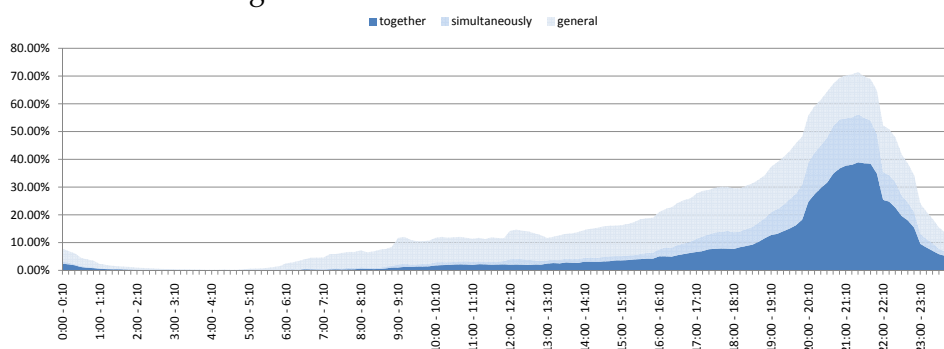
Figure 4.3: Distribution of Non-Market Time.
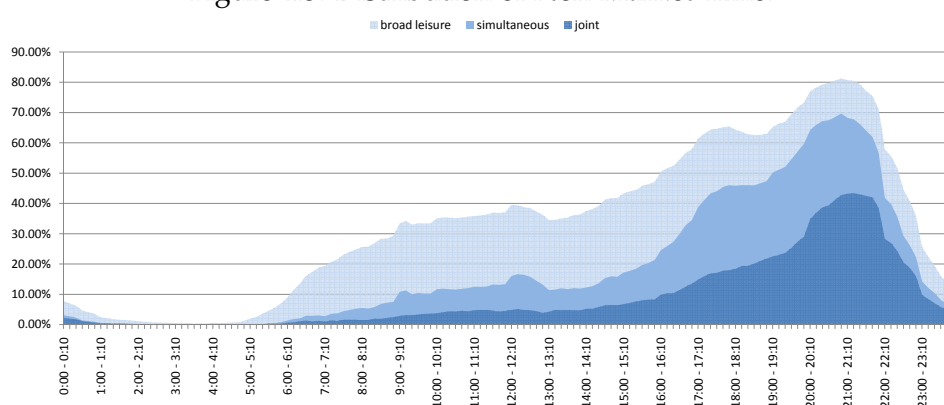
is most probable between 8 pm and 10 pm. The figure furthermore presents the distribution of time that both partners spend on pure leisure simultaneously but not necessarily with each other as well as jointly spent time. Since joint and simultaneous leisure requires that both partners enjoy leisure at the same time unit it follows that these two distributions are highly centered around a short time interval in the late evening.

To make the distinction between joint and simultaneous leisure even clearer, table 4.1 summarizes the respective hourly percentages of these aggregates for a standard workday. The last column of this table shows the fraction of simultaneous time that both partners indeed enjoy with each other. During peak leisure time, a maximum of about 70 percent of pure simultaneous leisure of the spouses is indeed enjoyed jointly. This fraction is even higher late at night and in the early morning hours. A recent strand of the literature analyzes whether couples actively synchronize their schedules or whether simultaneous time is just a result from the general organization of activities across an average workday. In contrast to the data used in this paper, these studies lack information on whether time is indeed enjoyed together with the spouse so that joint time is generally proxied by simultaneous leisure which, as is revealed by figure 4.2 greatly overestimates the

true amount of joint time and thus upward biases any results obtained on this basis (Hamermesh, 2000; van Velzen, 2001; Hallberg, 2003; Lesnard, 2004; van Klaveren et al., 2006; van Klaveren and Maassen van den Brink, 2007).

Table 4.1: Fraction of Leisure Spent Simultaneously with the Partner and Fraction of Joint and Simultaneous Leisure.

hour	together	simult.	fraction
1	1.28%	1.69%	75.42%
2	0.26%	0.35%	75.29%
3	0.06%	0.10%	67.50%
4	0.03%	0.03%	100.00%
5	0.00%	0.00%	-
6	0.09%	0.11%	84.09%
7	0.25%	0.43%	58.99%
8	0.35%	0.73%	48.03%
9	0.48%	1.08%	44.67%
10	0.99%	1.97%	50.37%
11	1.47%	2.45%	59.96%
12	1.52%	2.58%	58.91%
13	1.47%	3.07%	47.89%
14	2.07%	3.34%	62.12%
15	2.63%	4.06%	64.80%
16	3.40%	5.32%	63.89%
17	4.79%	8.56%	55.98%
18	6.88%	12.67%	54.32%
19	9.62%	16.46%	58.45%
20	16.46%	27.91%	58.97%
21	32.58%	49.07%	66.40%
22	35.44%	50.68%	69.92%
23	17.87%	24.83%	71.97%
24	5.57%	7.69%	72.40%

⁻ "fraction" refers to the fraction of time spent together with the spouse (column 2) relative to simultaneous leisure time of the partners (column 3).

It can be argued, that pure leisure is a residual aggregate that is enjoyed only after all other necessary and more pressing tasks are done. As a broader measure of free time, I therefore defined non-market time as leisure and household activities. The distribution of this aggregate is shown in figure 4.3. By doing so, more general statements can be made on family related free time that also comprises activities with and for other family members. The inclusion of household work widely spreads out the gender-independent distribution of non-market time as compared to pure leisure because household production is still highly dominated by women in Germany. The general distribution of non-market time is consequently not

limited to particular hours during the day explained by the fact that women often perceive household production as a substitute for paid market work. Combining these facts explains that household production is likely to be observed during daylight hours yet the distribution of non-market time reaches its peak between 5 pm and 10 pm.

Table 4.2: Average Minutes of Joint or Simultaneous Leisure and Non-Market Time.

	all		both work		husband only	
	leisure	non-market time	leisure	non-market time	leisure	non-market time
real couples:						
together	86.810	135.261	83.892	128.533	90.903	143.953
	(88.558)	(120.976)	(88.207)	(118.265)	(89.407)	(124.475)
simultaneous	134.361	275.001	127.055	250.242	142.935	306.028
	(98.168)	(161.062)	(97.134)	(152.336)	(97.775)	(166.678)
pseudo couples:						
random	98.401	238.220	94.496	223.908	103.395	256.418
	(72.536)	(139.976)	(71.531)	(131.723)	(73.670)	(147.667)
N	6966	6966	3810	3810	3046	3046

Standard deviations in brackets.

I am however interested in joint non-market time which limits the respective time frame to the evening hours just like for pure leisure which is shown by the dark shaded area in figure 4.3. The distribution of joint non-market time closely resembles the one of joint pure leisure yet with more mass in the left-hand tail. To make this point clearer, table 4.2 shows that real couples enjoy on average about 87 minutes jointly on pure leisure activities and more than 2 hours on joint non-market time during the standard workday. As mentioned earlier, the spouses spend only some fraction of their simultaneous leisure, namely on average 65 percent (=86.810/134.361) indeed with each other and only about 49 percent of their simultaneous non-market time. Table 4.2 furthermore shows the common time on both free time aggregates for randomly assigned couples and shows that they have a little less than 100 minutes of common leisure and more than double that amount of time of simultaneous non-market time. This table underlines the earlier statement that simultaneous time largely overstates the true amount of joint time which even strongly exceed simultaneous time of randomly assigned couples. Two-earner households are clearly more restricted in the timing of their free time because the schedules of both partners must be synchronized so that time can be enjoyed with each other which requires a higher degree of coordination. Table 4.2 supports this hypothesis as couples of which both partners are working for pay can enjoy on average about 7 minutes less leisure and 15 minutes less of joint non-market time.

4.4 Results

4.4.1 Estimation Results

Based on the theoretical model introduced in section 4.2, I will now analyze the determinants of workplace characteristics and job attributes on the couple's joint time. The model will thus be estimated according to the following equation:

$$\ln\left(L^j\right) \quad = \quad \mathbf{X}\beta_1 + \mathbf{H}\beta_2 + \mathbf{Z}\beta_3 + \delta_1 \ln\left(w^m\right) + \delta_2 \ln\left(w^f\right) + \epsilon. \quad (4.13)$$

Since the labor supply decision is entirely different for men and women, I will estimate the determinants on joint time by sex. But due to the endogeneity of workplace characteristics as discussed in section 4.2.3, simple OLS estimates will produce biased coefficient estimates which might result in potentially wrong conclusions drawn from naive investigations. In this case, one can only talk about establishing correlations between the regressors and the dependent variable. Yet, random assignment into pseudo couples accounts for this problem by randomizing the couple specific effect. In this specification, one can speak of an identification of *pure effects* that are independent of any diluting influences induced by individual preferences for spending joint time together with the own spouse. In order to find pure effects that are representative, random assignment into pseudo couples will be iterated 250 times and all the relevant regressions will also be repeated that often. The resulting average effects serve as a benchmark to shed more light on the influence of workplace characteristics on private life independent from coupling. Having this in mind, the effects of workplace characteristics and job attributes in general as well as the consequences on reconciling work and private life will now be discussed in more detail.

As mentioned earlier, the influences of the characteristics of the workplace on the couple's private life will be investigated using two different measures, namely (1) the narrower definition of pure joint or simultaneous leisure and (2) the broader aggregate of joint or simultaneous non-market time which is defined as the sum of pure leisure and household production.[8] Different conclusion can be drawn from these specifications: while joint pure leisure rather refers to time that only the spouses spend on enjoyable activities, joint non-market time furthermore includes activities that are spent with and for the whole family. The inclusion of household production into the broader aggregate accounts for the fact that some household activities are more enjoyable if they are undertaken with other household members and additional utility might be derived from it. Yet, to a certain extent, these tasks

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[8]As I noted earlier, time that the partners spent together with each other is some fraction of the time that both spent on leisure simultaneously without necessarily doing so jointly (see also table 4.1). Estimates on simultaneous time are similar to those presented on joint time and are available from the author on request.

need to be performed if either no market substitute is available or can be afforded by the household. As mentioned earlier, leisure does not need to be undertaken at all so that some couples choose to not enjoy any of it with each other during the workweek because other tasks have a higher priority and leisure is rather enjoyed during the weekend.

First estimation results determining the influences of workplace characteristics and job attributes on pure leisure and on non-market time for actual and randomly assigned couples are presented in table 4.3 for men and women separately. I find that measures aimed directly at increasing temporal flexibility of the worker and thus reconciling the balance between work and private life are not found to have a significant and positive impact. Flexitime arrangements are found to be negatively correlated with both activity aggregates for "real" wives as compared to women working with fixed schedules. So I find, that women working flexitime have more than 20 percent less joint leisure and joint non-market time than those with fixed working schedules. Accounting for endogeneity by regarding randomly assigned wives shows that this negative effect is confirmed yet it is insignificant and ranges between 3 – 5 percent. Taking these results together suggests that this limited form of flexibility rather leads to a de-synchronization of the spouses' joint time. This can be explained by the fact women seem to use flexitime in order to organize household and family tasks and activities in general that are at the expense of the spouses joint time but, following this line of reasoning, are family friendly. Other employment forms that grant a higher degree of temporal flexibility of working schedules are predominantly used by women, namely marginal employment and part-time work where the latter one is the reference group for women here. Marginal employment allows women with young children to work some restricted amount of time during the day without however neglecting their family duties. When endogeneity is accounted for, I find a positive though insignificant effect on both activity aggregates as compared to part-time employed women. Full-time work, in contrast, leads to less leisure but more importantly is found to reduce non-market time by about 16 percent for randomly assigned wives. So from the first impression, in contrast to the promotion of policy makers, it does not seem that measures designed to increase temporal flexibility in order to facilitate the reconciliation of work and private life, as defined here, are effective.

It could furthermore be argued that employees in the service sector have a lower routine of their working schedules and it could be used in order to be able to spend more time with spouse and family. Here, I find no significant correlations nor effects but the sign of the coefficient is informative. Average pure effects indicate that men enjoy about 4 – 7 percent less time with family and spouse than men working in other sectors while the opposite holds for women. These differences might be explained by the composition of these job so that women in the service sector seem

Table 4.3: General Estimation Results by Gender.

| | leisure | | | | non-market time | | | |
| | men | | women | | men | | women | |
	real	random	real	random	real	random	real	random
not working			0.373	-0.222			-0.104	-0.054
			(0.575)	(0.192)			(0.398)	(0.095)
marginally empl.			0.531	0.017			0.009	0.041
			(0.586)	(0.200)			(0.414)	(0.104)
full-time			-0.064	-0.057			-0.031	-0.159*
			(0.110)	(0.045)			(0.099)	(0.028)
shift work	-0.200*	-0.372*	-0.235*	-0.277*	-0.125	-0.116*	-0.210	-0.183*
	(0.098)	(0.043)	(0.143)	(0.069)	(0.088)	(0.035)	(0.131)	(0.037)
flexitime	-0.063	-0.027	-0.198*	-0.045	0.025	-0.039	-0.164*	-0.029
	(0.083)	(0.032)	(0.106)	(0.044)	(0.072)	(0.028)	(0.096)	(0.025)
service sector	-0.025	-0.065*	-0.079	0.070	0.043	-0.044	-0.055	0.125*
	(0.076)	(0.031)	(0.160)	(0.081)	(0.067)	(0.029)	(0.140)	(0.045)
public sector	0.141*	0.121*	0.288*	0.185*	0.087	0.099*	0.256*	0.103*
	(0.080)	(0.040)	(0.101)	(0.052)	(0.069)	(0.027)	(0.090)	(0.023)
self empl.	-0.211*	-0.216*	0.101	-0.030	-0.254*	-0.333*	-0.049	-0.069*
	(0.125)	(0.057)	(0.130)	(0.048)	(0.107)	(0.039)	(0.119)	(0.032)
second job	-0.302*	-0.008	-0.306*	-0.164*	-0.271*	-0.022	-0.182	-0.088*
	(0.095)	(0.045)	(0.131)	(0.059)	(0.084)	(0.035)	(0.115)	(0.030)
same building	-0.202	-0.092	0.081	0.001	-0.208	-0.139*	0.067	0.004
	(0.168)	(0.095)	(0.213)	(0.098)	(0.150)	(0.071)	(0.197)	(0.049)
weekend work	-0.182*	-0.176*	-0.209*	-0.122*	-0.220*	-0.135*	-0.120	-0.088*
	(0.078)	(0.040)	(0.094)	(0.045)	(0.066)	(0.020)	(0.085)	(0.022)
job in health sector	0.050	0.129	-0.164	0.009	0.029	0.127*	-0.127	0.028
	(0.227)	(0.121)	(0.158)	(0.075)	(0.189)	(0.076)	(0.142)	(0.033)
social job	0.212	0.031	-0.023	-0.036	0.134	0.011	-0.033	-0.018
	(0.145)	(0.069)	(0.142)	(0.058)	(0.118)	(0.060)	(0.125)	(0.031)
security job	0.071	-0.027	-0.483	0.118	-0.024	-0.001	-0.386	0.015
	(0.136)	(0.071)	(0.313)	(0.095)	(0.121)	(0.052)	(0.293)	(0.058)
log hourly wages	0.047	0.069*	-0.073	-0.109*	0.023	0.081*	0.031	-0.070*
	(0.083)	(0.031)	(0.084)	(0.039)	(0.076)	(0.035)	(0.077)	(0.021)
log avg. wrk. hrs.	-0.055	-0.068*	0.101	0.008	-0.096*	-0.095*	-0.003	0.003
	(0.059)	(0.023)	(0.069)	(0.025)	(0.042)	(0.022)	(0.049)	(0.016)
log min. of work way	-0.121*	-0.091*	-0.121*	-0.090*	-0.151*	-0.143*	-0.129*	-0.098*
	(0.020)	(0.009)	(0.022)	(0.011)	(0.018)	(0.006)	(0.020)	(0.005)
N	3483	3483	3483	3483	3483	3483	3483	3483
R^2	0.064	0.106	0.060	0.083	0.089	0.210	0.072	0.302

Robust standard errors in parentheses and bootstrapped standard errors for randomly assigned couples. * indicates significance levels of 10% or higher.

to generally have jobs that allow them to enjoy more leisure and non-market time. The coefficient estimates obtained for actual couples tell the opposite story and can be interpreted as identifying typical family related mechanisms. In this respect it can be argued that women schedule their working hours in such a way that informal childcare is provided for example by the partner which is consequently at the expense of joint time of the spouses but also time spent with other family members. However, these influences are low and insignificant. For people holding a second job strong negative correlations are obtained for real couples only but when endogeneity is accounted for hardly any effect can be identified for men on either activity aggregate. It can also be argued that people take up a second job only when informal childcare by the partner is assured which in turn reduces the time that the spouses can spend with each other on pure leisure or on non-market

activities likewise which strengthens the previous effect. According to this line of reasoning, however, second jobs are family friendly even if it is at the expense of the time that the spouses can spend with each other. Thus, the differentiation into pure effects (identified by random assignment) and simple correlations (results for actual couples) is crucial as it helps to uncover marriage related mechanisms on top of the pure effects of the workplace itself.

Those workplace characteristics that put the strongest restriction on the time available for other than market work activities explain the influence on private life most. Consequently, shift work, the occurrence of work during the weekend and a longer way to work significantly reduce time spent on joint leisure and on joint non-market time.[9] Shift work leads to a considerable reduction in both free time aggregates for men and women likewise but the effect on non-market time can only be identified by random assignment. Furthermore, spouses who work either sporadically or regularly during weekends are found to have less free time with spouse and family which ranges from 12 – 22 percent for actual couples and from 9 – 18 percent for randomly assigned ones. This variable could be interpreted as approximating the general work involvement of the person which suggests that a higher degree of weekend work is related to a stronger feeling of responsibility for the job which is at the expense of private life. A longer way to work has only a minor yet robustly negative impact on private life so that a 10 percent increase in the time needed to get to work reduces leisure and non-market time by about 1 percent.

Self-employed must be distinguished from workers in dependent employment as they generally bear a greater responsibility for their work which is further reflected by a higher work involvement at the expense of the family as confirmed by table 4.3 by a negative effect for both men and women. The negative influence is however only significant for men. In contrast to that, employees in the public sector have generally more routine in their working schedules and are bear a lower degree of responsibility as compared to employees in the private economy which is further reflected by the general positive effect on free time for men and women likewise. It shall also be mentioned that wages have opposing influences on men and women. While the positive income effect dominates over the substitution effect for men leading to significantly more non-market time when wages rise and also to slightly more leisure, the negative substitution effect dominates for women resulting in less free time. However, these findings must be regarded with caution as the differences in these findings are explained by the differences in hours worked on average as depicted in table 8.1.

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[9]Note that the time that each person needs to get to work is an average reported by the worker and is not derived from the time use information so that no simultaneity bias occurs here.

Differentiation by Household Type

Next, I will elaborate further on the effect of workplace characteristics and job attributes for different subsamples starting with influences depending on the household type. Results for men are presented in table 4.4 with columns 2-5 describing estimates for husbands being the only income earners and columns 6-9 show influences for men in two earner households. The table reveals that only relatively few workplace or job attributes have a significant impact on determining the actual couple's free time in particular husbands being the only income earner. A random assignment into pseudo couples help to uncover the effects and underlying marriage inherent mechanisms which mainly confirm previous results discussed so far.

Table 4.4: Estimation Results for Men Depending on Household Type.

| | only husband | | | | both work | | | |
| | narrow | | broad | | narrow | | broad | |
	real	random	real	random	real	random	real	random
shift work	-0.165	-0.349*	0.023	0.007	-0.225	-0.384*	-0.245*	-0.204*
	(0.148)	(0.116)	(0.129)	(0.062)	(0.138)	(0.113)	(0.126)	(0.078)
flexitime	-0.060	-0.040	0.026	-0.040	-0.022	-0.023	0.042	-0.049
	(0.125)	(0.088)	(0.106)	(0.048)	(0.115)	(0.087)	(0.102)	(0.056)
service sector	-0.027	-0.066	0.083	-0.044	-0.029	-0.052	-0.011	-0.037
	(0.111)	(0.085)	(0.096)	(0.051)	(0.107)	(0.083)	(0.095)	(0.056)
public sector	0.234*	0.115	0.141	0.093*	0.033	0.125	0.050	0.092*
	(0.114)	(0.088)	(0.096)	(0.048)	(0.117)	(0.086)	(0.102)	(0.056)
self empl.	-0.274	-0.216*	-0.173	-0.332	-0.236	-0.194	-0.325*	-0.311*
	(0.199)	(0.140)	(0.162)	(0.095)	(0.171)	(0.133)	(0.153)	(0.098)
second job	-0.255*	0.001	-0.226*	-0.023	-0.358*	-0.032	-0.323*	-0.041
	(0.135)	(0.104)	(0.117)	(0.061)	(0.137)	(0.103)	(0.124)	(0.070)
same building	-0.111	-0.077	-0.151	-0.123	-0.259	-0.084	-0.291	-0.164
	(0.270)	(0.200)	(0.221)	(0.136)	(0.227)	(0.188)	(0.211)	(0.140)
weekend work	0.013	-0.179*	-0.115	-0.123*	-0.310*	-0.182*	-0.300*	-0.141*
	(0.114)	(0.083)	(0.095)	(0.042)	(0.110)	(0.082)	(0.094)	(0.050)
job in health sector	0.379	0.129	0.177	0.121	-0.246	0.097	-0.133	0.086
	(0.346)	(0.246)	(0.272)	(0.151)	(0.312)	(0.232)	(0.270)	(0.162)
social job	0.054	0.049	0.101	0.074	0.357*	0.023	0.193	0.009
	(0.226)	(0.165)	(0.163)	(0.088)	(0.193)	(0.169)	(0.167)	(0.112)
security job	-0.089	-0.007	0.069	0.049	0.172	-0.030	-0.138	-0.028
	(0.200)	(0.159)	(0.162)	(0.082)	(0.192)	(0.154)	(0.180)	(0.105)
log hourly wages	-0.014	0.127	-0.000	0.139*	0.045	0.120	0.017	0.147*
	(0.136)	(0.081)	(0.120)	(0.062)	(0.147)	(0.089)	(0.145)	(0.071)
log avg. wrk. hrs.	-0.040	-0.103*	-0.082	-0.136*	-0.072	-0.080	-0.107	-0.139*
	(0.087)	(0.057)	(0.077)	(0.042)	(0.097)	(0.065)	(0.089)	(0.046)
log min. of work way	-0.144*	-0.107*	-0.161*	-0.160*	-0.111*	-0.085*	-0.142*	-0.134*
	(0.030)	(0.023)	(0.025)	(0.013)	(0.029)	(0.022)	(0.026)	(0.015)
N	1523	1519	1523	1519	1905	1909	1905	1909
R^2	0.070	0.072	0.082	0.202	0.080	0.060	0.109	0.130

Robust standard errors in parentheses and bootstrapped standard errors for randomly assigned couples. * indicates significance levels of 10% or higher.

When men are the only income earners of the family only those workplace characteristics have a remarkable effect on determining free time that strongly confine potential non-work time. This can be explained by the fact that wives in such households can more flexibly adjust their schedules to their husbands'.

In general, the main results from section 4.4.1 are however confirmed. As such, I find that shift work, self-employment, weekend work and a longer way to the workplace can be identified to significantly reduce leisure. It is interesting to note that the remarkable negative impact of shift work can only be identified by random assignment. No effect is however obtained on the determination of non-market time which suggests that pure leisure rather constitutes a residual aggregate that can only be enjoyed when all other more necessary tasks are done. Non-market time, on the other hand, is found to be significantly reduced only by the occurrence of weekend work and a longer way to work. Employment in the public sector has the same positive effect on non-market time that was uncovered earlier in the paper. The provision of informal childcare within married couples that facilitate taking-up a second job in order to earn some additional income at the expense of joint leisure and non-market time is further underlined here. It shall also be noted that the dominance of the positive income effect to a wage increase is confirmed.

Two-earner households are different as the working schedules of both spouses must be coordinated and consequently the available time for non work activities is strongly restricted. Accordingly, workplace characteristics play a more important role in determining the couple's free time and are thus driving the general results obtained for all husbands as described earlier in this section. The major results from table 4.3 for all men can be confirmed, namely that shift work, self-employment, weekend work and a longer way to the workplace reduce both activity aggregates while working in the public sector and higher hourly wages have a positive effect on free time. While shift work was found to only influence leisure in the case of the husband being the only income earner, I find now that when free time is even scarcer that also family time strongly negatively affected. Since free time is more restricted with both spouses working for pay, a second job is found to have a stronger influence than in the previous case due to a higher degree of coordination required to synchronize the mutual schedules of the spouses.

Presence of Children

I found earlier that a coordination of the schedules is important particularly when time is scarce in order to spend some time with the partner and the family. When children are in the household, time is likely to be de-synchronized in order to provide some sort of informal childcare.[10] In this section, I want to further analyze the effect of workplace characteristics and job attributes on the couple's free time depending on the age of the youngest child living in the household. More precisely I will look at differences in influences of households with the youngest child being younger or older than 10 years of age. I assume that children under the age of 10 need more care and attention of their parents then older ones. Since the labor

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[10]See also van Klaveren et al. (2006).

supply decision for women with children is a particular one, I will focus on the influences for men here. Estimation results for men are presented in table 4.5. Due to the comparatively low number of observations and the fact that the explanatory variables do not change over the workday, only very few workplace characteristics are found to have a significant impact on determining free time.

Table 4.5: Estimation Results for Men Depending on the Age of the Youngest Child in the Household.

	leisure				non-market time			
	0-9		10-17		0-9		10-17	
	real	random	real	random	real	random	real	random
shift work	-0.254*	-0.336*	-0.277	-0.420*	-0.167	-0.066	-0.193	-0.124*
	(0.152)	(0.061)	(0.179)	(0.087)	(0.131)	(0.051)	(0.167)	(0.058)
flexitime	-0.217	-0.035	0.106	-0.040	-0.075	-0.052	0.239*	-0.042
	(0.133)	(0.060)	(0.152)	(0.058)	(0.107)	(0.036)	(0.137)	(0.044)
service sector	-0.109	0.039	-0.047	-0.088*	0.013	0.045	-0.051	-0.041
	(0.118)	(0.047)	(0.138)	(0.049)	(0.099)	(0.046)	(0.121)	(0.042)
public sector	0.289*	0.143*	0.183	0.177*	0.140	0.103*	0.176	0.142*
	(0.126)	(0.052)	(0.142)	(0.049)	(0.103)	(0.033)	(0.124)	(0.047)
self empl.	-0.244	-0.332*	-0.238	-0.184*	-0.215	-0.391*	-0.396*	-0.313*
	(0.185)	(0.084)	(0.227)	(0.103)	(0.157)	(0.068)	(0.202)	(0.114)
second job	-0.473*	-0.149*	-0.125	0.059	-0.375*	-0.107*	-0.158	0.012
	(0.147)	(0.077)	(0.164)	(0.066)	(0.124)	(0.058)	(0.138)	(0.048)
same building	-0.205	-0.211	-0.326	-0.058	-0.076	-0.147	-0.455	-0.217
	(0.273)	(0.134)	(0.313)	(0.133)	(0.230)	(0.093)	(0.291)	(0.176)
weekend work	-0.087	-0.097*	-0.120	-0.128*	-0.200*	-0.100*	-0.153	-0.108*
	(0.127)	(0.054)	(0.143)	(0.058)	(0.099)	(0.036)	(0.126)	(0.048)
job in health sector	0.486*	0.221*	-0.146	0.361*	0.475*	0.264*	-0.140	0.314*
	(0.277)	(0.118)	(0.500)	(0.178)	(0.183)	(0.073)	(0.479)	(0.169)
social job	0.492*	-0.014	0.032	0.091	0.402*	-0.006	-0.061	-0.038
	(0.257)	(0.170)	(0.227)	(0.089)	(0.156)	(0.142)	(0.192)	(0.077)
security job	0.046	-0.137	0.207	0.029	0.110	-0.099	0.040	0.030
	(0.222)	(0.101)	(0.240)	(0.140)	(0.186)	(0.064)	(0.221)	(0.072)
log hourly wages	0.154	-0.009	-0.010	0.109*	0.060	0.033	0.009	0.143*
	(0.128)	(0.058)	(0.140)	(0.056)	(0.120)	(0.040)	(0.136)	(0.064)
log avg. wrk. hrs.	-0.068	-0.016	-0.137*	-0.075*	-0.108	-0.036	-0.135*	-0.131*
	(0.097)	(0.062)	(0.074)	(0.046)	(0.066)	(0.046)	(0.071)	(0.034)
log min. of work way	-0.105*	-0.074*	-0.099*	-0.098*	-0.142*	-0.140*	-0.124*	-0.142*
	(0.032)	(0.015)	(0.036)	(0.017)	(0.026)	(0.010)	(0.033)	(0.012)
N	1405	1405	1213	1213	1405	1405	1213	1213
R^2	0.087	0.115	0.076	0.132	0.093	0.244	0.105	0.218

Robust standard errors in parentheses and bootstrapped standard errors for randomly assigned couples. * indicates significance levels of 10% or higher.

The table reveals that just like before, employees in the public sector are found to enjoy pure leisure or non-market time significantly more (10 – 29 percent for real and 14 – 17 percent for randomly assigned husbands) as compared to those men having jobs in the private economy independent of the age of the youngest child. This influence can however only be identified when endogeneity is accounted for so that other diluting influences on joint time induced by preferences for spending time with the spouse are neglected. In contrast to that, shift workers, self-employed, people working during weekends and those having longer ways to the workplace can enjoy free time to significantly lower degrees. Shift work is only found to have a significant impact on pure leisure activities and reduces it by about 25 percent in

the case of real husbands and amounts to less 30 – 40 percent of pure leisure for randomly assigned husbands. One can argue here that shift work is rather family friendly as such working schedules might again assure some kind of informal child care so that always one partner is at home to take care of children at the clear expense of time that the spouses can spend with each other on pure leisure activities. Similarly, a second job is only taken up when children are taken care of which further strengthens the importance of informal child care, in particular for children under the age of 10. Here again, the influence of a second job cannot be identified by random assignment but rather unveil household inherent mechanisms which are significant only in the case of the youngest child being under the age of 10 which underlines the earlier hypothesis of informal childcare provision.

Self-employed have significantly less free time with spouses and family yet it must be noted that the effect is particularly pronounced for the determination of non-market time for older children. It seems as if such fathers seem to rather have priorities to enjoy leisure time with the spouse after work yet no joint household activities due to their higher work involvement. For younger children, the negative influence could only be identified by random assignment. The occurrence of weekend work only has a significant influence on explaining non-market time. Wages do not have a strong influence on free time and the earlier found dominance of the income effect is only confirmed on explaining non-market time for fathers of older children. Husbands who devote more of their available time to market work can potentially enjoy less leisure and non-market time together with the spouse yet it shall be mentioned that the impact is only significant for older children and predominantly affects non-market time.[11] Flexitime arrangements aimed at granting some degree of flexibility so that the reconciliation of work and private life is facilitated are not found to have a significant influence. For younger children, I find a negative correlation for real husbands which might hint a similar mechanism as described earlier namely that such arrangements are indeed family friendly yet at the expense of joint time of the spouses. This argumentation is further underlined by the fact that hardly any impact is obtained for randomly assigned husbands. Older children need less care and attention of their parents and thus, I find that flexitime has the opposite influence on actual couples which could be interpreted as evidence that in contrast to parents with younger children, spouses seem to actively synchronize their free time so as to spend the maximal amount of time with each other and rather seem to de-synchronize their schedules in the case of younger children.

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[11]It shall be noted here again that no simultaneity bias arises here because this information is not derived from the diaries but are reported as average hours worked during a standard workday.

4.4.2 Testing for Additional Marriage Induced Effects

By the creation of pseudo couples, I randomized the couple-specific effect (F_h) that was derived from the theoretical model presented in section 4.2. Thus, I separated the individual's decision to spend a certain amount of his daily available time at the workplace from the decision to spend non-work time with the partner. By doing so, I approach the endogeneity of workplace characteristics and job attributes in order to identify their so-called "pure" effects that are independent from any other diluting couple-specific influences due to marital preferences that do not directly stem from the workplace characteristic itself but rather from the way people make use of it which also affects free time. In this section, I want to formally find out, what marriage adds on top of the pure effects of the workplace identified by randomizing the coupling process. More precisely, I want to find out which of these effects are mitigated or intensified given marital preferences or whether marriage provides additional benefits to the household beyond the pure effects. In order to do so, I will test in how far the coefficients obtained for actual and randomly assigned spouses differ. Only if the difference of the coefficient estimates is statistically significant, statements can be made about the additional marriage-related influence. P-values of these tests for each coefficient are presented in table 4.6; p-values smaller than 0.10 indicate that coefficient estimates differ significantly between actual and randomly assigned spouses and these cases are highlighted in the table. Equality of the coefficients can only be rejected in very few cases. This finding strengthens the methodological correctness of randomization to approach the endogeneity problem of workplace characteristics when the influence on free time of couples shall be determined.

Let us now take a closer look at those estimation results that significantly differ for actual and randomly assigned couples as they are informative and help us unveil marriage inherent mechanisms. The equality of the coefficient of shift work between real and randomly assigned husbands on pure leisure can be rejected. A comparison of the size of the respective coefficients as shown in table 4.3 reveals that the influence in the case of real couples is less pronounced than the pure effect identified by random assignment. It can be argued that since actual couples are able to coordinate their schedules which thus mitigates the drastic negative influence on private life imposed by such jobs. Moreover, significant differences of a second job for real and randomly assigned husbands are obtained for both activity aggregates and in the case of wives equality can be rejected only for pure leisure. This finding strengthens the earlier made hypothesis that it is more likely that a second job is accepted only if it can be assured that one of the partners can take care of dependent children at the expense of joint free time of the spouses. Here, a de-synchronization of joint time occurs which is at the benefit of the family as a whole. Equality between real and randomly assigned couples can be rejected

Table 4.6: *P*-Values of Separate Tests by Coefficient Across Equations.

	pure leisure		non-market time	
	male	female	male	female
not working	-	0.3069	-	0.8876
marginally empl.	-	0.3444	-	0.9448
full-time	-	0.9657	-	0.1374
shift work	0.0314	0.7369	0.8763	0.8271
flexitime	0.5035	0.1086	0.4056	0.1069
service sector	0.4893	0.3649	0.1485	0.2109
public sector	0.7605	0.3541	0.9487	0.1249
self empl.	0.9692	0.2788	0.3766	0.9241
second job	0.0066	0.1911	0.0012	0.3391
same building	0.4586	0.7078	0.4984	0.7761
weekend work	0.8521	0.3681	0.1896	0.7238
job in health sector	0.6763	0.1658	0.5839	0.2824
social job	0.1837	0.9419	0.2827	0.9080
security job	0.4066	0.0314	0.8761	0.1705
log hourly wages	0.7734	0.6909	0.4404	0.2311
log normal hrs. work.	0.8153	0.1842	0.9834	0.9157
log min. of way to work	0.1214	0.2223	0.5682	0.1851

Highlighted numbers represent significant differences between the estimated coefficients of real and random husbands or wives at the significance level of 10% or higher.

also for flexitime arrangements of women for the determination of pure leisure. This supports the argumentation that such arrangements are made use of in order to better organize activities across the workday even at the expense of joint time with the spouse.

It follows that these tests strengthen the earlier made claims that married couples are able to synchronize their schedules and are thus able to reconcile family and work even if it is at the expense of joint time of the spouses. A negative sign of the coefficient estimate must therefore be regarded with caution as further marriage inherent mechanisms might be underlying that indeed facilitate the balance between work and private life.

4.5 Conclusion and Discussion

An increasing competition between firms in the growing product market and a more pronounced interconnection with international enterprises have shaped labor relations during the past decades. In this respect, political decision makers in many European countries have acknowledged the need to soften labor market rigidities stemming from strict regulations in order to render the labor market

more functional and but also to increase the labor market participation of women. In this context, flexible work arrangements such as flexitime, part-time work or marginal employment are promoted as a means to reconcile work and private life. I have shown in this paper that these measures aimed at increasing the temporal work flexibility are not found to be effective in the sense that the spouses can enjoy more of their limited free time with each other. In general, those workplace characteristics have the strongest effect on a couples' jointly spent free time that limit the available time most.

More importantly, by solving the endogeneity issue of the workplace characteristics and job attributes, I am able to uncover their pure effects on a couples' private life. Those workplace characteristics can be identified that significantly hamper the work-life balance (shift work, a second job, weekend work, self employment) or, on the contrary, that allow for a better reconciliation of both (employment in the private sector). Given the identification of the pure effects of the workplace on the private life, I am furthermore able to identify marriage inherent mechanisms that act on top of those pure effects and which need to be regarded separately. In this context, I find that a coordination of schedules among actual spouses leads to a mitigation of the strong negative pure effect imposed by shift work on the one hand. In contrast to that, couples particularly with young children rather de-synchronize their schedules in order to assure informal child care by one of the spouses allowing the other to e.g. hold a second job. Although these characteristics are found to be at the expense of joint time of the spouses, they are nevertheless very family friendly as it is assured that one of the parents is at home to take care of dependent children.

