To Marry or Not to Marry

Essays on Partnership Formation and Economic Labor Market Behavior of Married and Cohabiting Couples

vorgelegt von

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English Summary

Up to the 1970s, union formation was commonly not considered a relevant topic in economic research. Marriage was the only considered form of partnership and cohabitation was at most seen as prestage of it. This has changed drastically, with unmarried partnerships (cohabitation) becoming more and more attractive since it means fewer hurdles in case of separation and more independence and individualism for both partners. In addition to these personal impacts, changes in union formation also have immense economical consequences.

This dissertation aims to provide evidence for the necessity to differentiate couples into legally married couples and cohabiting couples without legal binding. The investigation provides proof of why this rather underestimated socioeconomic aspect needs to be more focused on in economic research. Analyzing couples assortative mating behavior and labor supply outcomes convey contributions and important policy implications in the field of labor market economics. This doctoral thesis consists of three self-contained papers, which can be read independently.

Chapter 2 'Assortative Mating of Married and Cohabiting Couples' focuses on the assortative mating behavior of married and cohabiting couples over time and the consequences for income inequality. Goals are to evaluate whether mating occurs based on similar or dissimilar characteristics and to provide insights in the differences between cohabiting and married couples. Economically, this is important to better understand differences in the work behavior between married and cohabiting couples and it stresses the potential consequences on income inequality. Evaluating the correlation of mating behavior among married and cohabiting couples and income inequality is the second major aim of this study. Using data from the German Socio-Economic Panel (SOEP) study from 1984 through 2013, I find distinct differences in the mating behavior of married and cohabiting couples and also changes over time. Cohabiting couples choose their mate according to similar market traits. This in turn correlates with a higher intra-household income equality but also with a higher inter-household income inequality, compared to married couples. These findings are robust to different inequality measures and are validated by counterfactuals (random mating).

Chapter 3 'The Added Worker Effect Differentiated by Gender and Partnership Status' examines the added worker effect (AWE), which refers to the increase of labor supply of individuals in response to a sudden financial shock in family income, that is, unemployment of their partner. While previous empirical studies focus on the responsiveness of married women, I explicitly analyze the spillover effects of unemployment on women and men and I also differentiate according to their partnership status (marriage vs. cohabitation). The aim is to evaluate whether intra-household adaptation mechanisms differ by gender and by partnership status. The underlying method is a difference-in-differences setting in combination with an entropy balancing matching procedure. The paper considers plant closures and employer terminations as exogenous forms of unemployment. Using longitudinal data from the German Socio-Economic Panel (SOEP) study from 1991 through 2013, the empirical investigation finds evidence of the existence of an AWE. The effect is largest when a woman enters unemployment and is mainly driven by changes on the intensive margin (increase of hours).

Chapter 4 'The Impact of Cohabiting and Married Partner's Earnings on Work Hours' investigates the determinants of women's labor supply in the household context. The main focus is on the effect of a change in male partner's wages on women's work hours. This is linked to the broader question of whether married and cohabiting women make different economic decisions and respond differently to changes in their partners' wages. To provide a complete picture of working behavior within households, I analyze both women and men. The main estimation results suggest that married women work less on the labor market and further, an increase in partner's wages results in a negative and significant effect on married women's work hours. The marital status of men, on the other hand, has no significant impact on their work hours. In addition, this study suggests that the "income-splitting" tax benefit for married couples is a potential explanation mechanism for the proven differences between marriage and cohabitation.

Keywords: Cohabitation vs. marriage, Income inequality, Plant closure, Entropy balancing, Women's work hours, Division of labor.

German Summary

Die Wahl der Partnerschaft (Ehe oder eheähnliche Gemeinschaft) spielte bis in die 1970er Jahre eine eher untergeordnete Rolle in der ökonomischen Forschung. Der Grund hierfür ist die simple Tatsache, dass die Ehe die einzige anerkannte Form einer Partnerschaft war. Das Konstrukt der eheähnlichen Gemeinschaft[1] spielte bis dato eine untergeordnete Rolle und wurde höchstens als Vorstufe der Ehe betrachtet. Dies hat sich im Verlaufe der letzten drei Jahrzehnte drastisch verändert. Tatsächlich wird die eheähnliche Gemeinschaft immer beliebter, nicht zuletzt aufgrund der gesetzlichen Vorteile. So bedeutet eine eheähnliche Gemeinschaft weniger Hürden im Trennungsfall und einen höheren Grad an Unabhängigkeit und Individualismus für beide Partner. Neben diesen persönlichen Aspekten hat die Wahl der Partnerschaft auch enorme ökonomische Auswirkungen.

Diese Dissertation zielt demnach auf die verschiedenen Aspekte der Partnerschaftswahl und deren ökonomischen Auswirkungen ab. Des Weiteren wird verdeutlicht, warum dieser bislang eher unterschätzte sozioökonomische Aspekt mehr in den Fokus der ökonomischen Forschung rücken sollte. Diese Doktorarbeit beinhaltet drei eigenständige Forschungsarbeiten, welche jeweils unabhängig voneinander gelesen werden können.

Kapitel 2 'Assortative Mating of Married and Cohabiting Couples' analysiert das assortative Paarungsverhalten (Wahl des Partners) von verheirateten Paaren und Paaren, die in einer eheähnlichen Gemeinschaft (kohabitierend) leben. Ein Ziel dieser Arbeit ist es zu beurteilen inwiefern die Wahl des Partners auf ähnlichen oder unterschiedlichen Charakteristika (z.B. Alter, Bildung oder Einkommen) beruht. Damit sollen Unterschiede zwischen den beiden Partnerschaftsformen dargestellt werden. Ökonomisch ist dies besonders relevant, denn so können Unterschiede im Arbeitsverhalten sowie der Einfluss auf die Einkommens(un)gleichheit besser nachvollzogen werden. Die Evaluierung des letzteren stellt das zweite Ziel dieses Kapitels dar. Die Ergebnisse der empirischen Untersuchung zur Partnerwahl zeigen zum einen eindeutige Unterschiede zwischen verheirateten und kohabitierenden Paaren und zum anderen auch Veränderungen im Wahlverhalten über die Zeit. So suchen sich kohabitierende Paare ihre Partner häufig aufgrund von ähnlichen

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[1] Die eheähnliche Gemeinschaft ist hier das Zusammenleben von zwei verschiedengeschlechtlichen Partnern, ohne dass diese formal verheiratet sind.

arbeitsmarktbezogenen Eigenschaften aus. Dies bedeutet, dass Paare, die in einer eheähnlichen Gemeinschaft leben untereinander gleicher sind als verheiratete Paare, in Bezug auf Arbeitsmarktcharakteristika. Daraus resultiert eine größere Gleichheit innerhalb von kohabitierenden Haushalten, aber im Umkehrschluss auch eine größere Ungleichheit zwischen kohabitierenden Haushalten, im Vergleich zu verheirateten Paaren.

Kaptel 3 'The Added Worker Effect Differentiated by Gender and Partnership Status' untersucht den Effekt des zusätzlichen Arbeiters (AWE). Dieser bezieht sich auf den Anstieg des Arbeitsangebotes eines Individuums als Reaktion auf einen plötzlichen finanziellen Schock des Familieneinkommens, z.B. durch Arbeitslosigkeit des Partners. Ich konzentriere mich ausdrücklich auf die Analyse von Ausstrahlungseffekten der Arbeitslosigkeit eines Familienmitgliedes auf andere Haushaltsmitglieder. Dabei erforsche ich separat die Reaktion von Frauen und Männern auf die Arbeitslosigkeit des jeweils anderen Partners und zusätzlich differenziere ich hinsichtlich ihres Partnerschaftsstatus (verheiratet bzw. zusammenlebend). Hierbei benutze ich ausschliesslich Firmenschließung und Kündigung durch den Arbeitgeber als exogene Formen der Arbeitslosigkeit. Das Hauptziel dieses Kapitels ist es, die ökonomischen Konsequenzen des AWE zu verstehen und zudem zu erfassen, ob sich Anpassungsmechanismen innerhalb eines Haushaltes je nach Partnerschaftsstatus unterscheiden. Dieses Kapitel findet Hinweise für die Existenz eines AWE. Im Vergleich von Paaren, in denen ein Partner arbeitslos wird und Paaren bei denen beide Partner berufstätig bleiben, findet sich eine signifikant höhere Wahrscheinlichkeit der Erhöhung des Arbeitsangebotes bei Individuen, deren Partner arbeitslos wird. Allerdings ist dieser Effekt größtenteils auf die potentielle Veränderung (Wunsch nach Anpassung) auf der einen Seite, sowie die Veränderung der Arbeitsstunden auf der anderen Seite zurück zu führen.

Kapitel 4 'The Impact of Cohabiting and Married Partner's Earnings on Work Hours' erforscht die Determinanten des Arbeitsangebotes von Frauen im Haushaltskontext. Hauptschwerpunkt der Analyse ist es, den Effekt einer Veränderung im Gehalt des männlichen Partners auf die Arbeitsstunden der Frau zu bestimmen. Dies widerum ist mit den übergeordneten Fragen, ob verheiratete und kohabitierende Paare unterschiedliche ökonomische Entscheidungen treffen und ob sie unterschiedlich auf Veränderungen im Gehalt des Partners reagieren, vernetzt. Um ein vollständiges Bild des Arbeitsverhaltens innerhalb von Haushalten abzubilden, analysiere ich sowohl die Reaktion von Frauen als auch von Männern. Die Ergebnisse der Hauptuntersuchung deuten darauf hin, daß verheiratete Frauen weniger auf dem Arbeitsmarkt arbeiten, als kohabitierende Frauen. Des Weiteren resultiert eine Gehaltserhöhung beim Ehemann in einem signifikant negativen Effekt auf die Arbeitsstunden der Ehefrau. Der Partnerschaftsstatus hat bei Männern hingegen keine signifikante Auswirkung auf deren Arbeitsstunden. Darüber hinaus präsentiert dieses Kapitel mit dem "Ehegattensplitting" einen potenziellen Erklärungsmechanismus für die nachgewiesenen

Unterschiede zwischen verheirateten und kohabitierenden Paaren. Denn der Steuervorteil, der aus dem "Ehegattensplitting" resultiert, ist nur für verheiratete Paare zugänglich.

Schlüsselwörter: Kohabitierend (zusammenlebend) vs. Ehe, Einkommensungleichheit, Werksschließung, Entropy balancing, Arbeitsstunden von Frauen, Arbeitsteilung.

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incentive to continue.

Most importantly, among all my friends and colleagues I owe my greatest thanks to Alexandra Avdeenko and Kathleen Ngangoué. We started the Ph.D. program at DIW Berlin in 2010 and we quickly grew together and became so much more than co-workers and fellows. We became friends. They accompanied me through all ups and downs, academically and personally. For being such good listeners, advisors, teachers, psychologists and shopping companions, I want to wholeheartedly thank them.

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Doreen Triebe

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1 Introduction

This dissertation provides evidence for the necessity to differentiate couples into legally married couples and cohabiting couples without legal binding. Investigating their assortative mating behavior (sorting into partnerships) and labor supply outcomes convey contributions and important policy implications in the field of labor market economics.

1.1 Motivation

Born in the early 1980s, I grew up in the Socialist GDR. As a child, I realized, but never questioned, why my parents, grandparents and all of their friends were married. Only years later, when I was old enough to understand what marriage means, I learned that it was likely necessary to get married during GDR times. The GDR was a nation of rules and getting married was critical for couples who wished to move out of their parents house and into an apartment of their own. Furthermore, young marriages (both partner under 26 years old) were eligible for an interest-free credit (Hoffmann and Schwartz, 2005).

Now, more than 25 years after the fall of the Berlin Wall, partnerships are more diverse. Not only did the collapse of the GDR change people's ideals and views, it also marked the birth of a less conservative generation that is more open to alternative living arrangements. As a consequence thereof, the role of women is changing. Especially in West Germany the model of male breadwinner and female homemaker was prevalent until the 1980s (Becker, 1985). However, increasing education, growing labor market participation and the consequential increasing options in life changed the role allocation and reduced the desirability for women to marry (Becker, 1991).

In fact, unmarried partnerships, namely cohabitation[1], are becoming more and more attractive, since it means fewer hurdles in the event of separation as well as more independence and individualism for both partners. The rapid rise in cohabitation since the 1980s was, therefore, one of the most dramatic changes in family life. Beforehand, union formation was characterized by early marriage. In contrast, cohabitation today is no longer just

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[1]Cohabitation means living together with a partner without being legally married.

a pre-stage of marriage or a necessity due to economic reasons (i.e. one cannot afford to marry). Instead, cohabitation is widespread and not restricted to a particular subgroup or social class. This is an interesting and considerable development to me, especially since there was simply no real alternative to getting married when I was a kid. I am very eager to see what happens in a society when rules, like the ones during GDR times, are broken up. Therefore, my personal background motivates me to analyze the growing trend of unmarried partnerships and its consequences; on one hand within the relationship, and on the other for the society.

Economically, understanding whether and how married and cohabiting couples differ in their characteristics, in their role allocation within partnerships, and in their labor supply behavior provides new insights, contributions and conclusions to the existing empirical literature. Therefore, being able to provide useful research and offer considerable resulting policy implications is, in addition to my personal interest, also an underlying motivation.

Consequently, this doctoral thesis bundles investigations, which are aimed at the afore-mentioned considerations. Firstly, it investigates assortative mating and its consequences on income inequality in chapter 2. Secondly, it explores the added worker effect as evidence from involuntary job loss in chapter 3. Finally, the impact of cohabiting and married partner's earnings on work hours is examined in chapter 4.

1.2 Contributions

Within the empirical literature, most researcher focus solely on married couples. I, in contrast, focus explicitly on married and cohabiting couples, which is necessary to detect differences in their labor market behavior and to be able to give subsequent policy implications. Additionally, most existing empirical literature in the field of economic labor market behavior focuses on the US. However, due to different fiscal policies and welfare state regimes, findings based on the US might not be transferable to Germany. Therefore it is important to conduct analyses in different countries. By examining Germany, I address a significant gap in the literature. Those aforementioned common contributions connect the independent studies, and thus forming one doctoral thesis.

In addition to the contributions that are common throughout all three studies, each chapter delivers individual insights that have important ramifications. Chapter 2 aims at contributing to the existing empirical literature in several ways. Firstly, this study extends the horizon of the assortative mating literature by analyzing different traits instead of simply focusing on educational differences. Secondly, I am able to analyze changes over time. Thirdly, this study connects differencing assortative mating behavior of married and cohabiting couples and potential consequences on income inequality, which has, to

the author's knowledge, not yet been investigated. Therefore, this is the first investigation which examines family structures (decrease of marriage in favor of cohabitation) and its consequences on income inequality by using the differing assortative mating behavior between married and cohabiting couples to explain the gap in inequality between them.

The most important contribution of chapter 3 is the solely consideration of unemployment due to involuntary job loss resulting from termination by employer and plant closures. This is useful for the underlying estimation in two different ways. On the one hand, I focus on preferably exogenous shocks and, on the other hand, those types of job loss are most likely to result in a negative impact on family income. Other types of job loss, such as own quits, retirements or seasonal employment, cannot be considered exogenous, since they are known beforehand and also might not result in a financial breakdown. Furthermore, in contrast to the literature, this study extends the horizon to unmarried partnerships and includes the job loss of women. Both contributions give credit to modern changing societies, where marriage is no longer the only accepted form of partnership and women no longer certainly serve as secondary worker; instead partners are more equal or even trade roles. Lastly, I use a combination of matching and difference-in-differences estimation in order to identify causal effects.

Finally, chapter 4 contributes to the existing literature on women's labor supply by differentiating between married and cohabiting couples, which provides new insights into household specialization issues and labor supply incentives. The underlying data from the German Socio-Economic Panel (SOEP) study allows for longitudinal analysis and the distinction into marriage and cohabitation. An additional unique feature of this chapter is the presentation of a potential explanation approach for the proven differences between marriage and cohabitation. This approach considers a specific characteristic of the German tax system: the tax benefit for married couples known as "income-splitting" (Steiner and Wrohlich, 2004).

1.3   Outline of the study

This dissertation contains three independent papers, each addressing a separate research gap in the empirical literature. Figure 1.1 provides an overview of the structure of this dissertation. In addition, common features of the chapters are represented. Table 1.1 offers a more detailed overview of the chapters. This overview contains content-wise information, such as research question and results, but also formal information about authorship, my contribution to each chapter and publication status.

The common baseline of all three papers is to conduct analyses in the field of labor market economics while differentiating into married and cohabiting couples. Further, each

Figure 1.1: Overview of the Structure
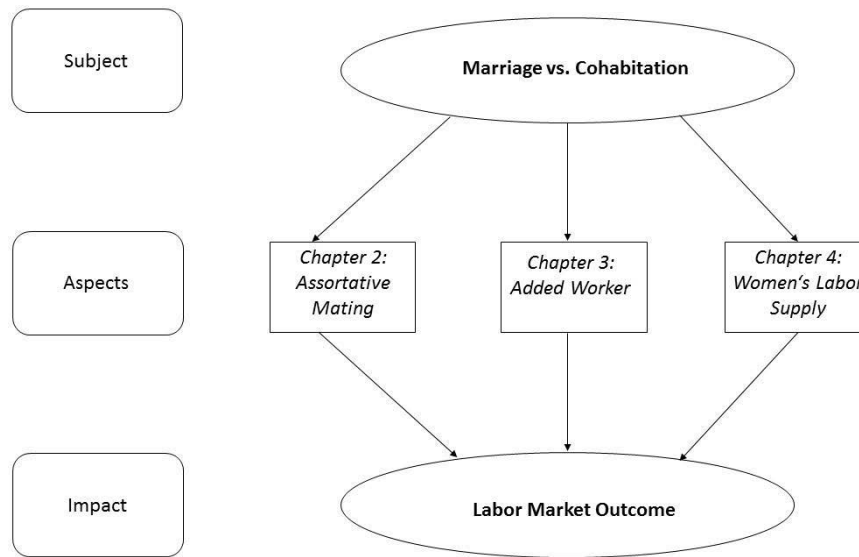
paper uses data from the German Socio-Economic Panel (SOEP) study and investigates changes over time. Main findings reveal differences between married and cohabiting couples in every investigation.

The structure of this dissertation follows a logical path. While chapter 2 focuses on the differences of mating behavior and its consequences between married and cohabiting couples, chapters 3 and 4 go one step further by taken the partnership formation (marriage or cohabitation) as given. Their main aim is to evaluate spillover effects within couples and differences over time. Chapter 3 thereby focuses on spillover effects of both male and female, while chapter 4, more specifically, analyzes female labor supply.

Chapter 2 investigates whether the higher inequality between cohabiting couples, compared to married couples, can be assigned to their different assortative mating behavior. I explicitly focus on spillover effects of assortative mating on income inequality and on changes over time. Thereby, I use longitudinal SOEP data from 1984 through 2013. I analyze assortative mating by using correlations and a binary logit model. Subsequently, I use two different inequality measures (Gini coefficient and coefficient of variation) to examine the coherence of both, assortative mating and income inequality. To support the findings, I also perform a thought experiment, in which I use counterfactuals (random mating) to see what would have changed in inequality using a different mating behavior. Findings clearly state that assortative mating influences inequality. It determines that assortative mating differs between married and cohabiting couples. Cohabiting couples face positive assortative mating in labor market traits, which means that these character-

istics serve as complements. In other words cohabiting couples match in terms of labor market traits on similar characteristics which means that they are more equal within one household (both partners tend to match each others wages and working hours), compared to married couples. This results in a higher intra-household equality but on the other side it also indicates that the inter-household inequality between cohabiting households is larger. This can be confirmed by the inequality measurement. The performed thought experiment, in which the matching is assigned to be random confirms the previous result, as income inequality among cohabiting couples is about 5 % lower under random mating.

Chapter 3 analyzes the effect of job loss on a partner's responsiveness. It reveals whether there is an added worker effect (AWE) by explicitly investigating the spillover effects of unemployment on women and men and distinguishes into married and unmarried partnerships. I use longitudinal SOEP data from 1991 to 2013. My sample consists of married and cohabiting couples with initially employed directly affected partners. The indirectly affected partners responsiveness (AWE) is measured by transitions either on the intensive margin or the extensive margin. Both transitions can additionally proceed as realized change (actual change between two periods) or potential change (wish to change labor supply, but its realization is not immediately possible). It is important to also consider the potential change, since it can give further insights in labor market mechanisms. Unaffected partners potentially want to work or want to increase work hours, but labor market constraints, economic downturns or personal social commitments might hinder them from starting work or work more hours. The underlying method in analyzing the AWE is a combination of matching (entropy balancing) and difference-in-differences (DiD) estimation. The treatment in the DiD setting is unemployment due to plant closure and termination by the employer (involuntary job loss). Both unemployment reasons most likely result in a financial breakdown for the household and provide an exogenous entry into unemployment, which is necessary for causal interpretations. I find evidence for the existence of an added worker effect for all considered subgroups (women, men, cohabiting couples and married couples). Partner of directly affected individuals show a significantly higher probability of increasing labor supply compared to those individuals whose partner remain employed. However, this effect is mainly driven by the potential change on one side and the intensive change on the other side. The latter result is in line with other researchers who find evidence for an AWE when considering the intensive margin (Gong, 2010; Bredtmann et al., 2014). This suggests that the insurance mechanism within households is still functioning in Germany. In general, the AWE is larger when a women enters unemployment, presumably because it is easier for men to adjust working hours as they are less responsible for childcare (Kümmerling et al., 2008) and have more possibilities on the labor market. The findings are robust over various specifications, e.g. different

methods, a placebo regression and different treatment group variations.

Chapter 4 focuses mainly on women's labor supply. While asking whether married women tend to make different economic decisions concerning their work hours than cohabiting women, the focus lies on the effect of a change in the male partner's wages on women's work hours. For comparison reasons, men are analyzed as well. I use longitudinal SOEP data for this study as well, and I focus on the years from 1993 through 2010. I identify the effects of partner characteristics and marital status on women's work hours using fixed effects regression. In doing so, I need to account for selection into the labor force and endogeneity of wages (Laczo, 2011). Therefore, I use a Heckman correction model (Heckman, 1979) and the Mincer wage regression (Mincer, 1974). The main estimation results suggest that women's work hours depend significantly on their marital status. Married women work less on the labor market. Further, an increase in partner's wages produces a negative and significant effect on married women's work hours. The marital status of men, on the other hand, has no significant impact on their work hours. A second step includes interaction terms to test the combined effect of cohabitation with the main characteristics. The regression analysis confirms that cohabiting women respond significantly more strongly to a change in partner's wages than married women.

Table 1.1: Overview of the Chapters

	Chapter 2	Chapter 3	Chapter 4
Title	Like or Dislike? – Assortative Mating of Married and Cohabiting Couples & its Impact on Income Inequality	Is there an Added Worker Effect in Germany? – Evidence from Involuntary Job Loss	The Impact of Cohabiting and Married Partners' Earnings on Work Hours
Author	Doreen Triebe	Doreen Triebe	Doreen Triebe
Author's Contribution	100%	100%	100%
Published Versions		SOEPpaper No. 740	SOEPpaper No. 614
Main Research Questions	Does mating differ between married and cohabiting couples? What is the impact of differing mating behavior on income inequality?	What are the spillover effects of unemployment on partners? What are economic consequences of AWE and does the intra-household adaptation mechanisms differ in different partnerships?	What is the effect of a change in male partner's wages on women's work hours? Does married and cohabiting women make different economic decisions and respond differently to changes in their partners' wages?
Data	GSOEP	GSOEP	GSOEP
Methods	Correlation; Logit; Gini coefficient; Coefficient of variation	Difference-in-differences; entropy balancing	Fixed effects regression
Main Results	Married and cohabiting couples differ in their mating behavior. Cohabiting couples show a higher intra-household equality but this also means a higher inter-household inequality in return.	The paper finds evidence for the existence of AWE. However, this effect is mainly driven by the potential change on one side and the intensive change on the other side.	Married women work less on the labor market and further, an increase in partner's wages results in a negative and significant effect on married women's work hours. The marital status of men has no significant impact on their work hours.

