Three Empirical Essays on Job Training, Income Support Programs, and Household Debt

by

Behnoush Amery

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Applied Economics

Waterloo, Ontario, Canada, 2016

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

This thesis consists of three essays examining the effects of education and job-related training on promotions and wages in Germany, the effects of a reduction in Unemployment Insurance duration on the likelihood of joining welfare in Germany, and examining the debt-asset and debt-income ratios across different income levels in Canada.

The first chapter uses the German Socio Economic Panel (GSOEP) to investigate the relative impacts of education and job-related training on job promotions within different occupation levels. The panel data allow me to control for the confounding effects of unobserved, time invariant, individual specific characteristics, and unobserved temporal shocks. My findings suggest that the recent job-related training increases the probability of promotion to middle level occupations, but has no significant effect on promotion to high and executive level jobs and on the corresponding wage increase. This effect appears greater for women than men. Although men have, on average, a higher probability of promotion and corresponding wage increase, job-related training increases the likelihood of promotion for women more than men. Moreover, the job-related training raises the probability of promotion to middle level jobs for higher educated employees more than for lower educated ones. That is, job-related training complements the role of higher education in increasing the probability of promotion to middle level occupations.

The second chapter uses the German Socio Economic Panel (GSOEP) to investigate how a reduction in the length of Unemployment Insurance (UI) benefits may affect the likelihood of joining a welfare program for the individuals who have used UI benefits in Germany. If the UI program is not helping to return the unemployed to employment, the UI users may transition to a welfare program such as Social Assistance (SA) which provides financial support to low income households. Any modifications in the UI system might affect this transition. The results show that a less generous UI system, in terms of a reduction in UI duration, as a result of the Hartz reforms in Germany, increases the hazard of joining welfare.

Lastly, the third chapter uses the Survey of Financial Security (SFS) to calculate the ratios of average total debts to total income and assets across different income levels over three years of 1999, 2005, and 2012. The debt-income ratio increases for all income levels over theses

three years. The average debt-income ratio for low-income households earning less than $40K is 4.3 in 1999 and 6 in 2012 suggesting that these households owe, on average, 4.3 dollars in 1999 and 6 dollars in 2012 for every dollar they earn. The debt-asset ratios have also increased for all income levels in 2005 compared to the ones in 1999, but this ratio has increased in 2012 only for income levels greater than $80K. The findings suggest that power of households to pay back their debts, specifically for low income households, decreases from 1999 to 2012. The main sources of the increasing indebtedness of Canadians over these years are found as the debts on mortgages on principal and non-principal residences.

Acknowledgements

Completion of this doctoral dissertation was possible with the support of several people. I would like to express my sincere gratitude to all of them. First of all, I am extremely grateful to my research supervisor, Dr. Anindya Sen, for his valuable guidance and consistent encouragement I received in all steps of my studies at the University of Waterloo. This feat was possible only because of the unconditional support provided by Dr. Anindya Sen. Thank you Professor Sen for everything you have done for me.

I am also greatly indebted to Dr. Kathleen Rybczynski for her scholarly inputs and encouragement I received throughout the research work. I am also grateful to Dr. Stephanie Lluis for her valuable suggestions and concise comments. I am deeply thankful for everything I have learned from Dr. Rybczynski and Dr. Lluis.

I would also like to thank faculty, PhD students, and staff from the Economics Department at the University of Waterloo, specifically Pat Shaw, for all her help.

There is no doubt that completing my PhD was impossible without the unconditional and consistent support of my beloved parents, my sisters, Behnaz and Bahareh, and my best friend, Sina Kajbaf. Sina helped and supported me technically, scientifically, and emotionally from the beginning steps of my studies. Words cannot express how much I appreciate everything these people have done for me.

Finally, I would like to thank Jane Russwurn in the writing centre at the University of Waterloo, the staff at cafe 1842 in Waterloo, and all my dear friends who accompanied me emotionally and motivated me to strive towards my goal. I specifically appreciate the existence of Arash Abadpour, Marzieh Riahinezhad, Sepideh Dadras, Najme Rad, Amir Jafari Salim, Omid Ardakanian, Ali Tehrani, and Soroush Dabiri.

Table of Contents

List of Tables

List of Figures

Chapter 1. The effects of education and job-related training on promotions and wages: Panel data evidence from Germany

1.1 Introduction

Understanding the relative impacts of educational attainment and job related training on promotions and wage growth is particularly important for firms and policymakers interested in encouraging productivity.[1] From the firm's perspective, providing job related training motivates an employee for a performance improvement and higher productivity. Following the theory of human capital in Becker (1964), job related training is a human capital investment which either increases employees' performance in their current job, or prepares them for a higher level occupation or higher income. Job related training can also be used as a screening device for employers to learn about employees' abilities and to select more productive workers for promotion to a higher job position. Training might benefit a higher educated employee more than a lower educated one if this worker has a higher ability to learn in the workplace. In this case, training is a complement to educational attainment. On the other hand, training might be a substitute for higher educational attainment if employees with lower levels of education use the job related training programs to obtain the required skills they did not receive through their formal education.