5 Compensation of Unusual Working Schedules

This paper examines pecuniary aspects of work during unusual hours based on the German Time Use Data for 2001/02. The findings show positive wage premia of 9 − 10 percent for shift workers and men who work during unusual hours. There is some evidence of negative selection which suggests that men with lower potential daytime earnings have a higher propensity to choose these jobs because of the associated wage premium. The findings further show a U-shaped impact of temporal work disamenity across the wage distribution with higher wage premia paid to the extreme 5-percentiles.

5.1 Introduction

In Germany, the share of shift workers steadily rose from 11 percent in the early 1990s to about 17 percent in 2008. A relaxation of regulations such as the shop opening hours further widen the working time distribution for a day so that work during unusual hours disseminates. Nowadays, shift work and also work during non-standard hours are fundamental work patterns across the German workforce and consequently influence the lifestyle of a large part of the population. These working schedules, however, disrupt the circadian cycle which might adversely affect well-being and increase the risk to health.[1]

Labor economists generally believe that disamenities must be compensated by higher wages (Smith, 1776; Rosen, 1987). The strong interest of medical and social sciences in the consequences of irregular working schedules shows that such working conditions can be perceived as disamenities which workers try to avoid if possible.[2] In addition, such jobs are found to increase the risks of gastric ulcer (Tüchsen et al., 1994), cardiovascular diseases (Bøggild and Knutsson, 1999) and even of cancer (Davis and Mirick, 2006). The major objective of this paper is to examine the compensation of shift work as well as of unusual working schedules (McNabb, 1989) based on the German Time Use Data for 2001/02.

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[1]The circadian cycle represents the regular recurrence of e.g. biological activities in cycles of approximately 24 hours from one stated point to another. See for example Culpepper (2010); Minors et al. (1986).

[2]See Presser (1988, 1995); Mellor (1986); Shiells (1987); White and Keith (1990); Mayshar and Halevy (1997) for social science research and Minors et al. (1986); Cunningham (1989); Costa (1996, 2003); Folkard and Tucker (2003) for medical research. Kostiuk (1990); Hamermesh (1999a) are representatives of the few economists addressing this question.

Although classical labor economic theory predicts substantial wage differentials for non-standard working schedules, in particular if health is at risk, there is only little empirical support. Work at non-standard hours is a common disamenity that is not based on individual characteristics and can thus be viewed as objective measure of the burden of work to everybody (Hamermesh, 1996). Only few studies attempt to estimate the size of the resulting wage premium. Kostiuk (1990) was one of the first authors to directly estimate wage premia for shift work in the US but limits his study to male manufacturing workers. He finds a positive selection into daytime work, yet is not able to identify a selection of any kind into shift work. Based on this work and by using better data, Lanfranchi et al. (2001, 2002) find a negative selection into shift work for France. Schumacher and Hirsch (1997) examine wage differentials only for registered nurses and find that shift work accounts for about 10 percent of the premium paid to hospital employees.

The incidence of evening and night shifts declined in Germany over the last decades. The majority of shift work nowadays is rather provided in rotating teams. In contrast, the occurrence of work during non-standard hours gained more importance by hence widening the working hours distribution. The rationale behind it is the stronger international integration of product markets and thus the intensification of world demand that requires employers for example to extend the operating hours of machines. If, however, the greater supply of work at unusual hours allows workers to choose these jobs because they prefer these working schedules, wage premia would be generally lower. In this case, no additional pecuniary incentives need to be paid to attract workers to such jobs. In this paper, I estimate the magnitude of wage differentials for two groups of workers with non-standard hours which are shift workers and men who work during unusual schedules in Germany by accounting for sample selection.

I find some evidence for a negative selection which is significant however only for shift workers yet not for men who work during unusual hours. It suggests that workers with more unfavorable characteristics choose such jobs to supplement their earnings as they would earn significantly lower wages for daytime work. The estimated positive and sizeable wage premia imply that workers would rather avoid these jobs but accept them because of the wage differential. I find further evidence of decreasing wage differentials for men with very long working hours which is evidence that non-pecuniary aspects of such jobs outweigh the financial compensation. To better understand the size of wage premia for these jobs across the overall wage distribution, I analyze wage differentials by quantiles and find a U-shaped impact across the earnings distribution. Following Lanfranchi et al. (2001, 2002), I additionally test for poolability of the separate wage equations for different groups to examine whether a treatment effect model or switching regression models with endogenous switching are more appropriate in this context. Poolability is however rejected for all groups of workers.

The paper is organized as follows: the subsequent section presents the theoretical motivation of the subsequent empirical analysis and section 5.3 gives a description of the estimation strategy. Section 5.4 is devoted to a description of the data. Additionally, the relevant variables and sample properties are described in more detail as well as the distribution of market work across a standard work day. Moreover, the presentation of the empirical results is divided into two parts: in section 5.5.1 the determinants of the choice of different types of temporal work disamenity are explored which are important for understanding the underlying selection process on observables. Based on these findings, the wage premia are investigated by accounting for a potential selection of the sample. Finally, section 5.6 concludes.

5.2 Theoretical Background

A simple theoretical framework will be presented here which will serve as foundation for the subsequent empirical analysis. Following Hamermesh (1999a), I assume heterogeneous firms. The production technology of the ith firm is given by

$$\Pi_i \;=\; \Pi_i(W_i, S_i), \qquad\qquad (5.1)$$

where W_i denotes the hourly wage rate of firm i and S_i is an indicator of work during unusual hours.

Each worker j maximizes his utilities given by:

$$U_j \;=\; U_j\left(W_j, S_j\right), \qquad\qquad (5.2)$$

where W_j is the hourly wage rate earned by the worker and S_j is again an indicator for works during unusual hours. The individual's decision about the number of hours worked will not be regarded in this paper as the sample is restricted to full-time employed workers only.

Workers sort themselves among employers depending on their tastes for working schedules and the employer's ability to reduce the incidence of work during unusual hours (Hamermesh, 1990). The firm's isoprofit curves (π) are concave and downward sloping because the reduction of work during unusual hours is costly. In contrast, indifference curves (I) of the workers are convex and upward sloping reflecting the higher compensations paid as incentive for work at non-standard working hours. It follows that the locus of all realized market wages (denoted by W) is a result of the decisions of both, firms and workers in equilibrium and is also upward sloping as shown in the left panel of figure 5.1. The wage-disamenity locus shown in this graph illustrates equilibrium combinations for homogeneous workers.

Figure 5.1: The Wage-Disamenity Locus.
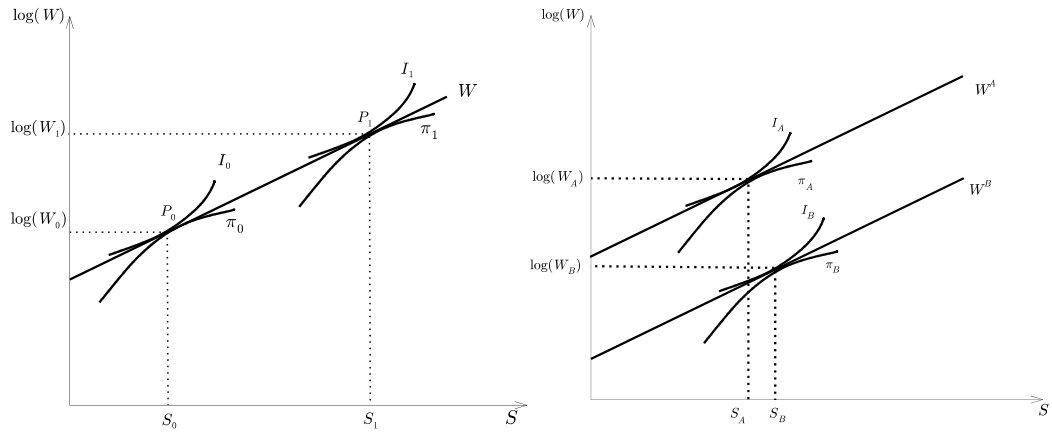
The size of the wage premium paid as incentive for workers to accept jobs which offer unusual working hours (S_j) heavily depends on the distribution of underlying tastes. A fraction of workers might not consider work during more undesirable hours as disamenity so that compensation needs not be very high. Others, in contrast, would only accept work under such conditions, if wages are high enough to compensate for the foregone leisure time which could be spent with sociable companions (Jenkins and Osberg, 2005). The distribution of the underlying tastes of the workers hence determines the size of the average wage premium and therefore the slope of the wage locus.

The assumption of heterogeneous workers is further depicted in the right panel of figure 5.1. For simplicity, two different types are assumed: A denotes a high-skilled type of worker and B the low-skill type (Hamermesh, 1999a). Both market wage-disamenity-loci (W^A and W^B) that are realized in equilibrium are shown. It is further assumed for simplicity that both types of workers face the same trade-off between the degree of unusual working hours (S) and log hourly wages which is why both wage loci have the same slope. However, both workers differ with respect to observable skills and are hence remunerated differently. The difference in the intercept of both wage-loci can be interpreted as income effect. Consequently, even without working unusual hours at all, worker A would receive higher wages than workers B. In addition, the figure shows that worker A could use some of his earnings power to avoid work during undesired hours and can therefore reduce S in equilibrium ($S_A < S_B$).

The focus of this study is the determination of the average wage differential for work at non-standard hours rather than to find the exact slope of the wage loci for different types of workers.[3] For an unbiased as possible determination of wage premia given the limitations of the dataset, it is crucial to account for a potential non-random selection.

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[3]Hamermesh (1999a) and Duncan and Holmlund (1983) amongst others try to identify the slope of the wage-disamenity trade-off.

5.3 Estimation Strategy

To estimate the influence of the temporal work disamenity on wages, the following simple wage equation will be estimated in a first step:

$$\ln w \;=\; \mathbf{X}\beta + \delta S + \epsilon, \tag{5.3}$$

with $\ln w$ denoting log hourly wages. The set of control variables can be grouped into matrices of predetermined individual characteristics ($\mathbf{X}$). Furthermore, S is a dummy denoting work during unusual schedules. The error term is denoted by ϵ.

   If the choice to work during unusual hours is not entirely random and reflects tastes of a rather selected group of workers, result obtained by simple OLS will be biased. Suppose that the choice of jobs that offer some sort of temporal disamenity is determined according to the following reduced-form choice equation:

$$S^* \;=\; \gamma \mathbf{Y} + \nu, \tag{5.4}$$

where S^* is a latent variable yet only the final binary decision (S) to work in such a job or not is observed. $\mathbf{Y}$ is a matrix of those variables that influence the choice and ν is a random error term. The equation further suggests that people choose to work in such jobs if the realized average wage premium exceeds the measured and unmeasured costs of such jobs (Kostiuk, 1990).

   The structural wage equations for both groups can be formulated as follows:

$$\ln w_s \;=\; \mathbf{X}\beta^s + \epsilon_s, \tag{5.5}$$

$$\ln w_d \;=\; \mathbf{X}\beta^d + \epsilon_d. \tag{5.6}$$

In the first equation $\log w_s$ denotes log hourly wages of men with unusual schedules and $\log w_d$ refers to the reference group.

   To start with, equations (5.3) and (5.4) will be estimated by a treatment effects model which is a restricted version of a selectivity controlled wage equation (Lanfranchi et al., 2001). The model assumes that jobs only differ with respect to the working schedules but do not require any additional skills. Put differently, all characteristics are equally valued independent of the timing of work. Consequently, coefficients are constraint to be the same for all men independently of whether they work during non-standard hours or not and a single equation including an indicator variable is appropriate. I will test this assumption in section 5.5.2.

   To allow for the possibility of different remunerations of skills for the respective groups, I will additionally estimate a switching regression model with endogenous switching. Lanfranchi et al. (2001) show that this is the appropriate model in the presence of non-random selection. If the ability of workers is not captured by the exogenous variables in the choice equation, wages might be affected and the error

terms ϵ_s and ϵ_d are biased with non-zero means. If in turn, wages affect the choice to work during unusual hours in addition to the influences already captured by the explanatory variables, also the error term v of the choice equation is biased. The direction of this bias depends on the underlying selection process. Given the reduced form choice equation (5.4) and following Maddala (1983), conditional wages can be computed as:

$$E \left(\ln w_s | S = 1\right) \;=\; \mathbf{X}\beta^s + \sigma_{\epsilon_s v} \frac{\phi\left(\gamma \mathbf{Y}\right)}{\Phi\left(\gamma \mathbf{Y}\right)}, \tag{5.7}$$

$$E \left(\ln w_d | S = 0\right) \;=\; \mathbf{X}\beta^d - \sigma_{\epsilon_s v} \frac{\phi\left(\gamma \mathbf{Y}\right)}{1 - \Phi\left(\gamma \mathbf{Y}\right)}, \tag{5.8}$$

with $\phi\left(\gamma \mathbf{Y}\right)$ denoting the normal density function and $\Phi\left(\gamma \mathbf{Y}\right)$ the normal distribution function of the choice equation. The last term of equations (5.7) and (5.8) will account for selectivity.

Results obtained from less restrictive switching regression models which allow for different coefficient estimates for the two groups will be expected to be lower than those from treatment effect models (Kostiuk, 1990). In the case of France, Lanfranchi et al. (2001) reject the hypothesis of poolability of the wage regressions for shift workers. The estimated wage differentials based on the treatment effects model are hence rather an upper limit of the true wage premium.

5.4 Data and Descriptive Statistics

This paper is based on German Time Use Data (*Zeitbudgeterhebung*) for the year 2001/02 collected by the German Federal Statistical Office (Statistisches Bundesamt, 2003). The data set is interesting for the present study as it provides – apart from the usual socio-economic, work and household characteristics – detailed information about the timing of activities for each 10 minute time interval during a day. The analysis of this paper is restricted to full-time employed men aged between 25 and 59 in dependent employment.

Following Burda et al. (2007), the more than 200 reported daily activities are aggregated into four major categories: pure leisure, paid market work, household work and tertiary time of which only the timing of market work is relevant to this chapter. It is defined as all direct job related activities of primary and second jobs, but also comprises time spent on internships, qualification and education on or for the job, job search as well as breaks during the workday and work-related travel time. Commuting time to work is further counted as being work related. From the time diaries, the exact timing of work per day is known which allows me to construct a direct measure of unusual working hours.

5.4.1 Variable Description

For the determination of wage premia for work at unusual hours, two different definitions will be used from now on. The first refers to shift work and is directly reported by the worker who indicates whether he works morning, evening, rotating or another kind of shift. All these categories are aggregated into a single indicator of shift work. A person belonging to this group will be referred to as self-reported *shift worker* in the remainder of this study. The relevant reference group consists of all men who do not report to work shifts and I will refer to them as daytime workers.

To go beyond the analysis of shift work in order to understand the importance of the timing of work, I will apply a second definition in this study. It is directly derived from the diary information. In this context, a standard workday is defined for all respondents which lasts from 8 am to 5 pm. Making use of the definition of a standard workday, a person is defined to work during *unusual hours* if more than 30 percent of his working hours lie outside this period.[4] The respective reference group consists of all other men and will be referred to as men who work during usual working hours from now on.

Table 5.1 shows the overlap between the different groups of workers. 53 percent of those men who work during unusual hours also report to be shift workers and about 41 percent of the shift workers also work during non-standard hours. Among all those men who do not report working shifts, 12 percent work during non-standard hours. Finally, of those who work normal hours, about 12 percent report shift work.

Table 5.1: Distribution Between Shift Workers and Those Who Work during Unusual Hours and the Respective Reference Groups.

| | **reported** | | |
	shift workers	daytime workers	N
unusual hours	406	358	764
standard hours	576	2664	3238
N	980	3022	4002

In addition to the distinctive advantages, this dataset also has some shortcomings. The exact amount of net monthly earnings is only available for about 70 percent

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[4]The Bureau of Labor Statistics (BLS) suggests to define shift work as any schedule in which more than half of the hours fall outside of a period between 8 am and 4 pm (Mellor, 1986). Since the focus is laid on full-time employed men only and in order to have a large enough sample, men who work shifts are defined, in contrast to the BLS, if more than 30 percent of working hours lie outside of the standard workday.

of the respondents. All other workers indicate wages in income brackets. To use this information, I assign the average wage of the income bracket to each of these workers. Men belonging to the highest income group are assigned 1.5 times the minimum value. More problematic is however that detailed information on job characteristics or on the employer are very scarce. This is a drawback to accurately estimate compensating wage differentials for work disamenities because firm characteristics (i.e. firm size) are important determinants to proxy onerous working conditions. The estimation results on wage differentials are therefore likely to be generally downward biased as larger firms tend to pay higher wages, for example, as incentive device to avoid shirking. These firms are also more likely to offer shift work because it is expensive to turn-off the machines during nights. Unfortunately, information on firm size is not available in the data.

I additionally control for some standard predetermined demographic variables that might explain wages but also the choice of such jobs. These explanatory variables comprise the worker's age in 5 categories, his educational attainment in three categories (low, medium (reference category) and high skills), dummies for being married, being a blue-collar worker and living in Western Germany as well as the number of kids, the log of usual weekly working hours.

5.4.2 Sample Description

General descriptive statistics are displayed in table 5.2 for all workers but also separately for shift and daytime workers. Among the shift workers, 14 percent work the morning shift, about 1 percent the evening/night shift, 74 percent the rotating shift and 11 percent another kind of shift. About 25 percent of all men in the sample report that they work shifts which exceeds the German average of 15 percent for the entire population for the year 2001. In addition, 19 percent of the sample men work during unusual hours and about 41 percent of these additionally report to work shifts.

Table 5.2 further shows differences in the composition of the sample groups. Shift workers and men with unusual hours are less educated and are found to have slightly more kids. Furthermore, these men are less likely to live in the Western part of Germany and net average hourly incomes are slightly higher for daytime workers. However, since these men are amongst others older and better educated, a comparison of net mean wages between the groups is not very informative.

Not only are shift workers and men who work during unusual hours very different from the respective reference group but the two groups differ considerably themselves. Men who work during unusual hours are generally better educated than self-reported shift workers. However, they are slightly less likely to be married, have more kids and are slightly more likely to live in Eastern Germany. Self-reported shift workers earn lower hourly wages but due to differences in educational levels, a mean comparison is again not meaningful.

Table 5.2: Summary Statistics.

	all workers (1)	rep. shift wrk (2)	unus. wrk hrs (3)	rep. day wrk (4)	normal wrk hrs (5)
work information:					
unusual wrk hours	0.191	0.414	1.000	0.118	0.000
	(0.393)	(0.493)	(0.000)	(0.323)	(0.000)
shift work	0.245	1.000	0.531	0.000	0.177
	(0.430)	(0.000)	(0.499)	(0.000)	(0.382)
rotating shifts	0.186	1.000	0.476	0.000	0.121
	(0.389)	(0.000)	(0.500)	(0.000)	(0.326)
blue-collar worker	0.404	0.727	0.545	0.300	0.371
	(0.491)	(0.446)	(0.498)	(0.458)	(0.483)
personal characteristics:					
age	43.850	43.222	43.173	44.053	44.010
	(7.078)	(7.471)	(8.058)	(8.256)	(8.076)
low skilled	0.021	0.047	0.035	0.012	0.017
	(0.143)	(0.212)	(0.185)	(0.110)	(0.130)
medium skilled	0.561	0.788	0.624	0.488	0.547
	(0.496)	(0.409)	(0.485)	(0.500)	(0.498)
high skilled	0.415	0.165	0.338	0.496	0.434
	(0.493)	(0.372)	(0.473)	(0.500)	(0.496)
married	0.820	0.837	0.792	0.814	0.826
	(0.385)	(0.370)	(0.406)	(0.389)	(0.379)
household information:					
# of kids	1.377	1.399	1.399	1.370	1.372
	(1.028)	(1.009)	(1.077)	(1.034)	(1.016)
Western Germany	0.821	0.827	0.810	0.820	0.823
	(0.384)	(0.385)	(0.392)	(0.385)	(0.381)
observations	4002	980	764	3022	3238

Standard deviations are given in parentheses.

In addition to compositional differences of shifts workers or men with unusual hours, table 5.3 reports the respective incidence by occupation group. Sample men who work shifts are predominantly employed as unskilled labor, packers, in metal production, as machine operating, in mining, the food industry and in medical occupations. In contrast, the incidence is least likely in leather processing, management, agriculture, office and social service occupations. Men who work during unusual hours are predominantly unskilled labor, they work in mining, paper and wood production, as packers and in other services, in the transportation

Table 5.3: Mean Incidence of Shift Work or Work During Unusual Hours by Occupation.

	reported shift work		unusual hours	
	mean	rank	mean	rank
agriculture	0.045	23	0.172	16
mining	0.667	5	0.375	2
paper and wood	0.577	8	0.354	3
metal production and processing	0.739	3	0.211	13
engineering	0.331	12	0.138	21
metal construction	0.279	13	0.179	15
textiles and leather	0.000	25	0.000	25
food	0.657	6	0.229	12
construction	0.192	15	0.145	19
upholsterers	0.151	17	0.110	23
painters	0.385	11	0.286	8
packer	0.767	2	0.333	5
unskilled labor	1.000	1	1.000	1
machine operators	0.675	4	0.338	4
engineers, chemists, physicists, etc.	0.183	16	0.161	17
merchants and traders	0.122	20	0.152	18
transportation	0.487	9	0.299	7
management and consulting	0.025	24	0.113	22
office occupations	0.056	22	0.097	24
security occupations	0.438	10	0.238	10
artists and authors	0.143	19	0.231	11
medicine and health care	0.622	7	0.273	9
social services	0.078	21	0.186	14
other service occupations	0.143	18	0.333	6
others	0.214	14	0.143	20

business and as painters but also in medicine. The least likely occupations of work at unusual hours are textiles and leather production, office occupations but also management, engineering and construction work.

5.4.3 The Timing of Market Work

To make the distinction between the different groups of workers clearer, figure 5.2 represents the distributions of working hours for self-reported shift and daytime workers (gray) and for men who work during unusual and standard hours (black). The vertical lines represent the standard workday which is derived from time diaries of the entire sample of employed. Since only few of the daytime workers also work during non-standard hours and only a small proportion of men with standard working hours also reports working shifts (see table 5.1), the working

Figure 5.2: Distribution of Working Hours by Worker Group.
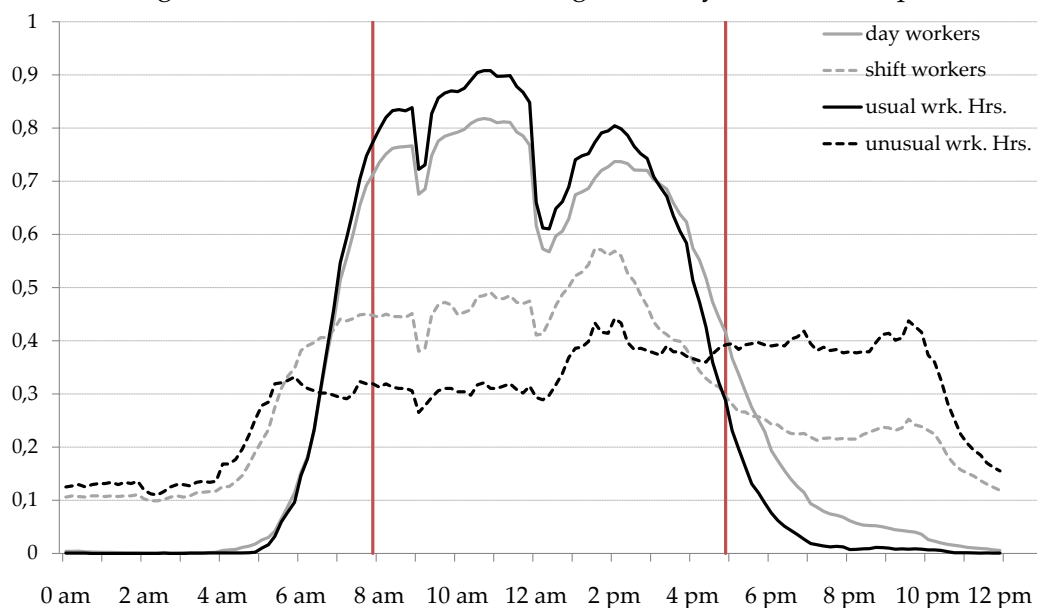
time distributions for men in the respective reference groups are relatively similar. In contrast, the distributions of working hours of men who work shifts and of those who work during unusual hours differ across a standard workday, in particular regarding evening hours. The high proportion of shift workers who work during standard hours explain that the average workday of self-reported shift workers is shifted slightly to earlier morning hours as compared to the reference group. During the evening hours, the probability of shift workers to work drastically exceeds the one for the reference group. The work time distribution of those men who work during unusual hours is more evenly distributed across the entire day with a particularly high probability of work during evening hours.

Additional descriptive statistics about the timing of market work and the total number of working hours are reported in table 5.4 for all men and by group. Work at 9 am and at 3 pm occurs with a probability between 27 and 44 percent for shift workers and men with unusual hours while it tends to be 30 – 46 percentage points higher for the relevant reference group. Daytime workers practically do not work during nights but shift workers and men with unusual hours have an average probability of about 13 percent to work at 3 am. More interestingly, men who report working shifts have a work probability at 9 pm of 24 percent and men with unusual working hours of even 41 percent. This corroborates the graphical evidence that men with unusual hours are very likely to work during evenings and nights.

Table 5.4 additionally presents the amount of average actual daily working hours by group. It shows that men with unusual working hours work on average one hour longer than men who report to work shifts. The *Working Time Act (ArbZG)*

Table 5.4: Selected Descriptive Statistics on the Timing of Work and on Aggregate Hours Worked.

	all men	reported		working hours	
		shift wrk	day wrk	unusual hrs.	usual hrs.
fraction of men at work:					
3 am	0.024	0.106	0.001	0.129	0.000
9 am	0.611	0.380	0.675	0.265	0.722
3 pm	0.644	0.435	0.703	0.377	0.708
9 pm	0.089	0.236	0.048	0.414	0.010
average daily hours worked:					
	9.14	8.89	9.20	9.80	8.96
	(2.26)	(2.31)	(2.24)	(3.24)	(1.87)
N	4002	980	3022	764	3238

Standard deviations in parentheses.

restricts working hours of night shift workers to 8 hours which can be extended to 10 hours per day provided that an average of 8 hours is maintained over a 6 months or 24 week period or alternatively in emergencies and under extraordinary circumstances.[5] The highly augmented average amount of working hours can additionally be explained by some outliers. People who work very long hours per day fulfill the defining criteria for this group but are compositionally very different. I will account for that in the subsequent analysis. Differences in the average daily working hours of the reference groups are less pronounced.

To find out more about the association between working schedules and earnings, figure 5.3 depicts differences in the distributions of market work by time slot t for particular income percentiles. The straight black line shows differences between the 90th and the 10th percentile of the earnings distribution. During evenings and night, work is slightly more pronounced for workers in the upper extreme percentile. Yet when time slots around the margins of the standard workday are regarded and in particular during the early morning hours, the figure shows that it is men in the lower extreme percentile who mainly bear the burden of work. The two remaining lines show differences in the timing of market work for the upper and lower half of the earnings distribution. For those earlier hours before the standard workday starts, the figure shows that it is rather workers in the lower part of the wage distribution that have a higher probability to work. The relationship seems to be positive so that with increasing position in the wage distribution, work tends to start later. To summarize the graphical evidence, differences in the

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[5]See also §6 of the Arbeitszeitgesetz (ArbZG).

Figure 5.3: Differences in the Incidence of Market Work by Position in the Wage Distribution.
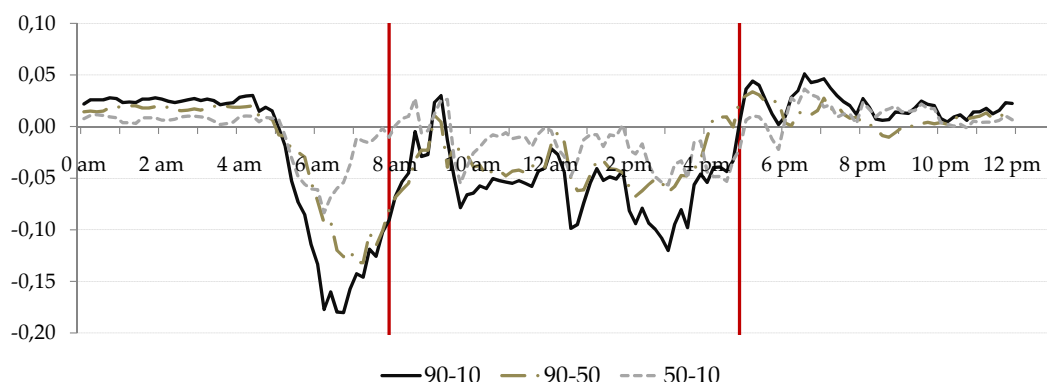
allocation of market work are most pronounced in the earlier morning hours and seem to be mostly borne by workers in the lower half of the wage distribution.

5.5 The Compensation of Onerous Working Conditions

5.5.1 Who Chooses Such Jobs?

Before analyzing wage premia in more detail, it is important to understand the differences in the choice to work shift or during unusual hours. The resulting determinants can be viewed as first indication about the possible direction of non-random selection based on observable characteristics. Marginal effects from reduced form probits of the choice equation (5.4) for shift workers (column (1)) and men with unusual hours (column (2)) are presented in table 5.5. Moreover, the third column of the table represents the determinants of the reduced-form choice equation of those shift workers who additionally choose to work during non-standard hours. Finally, column (4) presents marginal effects for all men who work during unusual hours and who additionally report to work shifts.

The main exclusion restrictions to identify the selection process but which does not affect wages are adopted and modified from Kostiuk (1990). They are defined as (i) the rate of reported shift work by occupation and sector for the German Time Use Survey of 1991/92 or alternatively, (ii) the rate of unusual working hours by occupation and sector in 1991/92. These exclusion restrictions capture differences in the occupation- and sector-specific tendencies of shift work or work during unusual hours and thus reflect differences in the preferences among workers of the different occupations. The underlying rationale is that men with a stronger dislike for such working conditions sort themselves into jobs that offer lower levels of temporal disamenities as depicted by P_0 in the first panel of figure 5.1.

The first line of table 5.5 shows the marginal effects of the exclusion restrictions of the respective choice equation. It is found to be highly significant which indicates

that a higher rate by occupation and industry in 1991/92 is strongly and positively associated with the choice of the relevant job in 2001/02. This suggests that industry and job differences from the beginning of the 1990s are highly correlated with shift choice 10 years later. Thus, they provide a good proxy for the propensity of such working conditions by occupation and industry. Over the decade, not many regulatory changes of working hours or shift work occurred in Germany. The general industry structure is comparable and serves consequently as a good indicator for shift choice in 2001/02. Since the data for the years 1991/92 and 2001/02 are independent cross-sections, the decision to work shifts in 1991/92 is not taken by the same individuals who chose to work shifts or during unusual hours in 2001/02. The exclusion restriction is therefore exogenous. This is an advantage over the exclusion restriction chosen by Kostiuk (1990) who aggregates over those individual decisions that need to be instrumented. This is a serious drawback of his study as the exclusion restriction is not exogenous and does not solve the endogenous job choice.

Regarding other choice determinants, the table shows that shift work is less likely for high skilled workers as well as for men with more kids. Married men as well as workers, who are either younger or older than the reference group, have a higher propensity to work in such jobs. Lower levels of education are associated with a higher probability yet it is not significant. Blue-collar workers tend to be about 15 percent more likely to work some shifts which indicates that low-skilled manual workers have higher tendencies. Men who live in West Germany are furthermore observed to have a slightly yet insignificantly higher probability. As mentioned earlier, the *Working Time Act (ArbZG)* restricts the daily working hours of night shifts to 8 hours per day which can be extended to 10 only in exceptional cases. This regulation is reflected by the negative coefficient on the number of average weekly working hours. The influence of the Working Time Act is even more sizeable if only evening and night shift workers were considered. The high fraction of workers in rotating teams therefore upward-biases the overall estimates. When only rotating shift workers are regarded, a positive relationship between the number of hours worked and the propensity to work shifts is obtained.[6]

Column (2) shows the determinants of the choice to work during unusual hours. Since this group of men is very heterogeneous, as mentioned in section 5.4.2, only few determinants have a significant impact on job choice. It follows that married men and those between 40 and 50 tend to be significantly less likely to work at unusual hours. It is possible that people accept work during non-standard hours when they are younger and more flexible for career concerns. Men with low educational levels tend to have higher probabilities while the number of kids is positively associated with such working schedules. In addition, blue-collar workers tend to be 9 percent more likely.

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[6]Results are not shown here but are available by request from the author.

Table 5.5: Marginal Effects of Probit Estimates of the Selection Equation.

	reported shift status (1)	unusual wrk hrs (2)	shift w/ unusual hrs (3)	unusual hrs w/ shift (4)
exclusion restrictions				
rate of shift work in 1991	0.777*	0.476*	0.458*	1.053*
	(14.79)	(7.98)	(3.41)	(11.13)
individual characteristics				
age: under 30	0.058*	0.008	-0.049	-0.019
	(1.95)	(0.27)	(0.57)	(0.28)
age: 40 - 50	0.042*	-0.031*	-0.167*	-0.055
	(2.40)	(1.71)	(3.51)	(1.29)
age: 50 - 60	0.085*	-0.026	-0.111*	0.074*
	(5.26)	(1.54)	(2.62)	(1.73)
age: above 60	0.025	-0.026	-0.009	0.028
	(1.39)	(0.94)	(0.20)	(0.62)
low skilled	0.058	0.062	0.057	-0.009
	(1.53)	(1.61)	(0.82)	(0.09)
high skilled	-0.093*	-0.000	0.056	-0.139*
	(6.55)	(0.01)	(1.29)	(4.19)
married	0.037*	-0.040*	-0.075	0.029
	(2.11)	(2.25)	(1.57)	(0.69)
household characteristics				
# of kids	-0.013*	0.012*	0.040*	-0.004
	(2.06)	(1.72)	(2.31)	(0.25)
West Germany	0.017	-0.013	0.003	0.016
	(1.03)	(0.82)	(0.06)	(0.41)
work characteristics				
usual wrk. hrs (log)	-0.041*	0.075	0.277*	-0.048
	(2.00)	(0.82)	(2.93)	(1.05)
blue-collar worker	0.151*	0.091*	0.092*	0.149*
	(11.21)	(6.37)	(2.49)	(4.74)
observations	4002	4002	989	719
pseudo R^2	0.224	0.045	0.035	0.307

Absolute z-statistics in parentheses. Standard errors are robust. * indicate significance levels of 10 % or higher.

The third column of the table further reports the marginal effects of those shift workers who additionally choose to work during unusual hours. Due to the heterogeneity of these workers, the pseudo R^2 is very low and only few characteristics have a significant influence. These characteristics are however interesting: I find that shift workers with more kids and those who are blue-collar

workers tend to be more likely to work also during unusual hours. In contrast, shift workers above 40 are less likely than prime age men. Finally, the last column reports marginal effects for men who report to work shifts among all those men who work during unusual hours. It is again blue-collar workers who tend to have higher probabilities. Interestingly, also men above 50 tend to have a higher probability to work shifts when they work at unusual hours. Higher levels of education, in contrast, lower the respective probability to choose such jobs.

It can be summarized that the combining element to work in such jobs is to be a blue-collar worker. In addition, it is predominantly workers with lower levels of education who tend to be more likely.

5.5.2 Compensation and Sample Selection

To work shifts or during unusual hours can generally be considered as disamenity because it entails lack of sleep, higher levels of stress and higher risks of accidents at the workplace (Folkard and Tucker, 2003; Minors et al., 1986) which might harm individual work efficiency and thus productivity (Hamermesh, 1999a). In addition, it is well established that workers who are exposed to work at non-standard hours have higher risks of gastric ulcer (Tüchsen et al., 1994), cardiovascular diseases (Bøggild and Knutsson, 1999) and even of cancer (Davis and Mirick, 2006). According to the theory of compensating wage differentials (Smith, 1776; Rosen, 1987) such onerous working conditions should be better remunerated in order to attract workers to accept such jobs despite the augmented risk to health. Differences in tastes for such working conditions across the population determine the size of the realized average wage premium which is paid as compensation.

Simple OLS estimates give a first naive indication about the size of wage premia and are reported in the first row of table 5.6. Accordingly, the wage differential associated with shift work is 4 percent on average. Estimated net hourly wage premia are more pronounced for men who work during non-standard hours. They are found to receive on average 6.2 percent higher net hourly wages as compared to the reference group. These simple associations suggest that German workers earn significant monetary compensations when they are exposed to shift work or to work at unusual hours. All additional wage determinants are reported in table 5.9.

If the choice to work shifts or during non-standard hours is non-random, estimates obtained from OLS are biased with sign and magnitude of this bias depending on the nature of the underlying selection process. If additional abilities that are important to determine wages are not entirely captured by the exogenous variables but are further reflected by higher wages, the error terms of the wage equation would be positive. In addition, if workers are more likely to work in such jobs because of the higher associated wage rate, also the error term of the choice equation would be positive as well as the covariance between the two equations. In other words, a positive selection into such jobs occurs or vice versa.