2 Like or Dislike? – Assortative Mating of Married and Cohabiting Couples & its Consequences on Income Inequality

Doreen Triebe

Chapter Abstract

This paper focuses on the assortative mating behavior of married and cohabiting couples over time and its consequences for income inequality. Goals are to evaluate whether mating occurs based on similar or dissimilar characteristics and to provide insights in the differences between married and cohabiting couples. Economically, this is important to better understand differences in the work behavior between married and cohabiting couples. Furthermore, it stresses the potential consequences on income inequality. Evaluating the correlation of mating behavior among married and cohabiting couples with respect to income inequality is the second major aim of this study. Using data from the German Socio-Economic Panel (SOEP) study from 1984 through 2013, I find distinct differences in the mating behavior of married and cohabiting couples and also changes over time. Cohabiting couples choose their mate according to similar labor market traits. This in turn correlates with a higher intra-household income equality but also with a higher inter-household income inequality, compared to married couples. These findings are robust to different inequality measures and are validated using counterfactuals (random mating).

Keywords: Assortative mating, cohabitation vs. marriage, income inequality.
JEL Classification: J12, J16

2.1 Introduction

How do individuals sort themselves into partnerships or households? This is an interesting and important economic issue. Not only because the process of selecting mates itself has evolved over the years, but also due to its major implications for labor market behavior, the distribution of income and resulting income inequality.

Becker's famous work, *Treatise on the Family* (1991), describes marriage as formal maximization problem where individuals derive utility from consuming goods, which are produced using a household production function (Dalmia and Lawrence, 2001). The term assortative mating came up as he showed that individuals select their mates in a non-random manner (Allegretto, 2002) but based on specific characteristics (complements and substitutes). After Becker's publication, assortative mating was widely discussed by economists, e.g., educational assortative mating and its implications for wage (Nakosteen et al., 2004; Lewis and Oppenheimer, 2000) or the impact of assortative mating on female labor supply (Bredemeier and Juessen, 2013). In their investigations of assortative mating, researchers mostly focused solely on married couples. However, a substantial growth in the number of cohabiting (unmarried) partnerships has occurred since the 1980s (Jepsen and Jepsen, 2002). Investigating those changing family structures, that is, decrease of marriage in favor of cohabitation, is a driving force of this research study.

Analyzing the assortative mating behavior of married and cohabiting couples can play an important role in understanding differences in labor supply behavior. Further, those differences in labor supply are likely to affect differences in income distribution and also differences in income inequality. Income inequality has substantially increased in most industrialized countries (Burtless, 1999; Martin, 2006; Harkness, 2010), which encouraged many economists to analyze underlying reasons. However, one main limitation of studies on assortative mating and income inequality is once again dominant focus on married couples only (Schwartz, 2010; Greenwood et al., 2014). Alternatively, they seek to find conclusions on income inequality due to changing female labor supply (Cancian and Reed, 1999; Harkness, 2010), but leave out the analyzing potential of differing family formation.

Nevertheless, increasing income inequality can be linked to changes in family structure (OECD, 2008). This research therefore explicitly seeks to combine changing family structure and income inequality. It aims at identifying the gap of income inequality between married and cohabiting couples as a result of their different assortative mating behavior. This is important since it can help to understand dynamics, to reveal causes that are potentially reflected in societal income inequality and to adjust policies aimed at decreasing income inequality. My assumptions behind this investigations are: Firstly, married and cohabiting couples differ in their assortative mating behavior. Secondly, this differ-

ent assortative mating behavior could lead to differences in the work behavior. Finally, different work behavior of married and cohabiting couples potentially has consequences on income inequality. Using data from the German Socio-Economic Panel (SOEP) study from 1984 through 2013, I find that cohabiting and married couples indeed differ in their assortative mating behavior, that is, they tend to choose partners differently. Cohabiting couples are more equal in terms of wage and labor market hours, compared to married couples. This indicates that individuals living in cohabitation choose their mate according to similar labor market traits which in turn has also consequences for the household income. Cohabiting couples face a higher income equality within partnerships or households but also a higher income inequality between different cohabiting households. These findings are robust to different inequality measures and validated by using random mating as counterfactual to support the findings.

This study contributes to the existing empirical literature in several ways. It firstly extends the horizon of the assortative mating literature by analyzing different traits instead of simply focusing on educational differences. Secondly, it also contributes to the income inequality literature by differencing into married and cohabiting couples. Thirdly, I am able to analyze changes over time. Finally, this study connects differencing assortative mating behavior of married and cohabiting couples and potential consequences on income inequality, which has, to the author's knowledge, not yet been investigated in that way. Thus, this is the first investigation which aims at changing family structure (decrease of marriage in favor of cohabitation) and its consequences on income inequality by using the differing assortative mating behavior between married and cohabiting couples to explain the gap in inequality between them.

The paper proceeds as follows. Section 2.2 gives background information on assortative mating and income inequality. Thereafter, section 2.3 provides the description of the underlying data and presents the empirical setting. Section 2.4 proceeds through illustrating the estimation results and finally section 2.5 concludes the paper.

2.2   Background

2.2.1   Assortative Mating Literature

The vast majority of empirical research on assortative mating concentrates on married couples. Becker (1991) argues that married men and women differ with respect to different traits (characteristics such as age, education or wage) and furthermore that mating depends on them. His prediction of negative assortative mating (dissimilar characteristics), with respect to labor market traits, results from his theory of gender-specific labor

market specialization (Jepsen and Jepsen, 2002).

Despite Becker's remarks according to different traits in the mating process, many empirical researchers focus solely on educational assortative mating. The increase of educational attainment, especially among women, led to a reallocation in the marriage market (Grave and Schmidt, 2012). As the boundaries of the traditional gender roles of male breadwinner and female homemaker, as proposed by Becker (1985), become soft, highly educated women are likely to be no longer satisfied with their role as homemaker. Additionally, Blossfeld and Timm (2003) state that educational institutions serve increasingly as marriage markets. Nevertheless, findings on educational homogamy among spouses is mixed. While literature suggests strong evidence of increasing educational homogamy in the US (Schwartz and Mare, 2005; Lewis and Oppenheimer, 2000; Kalmijn, 1991), the opposite is true for Norway and Britain (Chan, 2004; Birkelund and Heldal, 2003).

Analyzing exclusively the assortative mating behavior of married couples might lead to biased estimates due to the substantial growth of unmarried partnerships in the last decades (Adamopoulou, 2010). Nevertheless, only a few researchers included cohabiting opposite sex and cohabiting same sex couples in their investigations. Jepsen and Jepsen (2002)'s findings support Becker's predictions of positive assortative mating but find no evidence for gender specific labor market specialization (negative assortative mating). Allegretto (2002) finds positive assortative mating strategies as well, in both married and unmarried partners, but with a greater magnitude for married couples. Finally, Glei et al. (2002) find that never married parents are similar to married parents in choice of partner. All three studies examine US data.

2.2.2   Income Inequality Literature

Income inequality increased in most, but not all, OECD nations during the 1980s and early 1990s as Gottschalk et al. (1997) describe. Reasons include technological change and globalizaton, but also changing family structure, increasing earnings inequality and changes in married women's labor force participation. Earnings inequality arises due to the increasing gap between low and high paid workers. Earnings of low paid workers fall while earnings of high paid workers soar (Danziger and Gottschalk, 1995). Increasing married women's labor force participation is resulting in an increasing positive correlation of husband's and wife's earnings, which in turn tends to increase income inequality between couples (Gottschalk et al., 1997).

Empirical literature so far is mostly aimed at the impact of wife's earnings on income inequality. Cancian and Reed (1999) argue that wife's impact of earnings on family income inequality should be measured by the difference of the observed distribution and

counterfactual reference distributions (e.g., no wife's earnings or equally distributed wife's earnings). They conclude that wives' earnings reduced income inequality within marriage in a way that the income distribution would have been less equal in their absence. Recently, Harkness (2010) performed a cross-country analysis among 17 OECD countries and concluded that raising female employment and reducing employment inequality between women would have a substantial impact on reducing household income inequality, for all countries.

2.2.3   Consolidation of Assortative Mating and Income Inequality

Changing family structure impacts income inequality (OECD, 2008), but how can it be measured? It is reasonable to expect that a changing family structure (increasing share of cohabiting couples) is accompanied by differing assortative mating behavior of married and cohabiting couples. This probably leads to differences in work behavior and earnings distribution, which in turn has consequences on income inequality. Nevertheless, empirical papers on assortative mating among married and cohabiting couples with respect to income inequality are rare. Instead, the consolidation mostly only contains married couples assortative mating behavior. Accordingly, Schwartz (2010) for example, concludes that increases in the association between spouses' earnings have the potential to increase income inequality between married couples. This can be attributed to the fact, that married couples increasingly consist of two high-earning or two low-earning spouses.

Educational assortative mating among married couples and their consequences on income inequality is analyzed by Greenwood et al. (2014) and Torche (2010). Torche (2010) makes a comparative analysis of three Latin American countries and finds a close association of barriers to educational intermarriage and earnings gaps across educational categories between countries. Greenwood et al. (2014) argue that there has been an increase in educational assortative mating in the US and that this assortative mating indeed affects household income inequality.

So far, little empirical research on changes in family structure and its consequences on income inequality exists. Research accounting for family structure mainly addresses married couple households against single households (Burtless, 1999; Gottschalk et al., 1997). Burtless (1999) states, that the increasing number of single-adult families contribute to increasing income inequality between households. Single-adult households have a more unequal income compared to married households and are most likely at the bottom of the income distribution. However, changes in family structure should also include cohabitation, as distinct differences in characteristics, such as education and labor force participation, between married and cohabiting couples exist (Jepsen and Jepsen, 2002;

Allegretto, 2002). Nevertheless, there is to date only one empirical investigation of the change of family structure and its impact on income inequality that also includes cohabiting couples (Martin, 2006). She states that changes in family structure lead to increasing inequality. However, she is not focusing on assortative mating behavior in explaining the shift. In contrast to her, I especially focus on differences in assortative mating between married and cohabiting couples to provide explanations for the differing income inequality between them. It is reasonable to expect that a different assortative mating behavior of married and cohabiting couples can explain differing work behavior between them and therefore also differing income inequalities between them. Hence, the following sections aim at providing first insights into this topic.

2.3   Methodology

2.3.1   Data

This study uses data from the German Socio-Economic Panel (SOEP, v30) study, which is an annual representative longitudinal survey of private households in Germany that started in 1984 (Wagner et al., 2007). I use an unbalanced panel from 1984 through the most recent wave 2013 (SOEP, 2014). The SOEP provides information on individual and household level, which enables me to identify relationships among individuals belonging to the same household. The wide range of topics surveyed includes information on employment, earnings, subjective wellbeing, and, most importantly for the underlying investigation, household composition. Due to the survey design, I can not only differentiate between single and couple households, but I am also able to distinguish between married and cohabiting households. This is a key feature that makes the data set particularly useful for addressing the research question. The longitudinal structure of the SOEP is a second advantage since it allows me to analyze the dynamics of assortative mating over time. Even more important is the fact that it allows me to link those dynamics to the increasing income inequality in Germany over the past 30 years. In order to investigate assortative mating, I use both non-market traits and labor market traits. Non-market traits are age in years, education as years of schooling, housework hours as hours spend for housewoork per week and a nationality dummy, that takes on the value 1 for being German and the value 0 otherwise. Labor market traits in this study include labor market hours, measured in weekly work hours[1]; earnings, measured as annual labor income divided by 1000, including wages and salaries from all employments; white collar worker is a dummy which takes on value 1 for white collar worker and value 0 for blue collar

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[1]Individuals who are not working or are unemployed get 0 work hours assigned.

worker; and finally, leadership position, which is also a dummy that takes on value 1 for holding a leadership position and value 0 otherwise. To depict income inequality, I use both partners incomes.

My sample only includes couples (either married or cohabitating) and individuals who are between 20 and 65 years old.[2] I excluded all individuals currently in education or apprenticeship as well as self-employed people, civil servants, and retirees.

2.3.2 Empirical Setting

Assortative Mating

The first step of the empirical analysis is to test assortative mating; that is, whether or not married couples are more similar to their mates than cohabiting couples and whether there are differences over time. According to Becker (1991), assortative mating could be interpreted as positive or negative matching based on whether similar or dissimilar characteristics (traits) lead to the matching of partners. His theory includes the division of traits into complements (positive assortative mating), such as education and age, and into substitutes (negative assortative mating), such as wages and hours.

A first technique in analyzing the assortative mating patterns are correlations of traits within couples. Based on Becker's work, I use correlations to analyze whether individuals choose their partner according to similar characteristics or to dissimilar characteristics. For example, the traditional view of marriage includes household specialization in home and market production (female housekeeper and male breadwinner). According to that, I would expect negative correlation coefficients for market traits within marriage (due to specialization). Further, if this specialization is driven by aspects specific to marriage[3], I would expect positive coefficients for the same characteristics for cohabiting couples.

The second technique used in this study is a binary logit model that contrasts to the first method in being a regression framework. It can be used to analyze whether individuals living in marriage show greater similarities to their partners than those living in cohabitation, or whether the opposite is true (Jepsen and Jepsen, 2002). The included control variables are the same as in the correlation model. The regression is constructed as follows:

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[2]This was done in order to be in line with other research, which aims at family structure and income inequality, e.g., Burtless (1999); Martin (2006).

[3]Marriage underlies a different legal framework than cohabitation. This implies, for example, that cohabiting couples lack legal recognition of their partnership, face fewer hurdles in case of separation, but might require additional financial resources if the relationship comes to an end (Kerr et al., 2006; Morissette et al., 2012).

$$y_i = \begin{cases} 1 & \text{if couples are married} \\ 0 & \text{if cohabiting} \end{cases} \tag{2.1}$$

$$Prob\{y_i = 1\} = \frac{e^{\beta' x_i}}{1 + e^{\beta' x_i}} \tag{2.2}$$

The model contains characteristics x_i of couple i. The control variables are defined to be the absolute value of the difference between both partners, because the mating process likely depends on the relationship of both partners characteristics. According to Jepsen and Jepsen (2002), an interesting application is to determine which couple type (married vs. cohabiting) is more likely to display positive or negative assortative mating, respectively. They note that both the sign and the magnitude of the marginal effect are important to draw this comparison. Therefore, the marginal effect can be used to determine which couples are more similar to each other.

Income Inequality

Two appropriate methods for analyzing income inequality are the coefficient of variation (CV) and the Gini coefficient, which uses the Lorenz curve as graphical depiction. The coefficient of variation is defined as the standard deviation of income divided by the arithmetic mean (Cancian and Reed, 1999). It is largely used to identify trends in inequality by using its decompositional properties. Changes in the coefficient of variation can be decomposed into changes of inequality among male and female partners[4] as well as the correlation between both partners earnings. Formally, the decomposition for couples can be expressed as

$$CV_{HH}^2 = S_m^2 CV_m^2 + S_f^2 CV_f^2 + 2\rho_{mf} S_m S_f CV_m CV_f \tag{2.3}$$

where CV is the coefficient of variation for the respective income component (subscript HH denotes household income, m male partner's earnings and f female partner's earnings), ρ is the correlation between a pair of income components and S is the share of total income from component m or f. Thus, increasing inequality among male partners or female partners increases inequality among couples. Similarly, if the correlation between partner's earnings increases, it will also increase inequality among couples, holding all else constant.

A second very common technique to analyze inequality is the Gini coefficient with the Lorenz curve as graphical depiction. Starting with the Lorenz curve, the degree of inequality can be shown as a line that bows away from a 45 degree line of total equality

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[4]Other income sources, such as pensions or assets, can also be included.

between the lower left corner and the upper right corner. The further this line bows away from the total equality line, the more unequal is a society (Lorenz, 1905).

The Gini coefficient is derived by using the Lorenz curve

$$\frac{Area\ between\ Lorenz\ curve\ and\ the\ line\ of\ total\ equality}{Whole\ area\ under\ the\ equality\ line} \tag{2.4}$$

The Gini coefficient can be decomposed as well

$$G_{HH} = S_m R_m G_m + S_f R_f G_f \tag{2.5}$$

where $G_.$ is the Gini coefficient for the respective income component (subscript HH denotes household income, m male partner's earnings and f female partner's earnings), $S_.$ is share of total income from component m or f and $R_.$ is the Gini correlation between income component m or f and total income.

I assume married and cohabiting couples differ in income inequality, especially due to earning differences, since it is likely that labor market specialization issues are different (Jepsen and Jepsen, 2002). In other words, cohabiting couples are supposed to be more equal to each other in terms of earnings, compared to married couples, where the traditional gender roles of male breadwinner and female homemaker is still more common. Going one step further, higher equality among cohabiting couples is likely to result in a higher inequality between them, whereas married couples are presumably more specialized on the labor market, which is likely to result in less inequality between married couples. But in order to see consequences of assortative mating on income inequality, female partners must contribute to the total household income (Greenwood et al., 2014), which is more likely for cohabiting couples. If this holds true, a different inequality for cohabiting and married couples should be observable in both the coefficient of variation and the Gini coefficient.

Limitations

The presented methodology to analyze assortative mating and income inequality is not without limitations. First, the approaches are not aimed at providing causal relationships. I cannot determine the degree to which the calculated differences in assortative mating behavior among married and cohabiting couples caused the observed changes in inequality. Instead, this paper provides descriptions of the association of assortative mating among married and cohabiting couples and inequality trends. Included is the calculation of changing assortative mating behavior over time and between married and cohabiting couples, to provide insights into the consequences of different assortative mating patterns

on inequality. Second, this paper does not consider other legal or economic changes that might influence mating behavior and accordingly one's commitment to the labor force. The study also does not focus on changing tax policies (e.g., Tax revenue for married couples only (Steiner and Wrohlich, 2004)), educational changes, or changing female labor force participation as determinant of inequality.

2.4   Estimation Results

2.4.1   Descriptive Statistics

The summary statistics for selected characteristics for married and cohabiting couples are presented in Table 2.1. The partner characteristic thereby denotes the female partner characteristic.

Statistically significant differences between married and cohabiting couples are observable for all characteristics, except leadership position. Considering non-market traits, both cohabiting partners are younger than married couples, have more years of education and are more likely German. The male cohabiting partner works more hours per week in the household compared to their married counterparts. In contrast, cohabiting women work much less in the household than married women. The gap between cohabiting partners is much less compared to married spouses, indicating that cohabiting partners try to align with each other.

Labor market traits also provide some interesting insights. While being a white collar worker and having a leadership position is almost comparable between married and cohabiting couples, there are some distinct differences considering work hours and income. Married and cohabiting men work about 38 hours, almost the same number of hours, but cohabiting women work significantly more hours (11.2) than their married counterparts. While cohabiting and married men work comparable hours, the labor income of cohabiting men is significantly less. The opposite is true for their female partners. Cohabiting women earn significantly more than wives. Again, the gap within partnerships is much smaller among cohabiting couples (for both work hours and income).

To consider changes over time, I subdivided the whole time frame in 3 decades. Decade 1 contains 1984 through 1993, decade 2 the following ten years (1994 through 2003) and decade 3 considers the remaining years from 2004 through 2013. Descriptive statistics separately for each decade are depicted in Table 2.7, Table 2.8 and Table 2.9 in the Appendix. Overall, cohabitation is increasing over the years. While there are 3,947 individuals living in cohabitation in decade 1, it is about 13,000 in decade 3. Both marriage and cohabitation is increasing with time, but marriage at a slower pace. Thus, the share of cohabitation

Table 2.1: Summary Statistics for Selected Characteristics

	Marriage	Cohabitation	Difference
Non-market traits			
Age	44.2	36.1	-8.1***
Age partner	41.5	33.7	-7.8***
Years of education	11.6	12.1	0.5***
Years of education partner	11.2	12.1	0.9***
Housework hours	0.6	0.9	0.3***
Housework hours partner	3.5	2.1	-1.4***
German	0.8	0.9	0.1***
German partner	0.8	1.0	0.1***
Labor market traits			
Work hours	38.9	37.9	-1.0***
Work hours partner	18.3	29.5	11.2***
Labor income	31.6	27.1	-4.5***
Labor income partner	10.7	17.6	6.8***
White collar worker	0.4	0.4	0.1***
White collar worker partner	0.4	0.6	0.2***
Leadership position	0.2	0.2	0.0
Leadership position partner	0.1	0.1	0.1***
N	167081	26205	

Notes: The table shows the means of selected variables for both partners depending on whether they are married or cohabiting. The characteristics display male partners means and partner characteristic female partners means. The difference column outlines the difference in means between marriage and cohabitation, separately for both partners. Stars indicate the significance level of the differences (t-test): * p<0.1, ** p<0.05, *** p<0.01.
Source: SOEPv30 waves 1984 through 2013, own calculations.

is increasing. Approximately 7.5% of all individuals were living in cohabitation in decade 1, which increased to about 18% in decade 3. Considering specific characteristics, mean age and education of both partners (marriage as well as cohabitation) are increasing over time. Housework hours are decreasing. In terms of labor market traits, labor income is increasing, whereas work hours show a non-uniform picture. While hours for both cohabiting partners decrease slightly, the work hours of husbands are consistent and of wives increasing, indicating that the gender gap within married couples decreases over time. In general, decade 2 is usually in between the other two decades and also the development of both partners goes usually into the same direction. Therefore, I resist from showing the results for all three decades. Instead, I provide the results for decade 1 and decade 3 in

the following sections.[5]

2.4.2   Differences in Assortative Mating Behavior

Section 2.3.2 provided the necessary tools to investigate assortative mating behavior among different types of couples. This section reveals the results for married and cohabiting couples. Further, it depicts differences over time. Decade 1 refers to the pooled observations between 1984 and 1993 and decade 3 refers to the latest available data, from 2004 through 2013.[6] The results for Pearson correlations are presented in Table 2.2.

Table 2.2: Pearson Correlation Coefficients

	Decade 1		Decade 3		Time Trend	
	Marr.	Cohab.	Marr.	Cohab.	Marr.	Cohab.
Non-market traits						
Age	0.88*	0.77*	0.87*	0.82*	±	+
Education	0.56*	0.52*	0.55*	0.57*	±	+
Housework hours	-0.44*	-0.29*	0.15*	0.34*	+	+
German	0.89*	0.36*	0.64*	0.28*	-	-
Market traits						
Labor market hours	-0.30*	0.06*	-0.23*	0.22*	+	+
Labor income	-0.32*	0.19*	-0.16*	0.32*	+	+
White collar	0.23*	0.22*	0.22*	0.29*	±	+
Leadership position	0.10*	0.18*	0.12*	0.33*	±	+

Notes: Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. Marr. refers to married couples and cohab. to cohabiting couples. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed. * p<0.01.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

Married couples show negative correlations for hours (both labor market and housework hours) and labor incomes. This is consistent with Becker (1991), who finds positive correlations for non-market traits (age and education) and negative correlations for market traits (wage and hours). It also supports the hypothesis of labor market specialization within married couples. Other market traits, like white collar worker and leadership position yield positive correlation coefficients, which indicates that married couples tend to

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[5]Nevertheless, results for decade 2 are available upon request from the author.

[6]As explained in the descriptive statistics, trends are observable over time and developments lead into the same direction over all decades. Therefore, the results of decade 2 (1994 to 2003) are usually somewhere in the middle between decade 1 and decade 3. Due to that fact, I do not present the results for decade 2 here. The emphasis lies further on showing the total change over time and the representation of the consistent results throughout this study.

show positive assortative mating behavior with respect to those market traits. Non-market traits are positively correlated for married couples, indicating positive assortative mating. This is also in line with Becker's findings.

Becker (1991) does not consider couples who are not legally married, so comparisons are not possible. However, this study reveals somewhat different correlation coefficients of cohabiting couples, compared to married couples. While non-market trait correlations of cohabiting couples are positive as well, they show additionally positive correlations for all market traits, which means that cohabiting couples do not specialize in their labor market behavior. For them, labor market traits such as income and hours are complements, indicating that both partner tend to match each other in terms of labor market characteristics. This contradicts Becker's theory of substitution, which is expected to hold true for labor market traits.

Further insights in the assortative mating behavior of married and cohabiting couples can be obtained by comparing the results over time. Increasing positive assortative mating is observable for married couples in housework hours, labor market hours and labor income, indicating that married couples increasingly grew together, that is, get more equal over those 30 years. In contrast, they are less likely to be German. For cohabiting couples, almost all traits show increasing positive assortative mating, except nationality, which decreases over time. The latter effect can be explained (for both married and cohabiting couples) with increasing globalization and migration.[7] Increasing positive assortative mating for cohabiting couples indicates that couples become more equal over time. The most interesting change over time is observable for housework hours. While it is characterized by negative assortative mating for both married and cohabiting couples in decade 1, it changes to positive assortative mating in decade 3. There is still a gender gap in housework, but women almost halved their hours while men's hours only decreased slightly. Overall, both adjust their housework over time and this might be seen as a sign of turning away from the classical gender roles.