Analyzing the relative impact of education and job related training is also important for helping policymakers to determine whether more resources should be allocated to higher education or towards financing job training programs. Certainly, with respect to Canada, there has been an emphasis on government-funded programs such as the Canada Job Grant that encourages accumulation of occupation specific skills.[2] In a similar vein, some European countries have implemented the work program "Education and Training 2020" (ET 2020), which

[1] Job related training courses are usually held by companies, governmental education centres, or private training institutions.

[2] Based on this program, firms are eligible to apply for a maximum $5,000 federal contribution per person to train Canadians for an existing occupation at eligible training institutions. Including provincial/territorial and employer contributions, the grant could provide $15,000 or more per person. Provinces and territories are responsible for the design and delivery of the Canada Job Grant in their jurisdictions. For further details, please see Canada's Economic Action Plan at http://actionplan.gc.ca/en/initiative/canada-job-grant.

is a new policy framework for European cooperation in education and training aimed at enhancing human capital accumulation. The program focuses on recent and forthcoming labor market reforms to improve the employability of higher education graduates and also to develop shorter training courses for a variety of occupations (European Commission/EACEA/Eurydice, 2013).[3]

A number of studies have investigated promotion and corresponding wage increases as outcomes of high productivity.[4] Some empirical papers also study the likelihood of promotion and wage growth over different educational levels and on-the-job training, separately.[5] However, there is a relative paucity of econometric studies that have simultaneously investigated the relative impacts of these two human capital investments on promotions. This study contributes to the literature by exploiting individual level panel data from the German Socio Economic Panel (GSOEP) to examine the relative impacts of education and job related training on promotions and corresponding wage increases across different occupation levels. The information available from the GSOEP is particularly rich. Given the availability of career related and socio-economic data across individuals over a number of years, the GSOEP allows the researcher to assess the long run effects of formal education and job related training on probability of promotion and wage growth.

From the perspective of identification, the use of individual level panel data allows for an unbiased assessment of the effects of education and job training. Employing pooled cross-sections could result in biased estimates of training programs' effects. Specifically, the cross-sectional data are based on individuals' responses at a single point to whether they ever took a

[3] The program focuses on four education and training groups: early school leaving (ESL), higher education, youth employment and vocational education and training (VET) and lifelong learning. For further details, please see Education and Training in Europe 2020: Responses from the EU Member States at http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/163EN.pdf

[4] Lazear and Rosen (1981), Waldman (1984a), Rosen (1986), Meyer (1992), Baker, Gibbs, and Holmstrom (1994 a, b), Bernhardt (1995), Gibbs (1995), and McCue (1996).

[5] Bognanno (2001) offers evidence that wage dispersion upon promotion is greater for more educated workers and argues that the probability of promotion and corresponding wage increases rise with education levels. On the other hand, DeVaro and Waldman (2012) find that wage dispersion upon promotion is greater for less educated individuals.

job related course. Since the affirmative responses will be more prevalent among individuals with more ability or more motivation in the workplace, the coefficient estimates of job related training on promotion probability would then be biased upwards. Therefore, to control for such unobserved heterogeneity, it is necessary to follow an individual's career path over time in assessing the correlation between job related training and career advancement of employees with different educational levels.[6]

This study finds that training increases the probability of promotion to middle level jobs, and it has a complementary role for higher education within this promotion level. However, there is no evidence that training affects promotions to high or executive level jobs. The study also suggests the importance of job related training for women, specifically in low level jobs in order to enhance their productivity and likelihood of corresponding promotion.

The remainder of this paper is organized as follows. The relevant literature is discussed in section II. Section III describes the data and variables used in this study, and section IV illustrates the descriptive analysis of data on the relationships among education, training, and promotion. Section V develops the empirical models and reports the main findings, and section VI concludes.

1.2 Literature Review

Evaluating the determinants of job promotion and wages is of key importance in labor economics. The seminal theoretical research is based on the tournament models of Lazear and Rosen (1981). They suggest that promotion and corresponding wage increases are basically prizes to the winners of labor market tournaments in which firms commit to pay high wages to the workers in higher rank positions and lower wages to the workers in lower rank jobs. The greater spread between high and low wages induces workers to increase their effort which might consequently raise workers' productivity. More productive workers would be promoted to higher positions and receive higher wages as a prize for their efforts.[7]

[6] The unobserved ability which is correlated with training and education creates an omitted ability bias in the estimates. By using panel data and random effects estimations, we control for this unobserved ability effect.
[7] Other papers include Waldman (1984a), Rosen (1986), and Meyer (1992).