Table 5.6: Results from Wage Equations Estimated by OLS and Treatment Effects Models. Dependent Variable: Log Net Hourly Wages.

	reported shift wrk	unusual wrk. hrs.
OLS		
indicator	0.040*	0.062*
	(3.62)	(4.78)
sample selection model		
indicator	0.103*	-0.104
	(2.72)	(1.34)
inverse Mills ratio ($\hat{\lambda}$)	-0.040*	0.096*
	(1.76)	(2.16)
N	4002	4002

Absolute *t*-statistics are given in parentheses. Standard errors are robust. * indicates significance levels of 10% or higher.

To account for the potential non-random selection, the choice equation presented earlier will be used and will be estimated simultaneously with wage equation. The inverse Mills ratio is derived from the parameters estimates of the choice equation and is included as additional explanatory variable in the wage equation. The estimate of the inverse Mills ratios are presented in addition to the selectivity corrected estimate of the average wage differentials in the second and third line of table 5.6. The inverse Mill's ratio indicates sign and magnitude of the potential selection process. A negative estimate indicates that men who choose to work shifts or during unusual hours tend to have more unfavorable characteristics and vice versa.

The estimates of the inverse Mill's ratio suggest that shift workers are negatively selected workers with less favorable labor market characteristics. This suggests that OLS estimates are downward biased and that it is crucial to account for it. These workers would earn lower wages for comparable daytime work and select themselves into work with undesirable schedules because they can supplement their incomes that way. The selectivity corrected estimates of the wage premium from treatment effects models, as shown in table 5.6, reveal that shift workers earn on average 10.3 percent more per hour. This wage differential is sizeable and is evidence that these workers would rather avoid such jobs if possible but accept them because of the substantial monetary compensation.

According to the estimate of the inverse Mill's ratio, men who work during unusual hours tend to be positively selected group of workers as shown be the

Table 5.7: Top 5 Occupations of Employees with Unusual Hours and Associated Average Daily Hours of Market Work.

	unusual hours		standard hours	
	occupation	hours	occupations	hours
1st	transportation	9.91	managements, consulting	8.93
2nd	security occupations	8.12	metal engineering	8.83
3rd	management, consulting	10.59	engineers, chemists, physicists	8.68
4th	engineers, chemists, physicists	9.36	office occupations	8.22
5th	metal engineering	8.47	social occupations	7.13

second column of table 5.6. The estimate is positive and significant. This result indicates that men with favorable labor market characteristics choose to work at unusual hours. Consequently, OLS estimates are upward biased and the sign of the selectivity corrected estimates turns negative. This finding is however counter-intuitive.

As noted earlier, the coefficient estimates are likely to be driven by a small group of workers with very specific preferences and above average working hours. In this case, these coefficient estimates are likely to be an artifact that highly depends on the construction of the indicator. If men who work very long hours fulfill the criteria mentioned above and are thus allocated to this group, the results obtained are not representative. Table 5.7 underlines this hypothesis and depicts the top five occupations in which workers of the respective groups are most likely to be represented as well as the respective average hours of market work. Those men who are defined to work at unusual hours have the highest probabilities to be employed in such occupations that are associated with longer average working hours. The top five occupations comprise transportation, security, management and consulting but also engineering jobs. Many of these require higher skill levels which explains the positive selection according to table 5.6. It follows that men working in these occupations strongly drive these results but the respective workers might have entirely different preferences. Moreover, it is very likely that for these workers additional non-pecuniary aspects matter that also drive the choice of working hours. To account for this problem, I will henceforth restrict the daily amount of market work for this group of workers to not exceed 10 hours. In contrast to that, the working hours of the top 5 occupations for those men who work during normal hours are more homogeneous as shown by the table.

The more representative estimates of the wage differentials obtained from OLS and treatment effects models for men who work with unusual schedules but

Table 5.8: Estimates for Men who Work at Unusual Hours but Who Work Less than 10 Hours per Day.

	unusual wrk hrs	shift wrk w/ unusual hrs	unusual hrs w/ shift
OLS			
indicator	0.067*	0.068*	0.054
	(4.31)	(3.53)	(1.47)
sample selection model			
indicator	0.090	-0.327	0.124
	(1.09)	(1.20)	(1.10)
inverse Mills ratio ($\hat{\lambda}$)	-0.013	0.244	-0.045
	(0.28)	(1.45)	(0.71)
N	2931	779	464

Absolute *t*-values are given in parentheses. Standard errors are robust. * indicates significance levels of 10% or higher.

not more than 10 hours per day are reported in the first column of table 5.8. The estimates reveal that the now excluded workers have strongly biased the previous estimates. By restricting the number of working hours results in more reasonable and intuitive coefficient estimates. Accordingly, men with such working schedules earn wage premia of 11.1 percent which are sizeable but only inaccurately estimated. Moreover, these workers are negatively selected yet the selection term is not significant.

The table further shows wage differentials and the selection term for shift workers who work at unusual hours (column 2) and for men who work at unusual hours and who additionally work shifts (column 3). Simple OLS estimates show that shift workers who work during unusual hours tend to earn on average about 6.8 percent higher net hourly wages. In contrast, simple wage premia for men with unusual working hours who additionally report working shifts tend to be lowest and insignificant and amount to 5.4 percent.

The lower panel presents selectivity corrected estimates. The inverse Mill's ratio is not accurately estimated and is hence insignificant in both cases. The sign of these estimates is however interesting and reveals that among all shift workers those who work at unusual hours tend to be positively selected. Among the workers who work at unusual hours, those who also report to work shift, tend to have less favorable labor market characteristics. The estimates are however too large in size which indicates that the number of observation is too low to allow for a correct estimation of the coefficient estimates.

The remaining wage determinants are reported in table 5.9. Age has no significant influence on wages. Only workers under the age of 30 earn significantly lower

wages than prime-age men. Yet, these workers are a selected group that consists of a high fraction of men with lower levels of education and hence lower average wages who started their work life early. Better educated men with university degrees enter the labor market not until the age of 25. Married men and men with more kids, who live in Western Germany are found to earn significantly higher net hourly wages. In contrast, blue-collar workers and men with lower levels of education have lower earnings. In addition, men with longer average weekly working hours are found to earn significantly lower net hourly wages which might be evidence that overtime hours are on average not remunerated in terms of additional wages but are compensated differently.

Moreover, OLS estimates of the influence of explanatory variables and those obtained from treatment effects models as reported in columns (2) and (6) show to be relatively robust. I find that the selectivity-corrected estimates only change slightly for the skill groups and for blue-collar workers. This indicates that these are the determinants that are predominantly responsible for selection on observables. Since shift workers are negatively selected, the low-skill penalty increases slightly and so does the compensation for blue-collar work when selection is accounted for. When men who work at unusual hours are regarded wage penalties of lower skills slightly increase for lower skills but are unaffected in the case of blue-collar work.

5.5.3 Can Wage Equations Be Pooled?

If the determinants are differently valued in terms of wages for the different groups of workers, pooling wage equations into one single equation would result in overestimated wage premia (Lanfranchi et al., 2002). Poolability shall therefore be tested in more detail in this section. Columns (3) and (4) additionally report coefficient estimates from switching regression models with endogenous switching for separate wage equations for day and shift workers; columns (7) and (8) represent separate wage determinants for men who work usual and unusual hours.

Simple *F*-tests for the equality of all coefficient estimates of the separate wage equations are performed. The respective *F*-statistic is presented in the last line of table 5.10. It takes the value of 29.66 and has a *p*-value of 0.002 when testing for equality of remunerations between day and shift workers. The hypothesis of equal coefficients can be hence rejected for shift workers. It follows that the wage determinants are different between shift workers and men who do not report to work shifts and a switching regression with endogenous switching is the appropriate estimation method.

When men with unusual working hours are concerned, the *F*-statistic is 20.40 with a p-value of 0.040. It follows, that also in this case, the hypothesis that a similar remuneration for both groups of workers can be rejected at reasonable significance levels. Pooling both equations is therefore not appropriate and estimation by treatment effects models would deliver overestimated wage differentials.

Table 5.9: Estimation Results from OLS and Sample Selection Models. Dependent Variable: Log Net Hourly Wages.

	reported				unusual			
	OLS	sample selection			OLS	sample selection		
	all	all	day	shift	all	all	usual	unus.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
shift indicator								
shift indicator	0.040*	0.103*			0.067*	0.090		
	(3.62)	(2.72)			(4.31)	(1.09)		
inv. Mills ratio		-0.058*	-0.086*	-0.039		-0.013	-0.123*	-0.035
		(3.02)	(2.57)	(1.16)		(0.28)	(1.84)	(0.41)
individual characteristics								
age: under 30	-0.200*	-0.201*	-0.230*	-0.049	-0.235*	-0.234*	-0.213*	-0.315*
	(6.84)	(8.13)	(6.76)	(1.10)	(6.82)	(8.66)	(5.69)	(3.24)
age: 40 - 50	0.006	0.004	0.012	0.006	0.019	0.020	0.018	-0.001
	(0.42)	(0.25)	(0.71)	(0.24)	(1.21)	(1.22)	(0.97)	(0.02)
age: 50 - 60	-0.002	-0.009	0.017	0.001	0.009	0.009	-0.012	0.092
	(0.19)	(0.64)	(0.86)	(0.04)	(0.62)	(0.60)	(0.74)	(2.11)
age: above 60	0.053*	0.052*	0.067*	0.021	0.065*	0.066*	0.055*	0.098
	(3.77)	(3.80)	(3.91)	(0.79)	(3.81)	(4.23)	(3.00)	(2.15)
low skilled	-0.204*	-0.215*	-0.247*	-0.127*	-0.215*	-0.221*	-0.181*	-0.213
	(4.86)	(6.22)	(3.19)	(3.50)	(4.02)	(5.17)	(2.67)	(1.52)
high skilled	0.217*	0.225*	0.193*	0.117*	0.195*	0.196*	0.178*	0.239*
	(17.93)	(18.87)	(11.46)	(3.26)	(14.78)	(15.76)	(11.83)	(5.23)
married	0.190*	0.189*	0.206*	0.170*	0.190*	0.190*	0.185*	0.183*
	(12.37)	(13.32)	(11.15)	(5.76)	(10.63)	(11.94)	(9.59)	(2.95)
household characteristics								
# of kids	0.044*	0.044*	0.035*	0.054*	0.039*	0.039*	0.043*	0.024
	(7.70)	(8.26)	(4.95)	(4.90)	(6.20)	(6.66)	(5.99)	(1.37)
West German	0.373*	0.371*	0.373*	0.360*	0.347*	0.348*	0.337*	0.357*
	(27.59)	(29.16)	(22.94)	(15.68)	(22.15)	(23.49)	(18.55)	(9.22)
work characteristics								
log wrk hrs	-0.909*	-0.907*	-0.911*	-1.018*	-0.938*	-0.938*	-0.913*	-1.013*
	(24.15)	(46.26)	(22.94)	(20.82)	(23.13)	(40.97)	(16.94)	(27.86)
blue-collar	-0.259*	-0.276*	-0.207*	-0.201*	-0.263*	-0.266*	-0.268*	-0.203*
	(22.26)	(18.29)	(6.22)	(6.47)	(20.24)	(17.04)	(13.52)	(2.02)
constant	5.344*	5.329*	5.409*	5.801*	5.484*	5.480*	5.459*	5.819*
	(37.69)	(70.64)	(36.14)	(30.9)	(35.89)	(61.75)	(26.64)	(13.69)
observations	4002	4002	3022	980	2931	2931	2467	464

Absolute *t*-values are given in parentheses. Standard errors are robust. * indicates significance levels of 10%. or higher

To find out which wage of the wage determinants differ significantly for shift and daytime workers, table 5.10 further reports t-tests of the equality of each single coefficient between the separate equations. In the case of men with unusual working hours, almost no wage determinant differs significantly between the groups. The only exception is that the remuneration of low skills differs. Such men earn wage penalties of 18 percent when they work during standard working hours. In contrast,

Table 5.10: *P*-Values for Tests of Equality of Single Coefficient Estimates between Separate Equations by Group.

	shift workers	unusual hrs.
single coefficient tests:		
age: under 30	0.0013	0.3284
age: 40 - 50	0.8393	0.6954
age: 50 - 60	0.6155	0.0259
age: above 60	0.1413	0.3785
low skilled	0.1684	0.8387
high skilled	0.0534	0.2101
married	0.2953	0.9752
# of kids	0.1500	0.3368
West German	0.6541	0.6405
usual wrk. hrs (log)	0.0896	0.1073
blue-collar worker	0.8985	0.6726
test for all coefficients simultaneously:		
$F(14, 4002/2932)$	0.0018	0.040

$N = 4002$ in the case of shift workers; $N = 2932$ when men with unusual hours are considered whose working hours do not exceed 10 per day.

being at work during non-standard hours is associated with an even larger negative wage differential of 21 percent which is not significant though. In addition, the remuneration of longer average weekly working hours differs marginally between the groups. Also in this case, wage penalties are larger for men who work at unusual hours which might reflect the stronger regulations of working hours by the Working Time Act (*ArbZG*) in Germany. Although only few wage determinants differ between the wage equations of both groups, the overall F-tests suggests that it is more appropriate to investigate them based on a switching regression model with endogenous switching.

In the case of shift workers, as shown by table 5.10, more explanatory variables differ between the separate regressions. Men under the age of 30 receive drastic wage penalties for daytime work as compared with the reference group. In contrast, the wage penalty for these men is insignificant and rather in the case of shift workers. Table 5.5 additionally showed that these workers have a higher probability to choose to work shifts. The lower wage penalties are thus an indication for compensating wages to attract such workers (See also Hamermesh, 1999b for the US). In addition, higher levels of education are significantly better paid for daytime work. This corroborates the assumption of a higher earnings potential of these workers who thus avoid to work during non-standard hours. Finally, shift workers

have generally lower average weekly working hours. Here again, the regulation of the *Working Time Act (ArbZG)* might be one possible reason as it strongly restricts daily working hours in particular of night shifts.

The overall F-test rejects the equality of remunerations between all groups of workers. It follows that wage equations shall be estimated separately. The appropriate estimation method is thence a switching regression model with endogenous switching. Columns (3) and (4) of table 5.9 and (7) and (8) report the respective selection terms for the separate estimations. Consequently, shift workers but also men who work during unusual hours are negatively selected yet the selection term is not significant in these cases. In contrast, men who work during daytime hours but even to a greater extent those with standard working schedules are positively selected which suggests that they sort themselves into work during the day because of preferences or comparative advantage. Moreover, these men have large unmeasured components of daytime wages and can hence afford to use some of their earnings power to avoid working shifts (Hamermesh, 1999b). Shift workers and men with unusual schedules, in contrast, are not less suited for daytime work yet they seem to choose such jobs because of the associated wage premium (Kostiuk, 1990; Lanfranchi et al., 2002).

5.5.4 Wage Differentials by Wage Quantile

To get a better picture and to better understand the wage differential over the wage distribution, results obtained from quantile regressions for each 5th-percentile with 50 replications will be investigated. Unfortunately, a routine to control for sample selection is not readily available so that non selectivity corrected estimates are reported here. Yet, as shown earlier in this paper, since shift workers are significantly negatively selected, overall wage differentials will be downward biased. The coefficient estimates from quantile regressions must therefore be interpreted as lower limits. Since predominantly men with less favorable characteristics choose to work shifts, the downward bias will be stronger for men in the upper quantiles of the earnings distribution. Moreover, men with unusual working schedules who work not more than 10 hours per day do not tend to have systematically less unfavorable characteristics so that the estimates reported here are sufficient.

Figure 5.4 graphically represents the estimated wage premia for each 5th percentile of the earnings distribution. It shows a polarization of the wage differentials at the end points of the distribution for shift workers. Across the wage distribution, the differences in remunerations are rather U-shaped. Comparing wage differentials at the two extreme quantiles (0.95 and 0.05) reveals a difference of 2 percentage points. Shift workers at the 5th percentile earn wage differentials of 9.1 percent. Between the 15th and the 55th quantile, wage differentials are very similar and steeply increase afterwards.

Figure 5.4: Distribution of Working Hours by Worker Group.
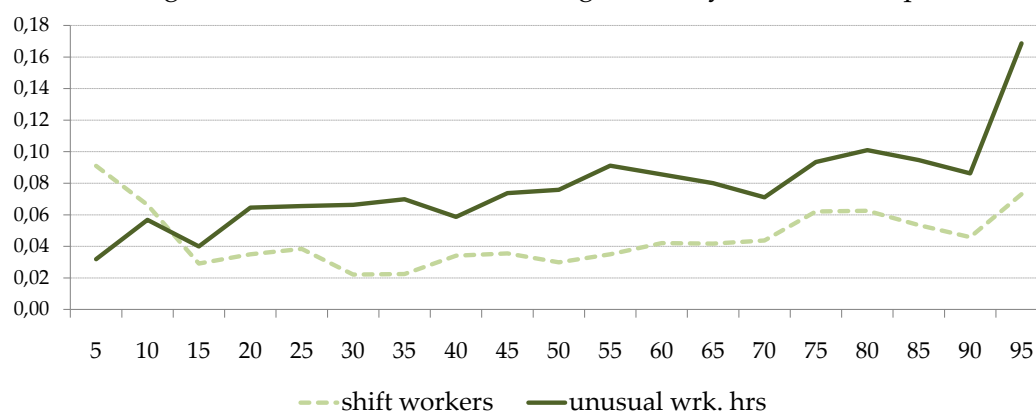
In comparison, wage differentials of men with unusual working schedules steadily increase by quantile. The difference between the extreme quantiles (0.95 and 0.05) amounts to 13.7 percentage points. Wage differentials are rather stable up to the 40th percentile and increase steadily thereafter. At the upper part of the earnings distribution, net hourly wage compensations for work during unusual hours increase to levels up to 10 percent and reach even 16.9 percent for the 95th quantile.

5.6 Conclusion and Discussion

15 percent of the European and the German workforce worked shifts in the year 2001 and such jobs are typically dominated by men. The average rate of shift work was with 10 percent lowest in France, Denmark and the Netherlands and reached 20 percent in the Northern countries as well as in Belgium, Italy and Austria in 2001. With a progressing economic globalization, shift work and to a growing extent work during non-standard hours have become fundamental work patterns and are now integral parts of the lifestyle of a large part of a nation's population. The resulting expansion of world demand required countries to react by, for example, relaxing work time regulations and also by prolonging shop opening hours. As a consequence, the distribution of working hours across a standard workday widened and shift work as well as work at unusual hours gained more importance and will continue to do so in the future.

The higher risks to health induced by these jobs require firms to give workers monetary incentives as compensation to attract workers to accept such jobs despite these risks. This paper analyzes these monetary incentives for men who either choose to work shifts or during unusual working hours. Treatment effect models reveal a significant and negative selection of shift workers but none for men who work during non-standard hours. Wage premia amount to 9 – 10 percent.

Separate estimations of hourly remunerations based on switching regressions with endogenous switching are not able to identify a significant negative selection into shift work or work at unusual hours. In contrast, daytime workers have large and positive unmeasured components which further increase their wages and which allow them to avoid work with undesired schedules. In addition, workers who devote more than 10 hours per day to market work tend to not be compensated financially for the associated work burden which are potentially outweighed by additional non-pecuniary aspects of the job such.

For a better understanding of the dynamics of wage differentials across the wage distribution, quantile regressions show a U-shaped impact across the earnings distribution. Hence, a polarization at the extreme points is revealed for shift workers. Wage differentials of men with unusual working hours, in contrast, tend to increase steadily by quantile. Accounting for the negative selection of shift workers would possibly intensify wage premia in particular for men at the upper part of the earnings distribution.

The significance of the selection term, its sign and magnitude further emphasize the importance of such working conditions for the German labor market. The combination of a sizeable wage differential, particularly at higher quantiles, and the high probability to work in such jobs among blue-collar and low-skilled workers suggests that such working conditions have a measurable impact on the overall distribution of wages. The fact that wage premia are highest at the upper end, might even entail a widening of the overall wage distribution. Since it is additionally workers in the lower half of the wage distribution that predominantly work in the early morning hours and thus contribute to a widening of the working hour distribution, the burden of such working schedules has hence to be disproportionately borne by already disadvantaged workers.

The sizeable wage differentials further imply higher opportunity costs for the respective workers which will further increase with a growing importance of such jobs. This will have however strong negative implications on the social life: higher opportunity costs of leisure further translate into a lower marginal utility of leisure and an increased difficulty to find suitable leisure companions which might in turn adversely affect well-being. These influences might mitigate the growth prospects expected from a widening of the working hours distribution (see also Jenkins and Osberg, 2005). The next chapter will elaborate on this aspect in more detail.

6 How Do Unusual Working Schedules Affect Social Life?

The widening of the working hour distribution complicates the coordination of social leisure. This paper examines the short- and long-run impact of unusual working schedules on social life using German Time Use Data for 2001/02. I find evidence that younger workers with higher than median earnings seem to accept higher levels of solitary leisure as investment and because of the substantial wage premia. Younger workers tend to substitute sleep with free time. Older workers, in contrast, tend to sleep less which can be interpreted as elevated risk of mental and physical health.

6.1 Introduction

The share of shift work in Germany rose steadily from 11 percent in the early 1990s to about 17 percent in 2008. Simultaneously, the dispersion of the working hours distribution increased not just due to the relaxation of work time regulations such as the shop opening hours but also the simultaneous expansion of employment in service activities. The importance of work during non-standard hours therefore increases and becomes more and more a fundamental pattern of the German workforce. It therefore influences the lifestyle of a large part of the population and has immediate consequences on social life in that the disconnectedness of a society's members intensifies (Burda, 2000). The implied decline in the marginal utility of leisure due to a lack of potential leisure companions and the resulting deterioration of social capital are likely to entail additional negative implications for an individual's well-being. The impact is even more severe if the higher fractions of solitary leisure are not due to higher preferences for aloneness (Putnam, 1995). In addition, non-standard working schedules are likely to disrupt the circadian cycle which has additional adverse effects on the worker's well-being and on physical and mental general health.[1]

The strong interest of medical and social sciences in the consequences of non-standard working schedules further underlines the perception that such working conditions are disamenities which workers try to avoid if possible.[2] Labor

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[1]The circadian cycle represents the regular recurrence of e.g. biological activities in cycles of approximately 24 hours from one stated point to another. See for example Culpepper (2010); Minors et al. (1986).

[2]See Presser (1988, 1995); Mellor (1986); Shiells (1987); White and Keith (1990); Mayshar and Halevy

economists generally believe that disamenities must be compensated with higher wages to attract workers to such jobs (Smith, 1776; Rosen, 1987; Kostiuk, 1990; Lanfranchi et al., 2002). However, the implications entailed by such working schedules on social life are important for understanding the additional threats to individual well-being but also to social capital have been largely ignored by economists so far.

The main objective of this paper is therefore to go beyond the examination of potential wage compensations and to investigate the repercussions of such work disamenities on social life. The analysis is based on a unique dataset, the German Time Use Data, for the year 2001/02 which allows for a direct investigation of social interaction. I explore potential short- and long-run implications by investigating the influences on the fraction of solitary leisure but also on the amount of sleep. Such an analysis is economically sensible as the exposure to higher levels of solitary leisure might increase psychological distress. A diminished probability of good leisure matches resulting from non-standard working schedules decreases the marginal utility of leisure (Jenkins and Osberg, 2005). This in turn adversely affects individual well-being. A reduction of individual well-being induced by the working schedules can potentially translate into adverse aggregate effects by mitigating the expected additional output from prolonged operating time.

An extensive exposure to non-standard working schedules over a longer time horizon is likely to increase the risk to mental and physical health. Work during non-standard working schedules itself disrupts the sleeping rhythm which aggravates with the length of exposure (Åkerstedt, 2003). The combination of less sleep and higher levels of solitary leisure are likely to increase the risk of depression or other health related problems and hence strongly reduce well-being (West et al., 1986; Aanes et al., 2010). Such long-run risks of depressions are detectable by analyzing sleep as about 90 percent of the depressive suffer from a deprivation of sleep (Tsuno et al., 2005). Neglecting these aspects in analyses that solely focus on pecuniary incentives, largely understates social costs associated with such working schedules. The direction of the causal impact of such jobs on social relations and mental health or well-being is not entirely clear yet (Skipper et al., 1990). But an investigation of the associated influences is very instructive.

Jenkins and Osberg (2005) develop a model of companionable time use and show that time use choices are not only influenced by the person's own timing of activities or of the spouse but also by any other potential leisure companion. The authors test the consistency of their theoretical model with British data and find evidence that the probability of accompanied leisure in a certain age group depends on the probability of others who also devote time to that activity. Burda (2000) and Burda and Weil (2005), in contrast, examine efficiency gains for shop owners from the extension of shop-opening hours by means of a general equilibrium model. The

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(1997) for social science research and Minors et al. (1986); Cunningham (1989); Skipper et al. (1990); Costa (1996, 2003); Folkard and Tucker (2003) for medical research.

authors argue that efficiency gains from longer opening hours be balanced against potential disadvantages arising from less coordinated leisure. The macroeconomic general equilibrium model allows the authors to derive testable implications about the impact of longer shop-opening hours on aggregate variables but they are unable to investigate the explicit consequences on solitary leisure. The current paper closes this gap in the existing literature by directly examining the interrelations between working schedules and solitary leisure in a labor supply framework.

The following section presents the simple theoretical motivation which builds the foundation for the subsequent empirical analysis. This section is followed by a description of data and variables as well as of the sample properties. Apart from that, the distribution of market work across a standard workday and differences in the timing of leisure for different groups of workers are described. Section 6.5 is devoted to the description and interpretation of the results for the short- and long-run consequences of unusual working schedules. Finally, section 6.6 concludes.

6.2 Theoretical Motivation

Before investigating the implications of the timing of working hours on social life and more specifically on the fraction of solitary leisure, I will present a very simple theoretical framework that builds the foundation for the subsequent empirical analysis. The following model is closely related to Jenkins and Osberg (2005).[3] Each individual maximizes his utility $U(C, L)$, by choosing the daily consumption bundle C and the amount of leisure L. I assume individual decision-making here, while the slightly more complex unitary household decision problem is given by Jenkins and Osberg (2005). Utility maximization is constraint by the available time per day as given by

$$T \;=\; L + H, \tag{6.1}$$

where H denotes the amount of hours worked and T is the total available time per day. The budget constraint can be formulated as:

$$C \;\leq\; wH + V, \tag{6.2}$$

with w denoting a vector of exogenously given wage rates and V is non-labor income. Hourly wages are allowed to vary over the day to account for wage premia paid to overtime hours or as compensation for more undesired hours.

During leisure time (L), a person can decide about the hours of leisure spent alone (A) or in the form of social leisure being enjoyed in the company of others

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[3] An alternative model is presented by Burda and Weil (2005) who use a general equilibrium model to investigate the influence of shop-opening hours on coordinated leisure and also on retail congestion.

(S). The total amount of leisure is thus the sum of time spent alone or with others: $L = A + S$. Given that working schedules are fixed, workers need to coordinate their time with others in order to socially interact. To find a suitable leisure match, people choose potential leisure companions from a ranked list. Social leisure is however uncertain ex ante because it depends on the mutual working schedules of both parties so that some leisure matches are not feasible during a particular day. The total utility derived from leisure can thus be rewritten as

$$U(C, L) \quad = \quad U(C, A, S_1, \ldots, S_n), \tag{6.3}$$

where $S_i, i \in \{1, \ldots, n\}$ denotes social leisure time with the ith leisure companion.

I additionally assume that people can decide to work during regular hours (H^R) or during unusual hours (H^U). People are furthermore assumed to work a certain fraction $\omega^R = [0, 1]$ of their daily working hours during the standard workday so that the number of daily working hours H can be reformulated as:

$$H \quad = \quad \omega^R H^R + \left(1 - \omega^R\right) H^U. \tag{6.4}$$

If people spend a higher fraction of work outside the standard workday, the process to find social leisure companions is hampered as the list of potential leisure matches diminishes. Since the list of leisure companions is ranked, it is furthermore assumed that the additional utility derived from social leisure increases by rank. A leisure match is created if both leisure partners agree to enjoy time with each other. The uncertainty of a feasible leisure match will be denoted by $p_i, i \in \{1, \ldots, n\}$. The expected utility derived from this match is hence $p_i U(S_i)$ and the total expected utility for each person can be parametrized as

$$E[U(C, L)] \quad = \quad U\left(C, A, \sum_{i \in k} p_i U(S_i)\right), \tag{6.5}$$

with k being the available list of potential leisure companions. Following MaCurdy (1981), equation (6.5) can be formulated as:

$$E[U(C, L)] = Y^C (C)^{\alpha_1} - Y^A (A)^{\alpha_2} + \sum_{i \in k} p_i Y^{S_i} (S_i)^{\alpha_3 + i}, \tag{6.6}$$

where $\alpha_j, \forall j \in \{1, \ldots, 3 + k\}$ are time invariant parameters that are common to all individuals. They have the property that $0 < \alpha_1, \alpha_{3+k} < 1$ which denotes decreasing returns and $\alpha_2 > 1$. Moreover, $Y^C, Y^A, Y^{S_i} > 0$ are functions of relevant and predetermined consumer characteristics such as age and educational level that affect preferences.

The probability to find a suitable leisure companion depends on the own available amount of free time of each person and on the working schedules of the potential

leisure companions. With longer working hours or a higher fraction of work during unusual hours, the average probability to find a suitable social leisure match declines. Hence, p_i is negatively associated with the amount of own working hours H and those of others that do not overlap with the own working hours H_{in}. The match probability can thus be expressed as:

$$
\begin{aligned}
p_i &= g\left(H + H_{in}\right) \\
&= g\left(\omega^R H^R + \left(1 - \omega^R\right) H^U + \omega_i^R H_{in}^R + \left(1 - \omega_i^R\right) H_{in}^U\right),
\end{aligned}
\tag{6.7}
$$

where $g'\left(H\right) < 0$ and $g'\left(H_{in}\right) < 0$. Equation (6.7) suggests that a higher degree of de-synchronized working schedules, compared to standard hours, resulting from an increase in H_{in} reduces the match probability and thus, the expected utility associated with a specific leisure match. The probability converges to 0 if the schedules do not overlap at all which implies that $\omega^R = 1$ and $\omega_i^R = 0$ or vice versa. The expected marginal utility from a leisure match is lowest in this case and also a synchronization of leisure with more preferred social companions is least likely. Jenkins and Osberg (2005) show that working hours increase unambiguously if social leisure is harder to arrange but no clear predictions are possible when it comes to the amount of time spent alone. Given that working hours for evening and night work are highly regulated and can only be extended under restrictive conditions implies that available time cannot be substituted with more market work. Consequently, the individual is more likely to spend a higher fraction of his total free time alone. The probability p_i of a successful leisure match is highest if the working schedules of both potential leisure companions overlap as much as possible meaning that $H_{in} \to 0$.

For the derivation of the estimation equation, λ will be associated with the budget constraint as given by equation (6.2). Maximizing the expected utility function (6.6) subject to the time constraint (6.1) and the budget constraint (6.2) yields the first order condition for solitary leisure time:

$$
\lambda w = \alpha_2 Y^A \left(A\right)^{\alpha_2 - 1}.
\tag{6.8}
$$

Taking logs and assuming that $Y^A = \mathbf{X}\rho + u$ yields, after re-arranging:

$$
\log A = \theta + \delta \log w + \mathbf{X}\beta + \eta,
\tag{6.9}
$$

where $\theta = \frac{\log \lambda + \log \alpha_2}{\alpha_2 - 1}$, $\delta = \frac{1}{\alpha_2 - 1}$, $\beta = -\delta\rho$ and $\eta = -\delta u$. Let us assume that not the log of the total amount of leisure time spent alone is examined but rather the fraction of solitary leisure relative to the total amount of leisure time $(A + \sum_{i \in k} S_i)$. This fraction will henceforth be denoted by a. The final estimation equation in

matrix form can thus be formulated as:

$$a = \delta \log w + \mathbf{X}\beta_1 + \mathbf{H}\beta_2 + \beta_3 U + \epsilon, \tag{6.10}$$

where $\epsilon = \theta_A + \eta$ is a compound error term, individual characteristics are captured by predetermined individual characteristics $\mathbf{X}$ and household information $\mathbf{H}$. U is an indicator variable denoting whether or not a person works during unusual hours. If preferences for solitary leisure of men who work during unusual working schedules do not differ systematically from those who work during normal working hours, the preference indicator θ is random and will therefore be part of the error term. Equation (6.10) can thus be estimated by simple OLS. If people with a higher preference for solitary leisure systematically select themselves into work during unusual schedules, estimates obtained by OLS are likely to be upward biased. The preference indicator θ will then be non-random and selectivity must be accounted for.

6.3 Identification Strategy

To control for the potential endogeneity between the choice of the timing of market work and the resulting implications on social life, I will apply an instrumental variable approach with three different instruments which address different potential channels of impact.

As shown in chapter 5 of this dissertation, people are attracted to shift work because of the wage premia. I account for this by using the average wage of full-time employed male workers by occupation and industry in 1991/92. This instrument accounts for the fact that workers rather accept unusual working schedules when wages are high enough. In addition, I use the rate of solitary leisure by occupation and industry in 1991/92 as well as its interaction with the rate of shift work or alternatively the rate of unusual working schedules by occupation and industry in the same year. This instrument accounts for preferences of being alone and also for such preferences in combination with shift work. The argument here is that people with a strong dislike for being alone would rather not work in industries or at hours when social interaction is more difficult and social leisure companions are more difficult to find.

6.4 Data and Descriptive Statistics

The analysis of this paper is based on German Time Use Data (*Zeitbudgeterhebung*) for the year 2001/02 collected by the German Federal Statistical Office (Statistisches Bundesamt, 2003). The data set is particularly interesting for the present study as it provides – apart from the usual socio-economic, work and household characteristics

– detailed information about the timing of activities for each 10 minute time interval during a day for each respondent. An additional feature that makes this dataset particularly suitable to this study is the additional information about who each time slot is spent with. This allows me to directly infer from the data how much of the total leisure is indeed spent without company and when so. The analysis of this paper is restricted to full-time employed men aged between 25 and 59 in dependent employment.

Following Burda et al. (2007) the more than 200 daily activities are aggregated into four major categories: pure leisure, paid market work, household work and tertiary time of which the first three are relevant for the current study.[4] More specifically, pure leisure (L), which is also referred to as the narrow definition of leisure (Burda et al., 2006), comprises all activities that are pleasurable but that do not need to be undertaken at all and nobody can be paid to do them. It subsumes activities such as organized leisure activities,[5] sports, games, reading and writing, watching TV as well as listening to the radio. Market work (MW) is defined as all direct job related activities of primary and second jobs, but also comprises time spent on internships, qualification and education on or for the job, job search as well as breaks during the workday and work-related travel time. Other activity aggregates will not be regarded in more detail in this chapter.

6.4.1 Description of the Variables

For the analysis of the influence of working schedules on social life, the same two definitions from Chapter 5 will be used here. The first group of workers with unusual working schedules comprises all shift workers. Each respondent indicates whether he works morning, evening, rotating or another kind of shift. All these categories are combined into a single indicator of shift work. A person belonging to this group will be referred to as *self-reported shift worker*. The relevant reference group consists of all men who do not report working shifts and will be called daytime workers from now on.

The second definition refers to all those men who work during non-standard hours. This information is directly derived from the diary information. Again, a person is defined to work during *unusual hours* if more than 30 percent of his total working hours lie outside this period.[6] To not wrongfully define people as working

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[4]Intervals of commuting or traveling time are added to the related activity. It can be further noted that an aggregation of the activities into these broad measures is inherently arbitrary.

[5]Organized leisure is defined as all those activities that involve amongst other things volunteerism or informal help for other households.

[6]The Bureau of Labor Statistics (BLS) suggests to define shift work as any schedule in which more than half of the hours fall outside of a period between 8 am and 4 pm (Mellor, 1986). Since only full-time employed men are regarded and in order to have a large enough sample, men who work during unusual hours are defined, in contrast to the BLS, if more than 30 percent of working hours lie outside of the standard workday.

with unusual schedules because they generally work very long hours, I restrict the attention in this chapter to those men who devote not more than 10 hours market work per day (see also Chapter 5). The reference group for this group of workers consists of all other men and will be referred to as men who work during usual or normal working hours from now on.

The two groups of workers are yet not exclusive and table 6.1 shows the respective overlap. 67 percent of the men who work during unusual hours also report shift work and about 42 percent of the shift workers additionally work at non-standard hours. Among all those men who do not report working shifts, about 12 percent work during non-standard hours. Of those men who are defined to work during standard hours, about 19 percent also report shift work.

Table 6.1: Overlap between Shift Work and Men with Unusual Working Hours and the Respective Reference Groups.

	reported		
	shift workers	daytime workers	N
unusual hours	311	153	464
standard hours	455	1946	3154
N	766	2099	2807

The diary information as well as information about who the respective time slot is spent with, make the dataset unique and particularly well-suited for this study. Yet, there are some shortcomings as no information on the employment history nor on job tenure is available. Hence, the data provides no information about the previous experience of shift work or the duration of the rotation schedule for men who work in rotating teams. These variables help to determine the risks of longer-run exposure to such jobs on social life. It is therefore likely that the results obtained here upward biased and are lower if it was possible to control for these influences.