It has been shown that, according to the correlation analysis, assortative mating behavior is different between married and cohabiting couples. Analyzing the labor income in further detail should give additional insights in earnings-mating of married and cohabiting couples.[8] Table 2.3 show the results for labor income categories.[9]

Focusing predominantly on the diagonal elements (assortative mating within a certain

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[7]The Schengen Agreement that led to the creation of Europe's borderless area in 1995 is one example for Europe's consolidation and mixture of nationalities (European Commission, 2010).

[8]For graphical distinction of married and cohabiting couples labor income correlation see Figure 2.2 in the Appendix.

[9]Low income depicts the lower 25th percentile of annual labor income, medium income 25th to 75th percentile, and high income the upper 25th percentile.

Table 2.3: Contingency Table – Assortative Mating by Labor Income Categories

Marriage

	Decade 1				**Decade 3**		
Husband		Wife		Husband		Wife	
	Low	Medium	High		Low	Medium	High
Low	**0.179**	-0.047	-0.039	Low	**0.106**	0.026	-0.084
Medium	-0.043	**-0.157**	0.015	Medium	0.020	**-0.157**	-0.064
High	-0.038	0.025	**0.116**	High	-0.082	-0.068	**0.098**

Cohabitation

	Decade 1				**Decade 3**		
Male		Female		Male		Female	
	Low	Medium	High		Low	Medium	High
Low	**0.247**	-0.114	0.200	Low	**0.142**	0.035	-0.097
Medium	-0.123	**0.163**	0.133	Medium	0.026	**0.101**	0.063
High	-0.104	0.076	**-0.078**	High	-0.093	-0.062	**0.214**

Notes: The upper panel shows the contingency table for married couples for the years 1984 through 2003 (decade 1) and 2004 through 2013 (decade 3). The lower panel shows the same table and the same years, but for cohabiting couples. Low income depicts the lower 25th percentile of annual labor income, medium income 25th to 75th percentile and high income the upper 25th percentile. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

income category) reveals, for married couples, that assortative mating decreased for low and high labor incomes, but stayed constant for medium income. For cohabiting couples, low and medium incomes show decreasing correlations, while high income provides a strong increasing assortative mating behavior. Especially high income cohabiting couples seem to match each other. Their increasing positive correlation (from negative to positive correlation) seems to dominate the overall picture. In contrast, married couples' overall negative income mating seems to be ruled by medium income.

The second step in evaluating assortative mating behavior among married and cohabiting couples is by using a binary logit model. Although it serves to emphasize differences between married and cohabiting couples, it does not allow for conclusions within couple types (that is, it is not used to determine negative or positive assortative mating among partners). A significant positive marginal effect means that married couples are less alike (show negative assortative mating behavior), with respect to the specific characteristic, than cohabiting couples (Jepsen and Jepsen, 2002). Table 2.4 presents the results of the binary logit model. All characteristics comprise the absolute difference between both partners.

Table 2.4: Binary Logit Model for Decade 1 and Decade 3

| | Marriage | | | |
| | Decade 1 | | Decade 3 | |
	Coeff.	Marginal Effect	Coeff.	Marginal Effect
Non-market traits				
Age	-0.053***	-0.003***	-0.078***	-0.010***
	(0.011)	(0.001)	(0.007)	(0.001)
Education	0.001	0.000	-0.024	-0.003
	(0.025)	(0.001)	(0.015)	(0.002)
Housework hours	0.381***	0.023***	0.392***	0.048***
	(0.020)	(0.001)	(0.018)	(0.002)
German	-0.646***	-0.039***	0.177	0.022
	(0.139)	(0.008)	(0.112)	(0.014)
Market traits				
Labor market hours	-0.000	-0.000	0.004***	0.001***
	(0.002)	(0.000)	(0.002)	(0.000)
Labor income	0.046***	0.003***	0.025***	0.003***
	(0.004)	(0.000)	(0.002)	(0.000)
White collar	-0.348***	-0.021***	0.172***	0.021***
	(0.069)	(0.004)	(0.047)	(0.006)
Leadership position	-0.148	-0.009	-0.194***	-0.024***
	(0.098)	(0.006)	(0.057)	(0.007)
Decade dummies	yes		yes	
N	34198	34198	49901	49901

Notes: Standard errors are in parentheses and clustered by person ID. Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. All traits comprise the absolute difference between both partners. Marginal effects are evaluated at the mean. The sample includes couples (cohabitation and marriage) with individuals aged between 25 and 65 who are either in dependent employment or non-employed. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

For decade 1 (1984-2003), labor income and housework hours between both partners reveal positive statistically significant marginal effects, indicating that married couples are less alike (show negative assortative mating behavior) with respect to those characteristics than cohabiting couples. Considering age (non-market trait), for example, has a negative significant marginal effect, indicating that married couples are more alike than cohabiting couples and therefore more likely to show positive assortative mating behavior. Further, this negative effect implies that a one-year decrease in the age difference increases the probability of being married by 0.003 percentage points. These findings are in line with the correlation analysis. The pooled result for 2004-2013 reveals a somewhat different

picture. In addition to the positive marginal effects of income and housework hours, the marginal effects of labor market hours and white collar work are statistically significant and positive as well. This indicates that married couples are more likely to show negative assortative mating behavior in decade 3 with respect to those characteristics.

Comparing the results over time, it become obvious that the marginal effect differs in its magnitude (increasing over time, except for German and white collar), but it is not possible to determine whether the marginal effects for decade 1 and decade 3 are significantly different. Table 2.5 provides therefore the binary logit model with decade interactions for some selected traits.

Table 2.5: Binary Logit Model with Interactions

	Marriage			
	Coefficient		Marginal Effect	
Age				
Age	-0.051***	(0.006)	-0.005***	(0.001)
Age*Decade 3	-0.024***	(0.008)	-0.002***	(0.001)
Housework hours				
Housework hours	0.390***	(0.013)	0.039***	(0.001)
Housework hours*Decade 3	0.005	(0.019)	0.000	(0.002)
Labor market hours				
Labor market hours	0.002*	(0.001)	0.000*	(0.000)
Labor market hours*Decade 3	0.002	(0.003)	0.000	(0.000)
Labor market income				
Income	0.030***	(0.002)	0.003***	(0.000)
Income*Decade 3	-0.004**	(0.002)	-0.000**	(0.000)
White collar				
White collar	-0.010	(0.041)	-0.001	(0.004)
White collar*Decade 3	0.194***	(0.053)	0.019***	(0.005)
N	141822		141822	

Notes: Standard errors are in parentheses and clustered by person ID. Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. All traits comprise the absolute difference between both partners. Each panel contains a model, in which the presented variable is interacted with decade 2, holding all else constant. Marginal effects are evaluated at the mean. The sample includes couples (cohabitation and marriage) with individuals aged between 25 and 65 who are either in dependent employment or non-employed. * p<0.1, ** p<0.05, *** p<0.01.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

The reference category is decade 1 (1984-1993) for each panel respectively. For age, labor market income and white collar is the difference between both decades significant. Considering age, for example, yields a negative marginal effect for decade 1, which means that married couples are more alike with respect to age than cohabiting couples. The

interaction term of age and decade 3 (2004-2013) is negative and significant, which reveals that married couples in decade 3 are even more alike with respect to age. The income coefficient is positive significant, meaning that married couples in decade 1 have been less alike than cohabiting couples. The income interaction term with decade 3 is negative significant, indicating a change over time.Married couples income become more alike with time, whereas being a white collar worker's change over time is the opposite to income (less alike) While married couples in decade 1 have been more alike than cohabiting couples (but insignificant), there is significant evidence that married couples become less alike with time.

To sum up, both techniques support my previous assumption of a different assortative mating behavior of married and cohabiting couples. Keeping that in mind, the next step is to investigate whether this different mating behavior has consequences on income inequality. I assume that the proven differences in terms of labor market income (married couples incomes are less alike, compared to cohabiting couples, who tend to match each others income) result also in differences in income inequality. The tendency that cohabiting partners are more equal within their relationship leads therefore to the assumption that they face a higher inequality compared to other cohabiting couples. It is further reasonable to expect that this fact combined with the increasing share of cohabiting couples leads to increasing income inequality within the society. Therefore, the following section evaluates the income inequality of married and cohabiting couples.

2.4.3   Mating and Income Inequality

Assortative Mating and Income Inequality

The existing literature on the relationship between income inequality and assortative mating (Schwartz and Mare, 2005; Cancian and Reed, 1999; Greenwood et al., 2014) state a positive relationship between them (analyzed within married couples). The previous section proved increasing positive assortative mating patterns over time, especially for cohabiting couples. Hence, if the mentioned positive relationship between assortative mating and income inequality holds true, the latter should increase as well and distinct differences between married and cohabiting couples should become obvious.

Income inequality can be measured using the coefficient of variation (CV) and the Gini coefficient. The CV aims at describing the dispersion of a variable in a way that does not depend on that variables measurement unit. Therefore it is possible to compare the dispersion of two variables in a meaningful way. The higher the CV, the greater is the dispersion of a variable. Hence, it is possible to compare the dispersion of annual household income among married and cohabiting couples and over time. The second set

of techniques are the Gini coefficient and the Lorenz curve. Results are displayed in Table 2.6. Overall, inequality is increasing over time. This can be ascertained using the CV and the Gini coefficient. Whether the main driver for increasing overall income inequality are married or cohabiting relationships will be discussed in this section.

Table 2.6: Income Inequality

Assortative Mating				
	All			
	Decade 1			Decade 3
CV	0.45		CV	0.55
Gini	0.220		Gini	0.250
	Marriage			
	Decade 1			Decade 3
CV	0.45		CV	0.56
Gini	0.220		Gini	0.247
	Cohabitation			
	Decade 1			Decade 3
CV	0.47		CV	0.51
Gini	0.215		Gini	0.258

Notes: Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. CV is the coefficient of variation and Gini is the Gini coefficient. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

Considering the CV, in decade 1 (1984-1993) cohabiting couples are more dispersed (0.47) than married couples (0.45), indicating that they are less equal within their partnership compared to married couples. But roles have changed over time. While income dispersion increased for both (0.51 for cohabiting couples and 0.56 for married couples) in decade 3 (2004-2013), it is obvious that, since dispersion increased at a slower pace for cohabiting couples, married couples are now more unequal than cohabiting couples. By implication, incomes within a certain cohabiting couple are more equal to each other (lower dispersion), supporting the hypothesis that cohabiting partners tend to match each others wages. On the other side, this means that inequality between cohabiting couples is higher compared to married couples.

Calculations of the Gini coefficient also support the previous findings of increasing inequality. While the Gini coefficient for decade 1 is 0.220, it increases to 0.250 in decade 3, considering all couples. Interesting insights become obvious when analyzing the inequality within subgroups. The inequality among cohabiting couples is a little smaller compared to married couples (0.215 vs. 0.220) in the first decade. In the third decade, inequality among cohabiting couples is 0.258, while married couples display an inequality of 0.247.

Comparing both decades, the increase of inequality is much higher for cohabiting couples, indicating that inequality today is not only higher compared to the 1980s, it also grows at a faster pace, compared to married couples. In addition, cohabiting and married couples drift apart with time. While inequality among cohabiting couples in the 1980s was smaller compared to married couples, it exceeds the value for married couples in decade 3. A possible explanation can be that cohabitation in the 1980s was mostly seen as pre-stage of marriage and therefore less common. Further, cohabiting partner tend to match each others working hours and incomes (Triebe, 2014). Therefore, cohabiting couples are more equal within the relationship but by implication this creates a higher inequality between households. In other words, intra-household inequality is lower among cohabiting couples while inter-household inequality is higher, compared to married couples.

Figure 2.1 depicts the differences of income inequality over time. Picture (a) shows the result for the pooled sample, whereas (b) and (c) depict married respectively cohabiting couples separately. It becomes obvious that inequality is increasing in Germany between decade 1 (1984-1993) and decade 3 (2004-2013), for all specifications. Furthermore, the overall increase of income inequality is most likely referable to cohabiting couples, as stated above. Admittedly, both married and cohabiting couples show increasing inequality patterns, but the larger increase in income inequality of cohabiting couples, combined with an increasing share of them, leads to the assumption that they dominate the pooled result.[10]

Figure 2.1: Lorenz Curve

(a) All couples   (b) Married couples   (c) Cohabiting couples
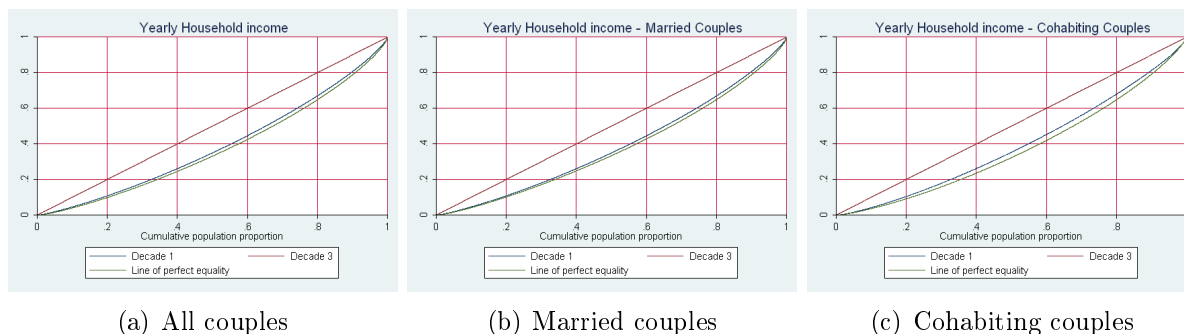
Notes: Decade 1 refers to the period from 1984 through 1993, decade 3 refers to the period from 2004 through 2013. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

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[10]To draw inferences from the income inequality evaluated here on society inequality, one has to take into account that other forms of living arrangements (e.g., singles or same-sex partnerships) are not included in this investigation. Nevertheless, the obvious trend of increasing income inequality of this subsample is also observable for the society as a whole (OECD, 2008).

Random Mating and Income Inequality

To shed more light on the question whether different assortative mating behavior among married and cohabiting couples creates differences in inequality, I carry out two thought experiments. The aim is to replace assortative mating with random mating, to draw conclusions on whether the assortative mating indeed has consequences on income inequality. Due to the proven differences in assortative mating between married and cohabiting couples (that is, cohabiting couples are more alike in income), I assume that income inequality of cohabiting couples is lower under random mating patterns, while the inequality of married couples is unchanged. The random assignment can be done in two different ways. First, it is created by assigning marital status (cohabiting vs. marriage) randomly, whereby the share of cohabiting couples of all couples is held constant (specification 1).[11] Second, the matching behavior of decade 3 is assigned to decade 1 and the other way round, whereby the respective share of cohabiting and married couples of one decade is conveyed to the other, but the assignment within one decade is random (specification 2).[12] The results are displayed in Table 2.12 in the Appendix.

As a result of the first specification, there is no difference between married and cohabiting couples for both CV (0.45) and Gini coefficient (0.22) in decade 1, and results are comparable to the result for married couples with assortative mating. In the absence of assortative mating patterns between married and cohabiting couples, that is, mating traits are random, both show the same inequality patterns. By implication, cohabiting couples who match under assortative mating in the 1980s are less (about 3%) unequal compared to cohabiting couples under random mating. In decade 3, both inequality measurements under random mating show differences compared to assortative mating. The CV is equal, respectively higher (married couples 0.56, cohabiting couples 0.53) compared to assortative mating (married couples 0.56, cohabiting couples 0.51), indicating that incomes are more dispersed when cohabiting couples formate randomly. That means, inequality would have been lower, if cohabiting couples would follow random matching patterns. On the other side, the Gini coefficient under random mating for married couples (0.251) is slightly higher than under assortative mating (0.247), indicating higher inequality under random mating. The Gini coefficient of cohabiting couples under random mating (0.247) is much lower compared to assortative mating (0.258), indicating that inequality among cohabiting couples is about 4% higher under assortative mating.

The second thought experiment (specification 2) underlines what would have happened

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[11]The overall share of cohabiting couples in all couples is 13.5%. Using the shares of the decades separately (7.5% in decade 1 and 18% in decade 3), would not change the results significantly.

[12]The cohabitation share of 7.5% in decade 1 is transferred to decade 3, while the 18% share of cohabiting couples in decade 3 is transferred to decade 1.

to income inequality if couples in decade 1 would have matched as in decade 3 (shares of decade 1, but randomly assigned) and the other way round. In decade 1, again, the result for married couples is unchanged. But if cohabiting couples in decade 1 matched randomly, but with the respective fractions of decade 3, there would be an increase in inequality (Gini of 0.223) and also a slight increase in dispersion (CV of 0.48). In decade 3, the inequality measures of married and cohabiting couples are identical in terms of CV and comparable considering the Gini coefficient, indicating that matching patterns do matter, as cohabiting couples are less unequal compared to assortative mating. Further, it declares that formation fractions has changed over time, since the results of inequality measures are identical for married and cohabiting couples, both in decade 1 of specification 1 and in decade 3 of specification 2, where the fractions of decade 1 are used.

These results confirm that the different assortative mating patterns among married and cohabiting couples have consequences on income inequality. Under random mating (specification 1), cohabiting couples are less unequal due to an equalizing effect, which diversifies incomes across partners. Therefore, inequality measures of cohabiting couples are closer to those of married couples under random mating. This equalizing effect is also observable in decade 3, specification 2, but inequality of cohabiting couples under random mating is higher compared to assortative mating, due to increasing cohabitation over time. Overall, the effect of random matching is smaller in decade 1 than in decade 3, which can also be explained with increasing cohabitation in the recent years.

2.5   Conclusion

The aim of the present study is to reveal how married and cohabiting couples differ in their assortative mating behavior. This is important to understand differences in income inequality, which is the second objective of this study. While previous studies focus either on assortative mating behavior or on income inequality, I explicitly focus on spillover effects of assortative mating on income inequality. Thereby, I use longitudinal data from the Socio-Economic Panel (SOEP) study from 1984 through 2013,[13] to additionally investigate changes over time. I analyze assortative mating by using correlations and a binary logit model. Subsequently, I apply two different inequality measures to examine the coherence of both assortative mating and income inequality. To support the findings, I also perform thought experiments, in which I use counterfactuals to see what would have changed in inequality using a random mating behavior.

This paper clearly states that assortative mating influences income inequality. It finds

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[13] The investigation of changes over time is conducted by comparing decade 1 (1984 through 1993) with decade 3 (2004 through 2013).

that assortative mating differs between married and cohabiting couples. Cohabiting couples face positive assortative mating in labor market traits, which means that these characteristics serve as complements. In other words, cohabiting couples match in terms of labor market traits on similar characteristics. They are more equal within one household (both partners tend to match each others wages and working hours) compared to married couples. This results, on the one hand, in a higher intra-household equality but, on the other hand, it indicates that the inter-household inequality between cohabiting households might also be larger. Furthermore, this study highlights that cohabitation increased drastically since the 1980s (7.5% in decade 1 vs. 18% in decade 3). Using different inequality measurements, I find that income inequality among cohabiting couples was lower in decade 1 when compared to married couples. However, this has changed over time. Cohabiting couples show a much higher income inequality than married couples in decade 3. Overall, income inequality of the analyzed subsample has increased over time, which is in line with income inequality measurements considering the society as a whole (OECD, 2008). The performed thought experiment, in which matching is assigned to be random, confirms the previous result as income inequality among cohabiting couples is about 4 % lower under random mating.

Increasing income inequality within a society is a major concern in politics. Even though this study focuses only on married and cohabiting couples, it is useful to understand dynamics and to reveal causes, which are potentially reflected in societal income inequality. Especially since the OECD (2008) states that increasing inequality is linked to changes in family structure. This study is therefore highly relevant for policies aimed at decreasing inequality, as it indicates that there is indeed a change in family structure, that is, higher share of cohabiting households. Further, it describes that cohabiting households are the main driver for increasing inequality (compared to married households). Finally, it highlights that differences in assortative mating between married and cohabiting couples can be transferred to differences in income inequality. Knowing that cohabiting couples income inequality is higher compared to married couples is important, as they have different legal rights and duties, for example, separation behavior and tax benefits. This, in turn, should also be considered in policies aiming at decreasing inequality. Policies that do not differentiate the recipients marital status are most likely suboptimal as they ignore the above stated differences and therefore leave out discretion to act.

2.6   Appendix

Table 2.7: Summary Statistics for Selected Characteristics I

	Marriage	Cohabitation	Difference
Decade 1			
Non-market traits			
Age	42.3	33.1	-9.3***
Age partner	39.4	31.0	-8.4***
Years of education	10.9	11.4	0.4***
Years of education partner	10.3	11.2	0.9***
Housework hours	0.8	1.1	0.2***
Housework hours partner	4.8	2.8	-2.0***
German	0.7	0.9	0.2***
German partner	0.7	0.9	0.2***
Labor market traits			
Work hours	39.6	39.1	-0.6*
Work hours partner	17.0	30.5	13.5***
Labor income	22.6	18.6	-4.0***
Labor income partner	6.5	12.3	5.8***
White collar worker	0.3	0.3	0.0**
White collar worker partner	0.3	0.6	0.3***
Leadership position	0.1	0.1	-0.0**
Leadership position partner	0.0	0.1	0.0***
N	48812	3947	

Notes: The table shows the means of selected variables for both partners depending on whether they are married or cohabiting. The characteristics display male partners means and partner characteristic female partners means. Decade 1 refers to 1984 through 1993. The difference column outlines the difference in means between marriage and cohabitation, separately for both partners. Stars indicate the significance level of the differences (t-test): * p<0.1, ** p<0.05, *** p<0.01.
Source: SOEPv30 waves 1984 through 1993, own calculations.

Table 2.8: Summary Statistics for Selected Characteristics II

	Marriage	Cohabitation	Difference
Decade 2			
Non-market traits			
Age	43.5	34.8	-8.6***
Age partner	40.8	32.5	-8.3***
Years of education	11.7	12.1	0.3***
Years of education partner	11.4	12.1	0.7***
Housework hours	0.6	0.9	0.3***
Housework hours partner	3.3	2.2	-1.2***
German	0.8	0.9	0.1***
German partner	0.8	0.9	0.1***
Labor market traits			
Work hours	38.3	37.7	-0.6**
Work hours partner	18.0	29.6	11.6***
Labor income	31.1	25.7	-5.4***
Labor income partner	10.8	17.0	6.2***
White collar worker	0.4	0.4	0.0***
White collar worker partner	0.4	0.6	0.2***
Leadership position	0.2	0.2	-0.0*
Leadership position partner	0.1	0.1	0.0***
N	60244	9510	

Notes: The table shows the means of selected variables for both partners depending on whether they are married or cohabiting. The characteristics display male partners means and partner characteristic female partners means. Decade 2 refers to 1994 through 2003. The difference column outlines the difference in means between marriage and cohabitation, separately for both partners. Stars indicate the significance level of the differences (t-test): * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1994 through 2003, own calculations.

Table 2.9: Summary Statistics for Selected Characteristics III

	Marriage	Cohabitation	Difference
Decade 3			
Non-market traits			
Age	46.5	38.1	-8.4***
Age partner	44.0	35.7	-8.4***
Years of education	12.2	12.5	0.3***
Years of education partner	12.0	12.5	0.6***
Housework hours	0.5	0.9	0.4***
Housework hours partner	2.5	1.7	-0.7***
German	0.9	0.9	0.1***
German partner	0.9	1.0	0.1***
Labor market traits			
Work hours	39.0	37.6	-1.3***
Work hours partner	19.8	29.1	9.3***
Labor income	40.2	31.3	-9.0***
Labor income partner	14.4	19.9	5.5***
White collar worker	0.5	0.5	0.0***
White collar worker partner	0.5	0.7	0.1***
Leadership position	0.3	0.2	-0.0**
Leadership position partner	0.1	0.1	0.1***
N	58025	12748	

Notes: The table shows the means of selected variables for both partners depending on whether they are married or cohabiting. The characteristics display male partners means and partner characteristic female partners means. Decade 3 refers to 2004 through 2013. The difference column outlines the difference in means between marriage and cohabitation, separately for both partners. Stars indicate the significance level of the differences (t-test): * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 2004 through 2013, own calculations.