I furthermore control for a number of standard predetermined demographic variables that have an impact on social life. These are the worker's age in 3 categories (younger than 35, 35-45 (reference group) and older than 45), educational attainment in three broad categories (low, medium (reference category) and high skills), a dummy for being married, for the presence of children under the age of 6 and for kids aged between 7 and 17 living in the household, for living in Western Germany as well as an indicator about whether or not the wife is not employed. Furthermore, I add the log of usual weekly working hours.

6.4.2 Sample Description

Descriptive statistics by worker group are reported in table 8.1 in the Appendix and are very similar to those presented in the previous chapter. It shows that shift workers and men with unusual hours are slightly younger, less educated and tend to have slightly more kids.

Not only are shift workers and men who work during unusual hours different from the respective reference group but the two groups themselves differ considerably. Men who work during unusual hours are generally better educated than self-reported shift workers but they are also slightly less likely to be married and have slightly more kids. Shift workers are less likely to have kids under the age of 6 but tend to have a higher probability to have kids above the age of 6. Shift workers earn on average lower hourly wages but due to differences in educational levels, a mean comparison is not meaningful here.

6.4.3 The Timing of Activities

Figure 6.1 represents the distributions of working hours for self-reported shift workers (dashed line) and of men who work during unusual hours (solid line). The vertical lines indicate the standard workday as defined in this paper. The working hour distributions of men who work shifts or during unusual hours differ from each other which is particularly pronounced during the evening hours. As before, the average workday of shift workers tends to be slightly shifted to the left as compared with the standard workday, i.e. it starts and finishes slightly earlier than the standard workday. Around 10 pm, the incidence of shift work amounts to about 25 percent. Work at night is less likely but still occurs with a probability of about 10 percent between midnight and 4 am. Men, who work during unusual hours, are most likely to work between 6 am and 10 pm. Around 10 pm, the probability to work is still pronounced and amounts to 40 percent. Hence, the figure suggests that it is not so much the incidence of work during nights that is expected to have the strongest adverse effect on social life and thus on social interaction, but rather work around the margins of the working hours distributions, i.e. the early morning and late evening hours.

To visualize the interdependence between the allocation of market activities as well as solitary and accompanied leisure, figure 6.2 depicts differences in the incidence (F_t) at each time interval t for the standard workday between men who report working shifts (gray lines) and of men who work during unusual hours (black lines) from the respective reference group:

$$\Delta_t \quad = \quad F_t(U = 1) - F_t(U = 0), \tag{6.11}$$

with U being a dummy variable that indicates whether the person works shifts or not or alternatively whether he works during unusual hours or not.[7] Straight

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[7]Dan Hamermesh has largely examined the impact of changes in working schedules over time for

Figure 6.1: Distribution of Working Hours by Worker Group.
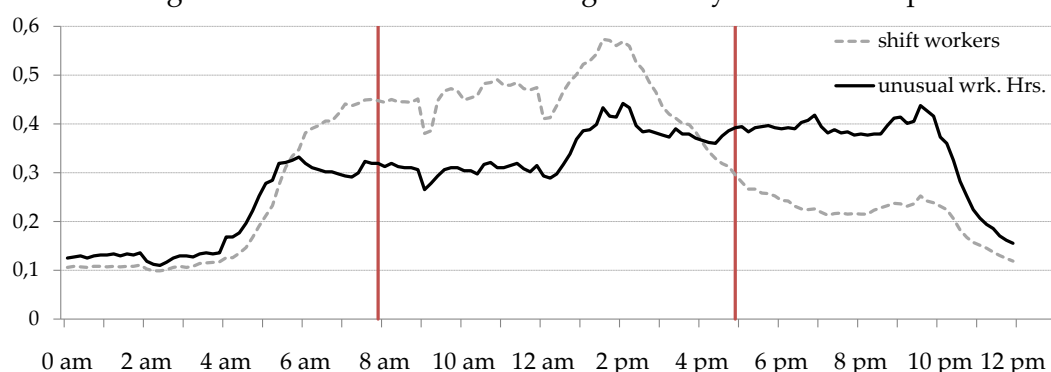
Figure 6.2: Differences in the Distribution of Accompanied and Unaccompanied Leisure for Men Who Work Shifts (Gray) and Who Work During Unusual Hours (Black) with the Respective Reference Group.
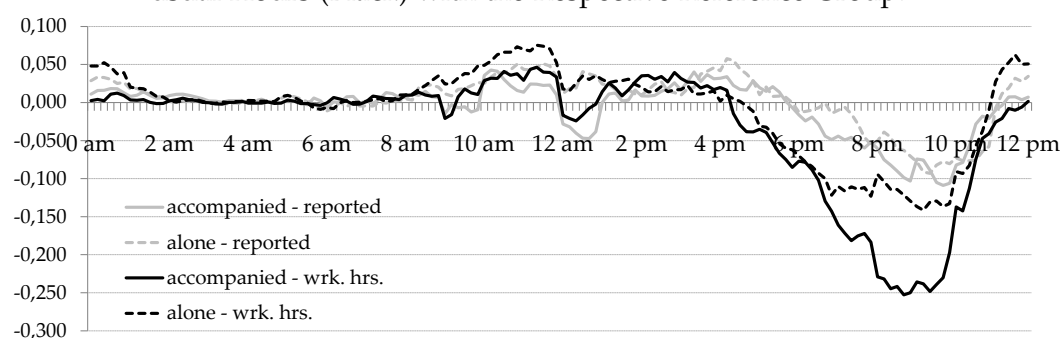
lines represent differences in the incidence of accompanied leisure by time interval and dashed lines refer to differences in solitary leisure. The figure suggests that differences in the allocation of leisure between the groups of workers are highest in the later evening hours between 6 pm and 12 pm. Since the propensity to work is largest during these time intervals, the incidence leisure is significantly reduced. The differences are most pronounced for men who work during unusual hours and hence the incidence of accompanied leisure is most strongly diminished. Between 8pm and 10 pm accompanied leisure of this group of men is about 25 percent less likely as compared to the reference group. In contrast, leisure is enjoyed to a higher extent during standard working hours but is more likely to be spent alone which demonstrates the higher social disconnectedness of these workers. Since the average workday of shift workers starts and finishes slightly earlier than the average workday of all workers, also leisure is more likely to be enjoyed earlier.

As shown by table 6.2, full-time employed men spend about 4 hours of their daily available time on purely enjoyable activities (pure leisure). A comparison of average hours of leisure reveals no big difference between shift workers and the reference group. These workers are found to differ with respect to the *timing* of

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various countries and for various different questions (1996; 1999a; 1999b; 2002).

Table 6.2: Selected Descriptive Statistics on the Timing of Leisure as well as Hours of General and Solitary Leisure and Market Work.

	all	reported		working hours	
		shift wrk	day wrk	unusual	usual
fraction of men enjoying leisure at:					
3 am	0.004	0.004	0.004	0.003	0.004
9 am	0.106	0.115	0.104	0.111	0.105
3 pm	0.066	0.097	0.058	0.100	0.057
9 pm	0.713	0.556	0.754	0.398	0.797
average daily hours:					
leisure	4.04	4.01	4.05	4.12	4.55
	(2.06)	(2.20)	(2.02)	(2.49)	(1.99)
solitary leisure	1.62	1.66	1.61	1.88	1.75
	(1.56)	(1.54)	(1.56)	(1.70)	(1.63)
market work	8.66	8.47	8.73	6.90	7.82
	(2.90)	(2.85)	(2.91)	(3.26)	(2.53)
sleep	7.17	7.21	7.16	7.60	7.21
	(1.43)	(1.78)	(1.29)	(2.01)	(1.36)
N	3915	967	2948	464	2401

Standard deviations are given in parentheses.

activities yet not the enjoyment in absolute hours. Men who work during unusual hours enjoy slightly more leisure and, workers who are defined to work during standard hours, in contrast, tend to spend almost half an hour more time than every other group.

The table additionally reports the amount of average actual daily working hours by group. It shows that men with unusual working hours tend to work on more than 1.5 hours less on average than men who report working shifts. The *Working Time Act (ArbZG)* restricts working hours of night work to 8 hours which can be extended to 10 hours per day provided that an average of 8 hours is maintained over a 6 months or 24 week period or alternatively in emergencies and extraordinary circumstances. This regulation might explain the lower average working hours of men who work with unusual schedules.[8] Also those men who work at standard hours yet not more than 10 per day are found to work on average only about 7.8 hours.

As mentioned before, sleep might be disrupted by unusual working schedules. Hence, table 6.2 presents the average hours of sleep by group. In total, all workers tend to spend about 7 hours sleeping without significant differences for shift and

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[8]See also §6 of the Arbeitszeitgesetz (ArbZG).

daytime workers. In contrast, men who work during unusual hours tend to spend significantly more time on this activity than all other groups of workers. One possible explanation is that these men substitute away their leisure time with sleep in order not to have even greater amounts of solitary leisure. In addition, work performed rather at the fringes of the workday yet not during nights does not disrupt the circadian cycle and thus the sleeping rhythm. A second explanation is therefore that workers with such schedules need to rest more in order to recover from the burden of work. In this context, more time devoted to sleep cannot be interpreted as a sign for an increased risk to health per se yet a longer exposure might aggravate stress and thus reduce well-being. The next section will explore these possible explanations in more detail. Besides, it needs to be mentioned that the standard deviations of the amount of sleep are strongly elevated for shift workers and for men who work during unusual hours. The dispersion is thus stronger and will also be explored more closely.

Table 6.3: Fractions of Solitary Leisure by Age Group and Mean Earnings.

	all	reported		working hours	
		shift wrk	day wrk	unusual	usual
solo leisure: all	0.411	0.432	0.403	0.477	0.388
	(0.326)	(0.329)	(0.325)	(0.319)	(0.313)
by age group:					
solo leisure: ≤ 35	0.418	0.417	0.419	0.448	0.381
	(0.334)	(0.324)	(0.337)	(0.313)	(0.311)
solo leisure: $35 - 45$	0.396	0.439	0.378	0.493	0.372
	(0.322)	(0.334)	(0.316)	(0.317)	(0.308)
solo leisure: ≥ 45	0.424	0.427	0.423	0.471	0.407
	(0.328)	(0.323)	(0.329)	(0.326)	(0.319)
by position in the wage distribution:					
solitary leisure: ≤ 50 %	0.443	0.428	0.449	0.493	0.415
	(0.347)	(0.356)	(0.344)	(0.330)	(0.336)
solitary leisure: ≥ 50 %	0.412	0.436	0.403	0.471	0.401
	(0.316)	(0.311)	(0.318)	(0.323)	(0.308)

Standard deviations are given in parentheses.

In addition, table 6.2 reports the average hours of time that men spent without company on solitary leisure. Even though men with unusual working schedules devote on average less time to market work and enjoy similar hours of leisure than the average worker, they simultaneously spent more of their total alone. In addition to this, table 6.3 shows the fraction of solitary leisure relative to the total amount

of time spent on purely enjoyable activities. All men spend on average about 41 percent of their total leisure time alone. This fraction is 2 – 6 percentage points higher for shift workers and for men with unusual working schedules. In contrast, solitary leisure fractions of those men belonging to the respective reference groups are significantly lower in particular men who work during the standard workday.

The table further reports differences in the fraction of solitary leisure by age group. It shows that solo leisure is generally lowest for workers aged 35 – 45 and is highest for workers older than 45. While the timing of solitary leisure of shift workers does not seem to differ for workers belonging to the youngest and oldest age group, prime age shift workers tend to spend on average about 6 percentage points more of their total leisure time alone. When it comes to men who work during unusual hours, the table reveals that these men tend to have always higher fractions independent of the age group. Differences in the unconditional means are again highest for prime aged men who tend to have 12.1 percentage points higher fractions of solitary leisure.

Table 6.3 also depicts unconditional means for the fraction of solitary leisure by position in the wage distribution. Solitary leisure fractions are highest for workers who earn lower than median wages. Shift workers in the lower half of the wage distribution are slightly less alone than the reference group yet the relationship is reversed for the upper 50 percent. The picture is very different for men who work during non-standard hours. Those men who have than median earnings spent almost half of their total leisure time without company. In contrast, men with standard working hours have on average 7 – 8 percentage points lower fractions of unconditional solitary leisure. In the following section, I will analyze in more detail whether there is evidence that young workers accept unusual working schedules from an investment perspective to accumulate additional income (see also Chapter 5).

6.5 How is Social Interaction Affected?

Work at unusual hours complicates social interactions with others as it gets increasingly more difficult and hence more costly to find suitable leisure companions (Jenkins and Osberg, 2005; Burda and Weil, 2005). The result is a deterioration of social capital (Putnam, 1995; Burda, 2000). The theoretical motivation suggests that the utility derived from social leisure decreases for these workers. The magnitude of the resulting decrease in marginal utility depends on the general distribution of working hours as well as of the working schedules of friends and family but also on individual preferences. The widening of the working hour distribution which has positive influences on output from the firm's perspective is however outweighed to some extent by additional negative externalities on the employee's

overall well-being. In the medium and long-run, even individual health and therefore productivity of workers might be impaired which further adversely affects firms. Jenkins and Osberg (2005) argue furthermore that working hours unambiguously increase when social leisure is harder to arrange which implies that workers substitute leisure by additional work. The predictions for the determination of the sign of the impact on solitary leisure are however not clear-cut. The reason is that each person is not only affected by his own working schedules but also by those of potential leisure companions. To account for these differences in the absolute amount of time, I will estimating the impact of working schedules on solitary leisure relative to the total amount of leisure time as reported by equation (6.10).

6.5.1 Results for all Workers

Coefficient estimates of the group identifier variable for OLS and IV regressions are reported in table 6.4. Each entry corresponds to an estimate of the indicator variable of separate regressions. The first column of the table reports coefficient estimates of the differences in the fraction of solitary leisure for the respective groups. Accordingly, shift workers tend to have 3.8 percentage points higher fractions of leisure without company. When endogeneity is accounted for, the estimates show that shift workers tend be on average about 7.5 percentage points more alone. The critical value of the first stage *F*-test is 176.59 in this case and reveals that the instruments are rather strong so that the IV estimates are convincing.

Among the shift workers, about 59 percent report also to work during standard hours so that the organization of social leisure is allegedly easier on average given the general distribution of working hours over a standard day. The estimates on solitary leisure are about 5 percentage points higher for men who work during unusual hours. The total difference amounts to an average of 9 percentage points higher fractions. When endogeneity is accounted for, the difference is even higher and amounts to about 16 percentage points more solitary leisure that is spent without others. Here again the *F*-test for the strength of the instruments shows again that the instruments are relatively strong. Since only those workers with less than 10 hours work per day, the overlap of leisure with potential leisure companions is likely to be more difficult and hence the organization of leisure matches.

Moreover, table 8.2 shows that significant selection cannot be detected which suggests that workers among the different groups are not systematically different in their unobserved components. The estimates show that the inverse Mill's ratios of a treatment effect models are not significantly different from zero. The exclusion restriction for the choice to work shifts or during unusual hours are the same as in the previous chapter, namely the rate of shift work or work during unusual hours by occupation and industry for the first wave of the survey. The estimates

Table 6.4: Coefficient Estimates of the Group Indicator on the Fraction of Solitary Leisure (1) and the Satisfaction with the Allocation of Time Devoted to Work (2), Leisure (3) and Friends (4).

| | fraction of solo leisure | satisfaction w/ timing of | | |
| | | work | leisure | friends |
	(1)	(2)	(3)	(4)
OLS or linear probability model:				
self-reported shift workers	0.038*	-0.039*	0.025	-0.025
	(3.01)	(1.92)	(1.23)	(1.21)
workers with unusual hours	0.092*	-0.051*	0.007	-0.033
	(5.51)	(1.89)	(0.25)	(1.17)
IV regressions				
self-reported shift workers	0.075*	-0.077	-0.006	0.018
	(2.41)	(1.56)	(0.13)	(0.37)
first stage $F-$ test	176.59	177.17	176.89	177.57
workers with unusual hours	0.162*	-0.037	0.178	0.188*
	(2.43)	(0.40)	(1.64)	(1.65)
first stage $F-$ test	40.22	52.66	41.66	37.77

Absolute t-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having children and having kids under the age of 6 and between 6 − 17, Western Germany, a non-employed wife, the log normal working hours.

for this term are highly significant. It can hence be concluded that it is sufficient to concentrate on the OLS estimates in the remainder of this chapter.

The remaining determinants of solitary leisure are reported in table 6.5. Accordingly, age and skill levels do not affect the fractions of solo leisure significantly. The only exception is that men under the age of 35 tend to have lower fractions of solo leisure. The estimate is significant when working schedules are regarded. Married men, those with kids as well as men who have a non-employed wife tend to have lower fractions, which is unsurprising given that these characteristics facilitate social interaction. Longer average weekly working hours are found to have a different impact depending on whether shift workers or men with unusual hours are considered. In addition, men who live in households with kids tend to spend less leisure alone. The table reveals that parents with kids under the age of 6 have about 8 − 9 percentage points lower fractions of solitary leisure. Households with kids above the age of 6 tend to spend on average 4 − 5 percentage points less solo leisure. Moreover, the region of residence does not when fractions of unaccompanied leisure time are regarded.

To better understand of the potential role of preferences, I further examine differences regarding the satisfaction with the allocation of time for different

Table 6.5: Determinants of Solitary Leisure for Shift Workers and Men with Unusual
Working Hours.

	shift work		unusual hrs	
	OLS	IV	OLS	IV
shift indicator:				
indicator	0.038*	0.075*	0.092*	0.162*
	(3.01)	(2.41)	(5.51)	(2.43)
personal characteristics:				
age: ≤ 35	−0.021	−0.019	−0.038*	−0.041*
	(1.27)	(1.17)	(2.06)	(2.18)
age: > 45	0.004	0.009	0.004	0.006
	(0.33)	(0.70)	(0.28)	(0.43)
low skilled	−0.013	−0.020	0.015	−0.009
	(0.34)	(0.50)	(0.32)	(0.18)
high skilled	−0.002	0.011	0.025	0.040*
	(0.12)	(0.53)	(1.27)	(1.68)
married	−0.191*	−0.190*	−0.162*	−0.157*
	(9.99)	(9.89)	(7.61)	(7.16)
household information:				
kids under 6	−0.090*	−0.087*	−0.083*	−0.079*
	(4.92)	(4.74)	(4.20)	(3.90)
kids 6-17	−0.056*	−0.056*	−0.047*	−0.044*
	(4.03)	(4.02)	(3.06)	(2.82)
Western Germany	0.011	0.016	0.028	0.042
	(0.48)	(0.70)	(1.16)	(1.53)
not employed partner	−0.056*	−0.053*	−0.062*	−0.062*
	(4.70)	(4.45)	(4.75)	(4.75)
work information:				
normal wrk. hrs (log)	0.003	−0.008	−0.054	−0.079
	(0.06)	(0.18)	(1.15)	(1.51)
constant	0.398*	0.451*	0.648*	0.779*
	(1.72)	(1.95)	(2.51)	(2.75)
observations	3609	3599	2648	2648
R^2	0.091	0.089	0.094	0.088

Absolute *t*-statistics in parentheses. * indicate significance levels
of 10 % or higher; standard errors are robust.

domains. The combination of these results might help to gain further insights
into potential consequences on the marginal utility of leisure and hence on well-
being. Table 6.4 reports coefficient estimates of the indicator variable from linear
probability models on the satisfaction with the allocation of time devoted to work

(2), leisure (3) and friends (4).[9] These estimates show that men who work shifts tend to be on average about 8 percent less satisfied with the allocation of their working hours as compared to the reference group. Men with unusual working hours even tend to have 3.7 percentage points lower levels of satisfaction. These estimates refer to differences in the satisfaction with the *timing* of work. Hence the results underline findings of the previous chapter according to which workers choose such jobs because of the higher associated wages yet not because of differences in preferences.

Moreover, the last column of table 6.4 reports differences with respect to the levels of satisfaction with the allocation of time with friends. Both groups, shift workers and men with unusual hours, tend to report lower average satisfaction levels which are not significant though in the case of simple OLS regressions. Yet, when endogneity is accounted for, these estimates reveal a positive influence in particular for men who work during undesirable hours. Finally, when the satisfaction with the allocation of leisure is regarded, as reported by column (3), no accurate estimates for the differences between the groups can be found. The combination of these last findings emphasizes the earlier made assumption that workers but in particular shift workers do not choose to work in such jobs due to different preferences for social leisure. In fact, the resulting working schedules of these jobs are disruptive in terms of social interaction and hence are likely to reduce the marginal utility that people derive from such jobs.

The remaining determinants of the separate satisfaction regressions are reported in table 6.6. It shows that men who are younger than 35 and to some extent also those older than 45 are more satisfied with the timing of their working hours as compared to the reference group. Older men, in addition also tend to be marginally more satisfied with the allocation of personal leisure although the coefficient is not very accurately measured. Married men and those with a non-working wife further tend to report higher levels of satisfaction. Coordination within such couples or finding a suitable leisure companion is on average easier which is reflected by the higher levels of satisfaction with the allocation of time for leisure and friends. In contrast, men with children and in particular with children younger than 6 tend to report lower average satisfaction levels. This suggests that reconciliation of work, family and friends is more difficult for these men. In addition, lower skilled workers tend to devote significantly lower satisfaction with the allocation of leisure. However, it must be noted, that lower educated workers tend to report in general lower levels of satisfaction (Blanchflower and Oswald, 2004).

The combination of these results is interesting and sheds more light on the potential underlying preferences for spending time alone. A coordination of schedules with others is easier and less costly for married men who consequently

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[9]Men are defined to be satisfied with the time allocation for market work, leisure and friends when they report higher than average satisfaction levels. All others are reported as being not satisfied.

Table 6.6: Coefficient Estimates from IV Regressions of Linear Probability Models for the Determinants of Satisfaction with the Allocation of Time Devoted to...

	shift workers			working hours		
	... work (1)	... leisure (2)	... friends (3)	... work (4)	... leisure (5)	... friends (6)
shift indicator:						
indicator	−0.077	−0.006	0.018	−0.037	0.176	0.188*
	(1.56)	(0.13)	(0.37)	(0.40)	(1.64)	(1.65)
personal characteristics:						
age: ≤ 35	0.117*	0.015	−0.012	0.120*	0.012	−0.013
	(4.43)	(0.58)	(0.47)	(4.36)	(0.39)	(0.39)
age: > 45	0.032	0.033	0.020	0.038*	0.030	0.021
	(1.51)	(1.58)	(0.91)	(1.83)	(1.25)	(0.83)
low skilled	−0.011	−0.151*	0.009	−0.024	−0.262*	−0.078
	(0.17)	(2.46)	(0.15)	(0.36)	(3.08)	(0.90)
high skilled	−0.060*	−0.047	0.025	−0.040	0.037	0.045
	(1.83)	(1.42)	(0.77)	(1.10)	(0.93)	(1.10)
married	0.029	0.008	0.086*	0.028	0.010	0.060*
	(1.01)	(0.29)	(3.00)	(0.92)	(0.30)	(1.73)
household information:						
kids under 6	−0.094*	−0.170*	−0.095*	−0.091*	−0.152*	−0.081*
	(3.20)	(5.75)	(3.16)	(3.05)	(4.37)	(2.30)
kids 6-17	−0.031	−0.045*	−0.027	−0.031	−0.025	−0.003
	(1.42)	(2.06)	(1.19)	(1.36)	(0.99)	(0.12)
Western Germany	−0.002	0.074*	0.125*	0.002	0.126*	0.159*
	(0.05)	(2.06)	(3.48)	(0.04)	(2.84)	(3.51)
not employed partner	0.059*	0.058*	0.034*	0.055*	0.080*	0.060*
	(2.89)	(2.91)	(1.66)	(2.70)	(3.48)	(2.51)
work information:						
log avg. wrk. hrs	−0.016	−0.146*	−0.296*	−0.011	−0.222*	−0.354*
	(0.22)	(1.96)	(4.17)	(0.13)	(2.38)	(3.85)
predicted errors	0.040	−0.083	−0.258*	0.038	−0.220*	−0.329*
	(0.57)	(1.20)	(3.72)	(0.43)	(2.42)	(3.57)
observations	3527	3584	3458	3535	2632	2535

Absolute *z*-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust.

tend to spend lower fractions of their total leisure time alone. They additionally tend to be more satisfied with the allocation of working hours and with the time spent with friends. The same holds for men with non-employed wives as these women can more flexibly adapt their schedules to match their husbands' which facilitates the coordination and hence increases utility derived from leisure. This is in accordance with Sullivan (1996) who finds that people derive the highest levels of utility from spending leisure with the spouse. Men with children also tend to have lower fractions of solo leisure yet it seems harder for them to combine

family and work. This is reflected by the generally lower levels of satisfaction with the allocation of work, leisure and friends. Men under the age of 35 also tend to spend lower though only partly significant fractions of their total leisure time alone. In addition, they tend to be more satisfied with the timing of their working hours. One might argue that full-time employed men in this age group are more career-oriented and tend to be more idealistic than workers in other age groups. Table 6.6 further reveals that West Germans tend to be more satisfied with the allocation of time devoted to leisure and friends as compared to East German workers even though there are no differences in the fraction of solitary leisure. Finally, longer average weekly working hours are positively associated with aloneness fractions of shift workers but negatively with levels of satisfaction. In contrast, longer average working hours in the case of men who work with unusual schedules tend to be associated with lower average levels of solitary leisure but the influence on levels of satisfaction is also negative.

Determinants of solitary leisure might be entirely different for workers belonging to the separate groups. Table 6.7 represents separate estimation results for shift and daytime workers as well as for men with usual and unusual working hours. Additionally, the table shows *t*-tests for each coefficient estimate between the groups. An *F*-test of equality for all coefficients is further reported in the last line of this table. This test clearly rejects equality at 10 percent significant levels for all groups. Hence, the overall impact of the explanatory variables on solitary leisure differs considerably between the respective groups. The determinants should consequently be analyzed separately.

The table shows that while shift workers above the age of 45 have generally lower levels of solitary leisure, the opposite holds for men who work during the day. In addition, shift workers with kids under the age of 6 as well as those with a non-employed wife have significantly lower fractions when they work during the day which suggests that shift work has a more disruptive influence on social leisure and hence hampers the reconciliation of family and work considerably. Section 6.5.2 is devoted to further examine such influences. Column (6) shows *t*-tests for the differences in the determinants of solitary leisure between men who work during standard and those with non-standard working hours. It follows that older men who work during unusual hours differ significantly in their fractions of solitary leisure. While those who work at unusual hours have lower fractions, they tend to be less alone when they work during normal hours. Like before, men with unusual hours without an employed partner tend to have significantly less negative estimates of solitary leisure as compared to men who work at standard hours. This further underlines the disruptive influence of such schedules in the possibility for social interaction.

Table 6.7: Determinants of Solitary Leisure by Group and *p*-Values of a *t*-test for Equality of OLS Regressions.

	shift workers			unusual hours		
	shift (1)	day (2)	test (3)	unusual (4)	usual (5)	test (6)
personal characteristics:						
age: ≤ 35	−0.041	−0.015	0.475	−0.046	−0.037*	0.849
	(1.33)	(0.78)		(1.06)	(1.82)	
age: > 45	−0.056*	0.027*	0.008	−0.057	0.016	0.093
	(2.06)	(1.79)		(1.40)	(1.04)	
low skilled	0.004	−0.012	0.841	−0.012	0.033	0.656
	(0.07)	(0.23)		(0.15)	(0.56)	
high skilled	−0.033	0.019	0.235	−0.005	0.031	0.515
	(0.85)	(0.92)		(0.11)	(1.47)	
married	−0.171*	−0.197*	0.542	−0.109*	−0.174*	0.244
	(4.64)	(8.80)		(2.18)	(7.44)	
household information:						
kids under 6	−0.142*	−0.070*	0.078	−0.112*	−0.074*	0.501
	(4.15)	(3.25)		(2.19)	(3.48)	
kids 6–17	−0.069*	−0.051*	0.568	−0.008	−0.054*	0.304
	(2.61)	(3.10)		(0.21)	(3.24)	
Western Germany	−0.046	0.038	0.101	0.008	0.035*	0.674
	(1.05)	(1.42)		(0.15)	(1.31)	
partner not empl.	−0.133*	−0.029*	0.000	−0.114*	−0.053*	0.101
	(5.58)	(2.13)		(3.33)	(3.79)	
work information:						
log normal wrk. hrs	0.159*	−0.065	0.023	−0.099	−0.056	0.741
	(1.86)	(1.31)		(0.83)	(1.10)	
predicted error term	0.224*	0.013	0.000	−0.046	0.056	0.493
	(2.60)	(0.25)		(0.37)	(0.88)	
observations	3609			2648		
p-value for equality	0.004			0.044		

Absolute *t*-statistics in parentheses. * indicate significance levels of 10 % or higher; errors are robust.

6.5.2 Results when Coordination is Less Costly

As described above, married men and those with kids tend to have significantly lower levels of solitary leisure. Coordination is clearly less costly for these men as potential leisure companions can always be found in the same household. Yet, the results also suggest that the timing of market work is crucial. To test whether the

overall results shown so far are driven by these coordination advantages and also to explore how disruptive these schedules are, I will now examine the impact of the allocation of work by marital status and the presence of children.

Results are reported in table 6.8. While married shift workers tend to spend about 9.8 percentage points more on solitary leisure, no significant differences are obtained for non-married shift workers. In addition, men who work with unusual schedules are found to have 16 percentage points higher fractions of solitary leisure when they are married but also non-married men tend to spend about 10 percentage points more time alone. The estimate is however not very accurately measured.

Table 6.8: Coefficient Estimates of the Group Indicator on the Fraction of Solitary Leisure by Marital Status and the Presence of Children.

		married		with children	
		yes	no	yes	no
Ordinary Least Squares (OLS)					
(1)	self-reported shift workers	0.051*	0.004	0.057*	−0.017
		(3.64)	(0.24)	(4.04)	(0.61)
(2)	workers with unusual hours	0.056*	0.092*	0.070*	0.043
		(3.62)	(2.99)	(4.44)	(1.50)
	N	2942	667	2774	835
Instrumental Variable Regressions (IV)					
(3)	self-reported shift workers	0.098*	0.009	0.099*	−0.041
		(2.71)	(0.14)	(2.82)	(0.64)
	first stage *F*-test	126.95	60.20	130.60	56.99
(4)	workers with unusual hours	0.164*	0.098	0.216*	0.015
		(2.26)	(0.91)	(2.87)	(0.14)
	first stage *F*-test	34.44	18.14	33.00	17.04
	N	2936	663	2766	833

Absolute *t*-statistics in parentheses. * indicate significance levels of 10 % or higher; errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having kids under the age of 6 and between 6 – 17, Western Germany, a non-employed wife, the log of normal working hours and the predicted error terms of wage regressions.

It must be noted in this context, that married workers tend to be on average older than singles. Younger workers in contrast are generally more flexible with respect to the organization of non-working schedules and it follows that it is hence likely to be easier to find potential leisure companions. Social coordination is thus easier to arrange which mitigates the adverse consequences arising from unusual working schedules. This might partly explain the strong differences among shift

workers. The fact that the difference among married and non-married men with unusual working schedules is not very large further indicated that such working schedules are indeed disruptive and significantly hamper the coordination of schedules and consequently the reconciliation of family and work. It shall be noted here that work during unusual hours and social interaction with others is likely to be endogenous. The *F*-tests of the first stage of the IV estimates show that that the set of instruments is considerably strong. Comparing the IV-estimates with those obtained from OLS reveals that not accounting for endogeneity strongly downward biases the coefficient estimates.

The last two columns of table 6.8 show differences in the extent of solitary leisure for men with and without children. Shift workers with kids, tend to have on average about 10 percentage points higher fractions. Among those shift workers without kids, no difference in the solitary leisure fractions of any kind is found. Fathers who work during unusual hours have larger difficulties to reconcile family life and work in that they have 22 percentage points higher fractions. For these men having no kids is associated with slightly though insignificantly higher solitary leisure fractions. Also for these estimates, the first stage *F*-test shows that the set of instruments is strong enough. OLS estimates are again strongly downward biased and underestimate the disruptive influence of these working schedules on social life.

In general, men without kids under the age of 18 are either younger or rather old. On average, these men tend to be older than the group of fathers. The possibility for social coordination is facilitated for fathers as here again potential leisure matches live in the same household. Yet, children under the age of 18 have on average shorter waking periods than their parents, which limits the possibility of leisure time overlap in particular if fathers work during non-standard hours. It follows that the family life in such cases is strongly adversely affected which is reflected by the significantly higher fractions of solitary leisure. In addition, with growing age, children tend to not consider their parents as suitable leisure companion which further limits the possibility for social interaction and might potentially upward bias the coefficient estimates.

6.5.3 Long-Run Risks

Potential adverse consequences of shift work on health are extensively studied in the medical literature (Minors et al., 1986; Cunningham, 1989; Skipper et al., 1990; Costa, 1996, 2003; Folkard and Tucker, 2003). In general, such working schedules disrupt the circadian cycle which implies sleepiness throughout the whole day. This might be reflected by longer sleeping intervals. If, in contrast, people are exposed to such working hours for too long, sleeping problems are likely to exacerbate even further. According to the medical literature, workers with longer job tenures in

Table 6.9: Coefficient Estimates of the Fraction of Solitary Leisure on Minutes of Sleep.

	shift		unusual	
	OLS	IV	OLS	IV
indicator	3.096	−18.524*	2.298	−9.907
	(0.73)	(1.67)	(0.50)	(0.48)
solitary leisure	21.023*	22.524*	21.057*	22.004*
	(4.35)	(4.61)	(4.38)	(4.30)
first stage *F*-test	–	156.62	–	50.55

Absolute *t*-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having children and having kids under the age of 6 and between 6 – 17, Western Germany, a non-employed wife, the log normal working hours, predicted error term of log hourly wage regressions and the month of the interview.

such jobs are likely to have interrupted sleeping intervals and to suffer from sleep deprivation (Härmä et al., 1998; Åkerstedt, 2003).

In the remainder of this section, I will therefore use the amount of time devoted to sleeping as a proxy for potential long-run consequences of such jobs in particular regarding the health related risks. To get a first impression about the association between sleep and aloneness ratios, table 6.9 reports the coefficient estimates of OLS and IV regressions of the fraction of solitary leisure on minutes of sleep as well as the estimate of the indicator variable. The table shows that higher levels of unaccompanied free time are positively correlated with minutes of sleep. An increase in the fraction of solitary leisure by 1 percentage point increases sleep by about 22 minutes per day. One explanation for this positive association could be that people who spend higher fractions of their total leisure alone, substitute sleep to some extent for free time to not having even higher fractions of solitary leisure. In this respect, positive associations do not directly hint at augmented levels of risk to mental health. In fact, on the contrary sleep might even have a therapeutic function (Bird and Fremont, 1991).

The table further shows differences in the average amount of sleep for shift workers and men with unusual hours. The estimates reveal that OLS strongly overestimates the influence and thus downplays the disruptive influence. IV regressions show reveal that the sleeping pattern is more strongly affected in the case of shift workers who tend to sleep on average about 18.5 minutes less than the reference group. Men with unusual hours report to sleep about 10 minutes

less yet this estimate is not accurately estimated. Here again, the first stage $F-$ test suggests that these are strong enough.[10]

Figure 6.3: Coefficient Estimates of the Fraction of Solitary Leisure by Decile of the Sleep Time Distribution.
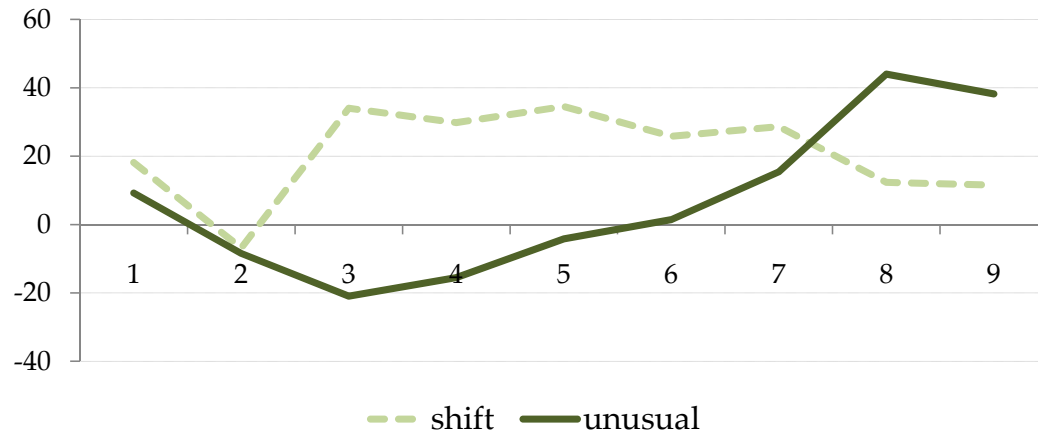
Until so far, only differences in the average aloneness fractions on the average minutes of sleep were explored. Higher risks to mental health determine however rather the extreme quantiles of the sleep time distribution. Hence, figure 6.3 presents differences in the estimates of the fraction of solitary leisure by sleep quantile between the groups of workers and the respective reference group. Positive values indicate that the estimates are higher for shift workers or men with unusual hours and vice versa. It is interesting to note that for men in the lower parts of the sleep distribution, solitary leisure is slightly though insignificantly correlated with less sleep when differences between workers with standard and non-standard hours are explored. In general, up to the median minutes of sleep, differences are insignificant and low. Substitution between free time and sleep is done to a similar extent between the groups of workers. Also in absolute terms, the coefficient estimates by decile of the sleep time distribution, are relatively low for the lower median. Since these lower values of the sleep time distribution can be interpreted as evidence for deprivation of sleep, men who work at unusual hours are not found to be exposed to augmented risks to mental health. For the upper half of the sleep distribution, higher fractions of solitary leisure are correlated with significantly more sleep of men who work at unusual hours. These findings are rather in line with the substitution hypothesis. Consequently, it can be argued that men who work at unusual hours are not exposed to higher risks of mental health mirrored by the impact on the minutes of sleep. Yet, since work at unusual hours, rather contributes to a widening of the working hours distribution but to a greater extent to work at the fringes of the standard workday, long-run consequences to health

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[10]For these estimations, I do not use the rate of hourly wages for full-time employed workers by industry and occupation in 1991/92 as instrument.

are expected to be minor. In addition, such working schedules have started to disseminate during the last decade so that long-run consequences are expected to arise with some delay.