Figure 2.2: Scatter Plots of Both Partners' Annual Labor Income

(a) Married couples - Decade 1

(b) Married couples - Decade 3

(c) Cohabiting couples - Decade 1

(d) Cohabiting couples - Decade 3
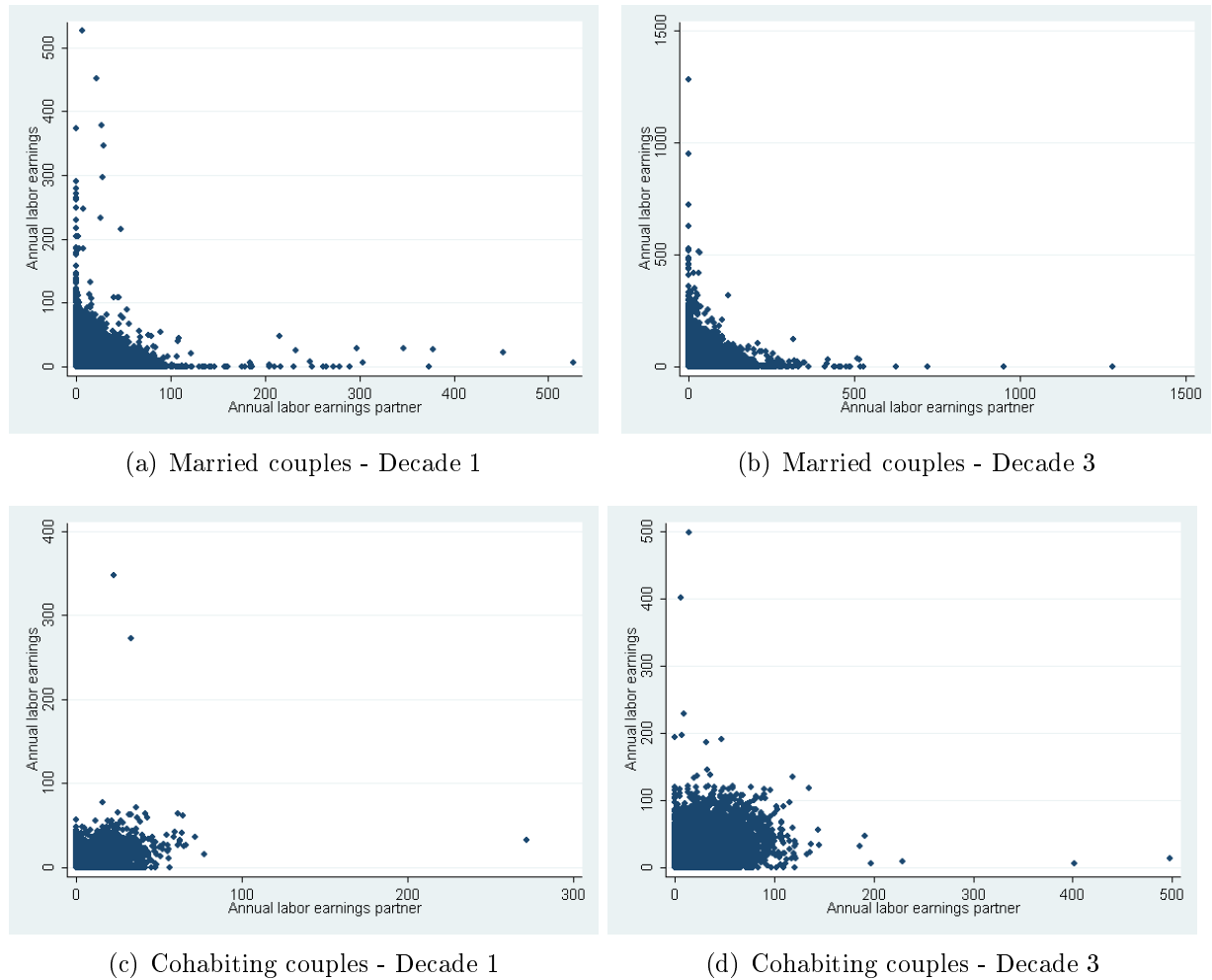
Notes: Scatter plot of annual individual labor income of both partners. Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

Table 2.10: Pearson Correlation Coefficients

	Marriage	Cohabitation
Non-market traits		
Age	0.88*	0.82*
Education	0.59*	0.56*
Housework hours	-0.22*	0.07*
German	0.81*	0.31*
Market traits		
Labor market hours	-0.25*	0.17*
Labor income	-0.14*	0.34*
White collar	0.25*	0.29*
Leadership position	0.13*	0.32*

Notes: The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed. * p<0.01.
Source: SOEPv30 waves 1984 through 2013, own calculations.

Table 2.11: Binary Logit Model

	Marriage	
	Coefficient	Marginal Effect
Non-market traits		
Age	-0.062***	-0.006***
	(0.005)	(0.001)
Education	-0.021*	-0.002*
	(0.012)	(0.001)
Housework hours	0.392***	0.039***
	(0.011)	(0.001)
German	-0.203**	-0.020**
	(0.079)	(0.008)
Labormarket hours	0.003***	0.000***
	(0.001)	(0.000)
Labor income	0.027***	0.003***
	(0.001)	(0.000)
Whitecollar	0.075**	0.007**
	(0.034)	(0.003)
Leadership position	-0.149***	-0.015***
	(0.043)	(0.004)
Decade dummies	yes	
N	81415	81415

Notes: Standard errors are in parentheses and clustered by person ID. All traits comprise the absolute difference between both partners. Marginal effects are evaluated at the mean. The sample includes couples (cohabitation and marriage) with individuals aged between 25 and 55 who are either in dependent employment or non-employed. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1984 through 2013, own calculations.

Table 2.12: Income Inequality – Assortative Mating and Random Mating

	Assortative Mating			
	Marriage			
	Decade 1		Decade 3	
CV	0.45		CV	0.56
Gini	0.220		Gini	0.247
	Cohabitation			
	Decade 1		Decade 3	
CV	0.47		CV	0.51
Gini	0.215		Gini	0.258
	Random Mating 1			
	Marriage			
	Decade 1		Decade 3	
CV	0.45		CV	0.56
Gini	0.220		Gini	0.251
	Cohabitation			
	Decade 1		Decade 3	
CV	0.45		CV	0.53
Gini	0.220		Gini	0.247
	Random Mating 2			
	Marriage			
	Decade 1		Decade 3	
CV	0.45		CV	0.55
Gini	0.220		Gini	0.251
	Cohabitation			
	Decade 1		Decade 3	
CV	0.48		CV	0.55
Gini	0.223		Gini	0.249

Notes: Decade 1 refers to the years 1984-1993 and decade 3 refers to 2004-2013. CV is the coefficient of variation and Gini is the Gini coefficient. The sample includes couples (cohabiting and married) with individuals aged between 25 and 65 who are either in dependent employment or non-employed.
Source: SOEPv30 waves 1984 through 1993 and waves 2004 through 2013, own calculations.

3   The Added Worker Effect Differentiated by Gender and Partnership Status – Evidence from Involuntary Job Loss

Doreen Triebe

Chapter Abstract

This paper examines the added worker effect (AWE), which refers to the increase of labor supply of individuals in response to a sudden financial shock in family income, that is, unemployment of their partner. While previous empirical studies focus on married women's response to those shocks, I explicitly analyze the spillover effects of unemployment on both women and men and I also differentiate according to their partnership status (marriage vs. cohabitation). My aim is to evaluate whether intra-household adaptation mechanisms differ by gender and by partnership status. The underlying method is a difference-in-differences setting in combination with an entropy balancing matching procedure. The paper considers plant closures and employer terminations as exogenous forms of unemployment. Using longitudinal data from the German Socio-Economic Panel (SOEP) study from 1991 through 2013, the empirical investigation finds evidence of the existence of an AWE. The effect is largest when a woman enters unemployment and is mainly driven by changes on the intensive margin (increase of hours).

Keywords: Added worker effect, plant closure, unemployment, entropy balancing, intra-household adaptation.
JEL Classification: D13, J12, J22

3.1   Introduction

This paper investigates the added worker effect (AWE) and delivers new insights by considering married and unmarried partnerships as well as gender differences. The AWE refers to the increase of labor supply by individuals in response to a sudden financial shock in family income, that is, unemployment of their partner. Theoretically, the implicit assumption is a hierarchical structure of labor supply within households. This means that one household member serves as the primary earner, the (male) breadwinner, who is permanently attached to the labor market, while the (female) partner typically acts as a secondary earner with transitory attachment to the labor force (Maloney, 1991).

This male breadwinner and female homemaker model (Becker, 1985) has changed since the 1980s. Women's work behavior has made a dramatic transition over the last three decades, with increasing numbers of women moving out of unpaid housework and into the labor market (Merz, 2008). Another significant societal change is the rising prevalence of cohabitation as opposed to marriage (Adamopoulou, 2010). It is reasonable to expect that both changes have an impact on the AWE. First, transitions in relationship dynamics have changed the role that each household member plays. If women do not solely serve as secondary workers, but rather as equal or even as primary workers, then a female partner's unemployment might significantly reduce the family income and hence lead the male partner to work more. Going one step further, the response of male partners might be even larger, since it is potentially easier for them to adjust their labor supply because women still bear more of the load of social responsibilities (e.g., childcare or elderly care). Second, distinguishing between married and cohabiting partnerships is important in detecting and explaining the AWE: Cohabiting partnerships are characterized by more pronounced individualism and independence of the female partners (Morissette et al., 2012). This again influences women's work behavior and potentially increases equality in terms of labor supply within partnerships (Jepsen and Jepsen, 2002), which in turn might also produce different types of added worker behavior between married and cohabiting couples. One can assume that the greater equality and independence among cohabiting partners might lead to a lower AWE. In addition, the presumed self-insurance mechanism within marriage (Lundberg, 1985) might be less distinct. Despite these arguments, no systematic research has been done so far on differences between married and cohabiting couples or gender differences in analyzing the AWE. The present study therefore adjusts the AWE framework to contemporary societal conditions by including married and unmarried partnerships as well as both women and men as potential added workers. With this unique approach, the paper provides an important extension to the existing literature and closes a research gap.

Following the arguments outlined above, this study seeks answers to the following

questions: First, is there any response of the unaffected partner to the negative shock of displacement of his/her partner and the subsequent income loss? Second, if there is a response, how can it be characterized? Is the unaffected partner more likely to respond at the intensive or the extensive margin? Does that parter adjust his or her actual or desired labor supply? Third, are there any gender differences in the response? Fourth and finally, do married and unmarried unaffected partners respond differently to the shock and is the self-insurance mechanism, which is a driving force of AWE within marriage, also applicable to cohabiting partnerships? In answering those questions, the empirical analysis relies on longitudinal data from the German Socio-Economic Panel (SOEP) study from 1991 through 2013. I find evidence of the existence of an AWE, that is, the AWE is observable for the pooled sample (all) and also for women, men and married couples. Only for cohabiting couples is the result insignificant (considering combined outcome). The effect is largest when a woman enters unemployment and is primarily driven by changes on the intensive margin for all subgroups (increase of hours).

My study contributes to the empirical AWE literature in several ways: I only consider unemployment due to involuntary job loss resulting from termination by the employer and plant closures. This is useful for the estimation in two ways. On the one hand, I focus mainly on exogenous shocks and, on the other hand, I concentrate on the types of job loss that are most likely to result in a negative impact on family income. Other types of job loss, such as own quits, retiring, or seasonal employment, cannot be considered exogenous, since they are known beforehand and also might not result in a financial breakdown. Further, in contrast to the previous literature, this study extends the horizon to unmarried partnerships and also includes job loss of women. Both contributions give credit to contemporary societies, where marriage is no longer the only accepted form of partnership and women are no longer certainly secondary workers. Instead partners are more equal or even have reversed gender roles. Lastly, I use a combination of matching and difference-in-differences (DiD) estimation to identify causal effects.

The paper proceeds as follows. Section 3.2 presents background information on the theoretical framework and literature. Section 3.3 explains the empirical setting. This is followed in section 3.4 by a description of the underlying data. Section 3.5 proceeds through illustrating the estimation results and finally, section 3.6 concludes the paper.

3.2 Background

3.2.1 Theoretical Framework

The theoretical literature dates back to Woytinsky (1942) and Humphrey (1940). Since their groundbreaking attempt to explain intra-household adaptations in cases of unemployment, the theory has been developed further by both labor and macro economists. Mincer (1962), for example, argues that unemployment by the primary earner leads to an income effect. In addition, Maloney (1987) considers a cross-substitution effect.

Based on those specifications, the AWE can be theoretically explained by the life-cycle model, where the household jointly maximizes lifetime utility. In this framework, involuntary unemployment of the primary earner (usually male) potentially increases the labor supply of the secondary earner (usually female) due to the aforementioned income and cross-substitution effects. The income effect posits that the total household income under unemployment of the primary earner is lower than it would be otherwise. It might therefore be preferable for the female partner to temporarily increase her labor supply (Mincer, 1962). This approach assumes that the household was not previously aware that unemployment would occur. In addition, according to the cross-substitution effect, unemployment forces the primary earner to consume more non-market time than desired, which may result in a takeover of a greater share of housework, allowing the secondary earner to increase his or her labor supply (Maloney, 1987).

3.2.2 Empirical Literature

The empirical literature on the existence and magnitude of AWE has produced inconsistent findings. Most researchers focus on the labor supply of wives in the United States, finding the AWE to either be small or non-existent (Lundberg, 1985; Maloney, 1987; Spletzer, 1997; Cullen and Gruber, 2000). In contrast, Stephens (2002) and Kohara (2008) report more considerable results using panel data for the US and Japan, respectively. But in general, the evidence of AWE is rather small, so it is still an open question why the theoretically well established AWE can not be empirically proven. The most common explanation is that the AWE is offset by the discouraged worker effect, which states that unemployment sends negative signals of poor job perspectives and discourages wives from even looking for jobs (Humphrey, 1940; Maloney, 1991). In addition, Cullen and Gruber (2000) discuss the possible influence of assortative mating in tastes for work on AWE. If wives of men who lost their job have a different taste for work than wives whose husbands did not lose their jobs, then this could bias the AWE findings. Furthermore, most studies

focus on actual labor supply, but as Basu et al. (1999) points out, it might be more accurate to consider desired labor supply as well. Due to market conditions, a secondary earner might not be able to actually get a job but nevertheless might look for one. Unemployment insurance is another potentially important factor. Especially in developed countries with efficient public insurance systems, it is likely that at least a fraction of the AWE is crowded out by the social insurance, making it essentially unnecessary for wives to compensate for the loss of income (Cullen and Gruber, 2000). Finally, it has been proven that the AWE is cyclical. In times of recessions, women are more likely to increase their labor supply (Mattingly and Smith, 2010).

The aforementioned literature on AWE is highly relevant to this paper, but other indirectly related strands of literature are also important. These include, for example, the literature on the impact of unemployment on different outcomes such as happiness, health, crime or subsequent earnings (e.g.,Huttunen et al. (2011); Siedler (2011)) and the literature on the differences between married and cohabiting couples (e.g., Jepsen and Jepsen (2002); Morissette et al. (2012)).

3.3 Empirical Setting

The estimation of the AWE relies on a difference-in-differences estimation (DiD) setting in combination with a matching procedure. DiD has become widespread since the work of Ashenfelter and Card (1985). In its basic setting DiD consists of two groups, with only one group exposed to a treatment. The treatment effect is modeled by estimating the difference between both groups outcomes. The main advantage of this strategy is that the unobserved variables that remain constant over time (e.g. personality traits) and that are correlated with both selection decisions (whether an individual belongs to the treatment or the control group) and the outcome variable (labor supply decision of the partner) will not bias the estimates. The key assumption of DiD is that the average change of outcome would be the same for both the control group and the treatment group if the latter had not been treated. According to Dee and Fu (2004) the violation of this assumption can be minimized by a careful selection of explanatory variables. Another possibility to adjust the DiD sample is by using matching techniques. The aim of those techniques is to find similar couples for the treatment and control group. Abadie (2005), for example, proposes using propensity score matching.[1] But instead of using propensity scores, which does not guarantee that the individual pairs will be well-matched on the full set of covariates (Stuart et al., 2009), I apply entropy balancing, a newly developed approach by Hainmüller

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[1]The propensity score is the probability of receiving the treatment conditional on the covariates.(Rosenbaum and Rubin, 1983)

(2012) and Hainmüller and Xu (2013). An advantage of entropy balancing is that control group observations are re-weighted in such a way that they satisfy pre-specified balancing requirements (Marcus, 2013). Another benefit of entropy balancing is the improvement of the balance of all conditioning variables compared to other preprocessing methods, which often leave several covariates imbalanced or even decrease the balance of some covariates (Hainmüller, 2012).

My estimation strategy consists of two steps. First, I implement entropy balancing for the whole sample. In addition, to make sure that gender and marital status is a perfect match on the treated individuals, I also implement entropy balancing separately for women and men as well as for married and cohabiting couples. Second, the regression step uses the weights obtained in the first step to regress the labor supply behavior of the unaffected partner on the treatment indicator in a DiD setting. All conditional variables of the matching step are also used as covariates in the regression step. In the DiD step, I focus on the average treatment effect on the treated (ATT), which is the change in labor supply behavior of individuals whose partners face involuntary unemployment (the average change from treatment for those who actually were treated).

$$ATT = E[Y_{1i} - Y_{0i}|D_i = 1] = E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 1] \tag{3.1}$$

where Y_{1i} denotes the potential labor supply of individual i if the partner faces unemployment and Y_{0i} denotes the potential labor supply of individual i if not. D_i refers to a dummy variable, indicating the treatment (involuntary unemployment of one partner due to plant closure or dismissal). $E[.]$ labels the mathematical expectation operator, that is, the population average of a random variable. The above expression highlights the counter-factual nature of a causal effect, meaning that Y_{0i} is unobservable for the treated and Y_{1i} is unobservable for individuals without treatment.

In order to identify the effects, I need to assume that no unobserved variable exists that can simultaneously influence changes in the outcome and the probability of being in the treatment group (involuntary unemployment of a partner). In other words, treatment and control group follow the same trend in the absence of treatment.

$$ATT = E[Y_{1i} - Y_{0i}|D_i = 1] = E[Y_{1i} - Y_{0i}|D_i = 0] \tag{3.2}$$

For the purpose of combining matching and DiD, I need to include the weights from the entropy balancing procedure in the estimation of the ATT. This results in the following formal definition:

$$ATT = E[Y_{1i} - Y_{0i}|W_{EB}(X), D_i = 1] = E[Y_{1i} - Y_{0i}|W_{EB}(X), D_i = 0] \tag{3.3}$$

where $W_{EB}(X)$ denotes the weights obtained from the entropy balancing procedure on the conditioning variables (X) from the first step.

3.4 Data

3.4.1 Sample Composition

This paper uses data from the German Socio-Economic Panel Study (SOEP, v30), which is an annual representative longitudinal survey of private households in Germany that started in 1984 (Wagner et al., 2007). I use an unbalanced panel starting after the 1991 German reunification through the most recent available 2013 wave (SOEP, 2014). The SOEP provides information on a wide range of economic and social indicators including demographics, education, employment and earnings, household composition and subjective well-being. It surveys not only households, but also individual household members, which allows me to identify relationships among individuals belonging to the same household. Therefore, I am able to reshape the data into an individual-partner structure. Its longitudinal character, which ensures the observation of the outcome variable before and after the treatment is also an attractive feature. In addition, the SOEP distinguishes between underlying causes of unemployment and different kinds of partnerships (marriage and cohabitation), information that is critical for this study.

3.4.2 Treatment and Control Group

An exogenous source of variation in the explanatory variable is essential to determine the purpose of treatment within a quasi-natural experiment setting. The aim of this study is to define a setting in which unemployment due to involuntary job loss of one household member can be used to analyze its impact on partner's labor supply. Other causes of unemployment might be endogenous, for example, quitting (voluntary job loss) might occur due to personal tastes and do not necessarily result in a financial crisis, which in turn is necessary for any intra-household response. In order to fulfill those claims, I use involuntary job loss due to plant closures or termination by the employer as exogenous sources of unemployment.[2]

Treatment and control group couples lived together in the same household, before (t_0) and after (t_1) the treatment. At the same time, I differentiate between married and cohabiting couples. However, I do not specify the number of years a couple had to live

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[2]The most appropriate way would be to focus solely on plant closures, but due to data insufficiencies, I need to include termination by the employer as second source of unemployment. For comparison, I discuss quitting, annulment contract, and temporary contract in the robustness section.

together. Both partners need to have provided valid labor supply information in both years.

The treatment group comprises couples, in which one partner is faced with involuntary unemployment due to plant closure or termination by the employer between two survey years. The treatment variable is an indicator taking on the value 1 if the respondent is registered as unemployed and states that he/she lost his/her last job due to plant closure or termination. Treated individuals are between 18 and 60 years of age and worked in dependent employment before the job loss. The indirectly affected partner of the treated individual has the same age restrictions, but irrespective of employment status. However, I consider only couples in which only one partner experienced involuntary job loss, since I am analyzing cross effects, which should not be influenced by personal experiences. In addition, in couples in which both partners experienced involuntary job loss, it would be uncertain for whom the income effect is accounted. In addition, same-sex couples are excluded from the sample, because I am seeking to analyze gender differences in the response to one partner's job loss.[3]

The control group consists of couples, in which the potentially affected partner (who is of the same sex as a counterpart in the treatment group) remains employed. In other words, the control group consists of households without any job loss experience. Besides that difference, couples in the control group are subject to the same restrictions as the treatment group. Thus, the change or desired change in labor supply of individuals whose partners did not lose their job (control group) identify what the situation would have been for individuals whose partners lost their job (treatment group) in the absence of job loss and unemployment.

In total, I have 1,633 treated couples. Out of those 1,633 treatments, 402 individuals (directly affected partner) lost their job due to plant closure. Further, 988 men and 645 women are treated. Out of those couples in which the man enters unemployment, 823 are married and 165 are cohabiting. For women, 545 are married and 100 are cohabiting. In comparison, I have about 153,000 person-year observations in the control group.

3.4.3   Outcome

This paper focuses on the labor supply outcomes of individuals whose partners suffer from job loss due to plant closures or termination by the employer. A diverse range of reactions to an external shock that decreases the household income are possible. To explore the implications of job loss on the partner's work behavior, this study does not

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[3]While 15 couples experience simultaneous job loss and 58 same-sex couples are included in the whole sample, none are represented in the treatment group.

focus solely on one particular change in labor supply behavior. Instead it combines changes at the extensive and intensive margins as well as realized and potential changes. Table 3.1 clarifies the components of AWE. All four subgroups consider the transitions of labor force participation and working hours between two periods.

Table 3.1: Components of AWE

	(t_0)	(t_1)
Realized change	not working	start working
	working	second job
	working	increase hours
	working part-time	working full-time
Potential change	not working	wants to start working
	working	wants to increase hours
Extensive Margin	not working	start working
	working	second job
	not working	wants to start working
Intensive Margin	working	increase hours
	working part-time	working full-time
	working	wants to increase hours

Source: Own presentation.

The extensive margin denotes the labor force participation and the intensive margin the number of work hours. In addition, the realized change describes an actual change between two periods, whereas the potential change denotes a desire to change the labor supply without the possibility of making this change. The outcome variable AWE consists of all possible combinations, whereby it is not possible to combine extensive with intensive margin or realized with potential change. 'Start working' denotes the transition from non-participating to participating. 'Starting a second job' occurs when an individual is already participating in the labor market but gets a second job. 'Increase hours' means an increase of at least one hour in (t_1) and 'working full-time' means an individual changed from working less than 35 hours per week (part-time) to more than 35 hours per week (full-time).[4] 'Wants to start working' is constructed by combing: likely or most certainly wants to start working in the future plus the desire to start immediately or within the next year. Finally, 'wants to increase hours' is realized if an individual's desired hours in

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[4]Some respondents do not answer the question of how many hours they work, but answer the employment status question. For those the transition from part-time to full-time is used instead of the actual change in hours (579 observations).

(t_1) are higher than the actual hours in (t_0).

3.4.4   Covariates

A set of covariates is included in the estimation. These variables are in line with other studies on the AWE (Stephens, 2002; Bredtmann et al., 2014; Kohara, 2008) and include demographics, labor market characteristics, and educational data. Covariates are either given on an individual level, partner level or household level and contain pre-treatment values. The variables used are: age, age^2, sex, marital status, education in years, number of children in the household, actual working hours, length of time with the firm, labor income, labor income^2, full-time and part-time experience in years, unemployment benefit, size and sector of the company, unemployment rate on federal state level, a maximum set of year and federal state dummies, as well as dummy variables indicating blue- or white-collar worker and German nationality. In addition, partner variables are included as well. These consists of age, age^2, actual working hours, full-time and part-time experience in years, education in years, labor income, labor income^2 and an indicator of not being employed. A full list, including the definition of the variables used, is provided in Table 3.6 in the Appendix.