In contrast, shift workers, tend to substitute more of their overall free time with sleep so that already for men in the lower parts of the sleep time distribution, higher fractions of solitary leisure are correlated with significantly more time devoted to sleep. Here again, the substitution hypothesis according to which shift workers are likely to sleep longer to not be alone might be a possible explanation. Another possible explanation could be that sleep is used therapeutically in order to cope with the higher burden associated with such jobs. These hypotheses cannot be disentangled here. Yet again, these estimates do not hint at augmented risks to mental health proxied by sleep deprivations.

To shed further light on further potential long-run risks due to the exposure to work at unusual schedules, I will now explore the interaction between sleep and age in more detail. Unfortunately, the dataset does not provide information about job tenure or the length of exposure to shift work or the rotating shift schedules. In order to explore potential long-run risks to health associated with shift work or work during unusual hours, I will use age as a proxy. I argue that age is not only positively correlated with job tenure and thus with the potential exposure to work at unusual schedules or to shift work but that people tend to be more likely to be adversely affected by work disamenities and hence by unusual working schedules with increasing age.

Figure 6.4 shows the coefficient estimates of the respective indicator variable for OLS (upper panel) and IV regressions (lower panel) by age group on the fraction of solitary leisure. It shows that the estimate is elevated across the age distribution for all men who work during unusual hours but in particular for men aged between 41 − 45. With increasing age, the differences between the respective group and the reference group reported by the IV regressions shrink. This is however not driven by differences in the incidence among these age groups as figure 8.1 in the Appendix suggests. One explanation could be that older workers have adapted their rhythm of life to their working schedules and have organized their activities around. Also, such men are likely to have stable networks of potential leisure companions who have some routine with the working rhythm which further facilitates social interaction and is likely to mitigate the differences between the groups of workers (Hamermesh, 2005).

Since age is a good proxy for tenure in the case of men, it is also a good proxy for the exposure to such working conditions. According to the estimates shown in figure 6.4, no average differences with respect to solitary leisure can be observed for older shift workers. Among the sample shift working men above the age of 50, about 22 percent report to work the morning shift, 63 percent in rotating teams

Figure 6.4: Coefficient Estimates of the Indicator Variable on Solitary Leisure Fractions by Age Group.
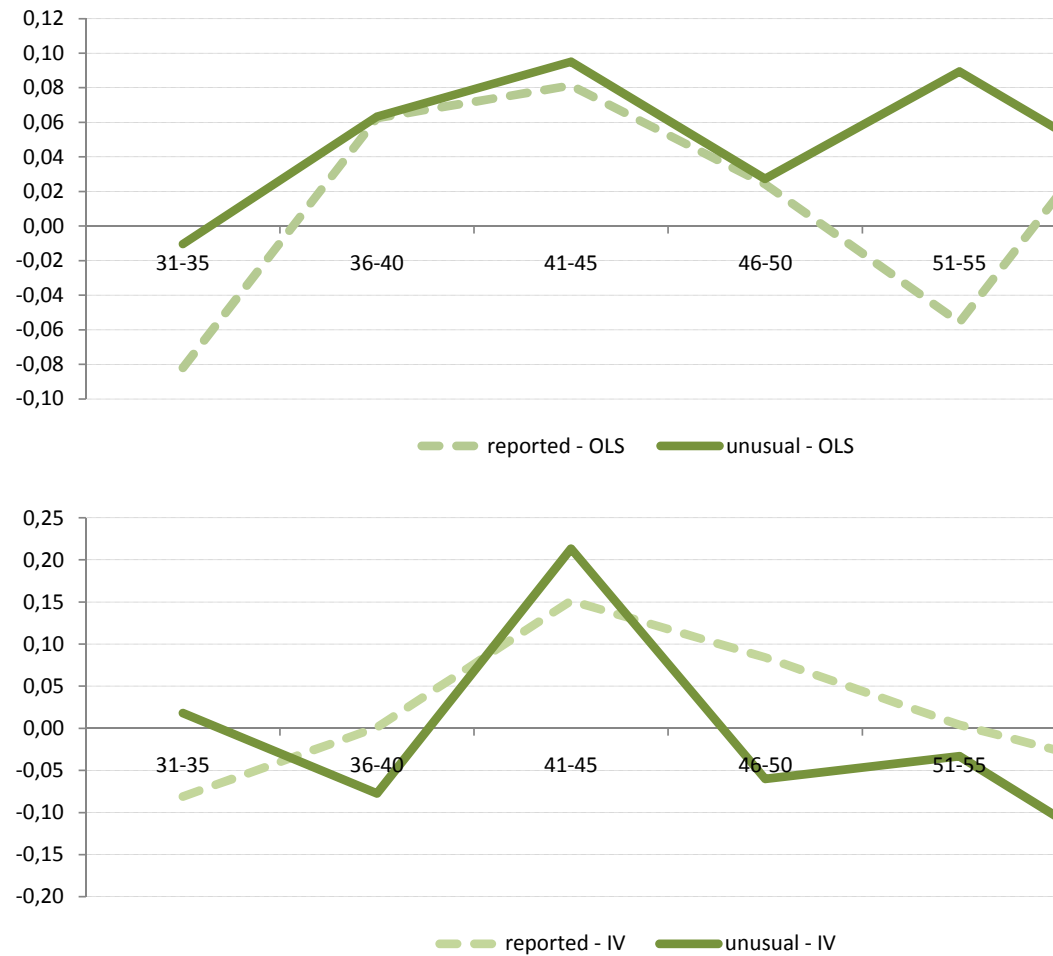
and 16 percent in other kinds of shifts. It can hence be argued that with longer job tenure, older workers have a higher propensity to work shifts with more desirable working hours which would be an alternative explanation for the insignificant differences on solitary leisure for older shift workers. In the case of men who work during unusual hours, however, differences in solitary leisure between the groups tend to shrink with age.

To examine the potential long-run risks of shift work or work at unusual hours, I will now analyze the influence between age being a proxy of job tenure and exposure on the one hand and sleep as indicator for potential health related risks on the other. Sleeping problems that might arise from the working schedules are likely to intensify with age and therefore further increase health related risks. The first line of table 6.10 presents coefficient estimates for average differences of shift work or work at unusual hours regarding the total minutes of sleep for all workers. Additional results by age group are further shown in the lower panel of the table. On average, people who work during undesirable hours and to a larger extent

Table 6.10: Coefficient Estimates of the Indicator Variable on the Minutes of Sleep.

	shift workers		unusual hours	
all workers:				
	2.541	−16.549*	2.298	−9.907
	(0.62)	(1.65)	(0.50)	(0.48)
first-stage *F*-test	–	200.62	–	50.55
by age group:				
under 35	4.772	−0.401	0.871	33.225
	(0.37)	(0.02)	(0.07)	(0.85)
first-stage *F*-test	–	48.70	–	21.72
35 – 45	11.720*	−3.882	7.343	46.250
	(2.07)	(0.27)	(1.10)	(1.46)
first-stage *F*-test	–	110.47	–	47.04
above 45	−8.020	−37.300*	0.317	−76.165*
	(1.25)	(2.11)	(0.04)	(1.83)
first-stage *F*-test	–	47.56	–	29.07

Absolute *t*-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having children and having kids under the age of 6 and between 6 – 17, Western Germany, a non-employed wife, the log normal working hours, predicted error term of log hourly wage regressions and the month of the interview.

those who work shifts tend to allocate less of their total available time to sleep. This estimate itself is not very informative as the consequences of the working schedules can affect the sleeping rhythm in opposite directions and both opposing influences cannot be disentangled.

To be able to find clearer evidence for potential forces that might be driving the amount of time allocated to sleep, table 6.10 additionally depicts estimates concerning the association between the indicator variable on total minutes of sleep by broad age group. These estimates suggest that shift workers under the age of 45 allocate slightly less time on average to sleep yet this estimate is low and insignificant. In contrast, men who work during unusual schedules tend to sleep more than the reference group of workers as the IV estimates show. Here, a possible explanation is that people with non-standard working schedules compensate their higher fractions of free time by more sleep. In this case, positive correlations are not directly evidence for an elevated risk to mental health. As I have shown earlier, younger men who work with unusual schedules additionally spend significantly

higher fractions of their total leisure alone. The combination of these findings can be interpreted as evidence in favor of the earlier hypothesis that these men tend to substitute their available free time with more sleep. If sleep substitution were not possible, it is possible that the fractions of solitary leisure would be even higher. In conclusion, these two results point into the same direction: men with unusual hours tend to have significantly lower levels of social interaction.

In contrast, shift workers but to an even greater extent men who work at unusual hours and who are in addition older than 45, sleep on average less than the respective reference groups. The coefficient estimate for the indicator variable is significant and can be interpreted as suggestive evidence that older workers with undesirable working schedules have a higher probability to be exposed to such jobs for a longer time span. This potentially intensifies sleeping problems as compared to the respective reference group. The first stage *F*-tests on the strength of the instrument[11] shows that the instrument is not weak.

Figure 6.5: Sleep Differentials by Decile of the Sleep Time Distribution by Age Group.
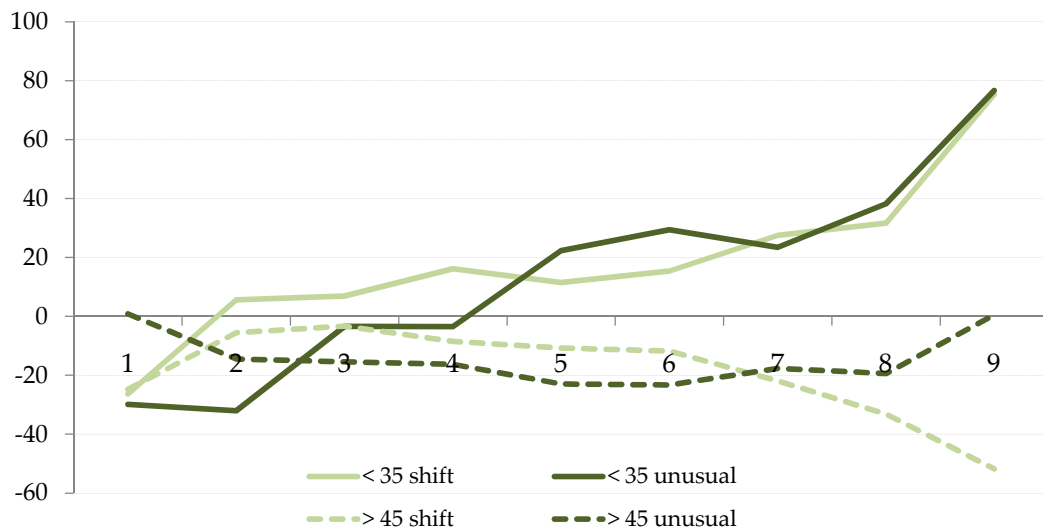
To be able to find out whether shift work or work at unusual hours indeed elevates the risk to health, it is not sufficient to merely analyze the average impact on sleep but to also explore the extremes of the sleep time distribution. Figure 6.5 reports differences among the groups per decile of the sleep time distribution with respect to prime aged men aged between 35 and 45. Negative values indicate that the sleep differential of the respective age group is lower than for prime age men. The absolute wage differentials by age group and decile are further shown in table 6.11 for a better understanding.

It follows that across the sleep time distribution, younger shift workers tend to have on average higher sleep differentials than prime age shift workers whereas

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[11]For these regressions, only the interaction between the rate of shift or work at unusual hours with the rate of solitary leisure by industry and occupation in 1991/92 is used as instrument.

Table 6.11: Coefficient Estimates of the Indicator Variable on the Minutes of Sleep by Decile and Age Group.

	shift workers			unusual hours		
	< 35	35 − 45	> 45	< 35	35 − 45	> 45
1	−56.08*	−5.00	−29.76*	−50.68*	−20.81	−20.00
2	−19.96	−20.00*	−25.54*	−33.33	−12.44	−15.76
3	−16.47	−20.00*	−23.34*	0.00	34.20	−12.05
4	0.00	−7.61	−16.15*	9.22	12.73*	−3.58
5	0.72	0.00	−10.79	40.57	18.30*	−4.69
6	13.75	10.15	−1.66*	59.44*	30.00*	6.71
7	28.00	22.40*	0.46	72.29*	48.87*	31.19*
8	44.04*	45.55*	12.37	104.53*	66.32*	46.93*
9	91.08*	67.62*	15.84	150.92*	74.28*	74.77*
N	614	1260	1556	442	1260	1141

Absolute t-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having children and having kids under the age of 6 and between 6 − 17, Western Germany, a non-employed wife, the log normal working hours, predicted error term of log hourly wage regressions and the month of the interview.

the opposite holds for shift workers above the age of 45. The table shows that with increasing age, the sleep differentials are lower and more negative for shift workers with lower average minutes of sleep per decile. When only workers above 45 are regarded, shift workers up to the 6th decile tend to sleep significantly less than the reference group. This is interesting and suggests that such jobs are disruptive in particular with increasing age and harm the sleep routine. In addition, older men tend to be exposed to shift work for a longer time span which further elevates the potential risk to health.

In contrast, younger or older men who work during unusual hours tend to devote less time to sleep than prime-age men over the whole distribution of minutes of sleep which results in lower or oven more negative sleep differentials. Table 6.11 further shows that younger men with non-standard schedules tend to devote significantly less time to sleeping up to the 40 quantile of the distribution as compared to men with normal working hours and also as compared to the sleep differential obtained for prime age men. It shall additionally be mentioned here that levels of solitary leisure do not significantly differ for these men under the age of 35 compared to the reference group. This can be interpreted as indication that younger workers with non-standard working schedules substitute sleep with

leisure which thus mitigates this strong adverse influence on solitary time at the expense of sleep. Such behavior cannot be interpreted as evidence for higher risks to mental health but might be more problematic with extended exposure. Men older than 45 also tend to devote less time to sleep than prime age men yet the differences are inaccurately estimated.

It can thus be concluded that younger workers are still able to master the stress associated with the working schedules by substituting sleep with leisure. Therefore, lower average levels of sleep are not indication enough for adverse long-run consequences on health. For older workers, in contrast, unusual working schedules and in particular shift work, tends disrupt the sleeping rhythm as lower average levels of sleep are observed across a large fraction of the sleep time distribution. Since sleep is one indicator for potential long-run risks and threats to mental health, these results can be interpreted as evidence in favor of augmented long-run consequences induced by the working schedules.

6.6 Conclusion and Discussion

In 2001, 15 percent of the European and the German workforce worked shifts. The relaxation of shop opening hours and of work time regulations in general imply that working hours at the margins of the work time distribution are inevitable in a more integrated world market. Such jobs are hence fundamental work patterns that shape the lifestyle of the population and will continue to do so to a growing extent.

This paper examines the consequences of a wider working hour distribution on social life to explore potential short and long-run risks arising from such working schedules. The higher hourly wage rates paid as compensation for the resulting disamenities further suggest that opportunity costs of leisure increase. Furthermore, lower levels of satisfaction with the allocation of work time further show that such jobs are not chosen because of preferences but rather because of monetary incentives as found in Chapter 5.

I find evidence that a wider working hour distribution is associated with higher average fractions of solitary leisure. Since people derive additional utility from spending time with others (Sullivan, 1996; Jenkins and Osberg, 2005), these findings imply lower marginal utility derived from leisure when social interaction becomes more difficult to arrange with others. The individual's well-being is hence likely to be adversely affected which in turn harms the individual's productivity.

Sleep and solitary leisure are positively correlated which suggests that people generally tend to substitute aloneness against sleep. In this respect, sleep is likely to have a therapeutic function. Yet, a longer exposure to aloneness on the one hand and adverse consequences of working schedules on the other is likely to augment

the potential long-run risks to health. I find that in particular older shift workers tend to have the highest risks. Younger shift workers, in contrast, rather substitute sleep against leisure which mitigates the strong disruptive influence on solitary leisure.

Repercussions of non-standard working schedules on social life arising from decreasing marginal utility of leisure are largely ignored in the economic discussion so far. Although it seems economically sensible to extend the margins of the working hour distribution and the incidence of shift work to increase firm's output and consequently to accelerate aggregate economic growth, strong adverse effects on social life must not be ignored. Individual and consequently aggregate well-being is likely to be impaired which under certain conditions might even decelerate economic growth. The combination of a negative selection of workers and sizeable wage premia paid as compensation for the disamenities of such jobs on the one hand and the higher levels of aloneness and the adverse consequences on sleep are further evidence that already disadvantaged workers are disproportionately affected. In addition, Hamermesh (1999a) points out that the focus on merely pecuniary aspects strongly downward biases the changes in inequality of overall returns to work over the last decades in the US. The potential threat of marginalization of these workers must be taken seriously but requires additional in-depth analysis which is left to future research. Current German laws protect evening and night workers from the drastic adverse consequences of the working schedules. It is therefore important to not only compensate such workers by higher wage premia as men with lower labor market characteristics are disproportionately attracted. Other forms of compensations must be offered for example in the form of higher leisure time compensations to mitigate the strong adverse consequences on social life and the resulting long-run disruptions to health.

7 Identifying the Effect of Temporal Work Flexibility on Parental Time with Children

It is recognized that employment policies must grant flexibility to the timing of market work to allow parents to reconcile family and work. By exploiting the particularity of the East German labor market, I am able to identify the causal effect of temporal work flexibility on parental time with children. The analysis unambiguously shows that flexitime allows parents to spend about 30 percent more time per day with their children. By means of an instrumental variable approach and GSOEP data, I find that the results can be generalized to Germany as a whole. Hence, temporal work flexibility in an important device to mitigate the adverse effect of parental employment on the child's cognitive development.

7.1 Introduction

The stimulation of domestic demand is high on the political agenda of industrialized countries not only in the aftermath of the worldwide financial crisis. The increase in female labor force participation is perceived as one important way to reach this goal by making use of the total available labor force potential in order to spur GDP growth. To facilitate female labor force participation but also to raise female working hours are therefore high on the political agenda. In this respect, concerns about a possible reconciliation of work and family are widely discussed and an extension of the provision of child care facilities is crucial. In recent years, this issue spread and is not merely a female matter any longer. Fathers are more encouraged to take parental leave and women take more advantage of career possibilities.

The increased labor supply, in particular of mothers, over the past decades has created new challenges that must be dealt with in modern societies. Psychologists claim that the first months and years of a child's life are crucial for its cognitive and emotional development so that maternal employment would have detrimental effects.[1] It is both, time and material resources that are important for the cognitive development of children. In particular, parental time is a major determinant for the human capital accumulation of children but its additional function is the intergenerational transmission of economic status (Guryan et al., 2008; Becker, 1965).

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[1]See for example Lewis and Brooks-Gunn (1979); Harris (1983); Baydar and Brooks-Gunn (1991)

Many economist, sociologist and psychologist have investigated the impact of early maternal employment on the cognitive development of children. But these studies have reached very heterogeneous conclusion and most are not able to establish a causal link. Some articles find a detrimental impact of early maternal employment in particular during the first year of a child's life on its cognitive development in later years (Baum, 2003; Ruhm, 2004; Hill et al., 2005; Ruhm, 2008; Bernal, 2008). The strong negative impact is however offset when maternal employment occurs during or after the second years of a child's life (Blau and Grossberg, 1992). To mitigate the adverse influences of parental employment, the need for higher degrees of temporal work flexibility is now widely acknowledged which enables parents to spend more time with their children.

The conjunction of high female labor supply and a good provision of childcare facilities as well as a more family oriented employment policy is not new for inhabitants of the former German Democratic Republic (GDR). The necessity to use the total available labor force potential in the post-war country was even intensified by a massive out-migration of younger and better educated East Germans to the Federal Republic of Germany before the construction of the German wall. These developments greatly shaped employment policies already in the early 1950s. In addition, the particularity of the labor market of the GDR allows me to identify and quantify the effect of temporal work flexibility on parental time with children. The German re-unification can be further exploited as a natural experiment and therefore serves as a clear-cut identification strategy. The major contribution of this paper is thus to causally examine the relationship between temporal work flexibility and parental time and to quantify it.

Every citizen of the GDR had the right but also the obligation to work. The freedom of choice of the workplace as postulated in Art. 24 of the constitution of the GDR was however not only restricted by personal qualification but also by the requirements of the central socialist plan. Moreover, educational choices were already strongly influenced and restricted by the socialist plan so that citizens could choose their education to a limited extent (Prantl and Spitz-Oener, 2009). Consequently, the allocation of jobs did not necessarily coincide with individual interests or societal needs (Frerich and Frey, 1993). Furthermore, the provision of childcare facilities was exceptionally good in the former GDR so that about 95 percent of the 3 – 6 year old children were enrolled in kindergarten in 1989. Contracted working hours were largely determined by the opening hours of daycare centers. Also, flexible working hours were granted only by the firm and workers themselves had no right to choose. It follows that flexitime can hence be viewed as being exogenous. These specifics of the GDR-labor market allow me to identify and estimate the effect of flexitime arrangements on parental time with children in East Germany after re-unification. For the analysis I employ German Time Use Data for the year 1991/92 for East German employees.

Even though being granted flexible working hours cannot be directly influenced by the worker, it is possible that some occupations are more likely to be granted such arrangements. If workers in these occupations are additionally more likely to spend their free time with their kids, OLS estimates would be biased. Yet, I find no evidence for such kind of non-random selection by occupations. I further test whether the results for East German workers can be generalized to all Germans by using GSOEP data for 2002 – 2008. To account for reverse causality, I use an instrumental variable approach. Results indicate similar effects of temporal work flexibility on parental time with kids.

Due to a lack of appropriate data, in particular of panel data, previous research mainly focuses on exploring the dependence between market work and time that parents spend with their kids (Hallberg and Klevmarken, 2003; Han, 2004; Guryan et al., 2008) and, as mentioned above, the resulting cognitive development of children.[2] Only few studies approach this question by trying to find a causal link. Dustmann and Schönberg (2008) use extensions of maternity leave regulations in Germany as exogenous variation to proxy higher parental time investments. They find that it has no effect on the child's cognitive outcomes. In contrast to that, Carneiro et al. (2010) find strong positive effects of extended maternity leave for Norway. Another strand of the literature is concerned with exploring the influence of working schedules on children's well-being (Strazdins et al., 2004, 2006) as well as the on the time shared by parents and kids (Hill and Stafford, 1980; Bryant and Zick, 1996; Daly, 1996; Zick and Bryant, 1996; Milkie et al., 2004). Only very few studies investigate the association between flexible working hours and labor supply (King, 1978; Barrett, 1982; Macpherson, 1988; Euwals, 2001). Yet to my knowledge, this is the first paper that analyzes and quantifies the causal effect of flexible working schedules on parental time with children.

The analysis of this paper is organized as follows: in a first step, I will describe the labor market situation and the employment policies of the former GDR in detail. The section further describes the estimation strategy and gives a discussion about potential threats to identification. Section 7.3 presents the data and shows descriptive statistics on the allocation of childcare related activities and market work over a standard day. The following section discusses the results. In a first step, I compare the determinants of job offering flexibility arrangements to explore potential compositional differences between the respective workers. The following part is devoted to the description of the main effects of work time flexibility on parental time. Section 7.3.4 tests whether selectivity is present and whether the results obtained for East Germany also hold for Germany as a whole by investigating GSOEP data for 2002 – 2008. Finally, section 7.5 concludes.

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[2]Most studies dealing find a negative association between early maternal employment and the influence on the cognitive development of children (Baum, 2003; Brooks-Gunn et al., 2003; Ruhm, 2004, Hill et al., 2005; Bernal, 2008; Ruhm, 2008; Blau and Grossberg, 1992).

7.2 Identification Strategy and Econometric Model

7.2.1 Background Discussion and Identification Strategy

To identify the effect of temporal work flexibility on the time that parents devote to their children, I concentrate on East German parents only. Labor market and employment policies in East Germany were very distinct from those in West Germany. This section gives an overview about the particularities and presents the identification strategy in more detail.

Already since the 1950s, the need to use the total available labor potential for the stimulation of growth has been recognized by the authorities in the former German Democratic Republic (GDR). A major aspect of the employment policies was the integration of the female labor potential into the labor market by ensuring a reconciliation of family and work (Frerich and Frey, 1993). Since the VIIIth and the Xth party congress of the Socialist Unity Party (SED) in 1971 and 1972, large social programs were launched by Erich Honecker. These programs were directly aimed at the creation and promotion of measures to encourage female labor participation. In this regard, the provision of childcare facilities for kids under the age of 6 was drastically expanded in subsequent years to create an environment in favor of female labor force participation. In addition, the labor code of the GDR (AGB, 1980) postulated explicitly in Art. 240 that each firm is obliged to create possibilities for working mothers to allow for a reconciliation of family and work without further specifications. Moreover, childcare facilities were regulated by law to be open between 7 am and 6 pm (Führ and Furck, 1998). For the usage of such facilities, parents were to pay only a very small proportion of their monthly incomes which was used for the provision of food.

According to Art. 167 of the labor code, begin and end of the individual work day of parents were determined between firm and worker but must lie within the opening hours of childcare facilities. Labor unions were also allowed to influence working hours and working time according to Art. 22, AGB yet flexible working hours or even flexitime arrangements were not explicitly formulated in the former GDR. The provision of childcare facilities reached its peak in 1989 so that according to the Statistical Office of the GDR, about 80 percent of kids under the age of 3 were enrolled in crèche in 1989 and even 95 percent of kids aged 3 – 6 were enrolled in kindergarten (Statistical Office of the GDR, 1990). Female labor force participation was also highest during this year: employment rates reached 90.6 percent among working age women in 1989.[3]

Art. 24 of the constitution of the GDR (1989) further postulated that each citizen had the right but also the obligation to work and was free to choose his workplace. In reality, however, this freedom of choice was restricted not only by

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[3]See Frerich and Frey (1993)

individual qualifications but more importantly by societal demand in conjunction with the central plan. Consequently, labor demand was not determined by profit maximization of firms. Hence, people could choose a suitable job from those provided at a given point in time by the state (Frerich and Frey, 1993). This means a priori that the allocation of jobs that was required for the fulfillment of the socialist production plan did not necessarily coincide with interests and needs of the individual employees. Since the VIIIth party congress of the SED in 1971, also occupational choices were to be made according to economic requirements of the centrally planned economy. Young people were to be nudged to choose to work in those occupations that had a great importance within the production process and for the supply of the population of the former GDR at the time of choice. Numerous sanctions and other means of exerting moral pressure were allowed in this process to induce an occupational choice in line with the planned economy. Given such a myopic education policy, it was likely that the available qualification did not match the required one.

To improve the search and matching process given the ever changing economic conditions in accordance with the socialist plan, a planning and steering system for workers and for career advice was established. It was administered by the state secretary and by administrative bodies in the councils of each county or district (Frerich and Frey, 1993). These councils had the right to restrict the number of hires but also to wield influence as to the choice of workers. Since firms were able to hire workers only within the limits of the central plan, each individual worker was also at risk of having to change the workplace if required. Over the decades, however, the East-German authorities mainly ensured the labor requirements in the major firms and allowed smaller ones more freedom in choosing their own workers.

The free choice of the workplace was thus *de facto* very limited and workers could not exert any influence on the working conditions that were being offered. The usual endogeneity problem between working hours and parental time that arises when parents are free to choose their workplace in combination with the associated working conditions is therefore not an issue for East German workers. It can therefore be argued that flexitime arrangements are indeed exogenous. Thus, the effect of flexible working hours can be regarded as being causal to the determination of parental time with their children in the case of Eastern German workers.

7.2.2 Empirical Strategy and Threats to Identification

To estimate the average effect of temporal work flexibility on parental time with children, I estimate the following equation:

$$\ln C_i \quad = \quad \mathbf{X}'_i \beta_1 + \beta_2 F_i + \epsilon_i, \tag{7.1}$$

where $i = \{m, f\}$ denotes observations for men or women, respectively. The main variable of interest is F_i which takes the value one if the person is granted flexitime arrangements and 0 otherwise. The coefficient of interest is β_2 which captures the average difference in maternal or paternal time with children that result from temporal work flexibility. The random error term is denoted by ϵ. The dependent variable, $\ln C_i$, is defined in three ways: (i) as minutes of parental time, (ii) as log of minutes of childcare related activities per day or (iii) as fraction of parental time relative to the total time spent on household production. Finally, $\mathbf{X}_i$ is a matrix of individual predetermined characteristics.[4]

The data used are German Time Use data for 1991/92 which were collected two years after the German re-unification. This could be understood as potential threat to identification. Yet, rapidly after the fall of the Berlin wall in 1989, East Germany underwent massive structural changes. According to Burda and Hunt (2001) employment declined by 35 percent between 1989 and 1992 and the East German GDP declined by roughly 30 percent during the same period. Unemployment rose from 0, as claimed by the authorities in the former GDR, to more than 15 percent when only registered unemployed are counted but was even above 30 percent if hidden unemployment (including early retirement, involuntary part-time work, training schemes for the unemployed etc.) were also included. The whole economy of the former GDR was in shambles.[5]

Given the dramatic increase in unemployment, joblessness and non-employment that followed the collapse of the former GDR, uncertainty about the future was high. Consequently, workers were predominantly interested in having *any* job and were less concerned about whether or not it offered flexible working schedules. In addition, the actual level of qualification of East German workers did not necessarily match those qualifications demanded by a market economy. Under such uncertain economic conditions it is hence very implausible that the degree of flexibility granted by a job was a choice criterion for East German parents. The previous argument that flexitime is exogenous therefore still holds.

In addition, the provision of full-time daycare centers was still exceptionally good in East Germany after the German re-unification so that according to the Federal Statistical Office, 114 kindergarten-places were available for 100 children aged 3 – 6 in the former GDR. This fact further reinforces the claim that flexitime was not chosen by workers for childcare concerns. In order to test for the possibility of non-random selection of flexible working hours for workers in certain occupations, I conduct robustness checks in section 7.3.4.

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[4]The matrix includes age, 3 educational dummies, 2 dummies for regional GDP per capita and 2 dummies for the regional structure.

[5]See Burda and Hunt (2001).

7.3 Data and Descriptive Statistics

This main analysis of this paper is based on German Time Use Data (*Zeitbudgeterhebung*) for the year 19991/92 which were collected by the German Federal Statistical Office (Statistisches Bundesamt, 2003). It provides a variety of socio-economic, work and household characteristics. In addition, this dataset contains detailed information about the exact timing and the duration of child related activities and market work for each 5 minute time interval per day which makes it particularly interesting for this study.

The more than 200 activities that respondents engage in during a standard workday are aggregated into four major time use categories: pure leisure, paid market work, household work and tertiary time of which the first three are relevant for the current study.[6] As described in section 3.1.3, pure leisure comprises all pleasurable activities which do not need to be undertaken at all and nobody can be paid to do them. Market work is defined as all direct job related activities as well as work-related travel time. Household production captures all activities for which market substitutes can be purchased so that somebody else could be paid to do them and which further satisfy the third-party rule by Reid (1934). The exception to the previous definition of chapter 3.1.3 is that childcare related activities are attributed to household related activities in this chapter.

Guryan et al. (2008) infer from their findings that parents perceive the time that they spend with their children as being fundamentally different from home production or leisure even though childcare is both productive and enjoyable at the same time. In this paper, childcare comprises only "primary" activities which are activities that parents directly devote to them such as learning, playing, care in case of illness, changing diapers, washing and feeding the kid, bringing it to bed, to cuddle it etc. All minutes of commuting time related to childcare are also defined as child related time. The data would further allow me to also derive childcare time as a broader concept by additionally including all "secondary" activities namely by including all those time intervals that parents spent in the company of their children. Yet, these activities are however mainly supervisory. In this paper, I will focus on primary childcare activities to capture only those activities that are associated with qualitative interactions between parents and children and thus capture the amount of time that is directly invested by the parent (Guryan et al., 2008).

Information about temporal work flexibility is provided by the respondent who is asked to indicate whether or not the job grants flexitime arrangements. Flextime is broadly defined as the ability to rearrange one's work hours within certain

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[6]Intervals of commuting or traveling time are added to the related activity. It can be further noted that an aggregation of the activities into these broad measures is inherently arbitrary. See also Burda et al. (2007).

predetermined limits offered by the company. In most cases, core hours (e.g., 10:00 am to 2:00 pm) are defined during which all employees must be working and are thus required to be on-site. Employees are given some degrees of control over their timing and to fulfill their work commitment (Hill et al., 2001).

7.3.1 Sample Description

To analyze the effect of temporal work flexibility on parental time, I restrict the sample to employed East German parents aged between 20 and 50 with children under the age of 15. Table 7.1 reports descriptive statistics by sex. In East Germany, shortly after the German re-unification, almost all of the employed sample men worked full-time and about 81 percent of the employed women. Flexitime arrangements are slightly more likely to be granted to women.

Table 7.1: TU: Summary Statistics for All Employed Workers by Gender.

	women	men
individual characteristics:		
age	34.282	35.905
	(5.671)	(6.022)
low skilled	0.039	0.027
	(0.194)	(0.162)
medium skilled	0.581	0.579
	(0.494)	(0.494)
high skilled	0.380	0.394
	(0.486)	(0.489)
married	0.808	0.905
	(0.395)	(0.293)
household characteristics:		
# of kids	1.984	2.036
	(0.818)	(0.866)
kids ≤ 3	0.175	0.195
	(0.380)	(0.396)
kids aged 3–6	0.250	0.257
	(0.433)	(0.437)
kids 6–10	0.262	0.230
	(0.440)	(0.421)
kids 10– 15	0.314	0.318
	(0.464)	(0.466)
work characteristics:		
full-time employed	0.811	0.981
	(0.392)	(0.135)
flexitime	0.219	0.184
	(0.414)	(0.388)
N	561	591

Standard deviations are given in parentheses.

The table further shows, that men are on average slightly older, are more likely to be married and tend to have on average more children than women. The age distribution is similar yet men are slightly more likely to have kids under the age of 3. Also the skill distribution among men and women is similar. The table shows that sample parents are generally well educated but among those with the lowest levels of education, women are represented to a greater extent than men.

7.3.2 Time Dimension

To get a first impression about the timing of activities across a standard workday, the temporal dimension of activities shall now be described more closely. The distribution of parental time with kids is shown by sex in figure 7.1. Independent of the gender, parents are most likely to spend time on child related activities around 6 – 8 am but to an even stronger extent in the evening hours between 5 – 8 pm. In addition, women are more slightly more likely to engage in primary child related activities during each time interval per day yet the differences are not very pronounced.

Figure 7.1: Time Use: Distribution of Parental Time with Kids across a Standard Day for Employed Parents by Sex.
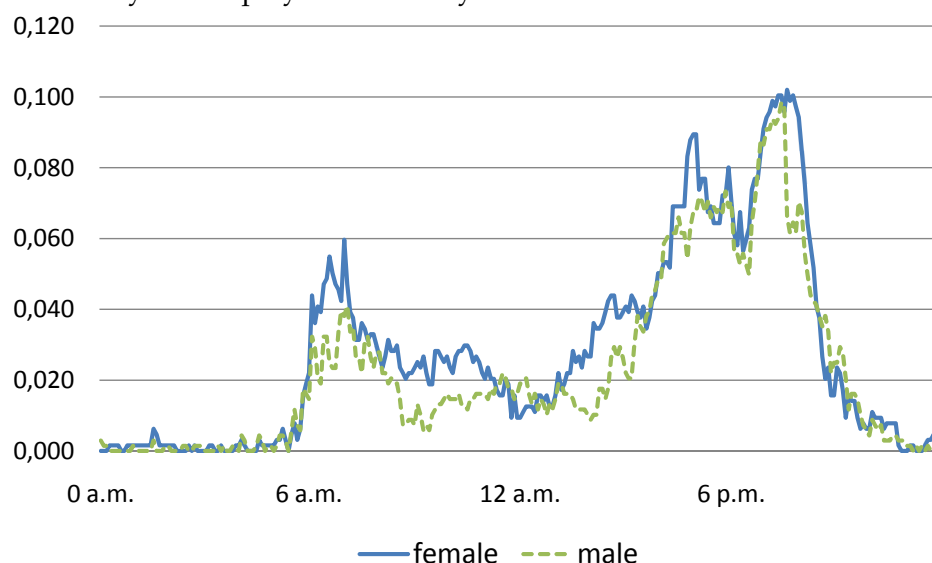
Table 7.2 reports average minutes spent of childcare activities for all employed East German men and women. In total, sample women spend on average about 48 minutes on primary child related activities while men devote about 9 minutes less time. When differentiating between flexitime status, women tend to devote an average of about 43 minutes to be with their kids when flexitime is not an option but if flexitime is granted, women spend about 18 minutes more on primary child time. For men, in contrast, the table shows only very little differences by degree of flexibility of working schedules.

Figure 7.2: Time Use: Distribution of Non-Zero Parental Time of Employed Workers by Sex.
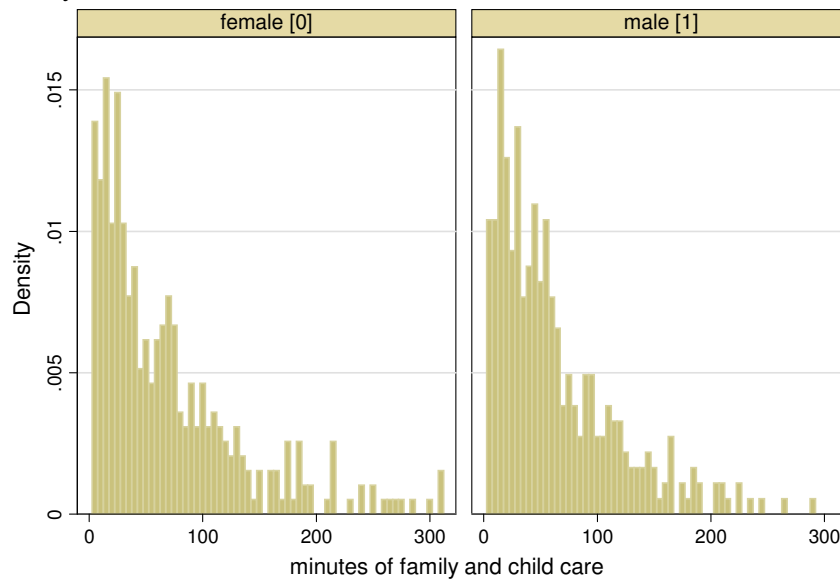
The relatively low average minutes of primary childcare time are strongly driven by the fact that about 31 percent of all women and about 38 percent of all men with children under the age of 15 report not have spent any primary time during the particular day with their kids. Measuring the minutes of parental time, only of those workers who reported non-zero time with their kids show about 69 minutes maternal time with kids and about 63 minutes in the case of men. Figure 7.2 shows the distributions of non-zero parental time by gender. It shows that the proportion of parents who spend only little primary childcare time is higher high. In addition, figure 8.2 in the Appendix illustrates the distribution of parental time by age group of their children. It shows that the high share of parents who spend only little primary childcare time is strongly driven by parents with older kids.

In addition to the absolute minutes of parental time, table 7.2 reports the fraction of parental time relative to the minutes of household work. This fraction amounts to 21 percent for all men independent of flexitime status and it ranges between 21 and 28 percent for women depending on whether people work flexitime or not.

Table 7.2 also shows the hours of market work and of household production for all employed men and women. While women report to work in general about 418 minutes (7 hours), men devote on average about 34 minutes more to market work.[7] It is interesting to note that both women and men who are granted flexitime arrangements tend to work longer hours and to spend more time with their children. Women with flexitime arrangements work about 46 minutes longer but tend to devote about 25 minutes less on household work. This is in line with the third party rule by Reid (1934) according to which people substitute household work

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[7]Note that diaries for weekdays but also during weekends are considered here.

Table 7.2: Allocation of Time by Employed Workers by Sex Depending on Whether or not the Job Offers Flexitime.

	women			men		
	all	no flex.	flex.	all	no flex.	flex.
min. of child time	47.65	43.79	61.38	38.71	38.27	40.64
	(61.91)	(58.87)	(70.24)	(51.56)	(51.51)	(51.98)
fraction of household time	0.22	0.21	0.28	0.21	0.21	0.21
	(0.24)	(0.24)	(0.25)	(0.26)	(0.26)	(0.24)
min. of homeproduction	217.19	222.51	198.05	186.42	189.74	171.76
	(166.49)	(172.70)	(140.90)	(137.06)	(150.96)	(122.62)
min. of market time	418.36	407.24	453.33	452.78	442.95	489.05
	(282.01)	(288.43)	(254.73)	(273.64)	(281.14)	(235.33)
N	561	438	123	591	482	109

Standard deviations are given in parentheses.

with market equivalents with higher with fewer hours of market work or higher opportunity costs of leisure. Differences for men with respect to market work are similar but they tend to devote only about 18 minutes less to household work compared to those who do not work flexitime.

Finally, the left panel of figure 7.3 gives an additional graphical representation of the difference in the allocation of parental time during each time interval t by gender depending on flexitime status. Positive values indicate that market work during the particular time interval is more common among parents who are granted temporal work flexibility. Vertical lines indicate the boundaries of the standard workday in East Germany according to the data.[8] Differences in parental time with children are noisy given the relatively small number of observations yet they are highest around the boundaries of the standard workday. This indicates that it is in particular those time intervals that parents who are more flexible with respect to the allocation of market work use more to be with their kids.

The right panel of figure 7.3 illustrates differences in the distribution of working hours depending on flexitime status for every time interval t across a day. Again, positive values indicate a higher propensity of work for people with flexitime arrangements during the t-th time interval. The graph reveals that parents who are granted flexitime arrangements are more likely to work during standard hours as compared to the reference group. Moreover, they tend to start their workday slightly later but also tend to end it slightly later on average. In the evening hours, work after 6 pm is less common for women when their jobs allow for flexitime while the opposite holds for men.

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[8]It is defined similarly to the standard workday in Chapter 5 by the average start of the workday and the average end of the workday in East Germany in 1991/92 reported by all respondents.

Figure 7.3: Time Use: Difference in the Distributions of Parental Time with Kids (left) and Market Time (right) for Employed Workers by Sex Depending on Flexitime Status.
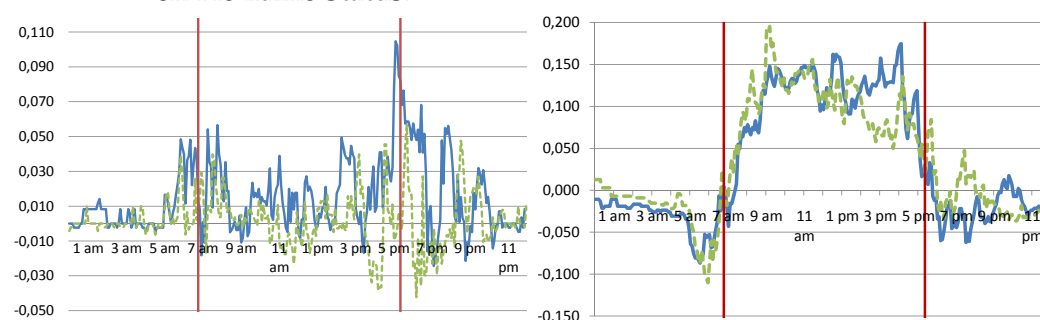
7.3.3 Results

Determinants of Flexitime

In a first step, I want to explore the determinants of being granted flexitime work in more detail which help us to detect potential compositional differences across these groups. In addition, it is an additional check of the validity of the identification strategy. Marginal effects by employment status and gender are reported in table 7.3. It shows that age is positively yet insignificantly associated with the probability to work flexitime in the case of female workers. Older men, in contrast, tend to have a lower probability. The level of education has no significant influence for either men or women. Additionally, being married or having an employed partner does also not significantly affect the probability to work flexitime. The fact that individual characteristics do not seem to play a role for being granted flexitime arrangements underlines the identification strategy according to which workers in East Germany had no choice to determine their degree of temporal work flexibility.

The major determinants are workplace characteristics. The table shows that being a white-collar workers and an employee in the service sector has the highest impact on being granted flexitime. Among the employed workers, having a white-collar job increases the probability by 20 percent for women and by 15 percent for men. Female service sector employees tend to be 12 – 14 percent more likely to have some degree of flexibility and men have 10 – 11 percent higher probabilities. Women with higher incomes tend to be more likely to work in such jobs while the wage rate is has no significant influence in the case of men.

The table furthermore shows differences in regional characteristics. The probability to work in such jobs is highest for East Germans who live in regions with the highest level of GDP per capita of all new länder. In regions with only some agglomeration, workers tend to have a lower probability as compared to urbanized regions yet flexitime arrangements are most likely to be granted in rural regions. In addition, the table shows that those East German workers living in regions with the highest unemployment rate (12.5 – 15 percent in 1991/92) tend to be less likely to be offered such working conditions.

Table 7.3: TU: Marginal Effects for the Choice to Work Flexitime by Sex and Employment Status.

	employed		full-time	
	female	male	female	male
personal characteristics:				
age	0.001	-0.007*	0.002	-0.007*
	(0.33)	(2.12)	(0.42)	(2.22)
low skilled	0.031	0.066	0.047*	0.053
	(0.33)	(0.72)	(0.42)	(0.56)
high skilled	-0.038	0.005	-0.050	0.005
	(1.10)	(0.15)	(1.33)	(0.14)
married	-0.017	0.039	0.002	0.018
	(0.39)	(0.69)	(0.04)	(0.30)
employed partner	-0.064	-0.004	-0.062	-0.010
	(0.91)	(0.08)	(0.84)	(0.18)
household characteristics:				
# of kids	-0.051*	-0.029	-0.051*	-0.027
	(2.36)	(1.54)	(1.92)	(1.43)
kids 3–6	0.058	0.081*	0.078	0.076
	(1.15)	(1.71)	(1.30)	(1.56)
kids aged 6–10	-0.067	0.042	-0.045	0.037
	(1.23)	(0.82)	(0.69)	(0.70)
kids aged 10–15	0.061	0.139*	0.069	0.130*
	(1.03)	(2.64)	(1.02)	(2.42)
workplace characteristics:				
white-collar	0.197*	0.152*	0.178*	0.148*
	(5.94)	(5.11)	(4.54)	(4.86)
log labor income	0.098*	0.014	0.096*	0.011
	(2.21)	(0.61)	(1.77)	(0.54)
service sector	0.116*	0.108*	0.137*	0.112*
	(3.41)	(3.61)	(3.55)	(3.66)
regional characteristics:				
GDP [30.000 DM; 35.000 DM]	0.109*	0.104*	0.086*	0.112*
	(2.33)	(2.29)	(1.68)	(2.41)
regions with some agglomeration	-0.125*	-0.066	-0.130*	-0.063
	(2.67)	(1.42)	(2.63)	(1.37)
rural	0.096*	0.090*	0.126*	0.090*
	(2.06)	(2.15)	(2.55)	(2.13)
unemployment rate: 12.5% – 15%	-0.054	-0.017	-0.094*	-0.020
	(1.18)	(0.43)	(1.95)	(0.48)
N	561	591	455	580
R^2	0.191	0.129	0.190	0.129

Absolute $z-$ statistics in parentheses. * indicates significance levels of 10%.

When the household composition is regarded, table 7.3 reveals that parents with more kids tend to be less likely to be granted flexitime arrangements. Moreover, the age of kids, however, has no significant influence on this probability for women. For fathers, I only find that having children aged 3 to 6 years or kids older than

10 is positively associated with the probability to work flexitime. These findings further emphasize the earlier claim that people do not choose to work flexible hours for childcare concerns. If people were free to choose the working conditions of the job, one would rather expect a positive association with respect to the number of children and also for younger kids.

The combination of the employment policies in the former GDR in and the ubiquitous provision of childcare facilities provide work environments in favor of higher levels of female labor force participation in East Germany and pronounced rates of full-time employment. These are also reflected in the sample of women of this study. The determinants of the probit regressions described here, in particular regarding age and number of children, further corroborate the validity of the identification strategy that East German parents were not able to choose flexible working schedules. Hence, such work arrangements can rather be understood as gift granted by the employer mainly to people in white-collar jobs and employees in the service sector (Guryan et al., 2008).

Does Temporal Flexibility Increase Parental Time with Kids?

Baseline Results

I will now turn to the analysis and quantification of the causal effect of temporal work flexibility on parental time with children. Estimation results are reported in table 7.4. It shows the coefficient estimate of the flexitime indicator for the absolute minutes of parental time (1), log minutes of childcare time (2) and the fraction of child time respective to total household work (3) by gender and employment status. I further compare the results obtained from a restricted model without potentially endogenous regressors (uneven columns) as well as models controlling for the presence of children younger than 6 years of age and the number of children living in the household (even numbered columns).

The table shows that flexitime in mainly exploited by mothers and is used to spend more time with their kids, while no significant differences are found for fathers. More precisely, women who work in jobs that grant some degree of temporal flexibility spend on average about 15 minutes more on primary childcare related activities than those women who do not. Given the comparatively low amount of time that all employed mothers spend on primary childcare time (47.65 minutes on average) as presented in table 7.2, the effect is sizable. If the coefficient estimate is expressed relative to the average maternal minutes spend with kids, these 15 additional minutes corresponds to an increase of more than 30 percent resulting from flexitime. In addition, mothers who are granted some temporal work flexibility tend to work on average more. Keeping this in mind further emphasizes the very sizeable impact that such work arrangements have on maternal time with kids. This is in line with Guryan et al. (2008) who argue that childcare

time is inherently different from both household work and leisure. In addition, it underlines the results by Bianchi (2000) who finds that average maternal time with children did not decline drastically over the years in the presence of maternal employment.

Men, in comparison, who are granted flexible working schedules do not spend significantly more time on primary childcare related activities. Full-time employed men spend about 4.5 minutes more on childcare time if they are granted flexible working hours yet this effect is not significant. This finding is not surprising given that such activities are considered to be predominantly female tasks.

Table 7.4: Estimation Results for the Flexitime Indicator on Child Related Time and the Fraction of Total Household Time by Gender and Employment Status.

| | employed | | | | full-time | | | |
| | female | | male | | female | | male | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. minutes of child time:								
flexitime	15.133*	15.650*	3.091	5.687	14.953*	15.987*	4.535	6.966
	(2.29)	(2.48)	(0.59)	(1.15)	(2.10)	(2.42)	(0.87)	(1.40)
add. controls	no	yes	no	yes	no	yes	no	yes
N	561	561	591	591	455	455	580	580
R^2	0.141	0.174	0.105	0.160	0.138	0.192	0.105	0.158
2. log minutes of child time:								
flexitime	0.254*	0.253*	0.016	0.070	0.280*	0.272*	0.039	0.087
	(2.03)	(2.12)	(0.12)	(0.57)	(1.95)	(2.05)	(0.30)	(0.71)
add. controls	no	yes	no	yes	no	yes	no	yes
N	389	389	365	365	318	318	356	356
R^2	0.090	0.148	0.098	0.159	0.082	0.155	0.099	0.159
3. fraction of total household time:								
flexitime	0.071*	0.071*	-0.008	0.002	0.066*	0.069*	-0.007	0.003
	(2.91)	(2.91)	(0.32)	(0.08)	(2.61)	(2.85)	(0.26)	(0.10)
add. controls	no	yes	no	yes	no	yes	no	yes
N	561	561	591	591	455	455	580	580
R^2	0.105	0.123	0.090	0.131	0.119	0.153	0.089	0.127

Absolute $t-$ statistics in parentheses. * indicates significance levels of 10% or higher. Standard errors are robust. Standard control variables: age, 2 skill dummies, a dummy for being married, dummies indicating whether the diary day was a normal day and whether the day was a weekend day as well as regional dummies accounting for GDP per capita and agglomeration type. Additional controls: dummy for kids under the age of 6 and a variable indicating the number of kids in the household.

Additionally controlling for the presence of young children and more kids living in the household as shown by even numbered columns in the first panel further increases the estimates obtained for both men and women in minutes. The difference is more pronounced for men. This indicates that men are more involved in childcare related activities when children are younger and when there are more of them living in the same household. Being granted some degree of flexibility enables them to do their share and to indeed spend some more time with them.

Yet, as shown earlier, many parents, particularly with older children, report zero minutes of primary childcare time. To account for that the second panel of table 7.4 reports the effect of flexitime arrangements only for those parents who report non-zero childcare activities. Accordingly, employed mothers with some temporal work flexibility spend on average about 25 log points or 28 percent more time to be with their kids without controlling for age and number of kids in the household. Restricting the sample to full-time employed mothers, results in 28 log points or about 32 percent more maternal time. For men, flexitime does not result in more paternal time with kids. Additionally controlling for child-related characteristics, does not change the estimates drastically.

Finally, when parental time is regarded relative to the total time devoted to household activities – as given by the third panel of table 7.4 – mothers spend about 7 percentage points more of their total household activities on child time when flexitime is granted. Given that women spend on average about 22 percent of their total household time on primary child time, an increase by 7 percentage points for mother who are granted flexitime arrangements corresponds to an increase of about 32 percent. The effect for men, in contrast, is again low and insignificant.

These baseline findings suggest that women, who are granted some degree of temporal work flexibility, use this freedom to spend a huge amount of time more on childcare related activities. These results can be interpreted as strong evidence in favor of an enhanced reconciliation of family and work. Given that parents and specifically mothers with flexible working schedules work on average longer hours as compared to the reference group, these figures emphasize the very sizeable positive influence even more. It allows parents to spend more quality time with their children and not to concentrate merely on satisfying basic needs. This hypothesis will be further analyzed in section 7.3.3. Moreover, the results suggest that time investments are relatively elastic to changes in the allocation of work.

By age of children

Until so far, only average effects of temporal work flexibility on parental time were analyzed, independent of the age of the child. Younger children need more time from both parents and time investments are found to be most effective in the first year of a child's life (Carneiro et al., 2010). In this section, I will therefore analyze and quantify the effect of temporal work flexibility depending on the age of children to derive additional information about the relative gain from flexitime. Table 7.5 reports coefficient estimates of the flexitime indicator by age group of children for all employed parents by gender.

With children under the age of 3 only, being granted some degree of temporal work flexibility increases maternal childcare time by about 51 minutes. Yet, the size of these estimates must be regarded with great caution as the number of

observations for these workers is very low. It is specifically these first three years of a child's life during which time and resource investments are most effective for the cognitive development of children.[9] However, also maternal employment is found to have the highest influence during these years. The estimates show that granting some degree of temporal work flexibility to mothers strongly increases time with kids. It is hence an important tool that contributes to a mitigation of the adverse effects of employment on the cognitive development of children. In this respect, such work arrangements do not only help mothers with very young kids to reconcile family and work but they also have a positive impact on the child himself. Also fathers with children under the age of 3 tend to spend about 14 minutes more time with their children when flexitime is granted yet this effect is not accurately measured.

The table also shows that mothers tend to spend about 54 log points or 72 percent more on primary childcare related activities with children under the age of 3 when only positive values of child time are considered. Given the low number of observations, these finding must again be regarded with caution. Father, in contrast, devote about 34 log points or about 40 percent more time to such activities yet the estimate is marginally insignificant. When the fraction of child time relative to the total amount of household work is regarded, mothers with kids under the age of 3 devote about 20 percentage points more of their total household time to childcare activities when flexitime is possible. Fathers, in contrast, tend to spend about 5 percentage points more to be with their kids but the coefficient estimate is again not statistically significant. Children under the age of 3 have also much shorter waking hours than their parents. The drastic positive effect of flexitime, particularly in the case of mothers, reflects this fact. Stress induced by having to deal with job and family is slightly reduced for the respective parent. A possible redistribution of the allocation of activities might be entailed by such working schedules yet the low number of observations does not allow for a detailed investigation of this hypothesis.

With increasing age, children need or even want less care from their parents. Time investments have a less drastic effect on the child's cognitive development. Moreover, with increasing age the importance of secondary childcare time is likely to increase drastically which is however not considered here. The lower time inputs lead to lower additional time that parents spent with their kids when being granted flexitime arrangements. Women with pre-school kids devote about 29 minutes more of their available time to be with their kids if their jobs allow for some degree of flexibility. Mothers with kids under the age of 10 enjoy only about 21 minutes more on childcare time. The mitigating effect of fathers with increasing age of their kids declines slightly when their working hours allow for some degree of flexibility. Restricting the sample to parents who report non-zero childcare time reveals a

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[9]See for example Baum (2003); Brooks-Gunn et al. (2003); Ruhm (2004); Hill et al. (2005); Ruhm (2008); Bernal (2008)

Table 7.5: Estimation Results for the Flexitime Indicator on Child Related Time and the Fraction of Total Household Time for Employed Workers by Gender, Depending on the Age of the Child.

	women			men		
	min. of child time	log min.	frac. of hh time	min. child time	log min.	frac. of hh time
kids $\leq$ 3	50.781*	0.540*	0.204*	13.758	0.337	0.054
	(2.22)	(1.80)	(3.77)	(0.89)	(1.54)	(0.85)
N	98	83	99	115	99	115
kids $\leq$ 6	29.045*	0.536*	0.121*	18.510*	0.324*	0.045
	(2.52)	(3.68)	(3.07)	(2.02)	(2.29)	(1.08)
N	238	181	239	267	205	268
kids $\leq$ 10	20.723*	0.461*	0.086*	14.948*	0.273*	0.026
	(2.43)	(3.62)	(2.80)	(2.07)	(2.11)	(0.82)
N	385	298	386	403	296	405
kids $\geq$ 10	18.321*	0.261	0.087*	-6.300	-0.556*	-0.018
	(2.11)	(0.88)	(2.33)	(1.54)	(1.99)	(0.49)
N	176	91	176	188	69	188

Absolute *t*- statistics in parentheses. * indicates significance levels of 10% or higher. Standard errors are robust. Standard control variables: age, 2 skill dummies, a dummy for being married, dummies indicating whether the diary day was a normal day and whether the day was a weekend day as well as regional dummies accounting for GDP per capita and agglomeration type.

relatively stable and very pronounced positive effect of flexitime. Accordingly, mothers tend to devote between 46 to 54 log points (58 – 72 percent) more time when their kids are under the age of 10. Fathers tend to spend on average about 27 – 33 log points (31 – 38 percent) more time with their kids. Relative to total household time mothers tend to have between 9 to 12 log points higher childcare fractions; paternal fractions are positive yet not statistically significant. This emphasizes the hypothesis that parents spend more quality time with their children which goes beyond the satisfaction of basic needs.

For kids older than 10, the effect of temporal work flexibility on parental time diverges for mothers and fathers. While mothers still tend to devote about 18 minutes more time, fathers tend to have different priorities when flexitime is possible. They are found to spend about 6 minutes less on child related activities than fathers who cannot influence their working schedules at all. Yet these estimates are marginally insignificant. Mothers who report non-zero minutes of primary child time have about 26 log points more with their kids while fathers with older kids reduce these activities by even 56 log points. This suggests that a large fraction of fathers in this age group reports zero minutes of childcare time which strongly

upward biases the overall results for these fathers. Those who indeed spend time with their children do so to a significantly lower extent when flexitime is possible. The number of observations is however very low so that these differences shall not be over-interpreted.

All findings obtained so far, point into the same direction: flexitime is used by parents to spend more time with their kids. It is most effective for very young children. These effects can be understood as evidence that such working conditions allow for a better reconciliation of family and work. This flexibility is also an important means to mitigate the adverse effect maternal employment on the child's cognitive development in particular during the first year of the child's life.

In addition, figure 7.4 gives a graphical representation of the coefficient estimates of the flexitime indicator by decile and gender. The upper panel reports coefficient estimates of flexitime on minutes of parental time with children. It shows for men and women likewise that with increasing childcare time, differences by flexitime status increase significantly for mothers and are insignificant across the distribution for fathers. At the median, women tend to spend 18 minutes more time with their kids when flexitime arrangements are granted. At the 9th decile, differences amount to a maximum of 39 minutes.

Figure 7.4: TU: Coefficient Estimates by Decile and Gender on Minutes of Childcare Time (upper panel) and Log Minutes (lower panel).
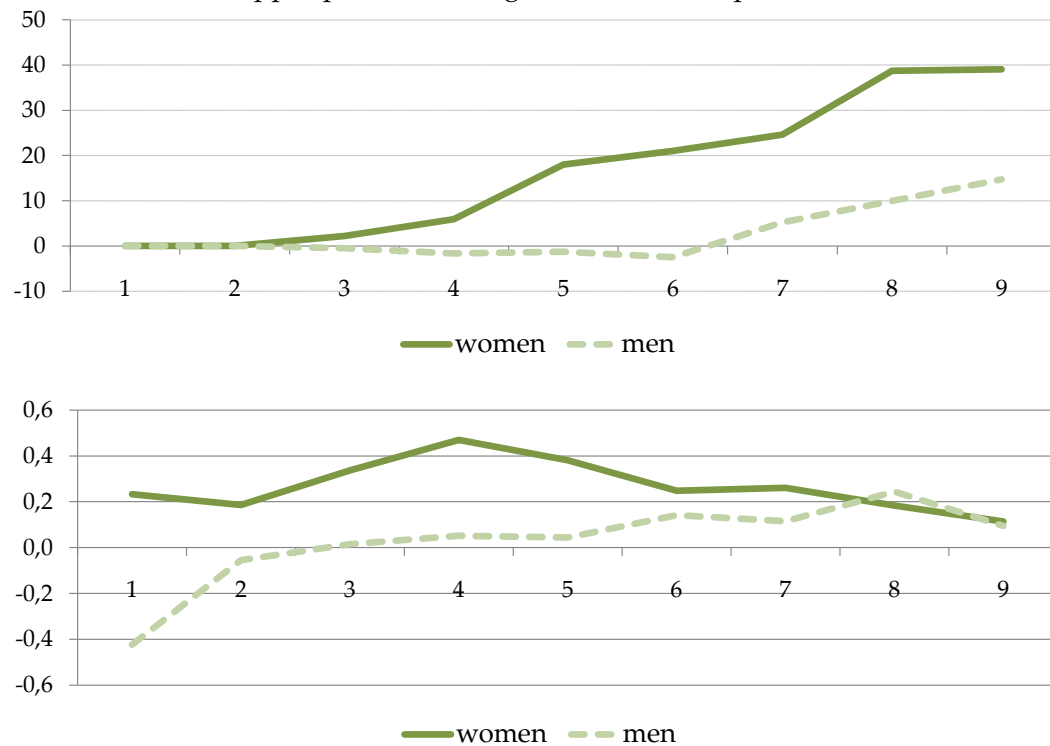
The lower panel of figure 7.4 shows differences in the coefficient estimate by quantile for the log minutes of parental time to only consider parents who indeed

spend some primary time with their kids. This picture is different to the previous one. It shows that women who work flexitime, spend more time with their kids across the whole distribution of parental time yet differences are inaccurate in most cases. I hence find that women in the lowest decile devote about 23 log points more time and in the highest decile, the difference shrinks to 11 log points. For fathers, differences are rather low and insignificant across the whole distribution.

It can hence be concluded from these estimates that flexitime allows mothers to schedule their working hours in such a way as to spend more time with their children and it is found to have no direct influence on East German fathers in 1991/92. Maternal differences increase with the decile of the child time distribution.

Determinants of Parental Time

All determinants of parental time with kids are reported in table 7.6 to minimize the risk of to identification introduced by bad controls.[10] The table shows that only few of the determinants have a significant influence on parental time but the direction of the effects is as expected.

Older parents tend to spend less time with their kids. This is easily explained by the fact that the age of children and their parents are positively correlated. Hence, kids of older parents tend to be older and need less care and attention of their parents. The age effect is of similar size for male and female workers and an increase of ten years reduces parental time by about 23 minutes or by 35 – 46 percent. The parent's education does not have a strong and significant effect on parental time. Maternal time is positively correlated with education so that low skilled parents spend generally less time on childcare activities as compared to medium skilled workers. Mother with higher skills, in contrast, are found to invest slightly more time yet the effect is not significant. High-skilled fathers seem to have different priorities. They are found to devote slightly though insignificantly less time to childcare related activities than fathers with medium educational attainments. The estimates furthermore show that while married mothers devote about half an hour less time to childcare related activities, the opposite holds for fathers. Husbands devote on average about 8.7 minutes more on time with their kids. These effects can be understood as indication that married couples share childcare responsibilities. The table furthermore shows that during weekends, mothers (fathers) devote on average 10 (16) minutes more on primary parental time. However, since employed mothers rather tend to do their household chores during the weekends due to time limitations during the workweek, I find that maternal time relative to all household work is reduced. In order to get a more representative picture about parental time, I additionally added a dummy indicating whether or not the diary day is a 'normal'

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[10]See Angrist and Pischke (2009) for potential biases induced by including bad controls into the regression.

Table 7.6: Time Use Data: Determinants of Time Devoted to Childcare in Eastern Germany by Sex for All Employed Workers.

	minutes		log minutes		fraction	
	female	male	female	male	female	male
flexitime indicator	15.133*	3.091	0.254*	0.016	0.071*	-0.008
	(2.29)	(0.59)	(2.03)	(0.12)	(2.91)	(0.32)
age	-2.278*	-2.272*	-0.030*	-0.038*	-0.011*	-0.011*
	(5.17)	(6.65)	(3.05)	(4.62)	(6.17)	(7.43)
low skilled	-14.542	-11.310	0.323	-0.011	-0.069*	-0.069*
	(0.89)	(1.01)	(1.19)	(0.03)	(1.84)	(1.95)
high skilled	3.916	-4.734	0.053	0.037	-0.015	-0.029
	(0.72)	(1.09)	(0.46)	(0.36)	(0.68)	(1.37)
married	-30.302*	8.675	-0.338*	0.219	-0.019	0.093*
	(4.00)	(1.20)	(2.74)	(1.42)	(0.89)	(3.14)
weekend day	10.187	15.960*	0.294*	0.433*	-0.036	0.011
	(1.42)	(2.44)	(2.09)	(3.56)	(1.50)	(0.40)
normal day	-8.587	-1.915	-0.206*	-0.125	0.011	0.034
	(1.18)	(0.31)	(1.49)	(0.95)	(0.43)	(1.33)
GDP dummies	yes	yes	yes	yes	yes	yes
agglomeration type	yes	yes	yes	yes	yes	yes
N	561	591	389	365	561	591
R^2	0.141	0.105	0.090	0.098	0.105	0.090

Absolute $t-$ statistics in parentheses. * indicates significance levels of 10% or higher.

day. The coefficient estimate reveals that during such days maternal time is about 8.6 minutes lower yet not significant. Fathers, in contrast, devote about 2 minutes less to parental time during normal days as compared to diary days of exceptional days. Additionally controlling for the number of children in the household and the presence of children under the age of 6 has the expected sign: both variable increase parental time for mothers and fathers likewise. Since these variables are potentially endogenous, I will not include them into the following regressions.

I additionally control for regional characteristics and find that parental time is lowest in regions with the lowest GDP per capita. This finding can be explained by the fact that parental time investments are positively associated with incomes at the disadvantage of their kids. Parents who live in regions with lower incomes rather worry about earning enough income to financially support their families (Guryan et al., 2008). The same argumentation holds for people living in rural areas which tend to be poorer on average. People therefore tend to spend less time on childcare related activities while parental time is higher in more urbanized areas.

Differences in the Usage of Time

I will now analyze the influence of flexitime arrangements on different usages of time related to childcare activities. Since the effect of temporal work flexibility is most pronounced for mothers, I will therefore concentrate on them in this section. I will split childcare activities into basic and recreational childcare time. Basic childcare time is defined as all those activities that are essential such as care responsibilities whereas recreational time is defined as activities related to playing, learning with the child etc and can be interpreted as quality time. Table 7.7 shows the marginal effects from probit models for all employed East German mothers who report to spend non-zero childcare time.

Table 7.7: TU: Marginal Effects of the Flexitime Indicator on Basic and Recreational Childcare Time for Mothers.

	basic time	recreational time
flexitime	0.155*	0.058*
	(2.75)	(2.01)
partner works flexitime	0.065	-0.052*
	(1.09)	(2.36)
N	386	386
pseudo R^2	0.103	0.108

Absolute $z-$statistics in parentheses. * indicates significance levels of 10%. The estimates refer to mothers who report to spent non-zero time with their kids. Additional control variables: age, 2 skill dummies, a dummy accounting for weekend diaries, a dummy indicating that the diary day was a normal day, 2 dummies controlling for GDP by regions and two dummies for agglomeration types.

The table shows that temporal work flexibility increases the probabilities to spend both, recreational and basic parental time yet the effect is more pronounced for the latter. Accordingly, mothers who are granted flexitime arrangements tend to spend about 15.5 percent more of their time on basic childcare related activities. When recreational time is considered, the difference is still 5.8 percent higher when the jobs allows for some degree of temporal work flexibility. These results corroborate the hypothesis that flexible working hours allow mothers to spend more quality time with their kids. Such activities are very important for stimulating a child's cognitive development but are also crucial determinants of mental well-being.

The table further reports the coefficient estimate of a dummy variable which captures whether the partner is granted flexitime arrangements on the mothers

probability to spend basic or recreational childcare time. The table shows that women whose husbands are granted flexitime arrangements tend to devote about 5.2 percent less recreational time with their kids. Whether or not the partner is allowed temporal work flexibility, does however not increase the probability of mother for spending basic time with their kids in a significant way. These result can be interpreted as evidence that partners do share some of their responsibilities for their children when quality time with their children is considered. However, all basic activities seem to be the major responsibilities of mothers.

Weekend Substitution?

Childcare related activities are predominantly performed by women since these tasks are still broadly perceived as female responsibilities. In contrast, fathers rather focus on work related activities during the workweek and tend to make-up for the forgone time with their kids by spending more time with them during the weekend. Table 7.8 presents the estimation results for men and women separately for the flexitime indicator as well as a dummy variable for weekend work as well as an interaction term of both.

Table 7.8: Estimation Results for the Flexitime Indicator on Child Related Time by Gender for All Employed Workers who Report a Weekend and a Workweek Day.

	women		men	
	(1)	(2)	(3)	(4)
flexitime	17.791	28.592	0.797	-25.479*
	(1.31)	(1.34)	(0.08)	(2.75)
weekend	12.695	16.405	17.479*	8.961
	(1.27)	(1.53)	(2.22)	(1.03)
weekend*flexitime		-17.571		50.983*
		(0.60)		(2.56)
N	186	186	196	196
R^2	0.167	0.169	0.162	0.187

Absolute $t-$statistics in parentheses. * indicates significance levels of 10%. Additional control variables: age, 2 skill dummies, a dummy indicating that the diary day was a normal day, 2 dummies controlling for GDP by regions and two dummies for agglomeration types.

Columns (1) and (3) present baseline specifications for those parents who completed diaries for one day during the workweek and the second being a weekend day. This restriction leads to a considerable drop in the number of observations and hence to less inaccurately estimated coefficients. Their size is comparable to

the previous sections though it is slightly augmented. The results of the baseline specification shows that mothers who are granted flexitime arrangements devote almost 18 minutes more of their time to childcare activities during the workweek as compared to the reference group. Furthermore, women tend to spend about 13 minutes more on primary childcare time during weekends as compared to workweek days. As reported in column (3), temporal work flexibility does not seem to affect paternal time with children during the workweek. In contrast, there is evidence that fathers tend to make up for not having enough time with their kids by spending about 17 minutes more with their children during weekends. This is considerable given the relatively very average minutes of primary childcare related time.

Augmented regression results are reported in columns (2) and (4) which I will use to analyze the hypothesis of whether or not and to what extent flexible working hours and weekend work are associated. Adding an interaction term results in a larger coefficient estimate of the flexitime indicator for mothers. Interacted with the weekend dummy, I find that mothers who are granted some degree of temporal work flexibility tend to spend more time with their kids during the standard workweek yet they tend to devote less of their time on primary childcare activities during the weekends. The interaction term is however not accurately measured.

Including the interaction term for fathers, has a very different impact. When only the flexitime indicator is considered, it is associated with significantly less paternal time during the workweek. These fathers seem to rather concentrate on other activities by leaving childcare tasks to their wives. The interaction term however reveals that fathers make up for this forgone time by spending significantly more time with their kids during weekends. The interaction term therefore reveals that father with job that grant some degree of temporal work flexibility spend during weekends about 51 minutes more of their time on primary childcare activities.

These estimates help us to understand the mechanism that flexible working hours has on parental time better. While women are mainly responsible for childcare related tasks, they use the time they gain from flexible working hours to spend more time with their kids during the workweek. Fathers, in contrast, make up for the time they did not spend with their kids during the workweek and compensate it by spending significantly more time during the weekend. It can hence be argued that mothers can hence devote their time during the weekend for other activities. This explains the negative sign of the coefficient estimate for the interaction term for mothers.