3.4.5   Descriptive Statistics

The summary statistics of selected characteristics for treated as well as control (un-matched) couples are presented in Table 3.2. They include individuals and partner characteristics and also household and regional (federal state level) characteristics.[5] Summary statistics are obtained before matching.

Treatment group and control group columns display means of selected covariates. The difference column illustrates the differences in means between treatment and control group and tests for their significance. Age for both partners and number of children in the household do not display significant differences. However, treatment and control groups differ significantly in many other respects. On the individual level, treated individuals are less likely German, have less education, earn less and work more hours than their untreated counterparts. The indirectly affected partner in the treatment group has significantly fewer years of education ,earns less and also works less hours compared to the control group. Considering the household, the unemployment rate and the female labor force participation (LFP) rate (both on the federal state level) are higher in the treatment group than in the control group. However, this is a problem in the classical DiD model, but after reweighting

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[5]Summary statistics for subgroups (women, men, marriage and cohabitation) are presented in the Appendix.

Table 3.2: Summary Statistics for Selected Characteristics

	Treatment group	Control group (unmatched)	Difference
All			
Individual characteristics			
Age	41.9	41.5	-0.3
German	0.8	0.9	0.0**
Years of education	11.2	11.8	0.5***
Labor income	19413.4	21811.6	2398.3***
Work hours	40.3	28.3	-12.0***
Partner characteristics			
Age partner	41.2	41.5	0.4
Years of education partner	11.4	11.8	0.4***
Labor income partner	15705.7	21850.5	6144.8***
Work hours partner	26.1	28.5	2.4***
Household and regional characteristics			
Number of children	0.9	0.9	0.0
Unemploymentrate	12.3	10.7	-1.7***
Female LFP	67.3	65.8	-1.5***
N	1633	152735	

Notes: The table shows the means of selected variables before treatment for treated individuals and unmatched controls. The difference column outlines the difference in means between treatment and control group. Asterisks indicate the significance level of the differences (t-test): * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1991 through 2013, own calculations.

the control group observations using entropy balancing, the means in the control group equal the means in the treatment group.[6] Clearly, after matching, the differences are no longer statistically significant, suggesting that matching helps reduce the bias associated with observable characteristics.

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[6]See Appendix for detailed summary statistics before and after matching.

3.5   Results

3.5.1   Estimation Results

The estimated coefficients of an involuntary job loss on the work behavior of partners are presented in Table 3.3. The columns denote the treated individual and the rows display the ATT for their partners (denoted AWE). Column by column, the table shows the results for all couples as well as separately for gender (women and men) and partnership status (married and cohabiting) subgroups. Whereas in the latter case, the focus is on institutional differences, that is, marriage as a legal form of partnership with a proven insurance mechanism against cohabitation with potentially less binding constraints. It therefore does not distinguish between gender.[7]

Panel A combines all possible outcomes[8], whereas the following panels use a decomposition into its four overlapping categories (realized and potential changes as well as extensive and intensive margins) to determine which of them exhibits the greatest impact of the treatment variable. It would be more appropriate to decompose the outcome into its individual components (compare Table 3.1), but due to a rather small number of observations in each subcategory, especially when considering only 'start working', I refrain from making a detailed decomposition.

Considering panel A, the transitions of the combined outcome in response to the involuntary job loss of the directly affected partner, estimates show significant positive effects for all specifications except cohabitation. The individuals whose partners involuntarily lost their job, compared to those whose partners did not, are about 5 percentage points more likely to increase labor supply, considering all couples. Surprisingly, there is not a large gender gap. Following the traditional role allocation within households, one might expect a larger impact if men lost their jobs since women are traditionally less likely to be the main earners in the household, and by implication, are more able to increase their labor supply. But contrary to this view, the analysis even shows a slightly higher impact on male partner's probability to increase his labor supply if the female partner lost her job. Looking at the result from a different angle, it becomes less surprising: Even though women might be less attached to the labor market, it is presumably easier for men to adjust their labor supply, since they are likely to have less childcare responsibilities (Kümmerling et al., 2008). In addition, men have presumably more possibilities on the labor market. This underlines my assumption that the distribution of roles within households

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[7]However, gender differences within different types of partnerships may be considered likely, and would therefore be desirable to analyze, but the underlying sample does not allow for further in-depth analysis.

[8]All possible transitions from (t_0) to (t_1): start working, start second job, increase hours, work full-time, want to start working and want to increase hours. For reference, see Table 3.1.

has changed, and that women no longer solely act as secondary earners. Distinguishing between married and cohabiting couples reveals that the effect is insignificant for cohabiting couples, indicating that the insurance mechanism is indeed a phenomenon bound to marriage. Furthermore, the traditional division of labor is less widespread among cohabiting couples. Instead, cohabiting women work more hours than married women, and try to match their partners' wages (Triebe, 2014). Therefore, if both partners work a relatively high number of hours, there is simply less room for adjustments.

Table 3.3: Main Added Worker Effects

Treated Individual	All	Men	Women	Marriage	Cohabitation
			Panel A		
Combined outcome					
AWE	0.054***	0.051***	0.056**	0.046***	0.069
partner	(0.016)	(0.020)	(0.024)	(0.017)	(0.043)
			Panel B		
Realized change					
AWE	0.033**	0.028	0.043*	0.026*	0.060
partner	(0.014)	(0.017)	(0.023)	(0.015)	(0.038)
Potential change					
AWE	0.035***	0.035**	0.034*	0.027*	0.062*
partner	(0.013)	(0.018)	(0.019)	(0.014)	(0.037)
			Panel C		
Extensive change					
AWE	0.013	0.019	-0.006	0.010	0.007
partner	(0.012)	(0.015)	(0.015)	(0.012)	(0.032)
Intensive change					
AWE	0.046***	0.044**	0.050**	0.040**	0.073*
partner	(0.015)	(0.018)	(0.023)	(0.016)	(0.038)
N	96417	55568	40849	82159	14258
N treated	1360	847	513	1137	223

Notes: The table shows the effect of one partner's involuntary job loss on the work behavior of the other partner (AWE). Columns denote the treated individuals. All cells present the ATT and its clustered (household level) respectively robust standard error (for men and women) in parentheses. All specifications combine a matching procedure with the DiD technique and include the whole set of covariates. Panel A displays the AWE for the combined outcome categories (start working, start second job, work full-time, and increase hours, plus want to start working and want to increase hours). Panel B subdivides the results into realized and potential changes and panel C subdivides the results into the extensive and intensive margins. N refers to the number of individuals (treated and control). N treated denotes the number of treated individuals. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1991 through 2013, own calculations.

Panel B distinguishes between realized and potential changes and the results suggest

that both specifications have significant impacts on the AWE, with the realized change being less significant and smaller in magnitude or even insignificant considering men and cohabitation. It has to be considered that the two effects are based on rather different groups. One group actually changed something in their work behavior, whereas the second group merely stated the desire to increase their labor supply. Giving such an answer in a questionnaire may be easier than actually following through, and in some cases may be simply a way of convincing oneself about the prospect of working. Also, a potential measurement error cannot be excluded, since the group of individuals who just stated that they wanted to increase labor supply could consist both of those who are willing, but due to external circumstances simply unable to do so immediately and, as noted before, of those who simply feel better by stating a desire to increase their labor supply but who do not actually intend to do so. The latter group can be seen as a special group that potentially differs in other characteristics as well. The difference if women are the ones who are indirectly affected by partner's job loss can additionally be explained by the fact that it is harder for women to increase their labor supply due to different labor market constraints and family ties (e.g., gender gap and children). The cohabitation effects suggest, that the insurance mechanism may works for cohabiting couples as well, and that it even has larger effects, but that the realized change is insignificant. This might be correlated with the small number of treated cases.

The last panel distinguishes between transitions on the extensive and intensive margins. Both specifications combine realized as well as potential changes. On the on hand, considering only the extensive change yields no significant results.[9] On the other hand, the effect of job loss on the intensive margin is significant for all subgroups. The step from not working to working, independently of whether this is potential or realized, seems to be more difficult to take than transitions on the intensive margin, probably since the resulting modifications in work-life balance are more negligible when only changing the number of work hours. In addition, transaction costs and sunk costs of job search are lower for the intensive change.

So far, the estimates display AWE effects for couples in which one partner involuntarily lost his or her job. The results clearly point to a positive impact on the partner's labor supply behavior. However, it is important to consider heterogeneous effects of the treatment, that is, to observe how the job loss has affected particular subgroups and outcomes (e.g., solely starting to work or increasing hours) differently. This may reveal different mechanisms by which the treatment impacts a partner's work behavior. Albeit, due to the rather small number of observations, especially when considering cohabiting couples,

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[9]This category has only 272 transitions in the treated case.

I refrain from more detailed inspections of heterogeneous effects.[10] Some considerations that may have an impact on the outcome will be discussed in section 3.5.2.

3.5.2   Robustness and Sensitivity

This section performs different robustness and sensitivity checks to test the plausibility of the results. A first set considers different treatment group specifications, including considerations regarding unemployment. A second set compares different methodological approaches and runs a placebo regression, and a third set tests the sensitivity towards different subgroups that may potentially affect the outcome.

Treatment group specifications

The first set of robustness checks considers different treatment group specifications. As stated in section 3.3 and section 3.4, to identify an AWE, one has to have a reduction in available household income due to unemployment. Since it is more likely to identify this reduction (and the resulting AWE) if the unemployment results from involuntary job loss, the treatment group in the main estimation only consists of job loss due to plant closure or termination by the employer. In contrast, these sensitivity checks use firstly other reasons of unemployment (quitting, temporary contract and annulment contract), and secondly, involuntary job loss as it is used in the main specification, but depending on different unemployment specifications (irrespective of whether job loss was followed by an unemployment spell, no unemployment spell, and unemployment spells of up to 5 years after job loss). The results for the combined outcomes are displayed in Table 3.4.

The first panel displays different reasons for unemployment. The results are overall as expected. Nevertheless, quitting provides mixed results. While no significant impact is observable for men and cohabiting couples, we see significant positive results for women and married couples. A potential explanation is that voluntary job loss has probably been agreed upon in advance within the household, and may therefore be less detrimental. If a job loss is expected and voluntary, it is likely that either adaptations within the household were made before quitting (that is, as soon as the decision was made) or that a new job is on the horizon. In addition, quitting is less likely to be accompanied by a financial shock. However, less voluntary reasons for quitting need to be considered as well, such as harassment, care of family members, or childcare responsibilities. The latter two especially tend to be more frequent among women, and childcare responsibilities are

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[10]Nevertheless, I did carry out a tentative analysis. Investigations of differential impacts of the job loss regarding marital status, sex, distance to job loss, region (former East and West Germany), high unemployment rate, high female labor force participation and high education do not produce any differential evidence. Tables are available from the author upon request.

Table 3.4: Added Worker Effect – Different Treatment Group Definitions

Treated Individual	All	Men	Women	Marriage	Cohabitation
Different reasons of unemployment					
Quitting					
AWE	0.060*	0.033	0.110**	0.089**	-0.052
partner	(0.036)	(0.051)	(0.046)	(0.038)	(0.075)
N	68928	42386	26541	59974	8954
N treated	338	180	158	277	61
Temporary contract					
AWE	-0.013	0.033	0.027	-0.021	0.072
partner	(0.038)	(0.057)	(0.062)	(0.042)	(0.071)
N	69032	42431	26601	60051	8981
N treated	444	226	218	356	88
Annulment contract					
AWE	0.011	-0.013	-0.038	0.030	0.258
partner	(0.070)	(0.075)	(0.079)	(0.089)	(0.193)
N	68746	42300	26446	59829	8917
N treated	156	93	63	132	24
Involuntary job loss and different unemployment specifications					
Irrespective of unemployment after job loss					
AWE	0.020*	0.025*	0.011	0.022*	0.014
partner	(0.011)	(0.014)	(0.018)	(0.012)	(0.027)
N	72073	44107	27966	62630	9443
N treated	2749	1767	982	2261	488
No unemployment after job loss					
AWE	0.028	0.024	0.032	0.032	0.028
partner	(0.031)	(0.037)	(0.047)	(0.036)	(0.060)
N	68935	42419	26516	59961	8974
N treated	345	212	133	264	81
Unemployed up to 5 periods after job loss					
AWE	0.054***	0.054***	0.053**	0.049***	0.045
partner	(0.016)	(0.020)	(0.025)	(0.017)	(0.046)
N	96417	55568	40849	82159	14258
N treated	1446	886	560	1211	235

Notes: The table shows the effect of one partner's involuntary job loss on the work behavior of the other partner. All cells present the ATT and its clustered (household level) respectively robust standard error (for men and women) in parentheses. The underlying method is the Matching/DiD procedure. Columns denote the treated individuals. The first panel considers different reasons for unemployment and the second panel shows different unemployment specifications while only involuntary job loss is considered. N refers to the number of treated individuals. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1991 through 2013, own calculations.

more likely within marriage. This may drive male partners or husbands of women who experienced job loss to increase their own labor supply significantly, even in cases where the job loss was voluntary. The ending of temporary contracts and annulment contracts show no significant results. These kinds of unemployment are in fact expected, but cannot be defined as voluntary or involuntary. It is highly likely that specific adaptations have been made within households before the job loss to compensate for upcoming unemployment.

The second panel shows involuntary job loss with different unemployment specifications. As stated above, one main assumption underlying the assumed necessity for the unaffected partner to adapt his or her labor supply behavior is a reduction of the available household income. If the job loss is irrespective of subsequent unemployment, the analysis reveals slightly significant results for men and marriage. In addition, the magnitude is smaller compared to the main effects, indicating that unemployment specifications do matter. This assumption is confirmed by the next specification, in which the individual is employed immediately after the job loss, where no significant impacts can be observed. An explanation could be that finding new employment immediately after job loss could make a reduction in household income less likely to be observable. The last row depicts a long-run approach to unemployment. Following Stephens (2002), it is unlikely that the response of an individual to a partner's job loss is always immediate. Reasons include the likeliness that the effort of increasing labor supply is lagged, rather than immediate, due to market conditions and the adjustment process. The indicator includes, in addition to the current unemployment period, up to five years in which the partner of a person who has directly experienced job loss could adjust his or her labor supply behavior.[11] The results are in magnitude and significance level comparable to the main added worker effect, supporting Stephens's (2002) assumption of long-run effects.

Different methodological approaches

A second set of robustness checks considers different matching methods. Instead of entropy balancing, the matching in the first panel relies on different propensity score matching specifications. One-to-one matching uses the nearest neighbor with replacement. In comparison, K-nearest neighbor matching uses the five nearest neighbors with replacement and for kernel matching, I use Epanechnikov kernel with a bandwidth of 0.06. All three specifications are under the assumption of common support. However, in comparison to entropy balancing, propensity score does not assign equal weights to each matched coun-

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[11]These long-term effects could last as long as five years after the treatment (Stephens, 2002). An additional control variable, distance to treatment, is included in this specification. Couples are only considered as long as the directly affected partner remains unemployed. The average number of years an individual stays unemployed after job loss is three years, including the year of job loss.

terpart. Propensity score matching in fact does not guarantee that the individual pairs will be well-matched on the full set of covariates, only that groups of individuals with similar propensity scores will have similar covariate distributions (Stuart et al., 2009). Results are provided for the combined outcome only. All three specifications result in significant results for all subgroups (including cohabitation) and the magnitude is higher than with entropy balancing. This may be related to the above mentioned differences between both matching techniques.

Table 3.5: Added Worker Effect – Different Methods

Treated Individual	All	Men	Women	Marriage	Cohabitation
Propensity score matching					
One-to-one matching					
AWE	0.089***	0.083***	0.078***	0.083***	0.099**
partner	(0.019)	(0.024)	(0.031)	(0.021)	(0.048)
N	96417	55568	40849	82159	14258
N treated	1360	847	513	1137	223
K-nearest neighbor matching					
AWE	0.077***	0.075***	0.058**	0.067***	0.14***
partner	(0.014)	(0.019)	(0.024)	(0.016)	(0.037)
N	96417	55568	40849	82159	14258
N treated	1360	847	513	1137	223
Kernel matching					
AWE	0.082***	0.085***	0.077***	0.070***	0.14***
partner	(0.014)	(0.017)	(0.022)	(0.015)	(0.033)
N	96417	55568	40849	82159	14258
N treated	1360	847	513	1137	223
Placebo Regression					
One period earlier (Entropy balancing)					
AWE	0.004	0.024	-0.031	0.006	-0.035
partner	(0.017)	(0.021)	(0.027)	(0.018)	(0.041)
N	96417	55568	40849	82159	14258
N treated	1076	674	402	919	157

Notes: The table shows the effect of one partner's involuntary job loss on the work behavior of the other partner. All cells present the ATT and its clustered (household level) respectively robust standard error (for men and women) in parentheses. The underlying method is the Matching/DiD procedure. Columns denote the treated individuals. The first panel considers different propensity score matching techniques and the second panel performs a placebo regression. N refers to the number of individuals (treated and control). * p<0.1, ** p<0.05, *** p<0.01.
Source: SOEPv30 waves 1991 through 2013, own calculations.

The second panel in this set of robustness checks gives the results of a placebo regression. All matching procedures (entropy balancing as well as propensity score methods)

assume, that all conditional variables which simultaneously influence transitions in un-employment due to plant closure and termination by the employer and partner's labor supply, are included. This assumption cannot be directly tested, but the use of a placebo regression can add more plausibility. I am using a placebo regression in which I pretend that the treatment happened one year earlier. To calculate the effects, I perform entropy balancing according to the main specification but with data from one year before. Table 3.5 displays insignificant results, indicating that the placebo treatment does not influence the labor supply of the partner. With this result, the placebo regression adds credibility to the assumption that treatment and control group follow the same trend before the treatment. In addition, it clarifies that the effects are not driven by other unobserved variables.

Different subgroups

Finally, I also perform some sensitivity checks, considering different sample specifications to test whether they reveal different outcomes (realized and potential labor supply behavior of the unaffected partner). In particular, I consider the sensitivity of partner characteristics, distinguishing between high and low partner earnings prior to the loss and between old and young partners. In addition, I also perform sensitivity checks of household and timing characteristics. Here, I distinguish between the 1990s and 2000s, poor and wealthy couples, and partners working in the same or a different industry. In all these specifications, I expect the willingness of indirectly affected partners to increase their labor supply in response to the other partner's unemployment to differ: for example, older partners are presumably less likely to increase their labor supply than younger partners. However, due to the rather small number of treated couples in some specifications, the results should be interpreted with caution. I present the results in Table 3.8 and in Table 3.9 of the Appendix.

The first panel investigates the earnings of the indirectly affected partner prior to the job loss of the other partner. 'Low' denotes all partners whose income is up to 50% of the earnings distribution and 'high' denotes partners whose income is above 75% of the earnings distribution. This has been done , on the one hand, based on the assumption that partners with a lower than average initial income are more willing to adjust their labor supply, since it is likely that such households need the additional income. On the other hand, it is reasonable to assume that individuals with a higher initial income do not have a high incentive to increase their labor supply, since the financial consequences of job loss can potentially be compensated without taking another job, or since they may already be in a full-time position. One problem that arises in separating according to partner earnings

is that for directly affected men, high income female partners are scarce, and the same is true for cohabiting couples with both high and low incomes. Therefore, results are only shown for the remaining subgroups and they confirm the aforementioned assumptions. Partners with low initial earnings (less than 50% of the earnings distribution) significantly increase their labor supply in response to the other partner's job loss, while high income partners (upper 25% of the earnings distribution) do not show significant results.

Considering the age of the responding partners yields higher significant results for partners aged 18 to 50 than for older individuals (51 to 60). Even though older partners do significantly increase their labor supply, it is at a lower magnitude and a lower significance level. Older individuals are presumably less willing to change their labor supply and, in addition, they are potentially more settled with less responsibilities (e.g., childcare), which makes it less necessary for them to adjust their labor supply.

The analysis over time gives further insights. A differentiation into 1991-2002 and 2003-2013 yields a higher effect in significance and magnitude for the last 10 years. The effect for the pooled sample is doubled between both decades. Interestingly, while in the 1990s, a significant effect is observable when women enter unemployment, it is the other way around in the 2000s, when women increase their labor supply by almost nine percentage points if their partner loses his job. This might be consistent with the increasing female labor supply in general.

Wealth questions where solely asked in the SOEP questionnaires in 2002, 2007 and 2012. I only consider the whole sample due to the small number of observations. Individuals living in 'poor' households (less than or equal than 50% of the wealth distribution) significantly increase labor supply in response to unemployment, whereas wealthier couples (more than 50% of the wealth distribution) do not significantly respond. The underlying explanation is comparable to that of high pre-displacement earnings. Wealthier couples simply do not need to adjust their labor supply in case of job loss because their initial wealth is potentially high enough to compensate for any financial shock.

Finally, I consider the economic sector of both partners. Again, due to the rather small number of observations, I only consider the whole sample. If both partners work in different sectors, the indirectly affected partner significantly increases his or her labor supply, whereas the result is insignificant if they are working in the same sector. The possibility of increasing labor supply therefore highly depends on whether both partners work in the same economic sector. It can be assumed that if the layoff or plant closure is related to sector specific characteristics, it is highly unlikely that the partner will find a new job in that same sector or be able to increase his or her hours.

3.5.3   Discussion of Results

The previous sections reported clear evidence of the AWE. Furthermore, distinct differences between the subgroups became obvious. Nevertheless, the afore mentioned results cannot be seen without hurdles. Even though the results are robust according to different specifications and methods, the estimates might be biased. Biases might occur due to measurement error or sample attrition. First of all, the effect of the treatment is measured after the treatment, which might lead to an measurement error since the expectation of job loss may lead to a labor supply adaption even before the job loss occurs (Stephens, 2002). If this holds true, the estimated AWE effect would be downward-biased. This anticipation effect would additionally contradict the assumption of the treatment being an exogenous shock. However, the placebo regression in the robustness section indicates that treated and matched controls do not differ with respect to their labor supply trend before the treatment. This further suggests that the job loss was not known before the treatment. Another measurement issue might be related to assortative mating. According to Allegretto (2002), individuals select their mates in a non-random manner but based on specific characteristics, including labor market characteristics. Following this assumption, it is likely that individuals with a higher probability of becoming unemployed choose their partner accordingly, resulting in a lower willingness of the partner to adjust his or her own labor supply in case of job loss of the other partner. Finally, the aforementioned discouraged worker effect might lead to an offsetting of the AWE, since unemployment might discourage the unaffected partner from even looking for jobs due to negative signals of the job loss (Humphrey, 1940; Maloney, 1991).

Second, panel studies often suffer from sample attrition between two survey years, which may have negative consequences for the informational content of a study. One factor of panel attrition is mortality, which might be of importance in the present study. Couples experiencing a greater negative impact due to unemployment (e.g., poorer or younger couples) might be more likely to drop out of the sample.[12] This might result in an underestimation of the true effect as a greater negative impact of unemployment results in a higher probability of adjustments within the partnership, that is, higher AWE. In contrast, random panel attrition should not influence the estimation effect. Further, unemployment may also increase real mortality, since it increases the probability of separation while this in turn increases drop outs of the survey (Ratcliffe et al., 2008).

In addition to potential biases, the data source should be considered. The SOEP is a relatively large database and very suitable for the analysis performed here because

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[12]A significant dependence between labor market durations and attrition is shown, e.g., by Berg and Lindeboom (1998) or Dorsett (2004).

of its wide range of indicators, its longitudinal character, and its questionnaire design. Nevertheless, it does not contain enough observations to analyze the pure impact of plant closures on AWE. The advantage of using only plant closures would be to give the estimates a more causal interpretation. Additionally, it is not possible to disentangle the outcome (AWE) completely into its components (see Table 3.1), again due to the rather small number of observations. But analyzing all components separately would yield further insights into the mechanisms of AWE.