To further analyze what kinds of activities are mainly performed during the workweek and during weekends in the case of mothers, I further analyze differences in the probability of performing basic or recreational time. Coefficient estimates of a linear probability model are presented in table 7.9 for those mothers who

Table 7.9: TU: Linear Probability Model for the flexitime indicator on basic and recreational time with children for mothers who report a weekend and workweek day.

	basic time		recreational time	
	(1)	(2)	(3)	(4)
flexitime	0.285*	0.163	-0.046	0.083*
	(2.79)	(0.98)	(0.90)	(1.73)
weekend	-0.250*	-0.301*	0.061	0.115*
	(3.24)	(3.61)	(1.51)	(2.20)
weekend*flexitime		0.217		-0.229*
		(1.00)		(2.35)
N	129	129	129	129
R^2	0.219	0.230	0.103	0.147

Absolute $t-$ statistics in parentheses. * indicates significance levels of 10%. Additional control variables: age, 2 skill dummies, a dummy indicating that the diary day was a normal day, 2 dummies controlling for GDP by regions and two dummies for agglomeration types.

again completed diaries for a day during the weekend and one for the workweek. Columns (1) and (3) show again the baseline specifications without interaction term. As shown in section 7.3.3, flexitime arrangements increase a mother's probability to spend time on basic activities with their children. In contrast, they are significantly less likely to be performed during weekends. The third column shows that the probability of spending recreational time decreases slightly when temporal work flexibility is granted and it is higher during weekends. The accuracy of the coefficient estimates for this specification is however relatively low which is due to the few observations.

The second and fourth column of table 7.9 present the respective coefficient estimates for the probability of basic and recreational time of mothers augmented by an interaction term between the weekend and flexitime indicators. Accounting for this term shows that mothers tend to have higher probabilities to spend time on basic and recreational childcare activities when merely the flexibility indicator is regarded. In addition, mothers are less likely to have basic childcare time during weekends and tend to rather devote recreational or quality time with their kids. Mothers who are granted flexitime are further found to be more likely to spend basic time during weekends with their kids but are less likely to have recreational time.

Combining these results with those of table 7.8 reveals that mothers who are granted flexitime arrangements devote more of their time during the workweek

to be with their kids and are also more likely to spend it on both basic and recreational activities. During weekends, however, they tend to spend generally less time on primary childcare time with an augmented likelihood of having basic childcare activities. These results can be interpreted as evidence that mothers use their temporal work flexibility to spend more time with their children during the workweek on basic and quality time and fathers tend to enjoy quality time with their kids rather during the weekend and concentrate on other activities during the standard workweek.

7.3.4 Robustness Check

In section 7.3.3, I have shown that individual characteristics do not determine the probability to be granted flexitime arrangements or not. However, such working conditions occur to a greater extent in particular industries and occupations namely in the service sector employees and among white-collar workers.

To further test this assumption, table 7.10 additionally shows the sample composition by flexitime status and by gender. By means of a simple t-test, I check whether the explanatory variables differ among the groups. Columns (3) and (6) report the respective p-values of the t-test for each variables separately. The dependent variables significantly differ for sample women yet there are no significant differences among men. Since these are the dependent variables, differences among the groups are essential for finding any effects of working flexitime using econometric techniques.

The t-test of the explanatory variables by flexitime status and gender reveals no significant differences. This finding corroborates the validity of the identification strategy and it can be argued that differences in parental time result from different allocations of market work but are not driven by different sample compositions. Non-random selection might originate from different channels though as described earlier.

In the former GDR, workers were assigned to particular jobs and could not choose it because of childcare concerns, for example. Table 7.11 reports the average incidence of flexitime arrangements by gender for different occupations in Eastern Germany for 1991/92. It shows that among men and women, flexitime is most likely to be granted in office occupations, in the textile industry as well as in social service jobs. Management employees as well as engineers and merchants are equally likely to be offered some degree of flexibility. These occupations tend to require a higher degree of education so that it can be argued that it is rather the better educated workers who benefit most from flexible working schedules. As Guryan et al. (2008) show better educated workers tend to spend quantitatively and qualitatively more time with their kids.[11] If a variable that affects both the

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[11] See also Bianchi and Robinson (1997); Bryant and Zick (1996); Datcher-Loury (1988); Leibowitz

Table 7.10: TU: Summary Statistics for Employed Workers by Flexitime Status and Gender as well as *t*-tests for Compositional Differences.

	female			male		
	no flex. (1)	flex. (2)	t-test (3)	no flex. (4)	flex. (5)	t-test (6)
dependent variables:						
minutes	43.790 (58.867)	61.382 (70.243)	0.005	38.268 (51.517)	40.642 (51.980)	0.665
log minutes	3.705 (1.029)	3.983 (1.054)	0.025	3.752 (0.921)	3.778 (1.044)	0.840
fraction of hh time	0.208 (0.241)	0.278 (0.248)	0.005	0.214 (0.259)	0.211 (0.244)	0.908
individual characteristics:						
age	34.201 (5.702)	34.569 (5.569)	0.525	35.929 (5.994)	35.798 (6.169)	0.837
low skilled	0.039 (0.193)	0.041 (0.198)	0.926	0.027 (0.162)	0.028 (0.164)	0.975
medium skilled	0.587 (0.493)	0.551 (0.498)	0.609	0.593 (0.492)	0.514 (0.502)	0.129
high skilled	0.374 (0.485)	0.398 (0.492)	0.630	0.380 (0.486)	0.459 (0.501)	0.128
married	0.822 (0.383)	0.756 (0.431)	0.102	0.907 (0.291)	0.899 (0.303)	0.808
work characteristics:						
full-time	0.817 (0.387)	0.789 (0.410)	0.473	0.979 (0.143)	0.991 (0.096)	0.420
N	438	123		482	109	

Standard deviations are given in parentheses.

occupation-specific propensity for flexitime arrangements and average parental time with children within this occupation is not controlled for but has a systematic impact, the coefficient estimate of the flexitime indicator will be biased. In this section, I will therefore test for potential non-random selection of workers in different occupations.

For an identification of potential non-random selection, I use three different exclusion restrictions. As shown earlier, service sector employees and employees in white collar-occupations have a greater probability to be granted flexitime arrangements. I therefore include two dummies accounting for these conditions

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(1977).

Table 7.11: TU: Flexitime Incidence by Occupation and Sex for All Employed Workers.

	female	male
agriculture & mining	0.132	0.109
paper & wood	0.000	0.000
metal production & processing	0.000	0.176
engineering	0.071	0.070
metal construction	0.111	0.083
textiles & leather	0.500	0.500
food	0.000	0.200
construction	0.053	0.036
upholsterers	0.000	0.000
painters	0.000	0.000
packers	0.000	0.000
machine operators	0.000	0.000
engineers, chemists, pysicists	0.286	0.216
merchants & traders	0.239	0.276
transport	0.115	0.093
management & consulting	0.300	0.293
office occupations	0.532	0.473
security operations	0.130	0.071
artists & authors	0.000	0.000
medicine & health	0.042	0.048
social services	0.382	0.404
other servicde occupations	0.000	0.000
others	0.222	0.286

into the choice equation. The major exclusion restriction, however, is the average rate of flexitime work in different occupations and different sectors for Germany derived from the second wave of the German Time Use Data (2001/02).[12] Similar to the exclusion restriction used in Chapter 5, it captures the difference in occupation- and sector-specific tendencies of flexitime arrangements. This exclusion restriction is appropriate if employers acknowledge that such working schedules influence the work output positively. In addition, information about the incidence of flexitime arrangements for the second wave aggregates choices that were taken *after* the survey year of interest. It can therefore be assumed that the exclusion restriction is highly correlated with the incidence of flexitime arrangements in different jobs and industries in 1991/92 but it does not affect parental time during the year of the analysis. The strong positive correlation of the rate of flexitime arrangements in

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[12]I tried different other exclusion restrictions: (i) the rate of shift work by sector and occupation in Eastern Germany only in 2001/02 and (ii) the rate of shift work in West Germany in 1991/92. Both other exclusion restrictions deliver very similar results to those reported here.

1991/92 and 2001/02 is further depicted in figure 7.5. It can therefore be concluded that the rate of flexitime in 2001/02 is an appropriate exclusion restriction for the identification of possible non-random selectivity within sectors and occupations.

Figure 7.5: TU: Correlation between the Rate of Flexitime Work in 1991/92 and 2001/02.
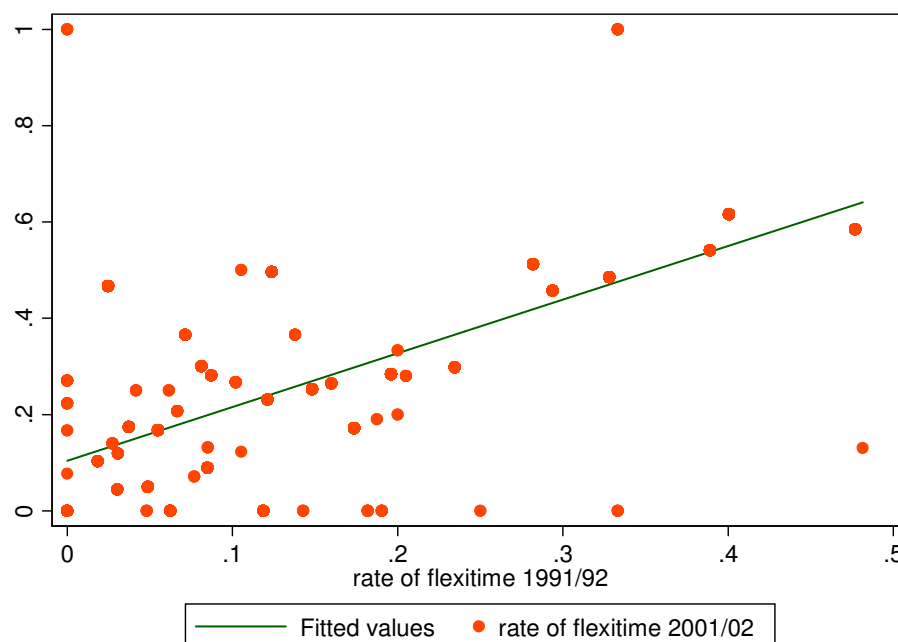
A selectivity corrected model, also known as treatment effects model, is estimated and selected results are reported in table 7.12. Estimates of the flexitime indicator, the selection term as well as the coefficient estimate of the main exclusion restriction of the first stage probit model by gender and employment status are presented. First, the table reveals that the rate of flexitime in 2001/02 by sector and occupation is highly significant in all regressions and is strongly positively correlated with the probability to be granted flexible working schedules. Consequently, the sector- and occupation-specific tendencies are well captured by this term.

Moreover, the selection term is insignificant in all cases which suggests that selection of workers in different occupations and sectors for unobserved occupational differences that are correlated with parental time is no issue in Eastern Germany in 1991/92. The only exception is obtained for full-time employed men on the total minutes of childcare time. Yet it is safe to assume that flexitime is rather granted to women for childcare reasons and it rather unlikely for men. OLS estimates are hence adequate when the causal effect of temporal work flexibility on parental time is explored. Selection corrected estimates further show a negative though insignificant selection term in the case of minutes of parental time. This suggests that OLS estimates are slightly downward biased. The coefficient estimates of the flexitime indicator reveals that parents who are granted some degree of temporal

Table 7.12: Coefficient Estimates of Flexitime Indicator, Selection Term and of the Exclusion Restriction from a Treatment Effects Model on Parental Time by Gender and Employment Status.

	employed		full-time	
	female	male	female	male
1. minutes of child time:				
flexitime	32.022*	28.124*	39.776*	33.963*
	(2.03)	(1.67)	(2.21)	(1.99)
selection term ($\hat{\lambda}$)	-11.506	-15.650	-16.703	-18.396*
	(1.18)	(1.57)	(1.52)	(1.82)
rate of flexitime (1st stage)	1.286*	1.075*	1.106*	1.064*
	(4.04)	(3.21)	(3.24)	(3.16)
N	561	591	455	580
2. log minutes of child time:				
flexitime	0.000	0.059	0.129	0.173
	(0.00)	(0.15)	(0.36)	(0.44)
selection term ($\hat{\lambda}$)	0.164	-0.025	0.093	-0.082
	(0.85)	(0.11)	(0.43)	(0.35)
rate of flexitime (1st stage)	1.260*	1.046*	1.153*	0.975*
	(3.17)	(2.45)	(2.69)	(2.20)
N	389	365	318	356
3. fraction of total household time:				
flexitime	0.074	0.048	0.164*	0.059
	(1.18)	(0.58)	(2.37)	(0.69)
selection term ($\hat{\lambda}$)	-0.002	-0.035	-0.064	-0.041
	(0.04)	(0.71)	(1.53)	(0.81)
rate of flexitime (1st stage)	1.286*	1.075*	1.106*	1.064*
	(4.04)	(3.21)	(3.24)	(3.16)
N	561	591	455	580

Absolute $t-$ statistics in parentheses. * indicates significance levels of 10% or higher. Standard errors are robust. Additional control variables: age, 2 skill dummies, a dummy for being married as well as regional dummies accounting for GDP per capita and agglomeration types. Additional exclusion restriction: dummy for white-collar workers.

work flexibility spend on average about half an hour more on childcare related activities. However, the fact that the selection term is not significant indicates that OLS estimates are appropriate to estimate the effect of flexitime on parental time.

7.4 Can the Results be Generalized?

East German workers are socialized differently than Western Germans and also the labor market in the former GDR was very particular as described in section 7.2.1. Consequently, it is possible that attitudes towards work and spending time with kids differ entirely but also that the sample itself is non-representative for Germany as a whole. In order to test whether the results obtained so far for East Germans also hold for all Germans a decade later, I will now use a different dataset, namely the German Socio-Economic Panel (GSOEP) for the years 2002 – 2008. The sample is again restricted to all employed workers under the age of 55 with kids under the age of 15.

7.4.1 Definition of Variables and Sample

Apart from a wide range of socio-economic information and workplace related characteristics, the GSOEP data contains information on average hours spent on childcare related activities during a typical weekday. Respondents do not fill in diaries but report the estimated average amounts of time. Accordingly, all sorts of activities that are enjoyed together with kids are contained by this activity aggregate. It is therefore not merely primary childcare time that the variable comprises as in the case of the German Time Use Survey. Secondary activities like watching TV together with the kid or eating dinner with the whole family or doing other things while the child takes a nap are also counted. An additional short-coming of this variable is that respondents can only specify integer hours of childcare time so that the individual variability of this variable between years is limited.

Moreover, detailed information on temporal work flexibility is scarce in this dataset. To approximate temporal work flexibility, I define temporal work flexibility by all people who indicate to start their workday at varying time intervals. This information is only available biannually between 2002 and 2008. Various reasons are possible as to why parents and particularly mothers start to work at different time intervals of the day. I will therefore analyze the influence of temporal work flexibility on parental time again by employment status. Since people with flexible working schedules might be compositionally different from those who work flex-itime and were analyzed by the German Time Use data in the previous section, I will examine the determinants of work with such schedules more closely in section 7.4.3.

Summary statistics of the sample are shown in table 7.13 for all employed men and women. It shows similar things as for the East German parents: men are slightly older, are more likely to be married and tend to have on average more children than women. The years of schooling are slightly higher for men. Only about 25 percent of all employed German women work full-time in the years 2002 – 2008.

Table 7.13: GSOEP: Summary Statistics for employed workers by gender.

	women	men
individual characteristics:		
age	34.39	40.30
	(5.85)	(6.03)
years of schooling	12.27	12.41
	(2.39)	(2.69)
married	0.79	0.93
	(0.41)	(0.25)
full-time employed	0.25	0.96
	(0.43)	(0.19)
household characteristics:		
# of kids	1.70	1.89
	(0.72)	(0.82)
kids ≤ 3	0.07	0.07
	(0.26)	(0.25)
kids aged 3–6	0.21	0.23
	(0.41)	(0.42)
kids 6–10	0.62	0.59
	(0.49)	(0.49)
kids 10– 15	0.49	0.50
	(0.50)	(0.50)
	3267	3618

Standard deviations are given in parentheses.

7.4.2 Descriptive Statistics: Parental Time with Children

Table 7.14 reports the allocation of average childcare time and market work for a usual workday by sex, employment status and depending on the flexibility status. Compared with the information on primary childcare time derived from the time diary information of the German Time Use Data, parental time reported here which includes secondary parental time is much higher.[13]

Table 7.14 shows that all employed mothers devote on average 5.1 hours on childcare activities between 2002 – 2008 and full-time employed mothers about 3.3 hours. Women who start their workday at varying time intervals tend to spend on average about 22 – 54 minutes more time with their kids. The table additionally shows that full-time employed women report to work on average more than 8.7 hours. By including also part-time employed mothers, average market

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[13]It has to be furthermore noted that the definitions of the activity aggregates are not comparable across the data sets.

Table 7.14: GSOEP: Allocation of Average Child Time and Market Work by Gender and Flexibility Status.

	women			men		
	all	no flex.	flex.	all	no flex.	flex.
full-time employed						
hours of child time	3.34	3.03	3.94	1.49	1.47	1.53
	(3.71)	(3.20)	(4.50)	(1.71)	(1.74)	(1.65)
hours of market work	8.74	8.92	8.39	9.82	9.93	9.59
	(1.76)	(1.71)	(1.80)	(1.64)	(1.10)	(1.75)
N	819	542	277	3485	2353	132
all employed						
hours of child time	5.11	4.98	5.35	1.52	1.50	1.56
	(4.76)	(4.71)	(4.83)	(1.78)	(1.82)	(1.68)
hours of market time	5.83	6.09	5.36	9.70	9.83	9.43
	(2.76)	(2.69)	(2.82)	(1.81)	(1.71)	(1.97)
N	3267	2099	1168	3618	2438	1180

Standard deviations are given in parentheses.

work amounts to an average of 5.8 hours. In this case, women who have some temporal work flexibility report to work 32 – 42 minutes less.

Men, in contrast, tend to spend only about 1.5 hours on childcare activities during a usual workday but there is virtually no difference by differentiating by the degree of temporal work flexibility. Regarding working hours, fathers report to work on average almost 10 hours. Men without flexibility report to work on average about 20 minutes longer.

Figure 7.6 shows the distribution of parental time by gender for full-time employed parents. While most men devote at most 2 hours on childcare activities, the distribution of mother's time is wider. The evolution of parental time with children over the sample period is further illustrated by figure 7.7. Employed mothers devote significantly more time to child care related activities than fathers over the whole time period. However, average parental time decreases from 2001 to 2008 but to a larger extent for women. While mothers spent on average about 5.8 hours on childcare time in 2002, the average time drops to 4.6 hours in 2008. Fathers, who devoted about 1.7 hours in 2002 on average, enjoy only 80 percent to be with their kids at the end of the sample period.

Even though the absolute amounts of time devoted to parental time differ between the datasets due to different definitions, the direction of impact is the same: women devote more of their time to be with their kids when their jobs allow for some kind of temporal flexibility. The association is however less pronounced

Figure 7.6: GSOEP: Distribution of Parental Time with Kids for Full-time Employed Germans by Gender.
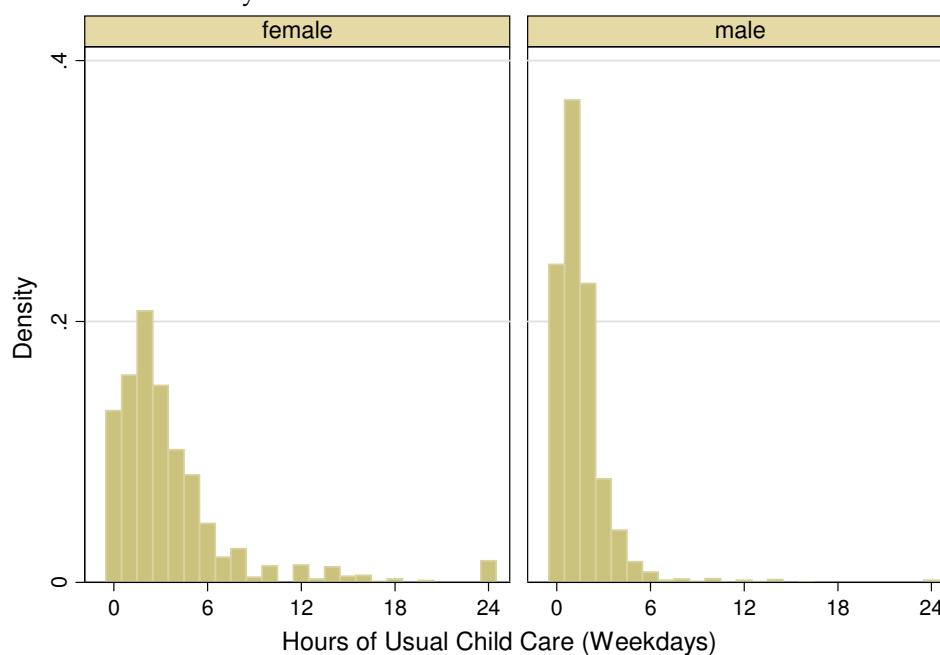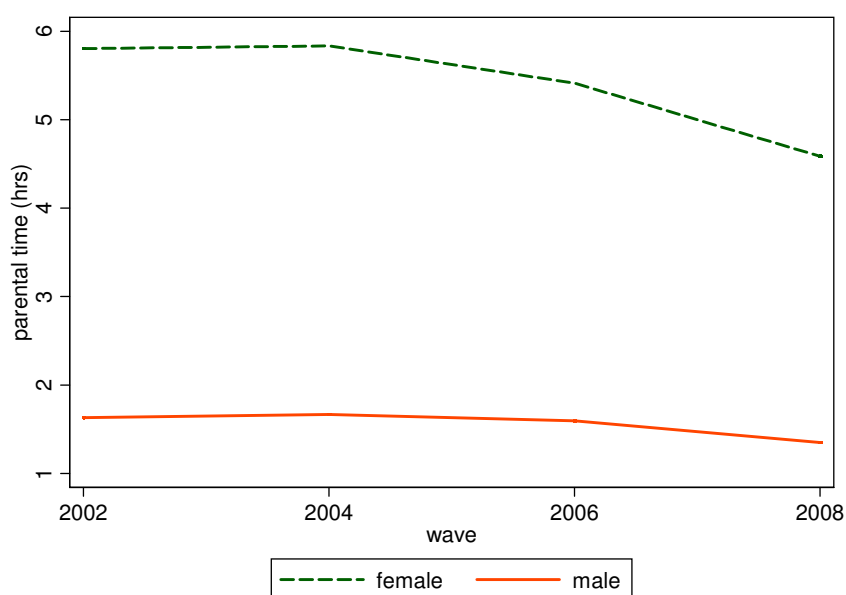

Figure 7.7: GSOEP: Parental Time with Children of Employed Parents by Sex (2001 – 2008).

in the case of fathers. The preceding analysis will show whether this is robust after controlling for pre-determined characteristics.

7.4.3 What determines a Varying Start of the Workday?

Table 7.15 shows the marginal effects of the determinants of temporal work flexibility as defined here by employment status and gender. The probability to choose such a job tends to decrease with tenure and age for women and with years of schooling for men.

Employed mothers with kids under the age of 6 tend to be more likely to start their workday at different time intervals while the opposite holds for fathers. This is one indication that the temporal work flexibility is endogenous and is likely to be driven for childcare concerns. The number of kids has no influence on the mother's decision yet it is associated with lower probabilities for fathers.

When it comes to workplace characteristics I find that, like for East Germany, service sector employees and parents employed in white-collar job tend to have a greater probability to start their workday at different time intervals. While the work biography does not matter for father, mothers with more years of full-time experience tend to be more likely to have some degree of temporal work flexibility. In addition, mothers who work in firms with no other coworkers also tend to have a higher probability. The probability of men for being granted some flexibility is highest when they work in firms with more than 2000 employees. Furthermore, log labor incomes are negatively associated with this choice when all employed mothers are regarded and the opposite holds for men. Others workplace characteristics do not have a significant impact on the choice of such a job.

7.4.4 Empirical Specification and Identification

The impact of temporal flexibility on parental time will be estimated by the following estimation equation:

$$\ln C_{it} = \mathbf{X}'_{it}\beta_1 + \beta_2 F_{it} + \gamma_t + \gamma_i + \epsilon_{it}. \tag{7.2}$$

where $\ln C_{it}$ is the log of childcare time reported by respondent i at time t. The main variable of interest is F_{it} which is again an indicator variable that takes the value 1 if the person has some temporal work flexibility and 0 otherwise. The respective coefficient β_2 therefore estimates the impact of childcare time due to being granted some degree of temporal work flexibility. Moreover, I control for time fixed effects, γ_t, to account for the fact that parental time with children generally trends downward over the observation period. Moreover, individual fixed effects, γ_i, are added in some specifications. Consequently, I compare individuals who are exposed to temporal work flexibility with those who are not. The matrix $\mathbf{X}_{it}$ contains pre-determined control variables such as age, years of schooling, federal state dummies and dummies for being married and holding the German citizenship.

Table 7.15: GSOEP: Marginal effects on the choice of starting to work at varying time intervals by sex and employment status.

	employed		full-time	
	female	male	female	male
personal characteristics:				
age	-0.004*	0.001	-0.010	0.000
	(1.66)	(0.17)	(1.62)	(0.04)
yrs. of schooling	-0.004	-0.027*	-0.006	-0.028*
	(0.82)	(5.62)	(0.61)	(5.65)
married	-0.009	-0.009	-0.032	-0.029
	(0.36)	(0.26)	(0.76)	(0.76)
german	-0.030	-0.015	0.024	-0.012
	(0.84)	(0.53)	(0.35)	(0.41)
household characteristics:				
# of kids	0.012	-0.018*	0.010	-0.015
	(0.84)	(1.72)	(0.32)	(1.39)
kids < 3	0.086*	-0.092*	-0.060	-0.094*
	(1.68)	(2.32)	(0.52)	(2.35)
kids 3–6	0.013	-0.043	-0.111*	-0.052*
	(0.41)	(1.61)	(1.73)	(1.91)
kids aged 6–10	0.034	-0.013	0.037	-0.016
	(1.50)	(0.61)	(0.79)	(0.75)
workplace characteristics:				
white-collar	0.042*	-0118*	0.024	-0.123*
	(1.91)	(5.79)	(0.47)	(6.00)
log labor income	-0.035*	0.033*	-0.004	0.030
	(2.89)	(1.84)	(0.17)	(1.42)
tenure	-0.002	-0.001	-0.007*	-0.001
	(1.11)	(0.63)	(2.05)	(0.74)
exp.: full-time empl.	0.004*	-0.004	0.008	-0.004
	(1.66)	(1.42)	(1.48)	(1.31)
service sector	0.087*	0.038*	0.022	0.039*
	(3.61)	(2.13)	(0.45)	(2.16)
no coworkers	0.171*	-0.053	0.198*	-0.022
	(3.64)	(1.08)	(1.91)	(0.44)
firm size: < 5	0.018	-0.247*	-0.083	-0.253*
	(0.50)	(6.62)	(1.03)	(6.59)
firm size: 5–200	-0.001	-0.280*	-0.031	-0.282*
	(0.05)	(13.55)	(0.59)	(13.61)
firm size: 200–2000	0.053	-0.113*	-0.023	-0.111*
	(1.57)	(4.97)	(0.37)	(4.89)
N	2656	2965	655	2866
R^2	0.040	0.097	0.073	0.104

Absolute $z-$statistics in parentheses. * indicates significance levels of 10% or higher. Additional explanatory variables comprise for the time use data: regional dummies, dummies for self-employment and a second job, conservative political beliefs, having an employed partner, as well as the number of weekly working hours and the years of unemployment experience and of part-time work.

The main problem to identification in this context is reverse causality. Parents are free to choose their jobs given the pecuniary and non-pecuniary compensation package offered. Workers and in particular mothers therefore tend to choose jobs that offer flexibility because of childcare considerations. In this case, OLS estimates

are biased. To deal with this concern, I use an instrumental variable approach in which I instrument the indicator of temporal work flexibility, F_{it}, with the rate of temporal work flexibility by occupation and sex of parents with children older than 10. This instrument is highly correlated with the individual inclination to have some degree of temporal work flexibility and it further takes account of the fact that flexibility is more likely to be granted in particular industries. Section 7.3.3 has further shown that parents and in particular fathers of older kids set their priorities independent from childcare concerns. For the instrument to be exogenous to the error term, it is important that the individual who works in a job that grants flexibility of working schedules to have more time with kids only operates through those parents with young kids who are excluded from the instrument.

These assumptions are relatively plausible as the instrument accounts for the fact that flexibility is more likely in particular industries. In addition, it is mainly parents of younger kids who choose to work in jobs offering temporal work flexibility in order to be with their kids, which is picked up. Older kids need less attention of their parents and teenagers might sometimes even refuse to spend more time than necessary with their parents. It follows that for parents with kids above the age of 10, the choice for a job that offers flexible working hours is not motivated by childcare concerns but by other factors.

7.4.5 Description of Results

Estimation results on log hours of parental time are reported in table 7.16. Column (1) presents results from pooled OLS regressions and column (2) shows IV estimates accounting for reverse causality. Column (3) reports results from fixed effects regressions and finally, column (4) depicts coefficient estimates of instrumental variable fixed effects regressions.

As before, each cell of the table corresponds to a coefficient estimate of the flexibility indicator of separate regressions by employment status and sex.[14] The results generally corroborate earlier findings in that they suggest that temporal work flexibility increases parental time in particular of mothers.

Pooled OLS results are reported in the first two columns of table 7.16. They indicate a positive effect of temporal work flexibility and maternal time. The Pooled IV results indicate that full-time employed women tend to spend on average about 9.6 log points more on childcare related activities. In absolute terms, these mothers devote about 0.32 hours or 19 minutes more of their time to be with their kids which is slightly increased as compared to the estimates obtained from time use data presented in table 7.4. This estimate is however not accurate. A possible reason could be the low variation of the average childcare time as people were allowed to report merely integer hours.

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[14]Predetermined variables such as age, years of schooling, marital status, German nationality, dummies for the federal state of residence and time dummies are additionally controlled for.

Table 7.16: GSOEP: Coefficient Estimate on Log Parental Time by Gender. OLS, IV and Fixed-Effects Regressions (2002 – 2008).

	OLS		FE	
	OLS (1)	OLS-IV (2)	FE (3)	FE-IV (4)
female workers:				
full-time employed	0.214*	0.096	0.034	0.603
	(3.73)	(0.71)	(0.36)	(1.51)
first stage *F*-statistic	–	174.67	–	9.90
N	592	448	592	363
R^2	0.123	0.160	0.085	0.066
part-time employed	0.068*	0.178*	0.055	-0.114
	(1.69)	(1.92)	(1.04)	(0.27)
first stage *F*-statistic	–	376.86	–	20.40
N	1426	977	1426	836
R^2	0.085	0.085	0.137	0.168
male workers:				
full-time employed	0.036	0.088	0.003	-0.036
	(1.32)	(1.60)	(0.08)	(0.20)
first stage *F*-statistic	–	591.78	–	27.27
N	1781	1781	1781	1690
R^2	0.108	0.106	0.030	0.021

Absolute $t-$ statistics in parentheses. * indicates significance levels of 10% or higher. Standard errors are robust. Additional controls: age, years of schooling, marital status, German nationality, dummies for federal states of residence as well as time dummies. The first stage *F*-statistic indicates the Kleibergen-Paap *rk* Wald *F*-statistic.

A comparison of the pooled OLS and IV estimates as reported by columns (1) and (2) further reveals the expected upward bias of simple OLS estimates when reverse causality is not accounted for. Coefficient estimates obtained from fixed effects regressions need to be regarded with caution exactly due to the low degree of changes in the flexibility indicator over time among individuals. Yet, the direction of impact is the same as before although the coefficient estimates are insignificant: full-time employed women who are granted some degree of temporal work flexibility spend more time on childcare activities than the reference group. The table additionally presents *F*-statistics of the instrument for the first stage regressions. The instrument is well suited for the pooled OLS regressions yet it is weaker in the case of instrumental fixed-effects.

The second panel of table 7.16 presents estimation results for part-time employed women who account for about 75 percent of all employed women in the sample. Such work itself grants already a higher degree of temporal flexibility. I will now analyze and quantify how time with children is additionally affected by starting the workday at different time intervals. The OLS estimates suggest that such women spend about 18 log points more on childcare time than part-time employed women with fixed schedules. Results from fixed effects regressions reveal however, that among the changers, being granted some degree of temporal flexibility reduces parental time with kids. However, only 20.6 percent of all part-time employed change the flexibility status over the years. Consequently, the coefficient represents only the decision of one fifth of the sample and must therefore be regarded with caution. The *F*-statistics of the first stage regression indicates that the instrument is again well suited in this case.

In the case of men, the OLS estimates show that being granted some degree of temporal work flexibility increases the time that fathers spend with their kids by about 8.8 log points which corresponds to an increase by 8 minutes. A comparison of the coefficient estimates of pooled OLS and IV regressions reveals a downward bias of the simple OLS estimates when reverse causality is not accounted for. Fixed-effects regressions, in contrast, show that temporal work flexibility hardly affects paternal time with kids. These results are not very surprising yet must again be considered with even greater caution. Firstly, fixed-effects regressions only explain the behavior of about 15 percent of the full-time employed fathers and 35 percent of these few changers even report multiple changes. In addition, figure 7.6 shows that the variability of paternal time with kids is low for only integer numbers of paternal time are allowed to be reported by the respondents of the survey.

It can be concluded from these results that the temporal work flexibility increases parental time with kids. The findings of the time use data for East Germany shortly after the re-unification can be confirmed for all German workers between 2002 and 2008.

7.5 Conclusion

Childcare activities are still largely perceived as female responsibilities. Yet, better occupational careers and equal opportunities for women will further weaken the differentiation into male and female tasks in the future. The impeding shortage of skilled labor in combination with an aging work force and falling birth rates will additionally make political measures that enhance female labor force participation indispensable. The importance for the creation of measures that facilitate the reconciliation of family and work will be growing even more. In this context, this paper examines the casual link between temporal work flexibility and parental time

with children and seeks to quantify this effect. This is an important issue not only because it alleviates the stress of mothers who have to juggle work and family and thus contributes positively to the well-being of the whole family. In addition, time investments are major determinants for the cognitive development of children in particular during the first year of a child's life. Yet, maternal employment during these years is found to negatively affect the child's cognitive development (Baum, 2003; Brooks-Gunn et al., 2003; Ruhm, 2004; Hill et al., 2005; Ruhm, 2008; Bernal, 2008).

For identification, I exploit the German re-unification as quasi-experiment. Even though, both parts of Germany were subject to similar regulations before 1990, the economic situations were very different. The particularity of the East German labor market can be employed to identify the causal link. More precisely, childcare facilities were almost ubiquitous in East Germany and the job choice was strongly restricted by the requirements of the centrally planned economy yet not by individual preferences. Working conditions can hence be regarded as being exogenous and are not subject to choice. The analysis of this paper is based on German Time Use Data for the year 1991/92. By means of GSOEP data for 2002 – 2008, the results obtained for Eastern Germany are found to be generalizable to Germany as a whole. The identification for this dataset is obtained by an instrumental variable approach.

The estimation results suggest that flexibility with respect to the organization of working hours increases parental time in particular of mothers by about 30 percent. While the positive effect is independent of the child's age for mothers, I find that flexitime arrangements increase paternal time only for kids under the age of 10. For older children, however, the opposite is found which suggests that these fathers rather substitute their non-market time away from child related activities as these kids need generally less attention and care from their parents. In addition, with an increasing position in the child time distribution, also the positive effect of temporal work flexibility intensifies drastically.

The results are robust and indicate that flexible working schedules indeed enhance the reconciliation of family and work not only for mothers. No evidence for systematic selectivity of flexitime arrangements in certain occupations is found for East German workers. Results obtained from GSOEP data for Germany as a whole further reveal that OLS estimates tend to overestimate the true influences of temporal work flexibility for mothers but underestimate the impact for fathers.

Increasing the labor supply of women is high on the political agenda. In order to encourage aggregate domestic demand and to boost aggregate domestic production and therefore to spur aggregate economic growth in the medium-run, it is essential for each country to use the total labor market potential. To give women an incentive to supply work at the extensive and intensive margin requires a reconciliation of

family and work. As the example of the former GDR shows, measures to enhance temporal work flexibility can only work in combination with an expansion of the provision of childcare facilities. A further modification of the tax system for married couples that discourages female labor force participation in Germany are additionally needed to improve the labor market situation and thus to stimulate growth.