3.6 Conclusion

The present study refines the AWE framework to reflect important changes in a contemporary society. It contributes to the existing empirical literature by explicitly analyzing the spillover effects of unemployment on women and men, and distinguishes between married and unmarried partnerships. I use longitudinal data from the German Socio-Economic Panel (SOEP) study from 1991 through 2013. My sample consists of married and cohabiting couples in which partners directly affected by unemployment were initially employed. The indirectly affected partners' response (AWE) is measured by transitions either on the intensive margin or the extensive margin. Both transitions can additionally proceed as a realized change (actual change between two periods) or a potential change (desire to change labor supply, but without the possibility to actually make this change). It is important to also consider the potential change, since it can give further insights into labor market mechanisms. Unaffected partners may want to work, or want to work more hours, but labor market constraints, economic downturns, or personal social commitments might hinder them from doing so. The underlying method in analyzing the AWE is a combination of matching (entropy balancing) and DiD estimation. The treatment in the DiD setting is unemployment due to plant closure and termination by the employer (involuntary job loss). Both reasons for unemployment are likely to result in financial problems for the household, and provide an exogenous entry into unemployment, which is necessary for causal interpretations.[13]

It is reasonable to expect that female labor supply transitions from unpaid homework to paid labor market work as well as the increase of unmarried partnerships influence the AWE. Nevertheless, impacts of women on the work behavior of men or differences according to partnership status have, to the author's knowledge, not been empirically analyzed to date. Therefore, this study provides an important extension to the existing literature and closes a research gap.

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[13]The placebo regression provides an indirect test which shows that this assumption is not violated.

The empirical investigation finds evidence for the existence of an added worker effect for all considered subgroups (women, men, cohabiting couples, and married couples). Partners of individuals directly affected by job loss show a significantly higher probability of increasing their labor supply than individuals whose partners remained employed. However, this effect is mainly driven by the potential change on one side and the intensive change on the other side. The latter result is in line with other researchers who find evidence of an AWE when considering the intensive margin (Gong, 2010; Bredtmann et al., 2014). This suggests that the insurance mechanism within households is still functioning in Germany. In general, the AWE is larger when a woman enters unemployment, presumably because it is easier for men to adjust their working hours as they are less responsible for childcare (Kümmerling et al., 2008) and have more possibilities on the labor market. The findings are robust over various specifications, for example, different methods, a placebo regression, and different treatment group variations.

The study highlights that unemployment due to involuntary job loss has consequences for both the directly affected partner and the indirectly affected partner, and indeed for the whole household. It further stresses that previous studies underestimate the true effect as they only consider married women. This study, in contrast, not only shows that the AWE extends beyond married women but also clarifies that the AWE is an important issue even in countries with a strong welfare system. The results have important implications for the design of labor market policies, especially when such policies are gender specific or aimed at couples.[14]

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[14]Policies usually equate couples with married couples, and ignore the fact that mechanisms such as joint taxation for married couples might have a different impact on cohabiting couples (Triebe, 2014).

3.7   Appendix

Table 3.6: Variables and Definitions

Variable	Definition
Outcome	
awep	Transition parameter – Transitions of labor supply (realized and potential) of the indirectly affected partner
Treatment	
tutdu	Dummy for unemployment due to involuntary job loss (plant closure or termination by employer)
Individual characteristics	
age	Age
age2	Age, squared
bilzeit	Education in years
tatzeit	Actual working hours per week
erwzeit	Length of time with firm in years
lnlabinc	Individuals labor income (logarithm)
labinc2	Individuals labor income, squared
expft	Work experience full-time in years
exppt	Work experience part-time in years
allbet	Size of the company in terms of employees
branch	Industry/sector of the company, derived from NACE classification
wcollar	Dummy for white collar worker
bcollar	Dummy for blue collar worker
german	Dummy for German nationality
distance	Distance to treatment in years
ubenefit	Unemployment benefit per year
Partner characteristics	
agep	Age
age2p	Age, squared
expftp	Work experience full-time in years
expptp	Work experience part-time in years
notempl	Dummy for not working
bilzeitp p	Education in years
lnlabincp	Individuals labor income (logarithm)
labinc2p	Individuals labor income, squared
Household/regional characteristics	
kids	Number of children in the household
bula	Dummies for the 16 German federal states
unemploymentrate	Regional unemployment rate (federal state level)
female_lfp	Female labor force participation rate (federal state level)

Notes: The table displays all used variables and their underlying definitions.
Source: SOEPv29 waves 1991 through 2011.

Table 3.7: Summary Statistics for Selected Characteristics of Subgroups

	Treatment group	Control group (unmatched)	Control group (matched)	Difference (unmatched)
Women				
Individual characteristics				
Age	41.2	40.3	41.2	-0.9**
German	0.9	0.9	0.9	-0.0
Years of education	11.3	11.6	11.3	0.3***
Labor income	14329.5	12326.3	14329.5	-2003.2***
Work hours	34.4	19.8	34.4	-14.6***
Partner characteristics				
Age partner	43.6	42.8	43.6	-0.7*
Years of education partner	11.5	11.9	11.5	0.4***
Labor income partner	24186.3	31286.3	24186.3	7100.0***
Work hours partner	35.6	36.9	35.6	1.3*
Household and regional characteristics				
Number of children	0.8	0.9	0.8	0.1***
Unemploymentrate	12.1	10.7	12.1	-1.5***
Female LFP	67.8	65.8	67.8	-2.1***
N	645	76539		
Men				
Individual characteristics				
Age	42.3	42.8	42.3	0.5
German	0.8	0.9	0.8	0.0***
Years of education	11.2	11.9	11.2	0.7***
Labor income	22396.9	31348.8	22396.9	8951.9***
Work hours	44.1	36.8	44.1	-7.3***
Partner characteristics				
Age partner	39.6	40.3	39.6	0.7**
Years of education partner	11.3	11.6	11.3	0.4***
Labor income partner	10728.7	12363.0	10728.7	1634.3***
Work hours partner	19.9	20.0	19.9	0.1
Household and regional characteristics				
Number of children	1.0	0.9	1.0	-0.0
Unemploymentrate	12.5	10.7	12.5	-1.8***
Female LFP	67.0	65.8	67.0	-1.2***
N	988	76196		
Cohabitation				
Individual characteristics				
Age	35.2	34.1	35.2	-1.0*
German	0.9	0.9	0.9	0.0
Years of education	11.4	12.2	11.4	0.8***
Labor income	18560.2	20839.2	18560.2	2279.0*
Work hours	41.8	31.7	41.8	-10.1***
Partner characteristics				
Age partner	33.7	34.2	33.7	0.4
Years of education partner	11.7	12.2	11.7	0.5***
Labor income partner	15244.3	20878.6	15244.3	5634.3***
Work hours partner	28.0	31.8	28.0	3.9***
Household and regional characteristics				
Number of children	0.6	0.5	0.6	-0.1***
Unemploymentrate	13.3	11.4	13.3	-2.0***
Female LFP	68.4	67.1	68.4	-1.3***
N	265	22559		
Marriage				
Individual characteristics				
Age	43.2	42.8	43.2	-0.3
German	0.8	0.8	0.8	0.0**
Years of education	11.2	11.7	11.2	0.5***
Labor income	19585.1	21980.1	19585.1	2395.0***
Work hours	40.0	27.7	40.0	-12.3***
Partner characteristics				
Age partner	42.6	42.8	42.6	0.2
Years of education partner	11.3	11.7	11.3	0.4***
Labor income partner	15798.6	22018.8	15798.6	6220.2***
Work hours partner	25.7	27.9	25.7	2.2***
Household and regional characteristics				
Number of children	1.0	1.0	1.0	0.0
Unemploymentrate	12.1	10.5	12.1	-1.6***
Female LFP	67.1	65.6	67.1	-1.5***
N	1368	130176		

Notes: The table shows the means of selected variables before treatment for treated individuals and controls (matched and unmatched). The difference column outlines the differences in means between treatment and control group (before matching). Asterisks indicate the significance level of the differences (t-test): * p<0.1, ** p<0.05, *** p<0.01.

Source: SOEPv30 waves 1991 through 2013, own calculations.

Table 3.8: Added Worker Effect – Sensitivity of Partner Characteristics

Treated Individual	All	Men	Women	Marriage	Cohabitation
Partner earnings prior to job loss					
Low					
AWE	0.059***	0.055**	0.066*	0.055***	
partner	(0.019)	(0.022)	(0.036)	(0.020)	
N	50291	40023	10268	43935	
High					
AWE	0.000		0.068	-0.041	
partner	(0.039)		(0.045)	(0.041)	
N	22546		17172	18874	
Age partner					
Young					
AWE	0.054***	0.052**	0.064*	0.040*	0.089**
partner	(0.020)	(0.024)	(0.033)	(0.022)	(0.040)
N	58417	37071	21346	46512	11905
Old					
AWE	0.054**	0.046	0.058*	0.056**	-0.100
partner	(0.025)	(0.033)	(0.032)	(0.025)	(0.109)
N	38000	18497	19503	35647	2353

Notes: The table shows the effect of one partner's involuntary job loss on the work behavior of the other partner. All cells present the ATT and its clustered (household level) respectively robust standard error (for men and women) in parentheses. The underlying method is the Matching/DiD procedure. Columns denote the treated individuals. The first panel considers partner earning levels prior to the job loss and the second panel distinguishes between young and old unaffected partner. N refers to the number of individuals (treated and control). * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Source: SOEPv30 waves 1991 through 2013, own calculations.

Table 3.9: Added Worker Effect – Sensitivity of Household and Timing Characteristics

Treated Individual	All	Men	Women	Marriage	Cohabitation
			Timing		
1991-2002					
AWE	0.045**	0.033	0.059**	0.039*	0.056
partner	(0.020)	(0.025)	(0.030)	(0.021)	(0.047)
N	48414	28626	19788	42035	6379
2003-2013					
AWE	0.083***	0.087***	0.069	0.080***	0.057
partner	(0.026)	(0.031)	(0.042)	(0.028)	(0.059)
N	45293	25241	20052	37695	7598
			Wealth		
Poor					
AWE	0.080*				
partner	(0.048)				
N	6508				
Wealthy					
AWE	0.070				
partner	(0.061)				
N	7584				
			Industry		
Different					
AWE	0.053***				
partner	(0.016)				
N	86027				
Same					
AWE	0.018				
partner	(0.051)				
N	10390				

Notes: The table shows the effect of one partner's involuntary job loss on the work behavior of the other partner. All cells present the ATT and its clustered (household level) respectively robust standard error (for men and women) in parentheses. The underlying method is the Matching/DiD procedure. Columns denote the treated individuals. The first panel subdivides the whole time frame into 2 decades, the second panel considers rich vs. poor households and the last panel considers whether the unaffected partner works in the same or a different sector as the directly affected partner. N refers to the number of individuals (treated and control). * p<0.1, ** p<0.05, *** p<0.01.
Source: SOEPv30 waves 1991 through 2013, own calculations.

4   Women at Work?

The Impact of Cohabiting and Married

Partners' Earnings on Work Hours

Doreen Triebe

Chapter Abstract

This study investigates the determinants of women's labor supply in the household context. The main focus is on the effect of a change in male partner's wages on women's work hours. This is linked to the broader question of whether married and cohabiting women make different economic decisions and respond differently to changes in their partners' wages. To provide a complete picture of working behavior within households, I analyze both women and men using data from the German Socio-Economic Panel Study (SOEP) from 1993 through 2010. The methodology for the main analysis relies on fixed effects regression. The main estimation results suggest that married women work less on the labor market and further, an increase in partner's wages results in a negative and significant effect on married women's work hours. The marital status of men, on the other hand, has no significant impact on their work hours. In addition, this study suggests that the "income-splitting" tax benefit for married couples is a potential explanation mechanism for the proven differences between marriage and cohabitation.

4.1   Introduction

Women's labor supply has changed dramatically over the past decades in almost all industrialized countries. The transition from unpaid housework to paid market work is one of the most striking changes identified in recent labor economic research (Merz, 2008). Simultaneously, marriage rates have decreased in the last few years, while more contemporary living arrangements - specifically cohabitation[1] - have become more prevalent (Adamopoulou, 2010). Both of these changes have generated a large body of research on women's labor supply and family formation. Therefore, the present study seeks to link those issues by asking whether married and cohabiting women differ in their labor supply decision and if so, to what extent. This is crucial to understand intra-household specialization issues and to comprehend the impact of women's work hours on household income.

To the best of the author's knowledge, there is little systematic research on whether married women make different economic decisions than cohabiting women. One reason might be that cohabitation was infrequent until the mid-1980s;[2] until then it was typically a short-term preliminary stage to marriage (Morissette et al., 2012). This has changed dramatically. In Germany, cohabitation increased by over one-third over a nine year period from 1996 to 2004 (Nöthen, 2004).[3] The increase was even larger (around 70%) among cohabiting couples in West Germany with children living in the household. Nonetheless, most of the research addressing women's labor supply so far, has focused on married women. This could lead to biased conclusions due to the variety of ways in which cohabiting couples differ from married couples. Cohabiting women have been found to display more pronounced individualism and independence (Morissette et al., 2012). In addition, in many countries including Germany, there is a different legal framework for cohabitation than for marriage. This means that cohabiting couples lack legal recognition for their relationship, face fewer hurdles to separation, and might require additional financial resources if the relationship comes to an end (Morissette et al., 2012; Kerr et al., 2006).

The aim of my study is to shed light on whether married women tend to make different economic decisions concerning their work hours than cohabiting women. The main focus therefore is on the effect of a change in the male partner's wages on women's work hours.[4] To examine these questions, I use longitudinal data from the German Socio-Economic

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[1]Cohabitation means living with a partner without being legally married.

[2]Another reason is that cohabitation was mostly not observable in the data until recently because questionnaires only divided into single and married individuals.

[3]Living-apart-together couples are not included in this calculation.

[4]For comparison reasons, I run identical regressions for women and men separately. My aim in doing so is to determine whether a change in a partner's wages affects women's and men's work hours differently.

Panel Study (SOEP) from 1993 through 2010. I identify the effects of partner character-istics and marital status on women's work hours using fixed effects regression. In doing so, I need to account for selection into the labor force and endogeneity of wages (Laczo, 2011). Therefore, I use a Heckman correction model (Heckman, 1979) and the Mincer wage regression (Mincer, 1974). The main estimation results suggest that married women work less on the labor market. Further, an increase in partner's wages produces a neg-ative and significant effect on married women's work hours. The marital status of men, on the other hand, has no significant impact on their work hours. A second step includes interaction terms to test the combined effect of cohabitation with the main characteristics. The regression analysis confirms that cohabiting women respond significantly stronger to a change in partner's wages than married women.

My study contributes to the existing literature on women's labor supply by taking not only marriage, but also cohabitation into consideration.[5] In this context, the differ-entiation between married and cohabiting couples provides new insights into household specialization issues and labor supply incentives. The underlying SOEP data allows for longitudinal analysis and the distinction into marriage and cohabitation. An additional unique feature of this study is the presentation of a potential explanation approach for the proven differences between marriage and cohabitation. This approach considers a specific characteristic of the German tax system: the tax benefit for married couples known as "income-splitting".[6]

The paper proceeds as follows. In section 4.2, I provide the theoretical background and the main hypotheses of the paper. The data is described in section 4.3. This is followed in section 4.4 by a descriptive analysis, including a discussion of extensive versus intensive margin of labor supply. Section 4.5 proceeds through the regression methodology in detailed steps. Section 4.6 describes the regression results, and section 4.7 provides robustness and sensitivity checks. This is followed by an explanation attempt of the proven differences in section 4.8. Finally, section 4.9 concludes the paper.

4.2   Theoretical Background and Literature

The theoretical framework for this study is derived from the family life course perspective (Elder Jr., 1985, 1997). This theory was developed in the 1960s to connect individuals with their social and historical contexts. One key principle of this approach is the idea of "linked lives", which states that people in close personal relationships with each other,

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[5]The distinction between marriage and cohabitation is determined as marital status in this study.

[6]The German law on personal income tax and splitting income taxation is the Einkommensteuergesetz (EStG, 2012). Steiner and Wrohlich (2004) examine its mechanisms and effects.

such as parents and children or spouses and cohabitants, are connected by interlocking developmental trajectories that continue over the entire course of their lives (Elder Jr. et al., 2003). Within a family, each individual's development is connected with and influenced by the life courses of all of the other family members. Although there is empirical research on "linked lives" and the life course perspective, no formal theory has yet been developed (Mayer, 2009).

Studies on women's labor supply find that partner characteristics influence women's labor force participation (Leibowitz and Klerman, 1995) and work hours (McGrattan and Rogerson, 2007). But most of these studies compare only married and unmarried (single) women and do not take the increasing number of unmarried partnerships into account. Accordingly, many authors treat cohabiting couples either as single (McGrattan and Rogerson, 2007) or as married (Merz, 2006). Neither strategy considers possible differences in the working behavior of married and cohabiting couples. This misspecification may lead to biased estimates of women's labor force participation and work hours. Laufer and Gemici (2011) report that cohabiting and married couples in the United States indeed differ in various ways, for example, with respect to both the dissolution of unions and tax rates. When it comes to dissolving a union, however, cohabiting couples have an advantage since the law does not provide any strict procedures for separation or duties after separation. However, by implication, this also means that no support after separation (e.g., financial assistance) from the partner is guaranteed. Women might therefore choose to work more in such relationships. In addition, marriage can be thought of as a traditional form of partnership based on traditional attitudes, whereas cohabiting couples might have more modern attitudes toward the division of housework and labor market specialization.

Drawing on the concept of "linked lives", I include partner's wage as a determinant, which allows me to assume that households make allocation decisions jointly rather than taking the income of the partner as given. I argue that a financial modification arising within a household will lead to a change in one partner's work hours if the other partner earns more or less. The joint allocation decision contrasts somewhat with the classical assumption of the division of responsibilities within the household, which is based on the male breadwinner / female homemaker model (Bernhardt, 2000; Abroms and Goldscheider, 2002). In modern societies, earning money is no longer only the sole domain of the male partner. This is especially true for cohabiting couples, as confirmed by literature on the links among living arrangements, partner characteristics, and labor market outcomes. Henkens et al. (1993), for instance, examined the labor force participation decisions of women in different types of partnerships in the Netherlands and found that women who cohabitate rather than marry are economically more independent. Abroms and Goldscheider (2002) analyzed how different partner or other adult relatives living in the same

household affects the labor market behavior of mothers in the US. Their results suggest that other adults in the household have different effects on maternal working behavior. Focusing on longitudinal data from the British Household Panel Survey, Laczo (2011) found that cohabiting women work two hours more per week than married women, controlling for age and children.

There is no question that children and the accompanying childcare responsibilities influence mothers' working behavior. Previous studies found that mothers reduce their labor supply if children are present in the household (Kümmerling et al., 2008). Furthermore, the younger the children are, the less their mothers participate in the labor force (Eichhorst et al., 2011). Although the decision to have a child is usually made jointly ("linked lives" principle), it mainly affects the labor supply of the mother. A radical modification of the German parental leave regulation in 2007[7] was carried out to encourage shared responsibility for children between both the mother and the father. But still, women are the ones who usually interrupt their careers to raise children (Böhm et al., 2011), suggesting that the responsibility for childcare lies mainly with women, regardless of marital status and paternal working behavior. Craig and Mullan (2011) confirmed this in an international comparison: in all of the countries analyzed, mothers spent more time on childcare than fathers.

4.3   Data

4.3.1   Sample

This study uses data from the German Socio-Economic Panel (SOEP) Study (Wagner et al., 2007), a representative longitudinal sample of private households in the Federal Republic of Germany that started in 1984. The SOEP provides information not just on households but also on individual household members, which enables me to identify relationships among individuals belonging to the same household. The wide range of topics surveyed includes information about employment, earnings, satisfaction indicators, and household composition. My analysis uses an unbalanced panel from 1993 through 2010 (SOEP, 2011). Starting with 1993 ensures that all relevant variables are also available for households in the former German Democratic Republic. At the time of writing, 2010 is the last wave of the SOEP available. One aim of the paper is to examine the labor market work hours as a function of the individual's and partner's gross earnings and other characteristics. I therefore reshaped the data into an individual-partner structure. My sample

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[7]The German law regulating parental leave is the Bundeselterngeld- und Elternzeitgesetz (BEEG, 2007). Geisler and Kreyenfeld (2012) give detailed information on the new parental leave benefit scheme.

includes individuals living in a partnership (either married or cohabitating) between the ages of 25 and 55. This leaves me with a sample of individuals of prime working age. Individuals younger than 25 have often not finished either an education or an apprenticeship, while those older than 55 may have entered early retirement.[8] Furthermore, all individuals currently in education or apprenticeship are excluded from the sample, as well as self-employed people, civil servants, and retirees. The sample is limited to individuals in dependent employment, first, because they can be presumed to have the same labor market requirements and therefore be more comparable, and second, due to the difficulties in measuring earnings of self-employed people. To analyze labor force participation, non-employed individuals are also included. The final sample consists of 75,506 person-year observations (38,320 women and 37,186 men). Approximately 14 % of individuals in the sample are cohabiting.[9]

4.3.2   Variables

My focus is on female labor supply, especially the paid work hours of women. These are computed by using actual or agreed work hours,[10] overtime, and a variable that determines whether overtime is paid or not. As a result, overtime is included, partly included, or excluded in the variable depending on whether the extra hours are paid, partly paid, or unpaid. Non-working individuals are assigned zero work hours. I restrict the work hours to a maximum of 84 hours per week (12 hours per day). The logarithm of gross hourly wages of the individual and her/his partner is calculated by dividing gross monthly wage, without extra pay, by monthly paid work hours. The wage is measured in 2005 Euros adjusted by the consumer price index (Federal Statistical Office of Germany, 2012). Hourly wages of fewer than 3 Euros are dropped from the sample. Having children plays a significant role in the evaluation of women's labor supply (Böhm et al., 2011; Cristia, 2008). Hours spent on housework by the individual and the partner are measured in hours per weekday. I consider the number of children in the household under the age of 17 as a basis for estimating current childcare responsibilities. In addition, I use children under the age of 3 as exclusion restriction to estimate the selection into labor force. This group presumably requires the most care time and affects mainly women's decision to work or not

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[8]Many large companies in Germany have programs that enable employees to switch to semi-retirement at the age of 55.

[9]The analysis of same-sex couples would be very informative in terms of the absence of traditional gender roles (Allegretto, 2002). Unfortunately, as there are only 241 observations (139 women and 102 men) available, I exclude same-sex couples.

[10]Usually, paid work hours correspond to actual work hours, but agreed work hours are used if data on actual work hours are not available or if overtime is not paid and if actual work hours exceed agreed work hours.

to work. The other exclusion restriction is non-labor income, which is defined as income from pensions, transfers, grants, and benefits. It is also deflated with the consumer price index and measured in thousand Euros per year.

I also include a variety of control variables that may affect labor supply behavior. These include education, measured by years of education, as well as age and its squared term to cover the nonlinear effect of age on work hours. Work experience and its squared term are measured as the sum of full-time and part-time experience in years. Further, I include a dummy to capture the effect of working in managerial positions,[11] a dummy indicating whether the respondent changed jobs since the last interview, and finally a variable that considers the region of residence (East or West Germany). In addition, to account for the influence of the partner on woman's employment decisions and work hours, I include different characteristics of the male partner. These are: earnings, work hours, housework hours as well as age and its squared term.[12] All variables are constructed in the same manner as for the observed individual.

4.4   Descriptive Analysis

Means and standard deviations of selected characteristics of women and men living either in marriage or in a cohabiting relationship are presented in Table 4.1. Those characteristics include personal as well as labor market characteristics and are either provided on individual or household level. Women as well as men in cohabiting relationships differ in various ways from women and men who live with a spouse.

Married women and men are, on average, four years older than those in a cohabiting relationship, and married men are generally older than women. Women have fewer housework hours per week if cohabiting, whereas men have more. Considering years of education, women as well as men living in cohabitation have slightly more education. Married couples have twice as many children as couples who are not legally married. This result might also be driven by the fact that cohabiting couples are younger. There is a considerable variation in the region of residence. About one-third of the observed cohabiting individuals live in East Germany (former GDR), while the share of married individuals living in East Germany is about 8 percent lower. Large differences become obvious when considering labor market characteristics. Cohabiting women work about 11 hours more per week than married women. In contrast, married men work slightly more than cohab-

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[11]Managerial positions include executive and supervisory positions with comprehensive management responsibilities at all levels of management.

[12]According to Becker (1985), human capital investments can foster the division of labor among household members. Further, partner's human capital variables may affect the individual's employment decisions (Cha, 2012).

Table 4.1: Means and Standard Deviations of Dependent and Independent Variables

	Women			Men		
	Cohabitation	Marriage	Diff.	Cohabitation	Marriage	Diff.
1. Personal characteristics						
Age	35.3	39.8	***	37.22	42.1	***
Housework hours	2.01	3.1	***	0.88	0.64	***
Yearly non-labor inc.	1.16	0.54	***	0.62	0.46	***
Years of education	12.47	11.73	***	12.46	11.98	***
Number of children	0.52	1.13	***	0.53	1.13	***
Region						
East	29.86	22.7		30.96	22.65	
West	70.14	77.3		69.04	77.35	
2. Labor market characteristics						
Work hours	29.02	18.54	***	36.12	37.33	***
Hourly wage	10.92	8.27	***	14.23	16.23	***
Job change	0.14	0.1	***	0.15	0.09	***
Managerial position	0.14	0.07	***	0.25	0.22	***
Work experience	11.75	13.49	***	14.11	20.0	***
N	4,681	33,639		4,688	32,498	

Notes: The table shows means of selected variables. Wage and non-labor income are measured in 2005 Euros. *** mean differences are significant at a 1 % level. The samples consist of women or men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
Source: SOEPv27 waves 1993 through 2010, own calculations.

iting men, and overall, men work more hours than women. They also earn much more per hour than women. Married women have the lowest hourly wages. Cohabiting individuals change jobs more often and work more often in managerial positions, but men more often than women. Overall, when considering labor market characteristics, it is clear that cohabiting women and men are more equal than their married counterparts.

The descriptive statistics provide an initial overview of differences between married and cohabiting individuals, with women displaying greater differences and the greatest difference (compared to men) in the dependent variable, weekly work hours (difference women=10.48, difference men=1.21). All displayed differences are statistically significant at the 1 percent level. This result underlines the necessity of multiple regression analysis.

4.4.1   Extensive and Intensive Margin

Labor supply can be divided in two different dimensions: labor force participation (LFP), which is the extensive margin, and work hours, which is the intensive margin. On the one

hand, there is an observable increase in women's LFP in almost all industrialized countries (Fernandez, 2007; Jaumotte, 2003). On the other hand, weekly work hours, conditional on working, provide a non-uniform picture. While women's work hours in the United States have been rising steadily since 1970 (McGrattan and Rogerson, 2004, 2007), the trend in Germany is the opposite. Full-time employment among women has decreased and part-time employment has increased over the same period, resulting in decreasing average work hours (Merz, 2008).

According to Heckman (1993), the extensive margin is of primary importance for economic analysis. But the intensive margin is also of interest to economic research since it serves as input into the production of goods and services (Merz, 2008) and is important for the evaluation of welfare programs that create disincentives to participate in the labor market and to work higher numbers of hours (Haan, 2005). While this study focuses primarily on the intensive margin, the extensive margin is considered as well in this section.

Figure 4.1: Women's Extensive and Intensive Margin
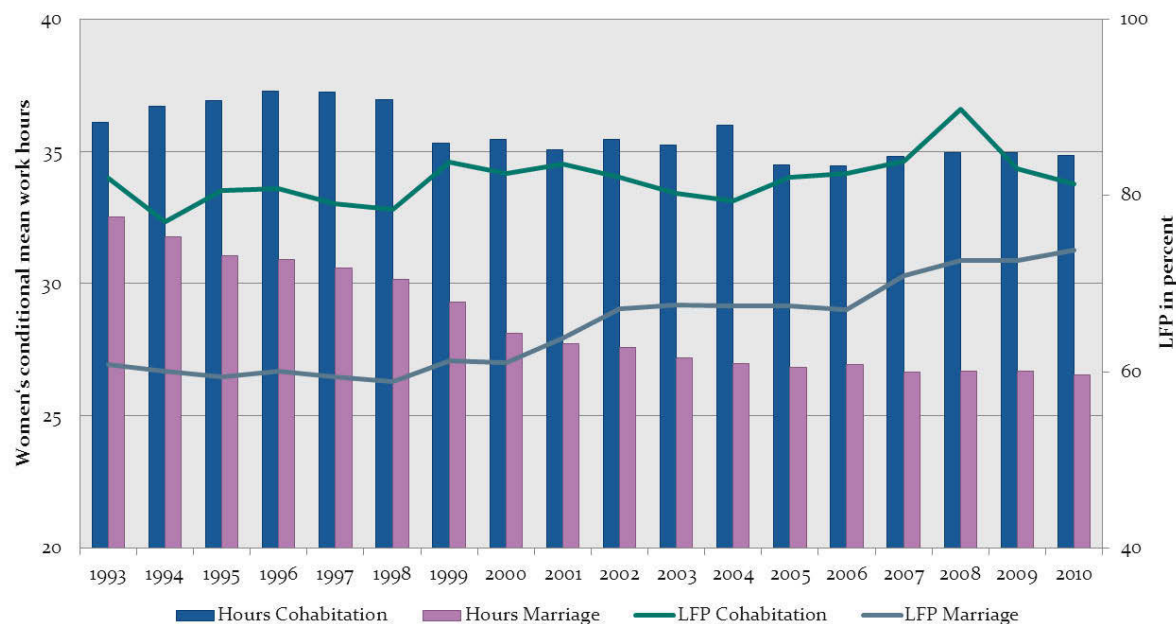
Notes: The sample includes women between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
Source: SOEPv27 waves 1993 through 2010, own calculations.

As noted above, women's labor supply has increased since the 1970s in Germany, as it has in many other developed countries.[13] The LFP, shown in Figure 4.1, of married

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[13]A large body of literature exists on the extensive margin of (married) women. See also Fernandez (2007), Leibowitz and Klerman (1995) or Jaumotte (2003).

women increased more than that of cohabiting women, but still, in 2010, cohabiting women worked at a higher rate than married women.[14] As previously noted cohabiting women have no legal right to financial support after separation and might therefore have a greater probability of participating in the labor market. Although the rate of married women participating in the labor force is increasing, the average number of hours worked per married woman is decreasing, while cohabiting women are steadily increasing the number of hours worked on average. Comparing full-time and part-time work shows an enormous shift from full-time to part-time work (full-time $\geq$ 35 hours) as presented in Table 4.2.

Table 4.2: Women's Share of Full-time and Part-time Work

	Cohabitation				Marriage				Share of Marriage
	Full-time	Part-time	Non-empl.	N	Full-time	Part-time	Non-empl.	N	
1993	65.16	16.77	18.06	155	38.02	22.83	39.15	1,857	92.3
1995	67.66	12.94	19.4	201	32.86	26.59	40.55	1,884	90.4
2000	60.34	22.1	17.56	353	26.61	34.43	38.96	2,777	88.7
2005	58.64	23.46	17.9	324	24.73	42.79	32.48	1,921	85.6
2010	56.69	24.65	18.66	284	25.82	47.94	26.24	1,456	83.7

Notes: The sample includes women between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
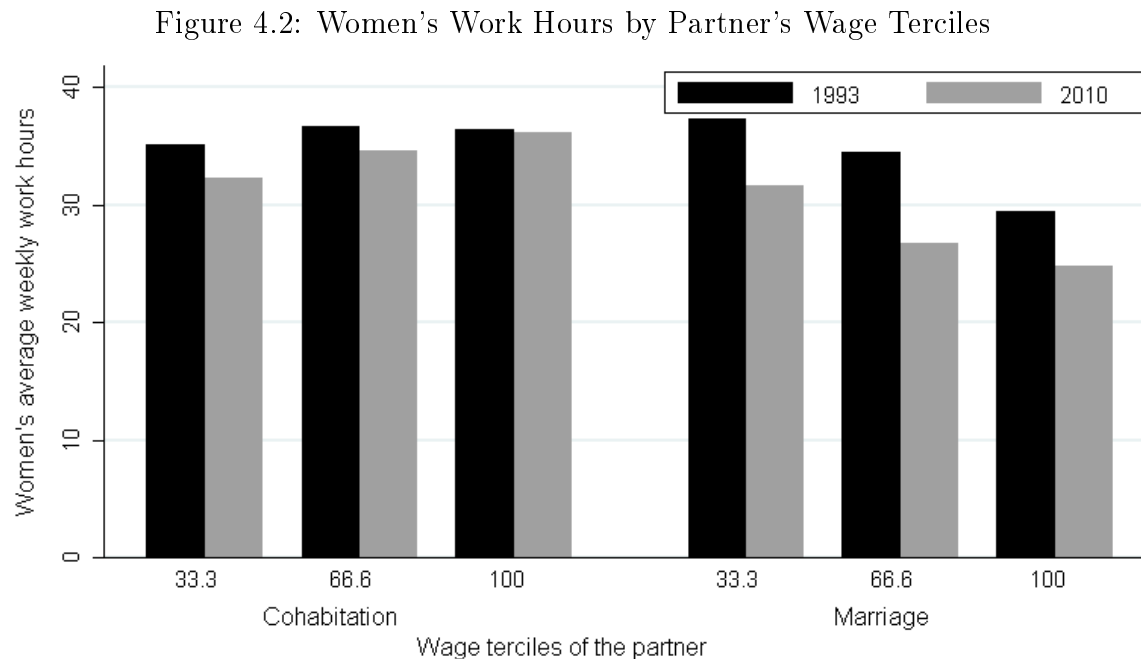*Source:* SOEPv27 waves 1993 through 2010, own calculations.

The shift is highest for married women. Table 4.2 also shows that the rise in labor market participation is dominated by an increase in part-time work. Cohabiting women are more often in full-time positions. This could be due to greater independence and individualism among cohabiting couples, or it might reflect the fact that they cannot benefit from the tax advantages provided to married couples if one partner earns (works) significantly less per month than the other.

4.4.2 Impact of Partner's Wages

Considering partners wage level again reveals a clear difference between marriage and cohabitation (Figure 4.2). Cohabiting women increase their work hours slightly with an increase in the partner's wages. This increase was lower in 2010, but overall, there was no large change over the observation period. In contrast, for married women, an increase in the husband's wages is generally accompanied by a reduction in work hours, with an

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[14]This is also true while comparing cohabiting and married women with one child and the same age respectively same number of years after finishing highest educational degree. The results are presented in the robustness section.

even larger decrease in 2010. In 1993, married women worked more hours on average than cohabiting women, if the partner was in the first tercile (33.3 %). This changed dramatically with an increase in the partner's wages and over time.

Figure 4.2: Women's Work Hours by Partner's Wage Terciles

Notes: The sample includes women between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
Source: SOEPv27 waves 1993 through 2010, own calculations.

4.5 Regression Methodology

This paper benefits from the panel data structure of the SOEP. Panel data allow the observation of dynamics over time and contain more information, which permits more precise estimations. I use fixed effects regression (FE)[15] to estimate the effect of partner's wage change on women's work hours. This estimation method overcomes one of the main challenges of estimating labor supply equations: time-constant unobserved heterogeneity. Using the within-transformation results in the disappearance of person-specific error (e.g., ability, assuming that ability does not change over the observation period). The underlying estimation model can only account for within-person changes over time, not for between-variation (e.g., gender or personality traits). I therefore estimate the regressions separately for women and men. The regression relies on the following labor supply equation:

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[15]Applying the Hausman test leads to the conclusion that the FE model is favorable over the random effects (RE) model.

$$h_{it} = \beta_0 + \beta_1 lnw_{it} + \beta_2 lnw_{it}^p + \gamma_1 X_{it} + \gamma_2 X_{it}^p + \delta_t + \varepsilon_{it} \tag{4.1}$$

$$i = 1, ..., n$$
$$t = 1993, ..., 2010$$

where h_{it} equals the number of paid weekly labor market hours[16] by individual i at time t, lnw_{it} is the logarithm of an individual's gross hourly wage rate, lnw_{it}^p is the logarithm of partner's gross hourly wage rate. X_{it} includes individual characteristics: education, age, age squared, housework hours, managerial position, job change, number of children, and region. X_{it}^p includes the characteristics of the partner: income, age, age squared, housework- and labor market hours. Finally, δ_t denotes period dummies that are included to estimate only the within variation that is above the time trend. Including both partners' incomes allows for joint time allocation decisions; in other words, partner's wages are not taken as given (Laczo, 2011). When considering the additive model, in which the analysis is conducted together for cohabiting and married individuals, no conclusion is possible between marital status and partner's wages. Therefore, interaction terms are used in another model to discuss whether cohabitants differ significantly from married individuals in terms of changing partner wages.

According to Laczo (2011), estimating labor supply equations face not only the problem of unobserved heterogeneity, but also the endogeneity of wages and self-selection into the labor market. The following sections address these challenges.

4.5.1 Endogeneity of Wages

The independent wage rate cannot be seen as exogenous since it is jointly determined with the dependent variable, thus leading to simultaneity bias. To avoid this simultaneity bias in the hours equation, all regressors in the wage equation must be exogenous (Puhani, 1995). One possible solution is to use exogenous instruments (IV) to estimate wages. Common instruments were introduced by Mincer (1974). His approach uses years of experience and years of education to estimate wages. In addition, other explanatory variables like demographic characteristics can be included in the model. I employed the Mincer wage equation as follows:

$$lnw_i = \alpha_0 + \alpha_1 S_i + \alpha_2 Exp_i + \alpha_3 Exp_i^2 + \alpha_4 X_i + u_i \tag{4.2}$$

$$i = 1, ..., n$$

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[16]The number of hours for non-working individuals is constrained to zero.

where lnw_i stands for the logarithm of gross hourly wages, S_i depicts years of education, Exp_i and Exp_i^2 for years of work experience (combined part-time and full-time experience) and its squared term, while X_i denotes all other characteristics, such as age, region, managerial position, job changes, and number of children. The predicted wage is obtained for all individuals (employed and non-employed), but separately for women and men. Thus Equation (4.1) can be rewritten as:

$$h_{it} = \beta_0 + \beta_1 ln\widehat{w}_{it} + \beta_2 ln\widehat{w}_{it}^p + \gamma_1 X_{it} + \gamma_2 X_{it}^p + \delta_t + \varepsilon_{it} \tag{4.3}$$

where $ln\widehat{w}_{it}$ and $ln\widehat{w}_{it}^p$ are derived from Equation (4.2). Using the IV approach is not without drawbacks. Puhani (1995) noted that the prediction of wages could lead to inefficient results if the correlation between the actual and predicted value is very low. He therefore included the predicted values only for those individuals who are not working. I have adopted this method here.

Further, when estimating the wage equation, the problem of self-selection into the labor force arises as well. To correct for this, I use the two-step procedure of the Heckman correction model, discussed in the next section, in the estimation of wages as well.

4.5.2 Sample Selection

Sample selection bias may arise if self-selection by individuals is present (Heckman, 1979). In this context, the individual decision of whether or not to work will determine whether an individual has observable labor market hours and wages. However, if the variables that affect the decision to participate in the labor market do not affect work hours and wages, unobserved hours and wages can be ignored (Lauer and Steiner, 2000). This is unlikely to hold in practice and ignoring it may lead to biased estimates. To correct for this selection bias, I use a modified Heckman correction model (Heckman, 1979). The modification (Berk, 1983) allows to apply the correction model to fixed effects regressions. This modified version is a two-stage procedure. The first stage determines whether the individual works or not and the second stage (estimation of wages and hours) includes a predicted value for the probability of working (inverse mills ratio) to control for selectivity bias. In the first stage, I estimate a probit model (Greene, 2003), which predicts the probability of working for women and men separately during each year of the observation period. The exclusion restriction thereby includes non-labor income and children under the age of three in the household. The younger a couple's children are, the lower is the mother's labor force participation (Eichhorst et al., 2011). Both determinants influence the decision whether or not to work and both are usually used to identify the labor force participation of women. All other variables are the same as in the labor supply regression,

as long as they are observable for employed and non-employed individuals. Using the selection equation, I computed an inverse Mills ratio of participation in the labor force and used it as an instrumental variable in the Mincer wage equation and in the labor supply equation to control for sample selectivity bias.

Overall, the estimation procedure of labor market hours involves three steps:

1. Estimation of selection into the labor market via a modified two step Heckman correction model and calculation of the inverse Mills ratio.

2. Estimation of Mincer wage equation using the inverse Mills ratio from the first step.

$$lnw_i = \alpha_0 + \alpha_1 S_i + \alpha_2 Exp_i + \alpha_3 Exp_i^2 + \alpha_4 X_i + IMR_i + u_i \tag{4.4}$$

3. Estimation of labor supply equation using a FE model (controlling for unobserved heterogeneity), while including predicted wage and inverse Mills ratio.

$$h_{it} = \beta_0 + \beta_1 ln\widehat{w}_{it} + \beta_2 ln\widehat{w}_{it}^p + \gamma_1 X_{it} + \gamma_2 X_{it}^p + IMR_{it} + \delta_t + \varepsilon_{it} \tag{4.5}$$

4.6 Regression Results

The main aim is to estimate the relationship between work hours and partner characteristics, distinguishing individuals by marital status. First, the results of the fixed effects regression (Equation (4.5)) for women and men are presented in Table 4.3.[17] 'All' contains the full sample of all couples. Out of them 565 women and 578 men change their marital status during the observation period. 'Cohabitation' and 'Marriage' present the results for the couples, which do not change their marital status during the observation period, i.e. either cohabiting or married couples. Table 4.4 presents the results using interaction terms to compare cohabiting and married individuals.[18]

For women, most investigated characteristics affect work hours in the expected direction. Considering the whole sample of women, the estimates indicate that there is a significant difference between women's work hours and marital status. Women work about 2.6 hours less per week when they are married (cohabitation serves as reference category). Women's own wages affects their work hours positively and significantly. A change in partner's wages negatively and significantly affects own work hours for women. A 1 % increase in the spouse's wages leads to a decrease in married women's work hours of 0.40

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[17] Results for a random effects (RE) model and Ordinary Least Squares (OLS) are available upon request.

[18] A modified Wald test for group wise hetreoscedasticity in fixed effects regression models was performed. The null of homoscedasticity was rejected. To control for hetreoscedasticity, robust standard errors were estimated.

hours (about 25 minutes). According to time allocation, one more child reduces women's work hours by significantly more than one hour. The effect of the partner's work hours is surprising. I would expect a negative relationship here, as a result of efforts within couples to adjust time allocation and childcare responsibilities. But, contrary to this expectation, the effect is positive and significant, although small, meaning that if the partner works 10 additional hours, women's work hours increase by about 10 minutes (0.18 hours). The number of hours spent on housework significantly influences work hours (negatively for own hours and positively for partner's hours). In addition, a set of control variables were included in the regression. Both a job change as well as holding a managerial position yield a significant and positive response in labor market hours. The effect of education is in the opposite of the hypothesized direction. One additional year of education results in a decrease of about 0.3 hours. Region has no significant impact on women's work hours.

The results of this study so far indicate that women work a different amount of hours, depending on marital status. As explained, possible reasons include higher individualism and independence among cohabiting women. But does this directly change with marriage? To approach to an answer, cohabitation and marriage are analyzed separately. Both models study the same characteristics but each subsample consists only of those couples that did not change their marital status during the observation period. The impact of partner's wages on married women is particularly interesting. Women who were married over the entire observation period reduced their labor supply by 0.3 hours if the husband's income increased by 1 %. The effect is not significant for cohabiting women, indicating that the overall effect is mainly determined by married women. One more child reduces women's work hours significantly. The effect is even larger for cohabiting women, even though it is unclear whether the difference is significant. The effect of partner's work hours is positive and significant. For cohabiting women, the result is not significant. Supervisory positions only significantly increase the work hours of married women. This leads to the conclusion that cohabiting couples behave differently than married couples.

For men, marital status has no significant impact on work hours. The own-wage effect yields a large positive and significant impact on men's work hours. When considering partner's wages, the results are different than hypothesized. While I expected that men are influenced very little by a change in women's wages, the opposite is true: Men are influenced significantly by a change in women's wages. A 1 % wage increase in women's wages results in 0.24 hours less per week for the man. The number of children does not significantly affect men's work hours. This supports the hypothesis that childcare is generally the responsibility of women, regardless of marital status. In addition to the whole sample, cohabitation and marriage are analyzed separately as well. The most interesting impact comes from partner wages. While the coefficient for cohabiting men

Table 4.3: Fixed Effects Regression Models of Women's and Men's Work Hours

	Women			Men		
	All	Cohabitation	Marriage	All	Cohabitation	Marriage
1. Marital status						
Marriage	-2.624***			-0.239		
	(0.375)			(0.291)		
2. Financial need						
Log wage	8.899***	11.760***	8.446***	12.048***	13.929***	11.986***
	(0.164)	(0.594)	(0.186)	(0.224)	(0.484)	(0.258)
Log wage partner	-0.398***	-0.092	-0.331**	-0.240**	-0.923**	-0.223**
	(0.135)	(0.470)	(0.149)	(0.096)	(0.429)	(0.111)
3. Time allocation/ childcare responsibility						
Number of children	-1.299***	-1.584***	-1.036***	-0.099	-0.411	-0.035
	(0.112)	(0.537)	(0.122)	(0.088)	(0.496)	(0.096)
Work hours partner	0.018**	0.032	0.015*	0.025***	0.040	0.023***
	(0.008)	(0.028)	(0.008)	(0.007)	(0.026)	(0.009)
Housework hours	-0.224***	-0.455**	-0.258***	-0.508***	-0.366*	-0.408***
	(0.053)	(0.218)	(0.057)	(0.079)	(0.222)	(0.089)
Housework hours partner	0.168***	0.334*	0.134*	0.037	-0.060	0.054
	(0.064)	(0.190)	(0.071)	(0.034)	(0.148)	(0.037)
4. Individual characteristics						
Jobchange	0.992***	1.601***	1.183***	2.730***	2.256***	2.812***
	(0.181)	(0.555)	(0.208)	(0.183)	(0.548)	(0.218)
Leadership position	2.127***	0.705	1.942***	0.201	-0.099	0.251
	(0.322)	(1.011)	(0.376)	(0.228)	(0.731)	(0.260)
Education in years	-0.331***	-0.987	-0.272**	0.038	-0.297	0.033
	(0.119)	(0.811)	(0.116)	(0.114)	(0.613)	(0.123)
Region	-1.696	4.531**	-3.123**	-0.203	1.533	-0.783
	(1.200)	(2.245)	(1.500)	(1.011)	(2.184)	(0.987)
Inverse millsratio	-15.11***	-10.26***	-13.33***	-17.29***	-13.26***	-18.06***
	(0.901)	(3.800)	(0.988)	(1.236)	(2.970)	(1.484)
4. Controls						
	yes	yes	yes	yes	yes	yes
Adj. R^2	.59	.65	.55	.56	.67	.55
N	35,971	2,672	28,716	36,089	2,788	28,711

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. 'All' contains the full sample and 'cohabitation' and 'Marriage' contain couples, who do not change their marital status during the observation period, respectively. Further control variables are included. Those are age and age^2 of individual and partner, a maximum set of year dummies and the constant. *Source:* SOEPv27 waves 1993 through 2010, own calculations.

shows a large negative and significant impact, the coefficient of married men is smaller and they even respond less than married women.[19] The traditional model of labor market specialization within marriage whereby the man plays the role of breadwinner leads to the fact that married men decrease their hours only slightly if their wife's income increases. In cohabiting couples, male and female partners are more similar to each other in terms of labor market traits (Jepsen and Jepsen, 2002). As men are not typically the sole breadwinners in these relationships, both partners are more equal in terms of work hours and wages than in married relationships. As a result, the male partner can afford to reduce hours on a high magnitude with an increase in the female partner's wages.

In these additive models, it is not possible to compare married and cohabiting individuals. Therefore another analysis including interaction terms was conducted. The advantage of including interaction terms is the ability to test whether the effect of one independent variable depends on another characteristic. In this analysis, interactions are used to test whether cohabiting women differ significantly from married women in labor supply effects of their own wage, partner's wage, number of children or partner's work hours. The influence of the husband serves as a reference category. The results are provided in Table 4.4 and Figure 4.3 for women and men separately.

The main effect of cohabitation is a large and significant positive effect on women's work hours. A cohabiting relationship increases women's work hours by about three hours. The coefficient of (cohabiting woman)*(cohabiting partner's wage) is large, positive, and significantly different from that of married women. Cohabiting women increase their work hours about 0.9 times more than married women, meaning that a 1 % increase in the cohabiting male partner's wage results in an increase in the cohabiting female partner's labor market hours of 0.4 hours (0.9-0.5=0.4). Partner's wages have opposite impacts on married and cohabiting women. While married women respond negatively to a wage increase of the husband, cohabiting women respond positively. This may be because cohabitation - in contrast to marriage, which is often associated with more traditional views about labor market specialization - provides women with more economic independence and may encourage them to seek to match their partner's wage. In fact, cohabiting women are more similar to their partners with respect to labor market traits than married women and their partners (Jepsen and Jepsen, 2002). This similarity between partners when choosing a mate might continue during the subsequent relationship. As previously noted, the number of children negatively affects women's work hours. The effect is much higher for cohabiting women. One possible explanation might be that cohabiting women work more hours in the first place and therefore reduce their working time at a higher magnitude in order to spend about the same amount of time with their children as married women.