8 Appendix

8.1 Appendix of Chapter 4

Table 8.1: Summary Statistics of workplace characteristics.

	all				both work			
	male		female		male		female	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
full-time	1.000	(0.000)	0.212	(0.409)	1.000	(0.000)	0.380	(0.486)
part-time employed	0.000	(0.000)	0.349	(0.477)	0.000	(0.000)	0.620	(0.486)
marginally employed	0.000	(0.000)	0.192	(0.394)	0.000	(0.000)	0.000	(0.000)
not employed	0.000	(0.000)	0.247	(0.431)	0.000	(0.000)	0.000	(0.000)
second job	0.146	(0.353)	0.279	(0.449)	0.136	(0.343)	0.153	(0.360)
shift work	0.194	(0.395)	0.084	(0.278)	0.196	(0.397)	0.149	(0.356)
flexitime	0.534	(0.499)	0.268	(0.443)	0.525	(0.499)	0.480	(0.500)
fixed wrk hrs	0.271	(0.445)	0.208	(0.406)	0.277	(0.447)	0.370	(0.483)
agriculture	0.035	(0.183)	0.006	(0.077)	0.032	(0.176)	0.011	(0.104)
industrial sector	0.401	(0.490)	0.044	(0.204)	0.424	(0.494)	0.077	(0.267)
service sector	0.565	(0.496)	0.511	(0.500)	0.544	(0.498)	0.912	(0.284)
public sector	0.323	(0.468)	0.224	(0.417)	0.290	(0.454)	0.397	(0.489)
self employed	0.158	(0.365)	0.085	(0.279)	0.174	(0.379)	0.076	(0.264)
same building	0.057	(0.232)	0.031	(0.174)	0.059	(0.235)	0.056	(0.230)
weekend work	0.780	(0.414)	0.304	(0.460)	0.784	(0.412)	0.538	(0.499)
job in health sector	0.027	(0.163)	0.060	(0.238)	0.029	(0.169)	0.104	(0.306)
social job	0.050	(0.217)	0.077	(0.267)	0.054	(0.225)	0.138	(0.345)
security job	0.068	(0.252)	0.015	(0.120)	0.067	(0.250)	0.026	(0.158)
hourly wage rate	14.834	(59.390)	6.852	(32.151)	13.214	(28.404)	12.364	(42.678)
min. of normal work	2555.142	(574.050)	956.882	(1009.116)	2578.362	(595.962)	1710.898	(730.331)
min. of way to work	52.466	(60.120)	20.767	(35.289)	53.774	(63.668)	32.352	(38.941)
N	3483		3483		1905		1905	

Table 8.2: Summary Statistics of household and personal characteristics.

	all				both work			
	male		female		male		female	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
demographic indicators								
age	43.034	(6.427)	40.608	(6.209)	43.567	(6.269)	41.178	(6.202)
low skilled	0.018	(0.132)	0.042	(0.200)	0.017	(0.129)	0.032	(0.175)
medium skilled	0.511	(0.500)	0.714	(0.452)	0.514	(0.500)	0.672	(0.469)
high skilled	0.468	(0.499)	0.239	(0.427)	0.466	(0.499)	0.294	(0.456)
good health	0.761	(0.427)	0.771	(0.421)	0.736	(0.441)	0.776	(0.417)
german citizen	0.984	(0.127)	0.986	(0.117)	0.979	(0.145)	0.991	(0.097)
not enough time for family	0.450	(0.498)	0.249	(0.433)	0.440	(0.497)	0.318	(0.466)
travel	0.198	(0.398)	0.156	(0.363)	0.207	(0.406)	0.171	(0.376)
extraordinary day	0.493	(0.500)	0.514	(0.500)	0.489	(0.500)	0.535	(0.499)
household information								
west	0.817	(0.387)	0.817	(0.387)	0.760	(0.427)	0.760	(0.427)
# of kids	1.671	(1.006)	1.671	(1.006)	1.449	(0.968)	1.449	(0.968)
kid younger than 6	0.243	(0.429)	0.243	(0.429)	0.164	(0.371)	0.164	(0.371)
kid aged 6-17	0.508	(0.500)	0.508	(0.500)	0.501	(0.500)	0.501	(0.500)
reg. child care (y/n)	0.234	(0.423)	0.234	(0.423)	0.203	(0.402)	0.203	(0.402)
min. of child care	106.500	(88.594)	106.500	(88.594)	105.815	(90.344)	105.815	(90.344)
size of apartment	119.588	(42.109)	119.588	(42.109)	118.661	(41.838)	118.661	(41.838)
N	3483		3483		1905		1905	

8.2 Appendix of Chapter 6

Table 8.1: Summary Statistics.

	shift workers		day workers	
	reported	unusual	reported	usual
work information:				
unusual wrk hours	0.421	1.000	0.120	0.000
	(0.494)	(0.000)	(0.325)	(0.000)
shift work	1.000	0.670	0.000	0.190
	(0.000)	(0.471)	(0.000)	(0.392)
log hourly wage	2.426	2.493	2.528	2.526
	(0.368)	(0.498)	(0.478)	(0.428)
usual wrk. hrs (log)	3.664	3.659	3.698	3.673
	(0.177)	(0.316)	(0.265)	(0.216)
personal characteristics:				
age	42.848	42.836	43.462	43.447
	(7.083)	(7.707)	(7.743)	(7.631)
low skilled	0.044	0.054	0.013	0.013
	(0.206)	(0.226)	(0.111)	(0.113)
medium skilled	0.794	0.677	0.494	0.566
	(0.404)	(0.468)	(0.500)	(0.496)
high skilled	0.161	0.265	0.490	0.419
	(0.368)	(0.442)	(0.500)	(0.493)
married	0.837	0.819	0.810	0.821
	(0.370)	(0.385)	(0.392)	(0.384)
household information:				
# of kids	1.411	1.433	1.404	1.418
	(1.005)	(1.072)	(1.026)	(1.027)
kids under 6	0.185	0.192	0.180	0.185
	(0.389)	(0.394)	(0.384)	(0.389)
kids aged 6 – 17	0.474	0.422	0.422	0.434
	(0.500)	(0.494)	(0.494)	(0.496)
Western Germany	0.826	0.825	0.817	0.843
	(0.379)	(0.380)	(0.387)	(0.364)
observations	967	464	2948	2401

Standard deviations are given in parentheses.

Table 8.2: Selection Corrected Coefficient Estimates of the Group Indicator on the Fraction of Solitary Leisure.

|	indicator variable (1)	selection term (2)
shift work	0.053*	-0.007
	(3.25)	(0.50)
unusual hours	0.134*	-0.026
	(2.96)	(0.99)

Absolute *t*-statistics in parentheses. * indicate significance levels of 10 % or higher; standard errors are robust. Also included in the regressions: age group dummies, skill indicators, dummies for being married, having children and having kids under the age of 6 and between 6 – 17, Western Germany, a non-employed wife and the log normal working hours.

Figure 8.1: Incidence of Shift Work and Work during Unusual Hours by Age Group.

8.3 Appendix of Chapter 7

Figure 8.2: Time Use: Distribution of Parental Time of Full-Time Employed East
Germans by Age of Kids.
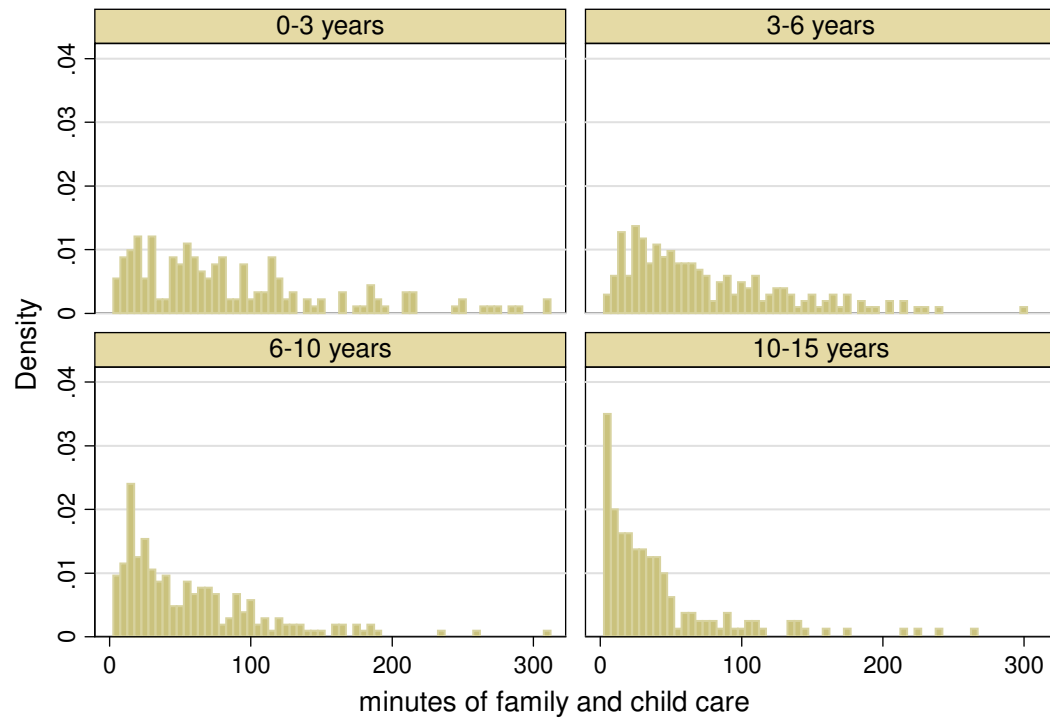
Bibliography

Aanes, Mette M., Maurice B. Mittelmark, and Jørn Hetland, "Interpersonal Stress and Poor Health: The Mediating Role of Loneliness," *European Psychologist*, 2010, *15* (1), pp. 3 – 11.

AGB, *Arbeitsgesetzbuch der Deutschen Demokratischen Republik [vom 16. Juni 1977]*, Vol. 6, Verlag Tribüne, Berlin: Staatsverlag der Deutschen Demokratischen Republik, 1980. Staatssekretariat für Arbeit und Löhne.

Aguiar, Mark and Erik Hurst, "Measuring Trends in Leisure: The Allocation of Time Over Five Decades," *The Quarterly Journal of Economics*, 2007, *122* (3), pp. 969 – 1006.

Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote, "Work and Leisure in the United States and Europe: Why So Different?," *NBER Macroeconomics Annual*, 2005, *20*, pp. 1 – 64.

Angrist, Joshua D. and Alan B. Krueger, "Empirical Strategies in Labor Economics," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 3, Elsevier Science Publishers BV, 1999, chapter 23, pp. 1277 – 1366.

▁ **and Jörn-Steffen Pischke**, *Mostly Harmless Econometrics: An Empiricist's Companion*, Oxford: Princeton University Press, 2009.

Apps, Patricia, "Gender, time use, and models of the household," Policy Research Working Paper Series 3233, The World Bank 2004.

Apps, Patricia F. and Ray Rees, "Labour supply, household production and intra-family welfare distribution," *Journal of Public Economics*, 1996, *60* (2), pp. 199 – 219.

▁ **and** ▁ , "Collective Labor Supply and Household Production," *The Journal of Political Economy*, 1997, *105* (1), pp. 178 – 190.

Barrett, Nancy S., "Obstacles to Economic Parity for Women," *The American Economic Review*, 1982, *72* (2), pp. 160 – 165.

Baum, Charles L., "Does Early Maternal Employment Harm Child Development? An Analysis of the Potential Benefits of Leave Taking," *Journal of Labor Economics*, 2003, *21* (2), pp. 409 – 448.

Baydar, Nazli and Jeanne Brooks-Gunn, "Effects of Maternal Employment and Child-Care Arrangements on Preschoolers' Cognitive and Behavioral Outcomes: Evidence From the Children of the National Longitudinal Survey of Youth," *Development*, 1991, *27* (6), pp. 932 – 945.

Becker, Gary S., "A Theory of the Allocation of Time," *The Economic Journal*, 1965, *75* (299), pp. 493–517.

_ , "A Theory of Social Interactions," *The Journal of Political Economy*, 1974, *82* (6), pp. 1063 – 1093.

_ , *A Treatise on the Family*, Cambridge, MA.: Harvard University Press, 1981.

_ , "Human Capital, Effort, and the Sexual Division of Labor," *Journal of Labor Economics*, 1985, *3* (1), pp. S33 – S58.

_ **and H. Gregg Lewis**, "On the Interaction between the Quantity and Quality of Children," *The Journal of Political Economy*, 1973, *81* (2), pp. S279 – S288.

_ **and Kevin M. Murphy**, "The Family and the State," *Journal of Law and Economics*, 1988, *31* (1), pp. 1 – 18.

_ **and Nigel Tomes**, "Child Endowments and the Quantity and Quality of Children," *The Journal of Political Economy*, 1976, *84* (4), pp. S143 – S162.

Berkman, Lisa F., "Assessing the Physical Health Effects of Social Networks and Social Support," *Annual Review of Public Health*, 1984, *5*, pp. 413 – 432.

Bernal, Raquel, "The Effect of Maternal Employment and Child Care on Children's Cognitive Ddevelopment," *International Economic Review*, 2008, *49* (4), pp. 1173 – 1209.

Bianchi, Suzanne M., "Maternal Employment and Time with Children: Dramatic Change or Surprising Continuity?," *Demography*, 2000, *37* (4), pp. 401 – 414.

_ **and John Robinson**, "What Did You Do Today? Children's Use of Time, Family Composition, and the Acquisition of Social Capital," *Journal of Marriage and Family*, 1997, *59* (2), pp. 332 – 344.

Biddle, Jeff E. and Daniel S. Hamermesh, "Sleep and the Allocation of Time," *Journal of Political Economy*, 1990, *98* (5), pp. 922 – 943.

Bird, Chloe E. and Allen M. Fremont, "Gender, Time Use, and Health," *Journal of Health and Social Behavior*, 1991, *32* (2), pp. 114 – 129.

Bird, Gloria W., Gerald A. Bird, and Marguerite Scruggs, "Determinants of Family Task Sharing: A Study of Husbands and Wives," *Journal of Marriage and the Family*, 1984, *46* (2), pp. 345 – 355.

Bittman, Michael and Judy Wajcman, "The Rush Hour: The Character of Leisure Time and Gender Equity," *Social Forces*, 2000, *79* (1), pp. 165 – 189.

Blanchflower, David G. and Andrew J. Oswald, "Well-being over Time in Britain and the USA," *Journal of Public Economics*, 2004, *88*, pp. 1359 – 1386.

Blau, Francine D. and Adam J. Grossberg, "Maternal Labor Supply and Children's Cognitive Development," *The Review of Economics and Statistics*, 1992, *74* (3), pp. 474 – 481.

Blundell, Richard and Thomas MaCurdy, "Labor supply: A Review of Alternative Approaches," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 3, Elsevier Science Publishers BV, 1999, chapter 27, pp. 1559 – 1695.

Bøggild, Henrik and Anders Knutsson, "Shift Work, Risk Factors and Cardiovascular Disease," *Scandivian Journal of Work, Environment and Health*, 1999, *25* (2), pp. 85 – 99.

Bosch, Nicole, Anja Deelen, and Rob Euwals, "Is Part-time Employment Here To Stay? Evidence from the Dutch Labour Force Survey 1992 – 2005," IZA Discussion Papers 3367, Institute for the Study of Labor (IZA) 2008.

Brooks-Gunn, Jeanne, Wen-Jui Han, and Jane Waldfogel, "Maternal Employment and Child Cognitive Outcomes in the First Three Years of Life: The NICHD Study of Early Child Care," *Child Development*, 2003, *73* (4), pp. 1052 – 1072.

Bryant, W. Keith and Cathleen D. Zick, "An Examination of Parent-Child Shared Time," *Journal of Marriage and Family*, 1996, *58* (1), pp. 227 – 237.

Bundesministerium für Familie, Senioren, Frauen und Jugend, *Europäischer Unternehmensmonitor Familienfreundlichkeit* 2010.

Bundesministerium für Familie, Senioren, Frauen und Jugend, *Unternehmensmonitor Familienfreundlichkeit* 2010.

Burda, Michael C., "Product Market Regulation and Labor Market Outcomes: How can Deregulation Create Jobs?," CESifo Working Paper Series 230, CESifo Group Munich 2000.

＿ **and Daniel S. Hamermesh**, "Unemployment, Market Work and Household Production," *Economics Letters*, May 2010, *107* (2), pp. 131 – 133.

＿ **and Jennifer Hunt**, "From Reunification to Economic Integration: Productivity and the Labor Market in Eastern Germany," *Brookings Papers on Economic Activity*, 2001, *32* (2), pp. 1 – 71.

＿ **and Philippe Weil**, "Blue Laws," mimeo, Humboldt-Universität zu Berlin 2005.

_ , **Daniel S. Hamermesh, and Philippe Weil**, "The Distribution of Total Work in the EU and US," IZA Discussion Papers 2270, Institute for the Study of Labor (IZA) 2006.

_ , _ , **and** _ , "Total Work, Gender and Social Norms," NBER Working Paper 13000, National Bureau of Economic Research, Inc 2007.

_ , _ , **and** _ , "The Distribution of Total Work in the EU and US," in Michael C. Burda Tito Boeri and Francis Kramarz, eds., *Working Hours and Job Sharing in the EU and USA: Are Americans Crazy? Are Europeans Lazy?*, Oxford University Press, 2008.

Cardoso, Ana Rute, Daniel S. Hamermesh, and José Varejão, "The Timing of Labor Demand," IZA Discussion Papers 3885, Institute for the Study of Labor (IZA) 2008.

Carneiro, Pedro, Katrine V. Løken, and Kjell G. Salvanes, "A Flying Start? Long Term Consequences of Maternal Time Investments in Children During Their First Year of Life," IZA Discussion Papers 5362, Institute for the Study of Labor (IZA) 2010.

Coen-Pirani, Daniele, Alexis León, and Steven Lugauer, "The Effect of Household Appliances on Female Labor Force Participation: Evidence From Microdata," *Labour Economics*, 2010, *17* (3), pp. 503 – 513.

Coleman, James S., *Foundations of Social Theory*, Cambridge, MA.: Harvard University Press, 1994.

Costa, Giovanni, "The Impact of Shift and Night Work on Health," *Applied Ergonomics*, 1996, *27* (1), pp. 9 – 16.

_ , "Shift Work and Occupational Medicine: An Overview," *Occupational Medicine*, 2003, *53* (2), pp. 83 – 88.

Culpepper, Larry, "The Social and Economic Burden of Shift-Work Disorder," *Supplement to The Journal of Family Practice*, 2010, *59* (1), pp. S3 – S11.

Cunningham, J. Barton, "A Compressed Shift Schedule: Dealing with Some of the Problems of Shift-Work," *Journal of Organizational Behavior*, 1989, *10* (3), pp. 231 – 245.

d'Addio, Anna Cristina and Marco Mira d'Ercole, "Trends and Determinants of Fertility Rates in OECD Countries: The Role of Policies," OECD Social, Employment and Migration Working Papers 27, OECD 2005.

Daly, Kerry J., "Spending Time with the Kids: Meanings of Family Time for Fathers," *Family Relations*, 1996, *45* (4), pp. 466 – 476.

Datcher-Loury, Linda, "Effects of Mother's Home Time on Children's Schooling," *The Review of Economics and Statistics*, 1988, *70* (3), pp. 367 – 373.

Davis, Scott and Dana K. Mirick, "Circadian Disruption, Shift Work and the Risk of Cancer: A Summary of the Evidence and Studies in Seattle," *Cancer Causes Control*, 2006, *17*, pp. 539 – 545.

Duncan, Greg J. and Bertil Holmlund, "Was Adam Smith Right After All? Another Test of the Theory of Compensating Wage Differentials," *Journal of Labour Economics*, 1983, *1* (4), pp. 366 – 379.

Durlauf, Steven N., "On the Empirics of Social Capital," *The Economic Journal*, 2002, *112* (483), pp. F459 – F479.

Dustmann, Christian and Uta Schönberg, "The Effect of Expansions in Maternity Leave Coverage on Children's Long-Term Outcomes," IZA Discussion Papers 3605, Institute for the Study of Labor (IZA) 2008.

Ehling, Manfred, "The German Time Use Survey - Methods and Results," in J. Merz and M. Ehling, eds., *Time Use - Research, Data and Policy*, Baden-Baden: Nomos Verlag, 1998.

Euwals, Rob, "Female Labour Supply, Flexibility of Working Hours, and Job Mobility," *The Economic Journal*, 2001, *111* (471), pp. 120 – 134.

Folkard, Simon and Philip Tucker, "Shift Work, Safety and Productivity," *Occupational Medicine*, 2003, *53* (2), pp. 95 – 101.

Freeman, Richard B. and Ronald Schettkat, "Marketization of Household Production and the EU–US Gap in Work," *Economic Policy*, 2005, *20* (41), pp. 6 – 50.

Frerich, Johannes and Martin Frey, *Handbuch der Geschichte der Sozialpolitik in Deutschland, Bd.2: Sozialpolitik in der Deutschen Demokratischen Republik*, Oldenbourg, 1993.

Führ, Christoph and Carl-Ludwig Furck, "Teilband 2: Deutsche Demokratische Republik und neue Bundesländer," in Christa Berg, ed., *Handbuch der Deutschen Bildungsgeschichte*, Vol. 6: 1945 bis zur Gegenwart, München: Beck, 1998.

Gerlach, Irene, "Familienpolitik: Geschichte und Leitbilder," Information zur politischen Bildung Heft 3, Bundeszentrale für politische Bildung 2008.

Gershuny, Jonathan and Oriel Sullivan, "The Sociological Uses of Time-use Diary Analysis," *European Sociological Review*, 1998, *14* (1), pp. 69 – 85.

Glaeser, Edward L., David Laibson, and Bruce Sacerdote, "An Economic Approach to Social Capital," *The Economic Journal*, 2002, *112* (483), pp. F437 – F458.

Gørtz, Mette, "Household Production in the Family - Work or Pleasure?," Discussion Paper 2006.

Graham, John W and Carole A Green, "Estimating the Parameters of a Household Production Function with Joint Products," *The Review of Economics and Statistics*, 1984, *66* (2), pp. 277 – 282.

Greenwood, Jeremy and Zvi Hercowitz, "The Allocation of Capital and Time over the Business Cycle," *The Journal of Political Economy*, 1991, *99* (6), pp. 1188 – 1214.

Gronau, Reuben, "Leisure, Home Production, and Work – The Theory of the Allocation of Time Revisited," *Journal of Political Economy*, 1977, *85* (6), pp. 1099 – 1123.

— , "Home Production – A Forgotten Industry," *The Review of Economics and Statistics*, 1980, *62* (3), pp. 408 – 416.

— , "The Intrafamily Allocation of Goods – How to Separate the Adult from the Child," *Journal of Labor Economics*, 1991, *9* (3), pp. 207 – 235.

Guryan, Jonathan, Erik Hurst, and Melissa Schettini Kearney, "Parental Education and Parental Time With Children," *The Journal of Economic Perspectives*, 2008, *22* (3), pp. 23–16A(–6).

Hallberg, Daniel, "Synchronous Leisure, Jointness and Household Labor Supply," *Labour Economics*, 2003, *10* (2), pp. 185–203.

— **and Anders Klevmarken**, "Time for Children, a Study of Parents' Time Allocation," *Journal of Population Economics*, 2003, *16*, pp. 205 – 226.

Hamermesh, Daniel S., "Shirking or Productive Schmoozing: Wages and the Allocation of Time at Work," *Industrial and Labor Relations Review*, 1990, *43* (3, Special Issue: Do Cempensation Policies Matter?), pp. 121S – 133S.

— , *Workdays, Workhours and Work Schedules: Evidence for the United States and Germany*, Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 1996.

— , "When We Work," *American Economic Review*, 1998, *88* (2), pp. 321 – 325.

— , "Changing Inequality in Markets for Workplace Amenities," *Quarterly Journal of Economics*, 1999, *114* (4), pp. 1085 – 1123.

— , "The Timing of Work over Time," *Economic Journal*, 1999, *109* (452), pp. 37 – 66.

_ , "Togetherness: Spouses' Synchronous Leisure, and the Impact of Children," NBER Working Papers 7455, National Bureau of Economic Research, Inc 2000.

_ , "Timing, Togetherness and Time Windfalls," *Journal of Population Economics*, 2002, *15*, pp. 601 – 623.

_ , "Routine," *European Economic Review*, 2005, *49* (1), pp. 29 – 53.

_ **and Stephan Donald**, "The Time and Timing Costs of Market Work," NBER Working Papers 13127, National Bureau of Economic Research, Inc 2007.

_ **, Caitlin Knowles Myers, and Mark L. Pocock**, "Cues for Timing and Coordination: Latitude, Letterman, and Longitude," *Journal of Labor Economics*, 2008, *26* (2), pp. 223 – 246.

Han, Wen-Jui, "Nonstandard Work Schedules and Child Care Decisions: Evidence from the NICHD Study of Early Child Care," *Early Childhood Research Quarterly*, 2004, *19* (2), pp. 231 – 256.

Harris, Paul L., "Infant Cognition," in P. H. Musen, ed., *Handbook of Child Psychology, Socialization, Personality, and Social Development*, Vol. 4, New York: Wiley & Sons, 1983, pp. 689–782.

Hartup, Willard W., "Social Relationships and Their Developmental Significance," *American Psychologist*, 1989, *44* (2), pp. 120 – 126.

Hersch, Joni and Leslie S. Stratton, "Household specialization and the male marriage wage premium," *Industrial and Labor Relations Review*, 2000, *54* (1), pp. 78 – 94.

Hill, C. Russell and Frank P. Stafford, "Parental Care of Children: Time Diary Estimates of Quantity, Predictability, and Variety," *The Journal of Human Resources*, 1980, *15* (2), pp. 219 – 239.

Hill, E. Jeffrey, Alan J. Hawkins, Maria Ferris, and Michelle Weitzman, "Finding an Extra Day a Week: The Positive Influence of Perceived Job Flexibility on Work and Family Life Balance," *Family Relations*, 2001, *50* (1), pp. 49 – 58.

Hill, Jennifer L., Jane Waldfogel, Jeanne Brooks-Gunn, and Wen-Jui Han, "Maternal Employment and Child Development: A Fresh Look Using Newer Methods," *Developmental Psychology*, 2005, *41* (6), pp. 833 – 850.

Hochschild, Arlie Russell and Anne Machung, *The Second Shift*, New York: Viking Penguin, 1989.

Härmä, Mikko, Leena Tenkanen, Tom Sjöblom, Tiina Alikoski, and Pertti Heinsalmi, "Combined Effects of Shift Work and Life-Style on the Prevalence of

Insomnia, Sleep Deprivation and Daytime Sleepiness," *Scandinavian Journal of Work, Environment and Health*, 1998, *24* (4), pp. 300 – 3007.

Jenkins, Stephen P. and Lars Osberg, "Nobody to Play With? The Implications of Leisure Coordination," in Daniel S. Hamermesh and Gerard A. Pfann, eds., *The Economics of Time Use*, Elsevier, 2005, pp. 113 – 145.

Juster, F. Thomas, "Preferences for Work and Leisure," in F. Thomas Juster and Frank P. Stafford, eds., *Time, Goods, and Well-Being*, Institute for Social Research, University of Michigan, Ann Arbor, Michigan, 1985.

— **and Frank P. Stafford**, "The Allocation of Time: Empirical Findings, Behavioral Models, and Problems of Measurement," *Journal of Economic Literature*, 1991, *29* (2), pp. 471 – 522.

Kerkhofs, Marcel and Peter Kooreman, "Identification and Estimation of a Class of Household Production Models," *Journal of Applied Econometrics*, 2003, *18* (3), pp. 337 – 369.

Killingsworth, Mark R. and James J. Heckman, "Female Labor Supply: A Survey," in O. Ashenfelter and R. Layard, eds., *Handbook of Labor Economics*, Vol. 1, Elsevier Science Publishers BV, 1986, chapter 2, pp. 103 – 204.

King, Allan G., "Industrial Structure, the Flexibility of Working Hours, and Women's Labor Force Participation," *The Review of Economics and Statistics*, 1978, *60* (3), pp. 399 – 407.

Knack, Stephen and Philip Keefer, "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation," *The Quarterly Journal of Economics*, 1997, *112* (4), pp. 1251 – 1288.

Kooreman, Peter and Arie Kapteyn, "A Disaggregated Analysis of the Allocation of Time within the Household," *The Journal of Political Economy*, 1987, *95* (2), pp. 223 – 249.

Kostiuk, Peter F., "Compensating Differentials for Shift Work," *The Journal of Political Economy*, 1990, *98* (5), pp. 1054–1075.

Kraus, Franz, "The German System of Official Social Surveys," EuReporting Working Paper 36 2001.

Landry, Susan H., Karen E. Smith, and Paul R. Swank, "The Importance of Parenting During Early Childhood for School-Age Development," *Developmental Neuropsychology*, 2003, *24* (2 & 3), pp. 559 – 591.

Lanfranchi, Joseph, Henry Ohlsson, and Ali Skalli, "Compensating Wage Differentials and Shift Work Preferences. Evidence from France," Working Papers in Economics 55, Göteborg University, Department of Economics 2001.

__ , __ , **and** __ , "Compensating Wage Differentials and Shift Work Preferences," *Economics Letters*, 2002, *74* (3), pp. 393–398.

Larson, Reed, "Thirty Years of Research on the Subjective Well-Being of Older Americans," *Journal of Gerontology*, 1978, *33* (1), pp. 109 – 125.

Leibowitz, Arleen, "Parental Inputs and Children's Achievement," *The Journal of Human Resources*, 1977, *12* (2), pp. 242 – 251.

Lesnard, Laurent, "Schedules as Sequences: A New Method to Analyze the Use of Time Based on Collective Rhythm with an Application to the Work Arrangements of French Dual-Earner Couples," *Electronic International Journal of Time Use Research*, 2004, *1* (1), pp. 60 – 84.

Lewis, Michael and Jeanne Brooks-Gunn, *Spacial Cognition and the Acquisition of Self*, New York: Plenum, 1979.

Maccoby, Eleanor E., "The Role of Parents in the Socialization of Children: An Historical Overview," *Developmental Psychology*, 1992, *28* (6), pp. 1006 – 1017.

Macpherson, David A., "Self-Employment and Married Women," *Economics Letters*, 1988, *28* (3), pp. 281 – 284.

MaCurdy, Thomas E., "An Empirical Model of Labor Supply in a Life-Cycle Setting," *The Journal of Political Economy*, 1981, *89* (6), pp. 1059 – 1085.

Maddala, Gangadharrao Soundalyarao, *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge: Cambridge University Press, 1983.

Mayshar, Joram and Yoram Halevy, "Shiftwork," *Journal of Labor Economics*, 1997, *15* (1), pp. S198 – S222.

McLanahan, Sara S., Nancy V. Wedemeyer, and Tina Adelberg, "Network Structure, Social Support, and Psychological Well-Being in the Single-Parent Family," *Journal of Marriage and Family*, 1981, *43* (3), pp. 601–612.

McNabb, Robert, "Compensating Wage Differentials: Some Evidence for Britain," *Oxford Economic Papers*, 1989, *41* (2), pp. 327 – 338.

Mellor, Earl F., "Shift Work and Flexitime: How Prevalent Are They?," *Monthly Labor Review*, 1986, *109* (11), pp. 14 – 24.

Milkie, Melissa A., Marybeth J. Mattingly, Kei M. Nomaguchi, Suzanne M. Bianchi, and John P. Robinson, "The Time Squeeze: Parental Statuses and Feelings about Time with Children," *Journal of Marriage and Family*, 2004, *66* (3), pp. 739 – 761.

Minors, D. S., A. R. Scott, and J.M. Waterhouse, "Circadian Arrhythmia: Shiftwork, Travel and Health," *Occupational Medicine*, 1986, *36* (4), pp. 39 – 44.

OECD, "OECD Employment Outlook 2006: Boosting Jobs and Incomes," Free Policy Report, OECD Publishing 2006.

_ , "OECD Employment Outlook: Tackling The Jobs Crisis," Free Policy Report, OECD 2009.

Prantl, Susanne and Alexandra Spitz-Oener, "How Does Entry Regulation Influence Entry into Self-Employment and Occupational Mobility?," IZA Discussion Papers 4221, Institute for the Study of Labor (IZA) 2009.

Presser, Harriet B., "Shift Work and Child Care among Young Dual-Earner American Parents," *Journal of Marriage and Family*, 1988, *50* (1), pp. 133 – 148.

_ , "Job, Family and Gender: Determinants of Nonstandard Work Schedules Among Employed Americans in 1991," *Demography*, 1995, *32* (4), pp. 577 – 598.

Putnam, Robert D., "Bowling Alone: America's Declining Social Capital," *Journal of Democracy*, 1995, *6* (1), pp. 65 – 78.

_ , *Bowling Alone*, New York: Simon and Schuster, 2000.

Åkerstedt, Torbjörn, "Shift Work and Disturbed Sleep/Wakefulness," *Occupational Medicine*, 2003, *53* (2), pp. 89 – 94.

Reid, M., *Economics of Household Production*, New York: Wiley, 1934.

Rosen, Sherwin, "The Theory of Equalizing Differences," in O. Ashenfelter and R. Layard, eds., *Handbook of Labor Economics*, Vol. 1, Elsevier Science Publishers BV, 1987, chapter 12.

Ruhm, Christopher J., "Parental Employment and Child Cognitive Development," *Journal of Human Resources*, 2004, *39* (1), pp. 155 – 192.

_ , "Maternal Employment and Adolescent Development," *Labour Economics*, 2008, *15*, pp. 958 – 983.

Schröder, Klaus, *Der SED-Staat*, Carl Hanser, 1998.

Schumacher, Edward J. and Barry T. Hirsch, "Compensating Differentials and Unmeasured Ability in the Labor Market for Nurses: Why Do Hospitals Pay More?," *Industrial and Labor Relations Review*, 1997, *50* (4), pp. 557 – 579.

Shiells, Martha, "Hours of Work and Shiftwork in the Early Industrial Labor Markets of Great Britain, the United States, and Japan," *The Journal of Economic History*, 1987, *47* (2), pp. 497 – 499.

Skipper, James K., Fred D. Jung, and Linda C. Coffey, "Nurses and Shiftwork: Effects on Physical Health and Mental Depression," *Journal of Advanced Nursing*, 1990, *15*, pp. 835 – 842.

Smith, Adam, *The Wealth of Nations*, New York: Modern Library Edition, 1776.

Statistical Office of the GDR, *Statistisches Jahrbuch der Deutschen Demokratischen Republik*, Göttingen: Digizeitschriften e.V., 2006, 1990.

Statistisches Bundesamt, "Wo bleibt die Zeit? Die Zeitverwendung der Bevölkerung in Deutschland 2001/02," Technical Report, Statistisches Bundesamt, Wiesbaden, Germany 2003.

⎯ , "Qualitätsbericht – Zeitbudgeterhebung 2001/02," Technical Report, Statistisches Bundesamt, Wiesbaden, Germany 2005.

⎯ , "Kindertagesbetreuung regional 2008 – Ein Vergleich aller 429 Kreise in Deutschland," Technical Report, Wiesbaden: Statistisches Bundesamt 2009.

Strazdins, Lyndall, Mark S. Clements, Rosemary J. Korda, and Dorothy H. Broomand Rennie M. D'Souza, "Unsociable Work? Nonstandard Work Schedules, Family Relationships, and Children's Well-Being," *Journal of Marriage and Family*, 2006, *68* (2), pp. 394 – 410.

⎯ , **Rosemary J. Korda, Lynette L-Y. Lim, Dorothy H. Broom, and Rennie M. D'Souza**, "Around-the-Clock: Parent Work Schedules and Children's Well-Being in a 24-h Economy," *Social Science & Medicine*, 2004, *59* (7), pp. 1517 – 1527.

Sullivan, Oriel, "Time Co-Ordination, the Domestic Division of Labour and Affective Relations: Time Use and the Enjoyment of Activities within Couples," *Sociology*, 1996, *30* (1), pp. 79 – 100.

Thoits, Peggy A., "Conceptual, Methodological, and Theoretical Problems in Studying Social Support as a Buffer Against Life Stress," *Journal of Health and Social Behavior*, 1982, *23* (2), pp. 145 – 159.

Thompson, Ross A., "Development in the First Years of Life," *The Future of Children*, 2001, *11* (1), pp. 20 – 33.

Tsuno, Norifumi, Alain Besset, and Karen Ritchie, "Sleep and Depression," *Journal of Clinical Psychiatry*, 2005, *66* (10), pp. 1254 – 1269.

Tüchsen, Finn, Jeppe Jeppsen, and Els Bach, "Employment Status, Non-Daytime Work and Gastric Ulcer In Men," *International Journal of Epidemiology*, 1994, *23* (2), pp. 365 – 370.

van Klaveren, Chris and Henriëtte Maassen van den Brink, "Intra-Household Work Time Synchronization – Togetherness or Material Benefits?," *Social Indicators Research*, 2007, *84* (1), pp. 39 – 52.

_ , _ , **and Bernard van Praag**, "The Influence of Work Time Adjustment on Joint Activities and the Demand for Child Care," MPRA Paper 1213, University Library of Munich, Germany 2006.

van Velzen, Susan, "Synchronizing Rythms of Work and Leisure; An Analysis of the Timing of Market Work, Household Work, and Leisure of Dual-Earner Couples in the Netherlands, In: *Supplements to the Economics of Household Behavior*." PhD dissertation, Tinbergen Institute Research Series, University of Amsterdam 2001.

Verfassung der Deutschen Demokratischen Republik und Jugendgesetz, , Vol. 15, Staatsverlag der DDR, 1989.

Weiss, Yoram, "Synchronization of Work Schedules," *International Economic Review*, 1996, *37* (1), pp. 157– 179.

West, Donald A., Robert Kellner, and Maggi Moore-West, "The Effects of Loneliness: A Review of the Literature," *Comprehensive Psychiatry*, 1986, *27* (4), pp. 351 – 363.

White, Lynn and Bruce Keith, "The Effect of Shift Work on the Quality and Stability of Marital Relations," *Journal of Marriage and Family*, 1990, *52* (2), pp. 453 – 462.

Zick, Cathleen D. and W. Keith Bryant, "A New Look at Parents' Time Spent in Child Care: Primary and Secondary Time Use," *Social Science Research*, 1996, *25* (3), pp. 260 – 280.

Selbständigkeitserklärung

Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Berlin, September 1, 2011   Juliane Scheffel