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[19]It is unclear whether the impact for married men is significant or not.

Table 4.4: Interaction Models with Cohabitation for Women and Men

|	Women	Men
Reference Category - Spouse		
Log wage partner	-0.518***	-0.216**
	(0.143)	(0.100)
Number of children	-1.208***	-0.070
	(0.115)	(0.091)
Work hours partner	0.020**	0.024***
	(0.008)	(0.008)
Cohabitation	3.254*	-0.435
	(1.763)	(1.476)
Interactions with cohabitation		
Cohabitation * log wage partner	0.887**	-0.305
	(0.373)	(0.303)
Cohabitation * number of children	-1.231***	-0.358
	(0.331)	(0.271)
Cohabitation * work hours partner	-0.016	0.008
	(0.023)	(0.091)
Adj. R^2	.60	.56
N	35,971	36,089

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. Individual characteristics and control variables are the same as in the main specification.
Source: SOEPv27 waves 1993 through 2010, own calculations.

The interaction term of cohabitation and working hours of the partner does not lead to a significant difference between married and cohabiting women. Analyzing the interaction terms of men shows that cohabiting men are not significantly different from married men in either of the tested interactions.

Figure 4.3 graphs conditional effect plots of women and men in cohabitation in comparison to marriage depending on partner wages, number of children, and work hours of the partner, holding all else constant. One main result is that cohabiting women increase their work hours with increasing wages of their partners, while married women decrease their hours with increasing wages of their spouses.

Figure 4.3: Conditional Effects Plots
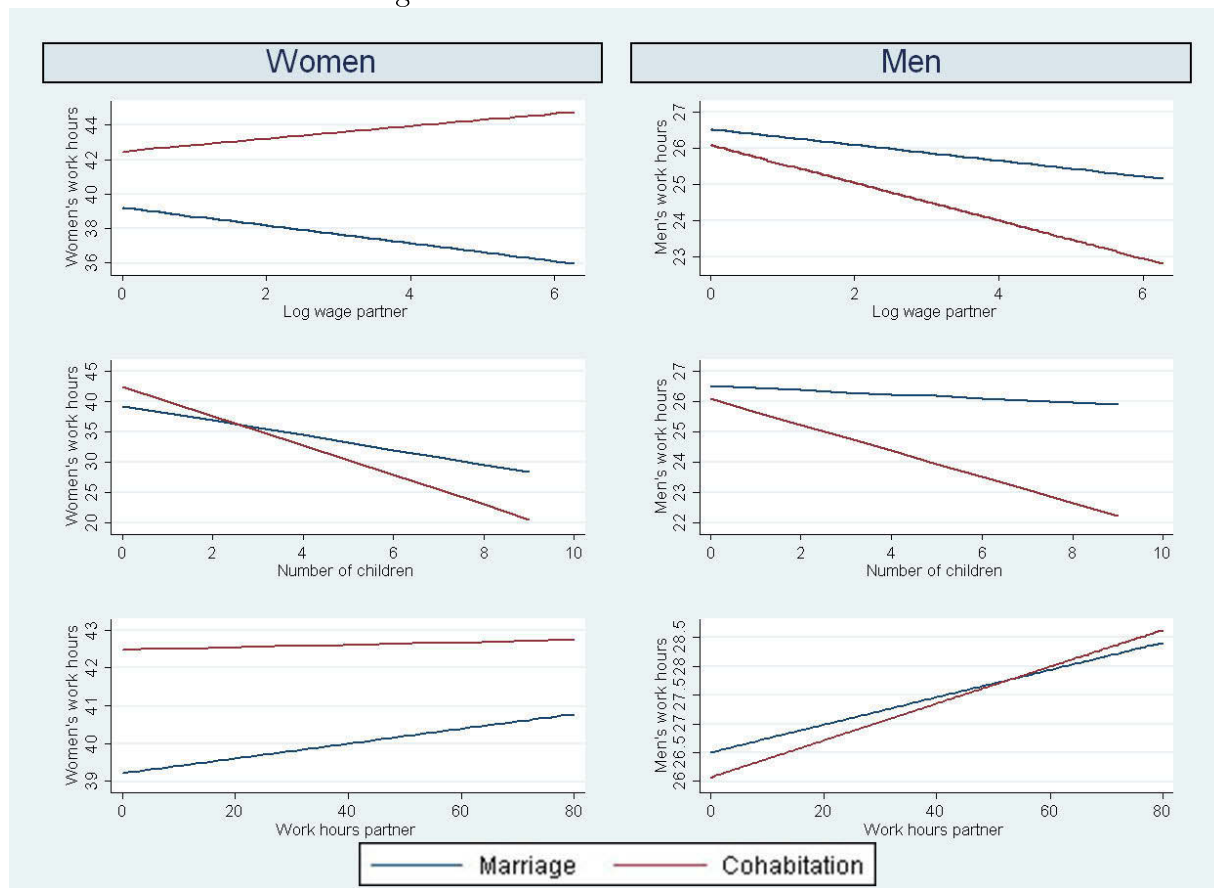
Notes: The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
Source: SOEPv27 waves 1993 through 2010, own calculations.

4.7 Robustness and Sensitivity

In this section, I briefly discuss several robustness and sensitivity checks aimed at addressing important concerns about my specifications. First, I consider different age and wage groups. Second, I comment on the argument that differences are only observable because cohabiting and married women are two different groups of women in different stages of the life course. Third, I investigate alternative models to analyze work hours. Finally, I present the results obtained while using the bootstrapping method.

4.7.1 Grouped Subsamples

In the previous section, I presented the estimation results for individuals between the ages of 25 and 55, including all earnings from "one Euro jobs" through top management.

This wide range of age and earnings might lead to two possible concerns. First, the age difference between cohabiting and married couples, as it is clear that cohabiting couples are much younger than their married counterparts. Consequently one might ask whether younger individuals display different working behavior. Second, one might ask whether the reaction to a change in partner's wages may differ depending on the amount of income. The results of women's and men's coefficients are presented in Table 4.6 in the Appendix. Looking at different wage quintiles of the partner, we see that women only significantly reduce their work hours if the partner's wage is in the highest quintile. The results are insignificant for all other wage distributions. In contrast, men reduce their work hours significantly if women's earnings lie in the three highest quintiles. With increasing age, women work significantly less compared to the reference category. Men show no significant differences for different age groups.

4.7.2 Women Differ Across the Life Course

As can be seen in the descriptive statistics, cohabiting women are younger than married women and have fewer children. One might therefore argue that I have analyzed cohabiting and married women in different stages of life and that this is the real explanation why cohabiting and married women have shown different reactions to changes in partner's wages. I try to account for this by using only women who are similar in key characteristics. Not simply the same age is crucial but the same number of years after completing education, since education leads to postponement of childbearing (Nicoletti and Tanturri, 2005). I therefore compare cohabiting and married women between 10 and 30 years after finishing education with one child in the household. The results of women's coefficients are presented in Table 4.7 in the Appendix. The return to partner wages is comparable to that for the reduced sample of couples who did not change their marital status during the observation period. A partner's wage increase leads married women to reduce their work hours significantly, whereas the impact on cohabiting women is insignificant. The results for this subsample mitigate the concern about comparing two different groups in different stages of life.

4.7.3 Alternative Models

The results presented above were obtained in a step-by-step estimation procedure. One potential concern with this method is that potential misspecifications or measurement errors that occur while estimating the first steps are carried through into later calculations. I estimated different models to control for this. First, I estimated the models without the sample selection step, second without estimating the Mincer wage regression, and third

without either of these two steps (Table 4.8 in the Appendix). The estimation using different models, however, results in comparable, but slightly different coefficients, with the same significance levels for the main variables.

4.7.4 Bootstrapping

Another concern might be the violation of the assumption that work hours are normally distributed (a skewed distribution). This is an understandable worry, since working hours indeed peak at around 40 hours per week, but other concentrations can be found as well. Women often work part-time at around 20 hours per week and men often work more than 40 hours per week. They have another concentration at 50 hours per week as well as at 60 hours per week. Therefore the assumption of normality may lead to unstable results and an inference in error (Efron and Tibshirani, 1993). The bootstrapping procedure is an appropriate way to control and check the stability of the results since it does not require any assumption of distribution. Instead it is an indirect method to assess the parameters of interest by treating the given sample as population. The main strategy is to derive data sets from the original data (with or without replacement). The new datasets consist of observations from the original data, but some of the original observations are included multiple times, while others are not included at all. Subsequently, the regression will be run on each of these new datasets and finally the parameters will be interpreted in the same way as in the original regression. Mooney and Duval (1993) outline these steps in detail. As a robustness check, I used a bootstrap procedure with replacement and 1,000 iterations. The parameters presented in Table 4.9 in the Appendix have comparable magnitudes, proceed in the same direction, and maintain the same significance level.

4.8 Explanation Attempt: Germany's Joint Taxation System and its Impact on Work Incentives

The main issue of this study aims at the influence of partner's wage on women's work hours. In both, the additive and the interaction model, the difference between cohabiting and married women is obvious. This raises questions about the mechanism driving the result. This section provides a potential explanation using a unique feature of the German tax system which provides tax advantages for married couples only and is known as "income-splitting" (Steiner and Wrohlich, 2004).

In Germany, joint taxation of couples and its accompanying "income-splitting" benefit is only available for married but not for cohabiting couples. The benefit increases with increasing household income and provides a greater utility if one partner earns significantly

more than the other, i.e. the distribution of total household income is unequal.[20] This may place cohabiting couples, who file jointly, at a disadvantage concerning taxes and may lead cohabiting women to work more in order to offset the tax disadvantage. This can be shown by considering two different types of couples. Couples with an income distribution more equal than 60%/ 40% and couples whose income distribution is more unequal than 60%/ 40%. The crucial difference between both types is that while those couples with a relatively equal earnings distribution (more equal than 60%/ 40%) cannot benefit from the tax-splitting advantage (no matter if married or cohabiting), couples whose distribution is more unequal than that are eligible for joint taxation and the underlying benefit as long as they are married. Descriptively, this results in comparable weekly work hours for cohabiting women (38.5 hours) and married women (36.9 hours) in the former case and in distinct differences in the latter case with 26.8 hours for cohabiting women compared to 12.7 hours for married women (compare Figure 4.5 in the Appendix).

Table 4.5: Fixed Effects Regression Models of Women's and Men's Work Hours – Reduced Sample of Couples with a More Equal Income Distribution than 60%/ 40%

	Women			Men		
	All	Cohabitation	Marriage	All	Cohabitation	Marriage
1. Marital status						
Marriage	0.147			0.148		
	(0.238)			(0.268)		
2. Financial need						
Log wage	-13.55***	-10.10***	-14.09***	-14.51***	-12.68***	-15.36***
	(0.543)	(1.186)	(0.601)	(0.941)	(2.799)	(0.825)
Log wage Partner	5.643***	3.914***	6.041***	5.661***	5.181***	5.566***
	(0.581)	(1.033)	(0.566)	(0.638)	(1.943)	(0.634)
3. Time allocation/ childcare responsibility, individual characteristics and controls						
	yes	yes	yes	yes	yes	yes
Adj. R^2	.41	.31	.43	.34	.29	.36
N	8,803	1,939	6,864	8,862	1,953	6,909

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. 'All' contains the full sample and 'cohabitation' and 'marriage' contain couples, who do not change their marital status during the observation period, respectively. Time allocation/ childcare responsibility, individual characteristics and control variables are the same as in the main specification.
Source: SOEPv27 waves 1993 through 2010, own calculations.

I apply the fixed effects regression methodology used in the former analysis to that reduced sample of couples whose income distribution is more equal than 60%/ 40%. Their

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[20]This is graphically shown in Figure 4.4 in the Appendix.

tax-splitting benefit is very low compared to a more unequal distribution (Steiner and Wrohlich, 2004). Estimation results which are presented in Table 4.5 state that marital status does not have a significant impact on those couples, implying that married and cohabiting women do not significantly differ in their work behavior if none is eligible for the "income-splitting" tax benefit. Partner's wage has a huge positive and significant impact. This suggests that the full sample is driven by the tax advantage for married couples.

This leads to interesting policy implications. This current German taxation scheme may create counterproductive incentives that lead to a reduction of work hours for one partner within married partnerships. In general, this would presumably be the woman, since married women work fewer hours and earn less than their partners. Against the backdrop of increasing women's labor supply, it would be desirable for married women to increase work hours to the levels reported for cohabiting women. The German "income-splitting" benefit runs counter to this goal. Consequently, the abolition of this tax scheme would yield a positive effect on married women's work incentives.

4.9   Conclusion

Using longitudinal data, this study finds that cohabiting women are more similar to their partners in terms of labor market traits than married women are to their husbands. In addition, women's work hours depend significantly on their marital status. To provide a full picture of intra-household specialization issues, I conducted the same analysis for men. I find that men respond significantly negatively to changes in women's wages, regardless of marital status. The results support the hypothesis that it is indeed important to distinguish between marriage and cohabitation when studying women's labor supply and labor market specialization issues within the household.

While the SOEP data provide a longitudinal sample for Germany, they do not provide information on all important facets of partnerships. A meaningful investigation of same-sex couples is currently not possible, and there is no way to identify other kinds of partnerships such as living-apart-together couples or relationships with multiple partners. Another weakness results from the sample selection estimation strategy. The specification of the exclusion restriction is basically an instrument. The chosen instruments (non-labor income and number of children under the age of three in the household) might be seen as fairly traditional. It would therefore be helpful to find other legitimate predictors which influence employment in general, but not working hours, in order to further advance our understanding of these issues.

Nonetheless, this study has interesting conclusions. The unequal effects of own and

partner characteristics in marriage and cohabitation on women's work hours indicate that women maintain different kinds of backup options. In marriage, the man is still the main financial provider and the relationship has a legal foundation, meaning that long-term support is assured. Therefore, married women have lower incentives to work and, consequently, respond negatively to an increase in their partner's wages. Cohabiting women seem to have higher incentives to work since they have less financial security in case of separation. Within cohabiting households, both partners provide more equal amounts of labor and it appears that women seek to match their partner's wages. This leads to a more equal division of labor in such households and less labor market specialization, which also entails a rejection of the classic relationship model with the man as breadwinner and the woman as homemaker (Becker, 1985). Although there is less inequality within cohabiting households, the more equal division of labor within the household could also be an indicator of higher inequality between households. Analyzing the differences between households is a possible area for further study.

4.10   Appendix

Figure 4.4: "Income-splitting" Tax Benefit for Married Couples
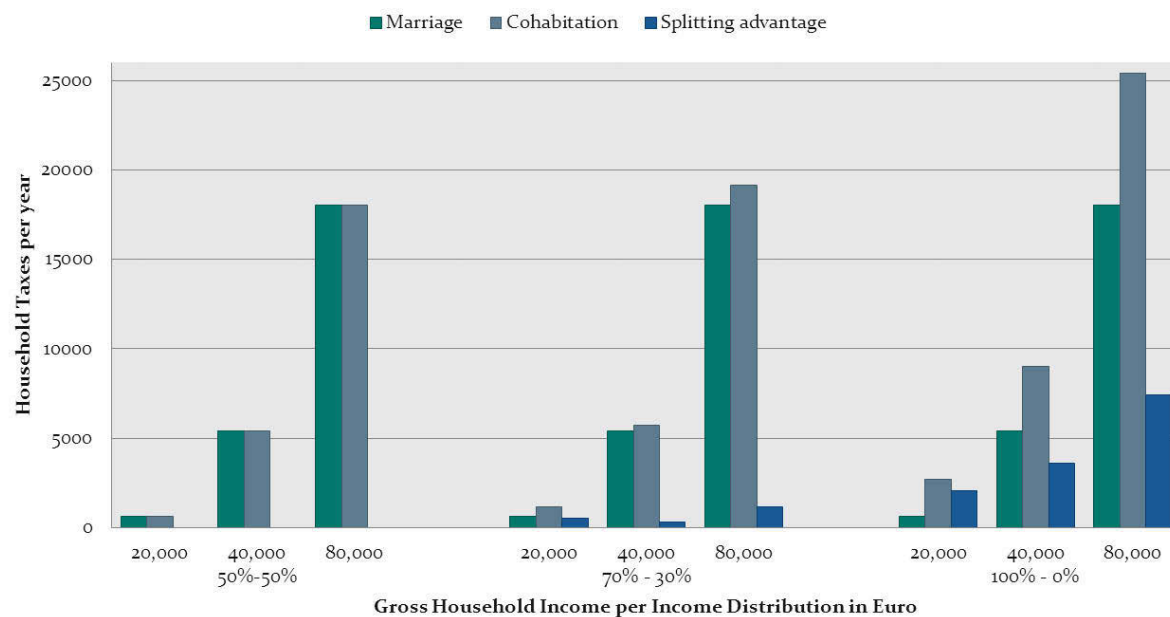
Source: Income tax table for Germany 2012, own presentation.

Figure 4.5: Hours Corresponding to Highest Wage Tercile of the Partner
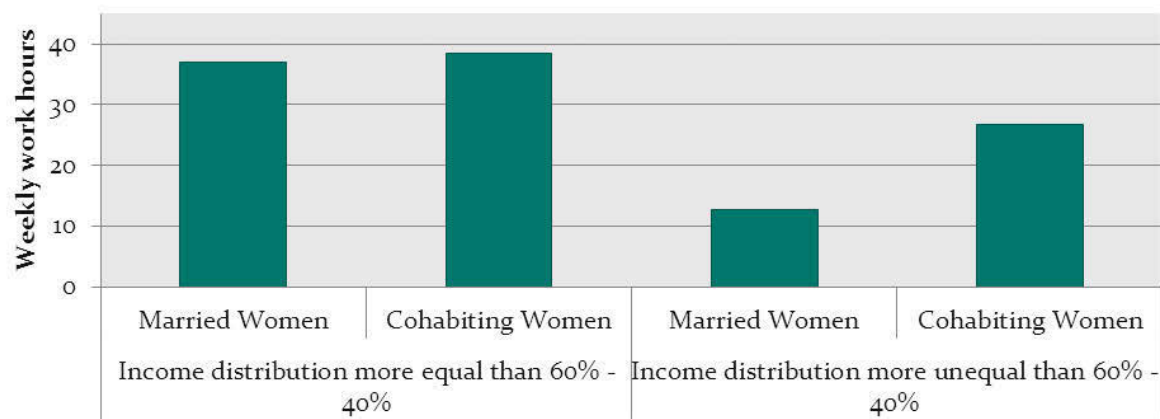
Notes: The sample includes women between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed.
Source: SOEPv27 waves 1993 through 2010, own calculations.

Table 4.6: Fixed Effects Regression Models of Women's and Men's Work Hours – Different Wage and Age Groups

	(1)		(2)	
	Women	Men	Women	Men
1. Marital status				
Marriage	-2.614***	-0.261	-2.596***	-0.232
	(0.375)	(0.291)	(0.374)	(0.292)
2. Financial need				
Log wage	8.896***	12.048***	8.894***	12.050***
	(0.164)	(0.224)	(0.164)	(0.224)
Log wage Partner			-0.401***	-0.242**
			(0.135)	(0.096)
Quantile 1 (reference)				
Quantile 2	0.013	-0.058		
	(0.419)	(0.200)		
Quantile 3	-0.348	-0.402*		
	(0.419)	(0.222)		
Quantile 4	-0.540	-0.671***		
	(0.409)	(0.236)		
Quantile 5	-0.987**	-0.993***		
	(0.417)	(0.269)		
3. Time allocation/ childcare responsibility				
Number of children	-1.294***	-0.118	-1.264***	-0.106
	(0.112)	(0.088)	(0.114)	(0.089)
Work hours partner	0.005	0.019***	0.018**	0.025***
	(0.009)	(0.007)	(0.008)	(0.007)
Housework hours	-0.224***	-0.505***	-0.223***	-0.507***
	(0.053)	(0.079)	(0.053)	(0.079)
Housework hours partner	0.175***	0.039	0.169***	0.036
	(0.064)	(0.034)	(0.064)	(0.034)
Age				
25-30 (reference)				
31-45			-0.621**	-0.106
			(0.255)	(0.272)
46-55			-0.946***	-0.268
			(0.323)	(0.326)
4. Individual characteristics and controls				
	yes	yes	yes	yes
Adj. R^2	.60	.56	.60	.56
N	35,971	36,089	35,971	36,089

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. (1) contains dummies for partner's wages and (2) contains dummies for own age. Individual characteristics and control variables are the same as in the main specification.
Source: SOEPv27 waves 1993 through 2010, own calculations.

Table 4.7: Fixed Effects Regression Results of Comparable Women

	Cohabitation	Marriage
1. Financial need		
Log wage	9.067***	7.720***
	(0.927)	(0.338)
Log wage Partner	-0.596	-0.598**
	(0.640)	(0.296)
2. Time allocation/ childcare responsibility		
Work hours partner	0.085*	0.023
	(0.045)	(0.015)
Housework hours	-0.898**	-0.431***
	(0.448)	(0.121)
Housework hours partner	-0.002	-0.013
	(0.398)	(0.128)
3. Individual characteristics and controls		
	yes	yes
Adj. R^2	.63	.52
N	852	7,784

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. 'Comparable women' indicate, all women have one child and are analyzed 10 to 30 years after finishing education. They only differ by marital status. Individual characteristics and control variables are the same as in the main specification.
Source: SOEPv27 waves 1993 through 2010, own calculations.

Table 4.8: Fixed Effects Regression Models of Women's and Men's Work Hours – Different Models

	w/o Mincer		w/o Heckman		w/o both	
	Women	Men	Women	Men	Women	Men
1. Marital status						
Marriage	-2.411***	-0.200	-3.379***	-0.163	-3.192***	-0.151
	(0.372)	(0.287)	(0.390)	(0.291)	(0.385)	(0.286)
2. Financial need						
Log wage	8.057***	11.660***	9.597***	12.904***	8.726***	12.467***
	(0.137)	(0.201)	(0.151)	(0.193)	(0.129)	(0.176)
Log wage	-0.355***	-0.236***	-0.385***	-0.234**	-0.360***	-0.241***
partner	(0.127)	(0.086)	(0.136)	(0.097)	(0.129)	(0.087)
3. Time allocation/ childcare responsibility						
Number of	-1.088***	-0.068	-1.781***	-0.171*	-1.599***	-0.160*
children	(0.112)	(0.087)	(0.114)	(0.090)	(0.113)	(0.088)
Work hours	0.016**	0.027***	0.035***	0.032***	0.036***	0.034***
partner	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Housework	-0.231***	-0.494***	-0.915***	-1.141***	-1.005***	-1.131***
hours	(0.052)	(0.078)	(0.047)	(0.080)	(0.044)	(0.078)
Housework	0.169***	0.040	0.535***	0.086**	0.576***	0.092***
hours partner	(0.063)	(0.033)	(0.063)	(0.034)	(0.062)	(0.033)
4. Individual characteristics and controls						
	yes	yes	yes	yes	yes	yes
Adj. R^2	.61	.57	.59	.55	.60	.56
N	36,240	36,646	36,159	36,338	36,583	37,135

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are clustered at the individual level. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. Different model specifications are used. Individual characteristics and control variables are the same as in the main specification.
Source: SOEPv27 waves 1993 through 2010, own calculations.

Table 4.9: Fixed Effects Regression Models of Women's and Men's Work Hours with Bootstrapped Standard Errors

	Women	Men
1. Marital status		
Marriage	-2.624***	-0.239
	(0.276)	(0.239)
2. Financial need		
Log wage	8.899***	12.048***
	(0.122)	(0.187)
Log wage Partner	-0.398***	-0.240**
	(0.123)	(0.094)
3. Time allocation/ childcare responsibility		
Number of children	-1.299***	-0.099
	(0.085)	(0.075)
Work hours partner	0.018**	0.025***
	(0.007)	(0.007)
Housework hours	-0.224***	-0.508***
	(0.046)	(0.074)
Housework hours partner	0.168***	0.037
	(0.060)	(0.034)
4. Individual characteristics and controls		
	yes	yes
Adj. R^2	.60	.56
N	35,971	36,089

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$, robust standard errors in parentheses. Standard errors are bootstrapped separately for each column. The sample includes women and men between 25 and 55 who are living with a partner (spouse or cohabitant) and are either in dependent employment or non-employed. Individual characteristics and control variables are the same as in the main specification. *Source:* SOEPv27 waves 1993 through 2010, own calculations.

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