Baker, Gibbs, and Holmstrom (1994 a, b) offer some evidence that education increases probability of promotion. The underlying principle is that education results in skills development, which enhances employee productivity and the probability of promotion. Baker et al suggest that "fast learner" employees, the ones who accumulate human capital more quickly, have the most career success in a firm.[8] McCue (1996) also shows a positive relationship between higher education and wage increase associated with promotion.[9]

Nevertheless, some studies find that the high life-time earnings come from sustained high productivity, even after receiving a promotion, and not just from the promotion itself. Gibbs (1995) extends the market-based tournament approach of promotion and suggests that increasing high productivity is a crucial factor for income growth. Some studies find that job-specific and firm-specific initiatives are important for a sustained high productivity increasing wage growth. In this regard, Bernhardt (1995) extends the model of Waldman (1984a) and employs an asymmetric learning model by allowing the employees to gain general or specific training during their working periods. He shows that receiving more training after the first promotion might sustain the high productivity of promoted workers and keep sending accurate signals about their productivity to the market for the second round promotion tournaments.[10] Acemoglu and Pischke (1998) also develop a model in which firms provide job related training. They argue that firms' willingness to offer job-related training is affected by worker firm-specific tenure and the firm's incentive to increase worker productivity.

---

[8] They use personnel records for 68,437 employees from a medium-sized US firm in a service industry over the years 1969-1988. They also investigate job mobility within a firm and offer evidence that employees do not move from one job to another job through competitions. They argue that career paths are determined and stable in an organization that creates a long term worker-firm attachment.

[9] McCue (1996) uses a panel data of 50,660 person-year observations from Michigan Panel Study on Income Dynamics (PSID) during 1967-1988 and show that higher education increases the wage growth corresponding to promotion.

[10] He also takes the time of receiving promotion into account and argues that if promotion happens earlier in a worker's working period, it reveals that the advantage of promoting the worker to a higher level job exceeds the disadvantage of releasing the private information on her high productivity. That is, the time of promotion depends on the importance of workers' skills in the market.

Furthermore, a limited number of papers consider training on the job as a determinant of promotion since job training might raise employees' productivity. In this respect, Pergamit and Veum (1999) examine the factors affecting promotion among trained individuals in different firms and suggest that trained workers are more likely to be promoted than untrained workers; men more than women; and whites more than blacks or Hispanics. The findings suggest an evidence of discrimination in the absence of jobs and firm-specific characteristics.[11] Zabojnik and Bernhardt (2001) also find that more human capital, obtained through job training, is a main determinant of promotion. They argue that those firms which have more trained workers have more promotion. In this respect, firm size is an important factor affecting the amount of training offered by firms, such that larger and more technology intensive firms usually have more trained workers who receive promotions. Zabojnik and Bernhardt (2001) suggest a positive relationship between firm size and wage growth.

In addition to firm size, hierarchy in firms also affects wage increases. Bognanno (2001) shows that wage growth is positively correlated with the occupational positions in the firm. His results suggest that wage increase, as the "tournament prize", rises with education as well as with the number of competitors for the CEO. positions.[12] Based on the tournament theory predictions, the probability of winning a promotion tournament for CEO positions is less affected by workers' effort when there are more competitors. Therefore, the wage difference between CEO positions and lower positions must be large enough to increase effort. However, Bognanno does not consider the effect of job training along with the effect of education in his analysis to see whether taking training courses affects the job mobility of CEOs.

With respect to the effects of training, Almeida and Carneiro (2009) also estimate the rate of return to firm investments in job training by using a census of large manufacturing firms in

[11] They estimate probit and fixed effect models by using the National Longitudinal Survey of Youth (NLSY). The data consist of 3,355 men and women for private sectors in 1989 and 1990.

[12] The study uses 73,062 observations based on 25,000 managers and executives (four executive job levels) from 600 US corporations during 8 years, 1981-1988. The dependent variables are ln(CEO pay), ln(VP pay), ln(CEO pay-VP pay), and ln(CEO prize). The independent variables are the number of executive board members and its squared term, CEO age and its squared term, years at CEO and its squared, mean of VP age and its squared term, mean years of education and its squared term.

Portugal between 1995 and 1999. The return to job training is measured by estimating the change in marginal product of employees in the production function. They find that investing in job training has a high return which is comparable with the return on investments in schooling. However, the relationship between training and education is not identified in their analysis to see how the rate of return on job training would differ among individuals with different levels of schooling.

In terms of research that specifically focuses on the effect of job training on promotion, Melero (2010) suggests that the career path of women is affected by training activities. However, this is not the case for men.[13] Instead, the career progress of men is impacted by other factors such as overtime work. Melero (2010) concentrates only on the impacts of job-related training; he does not take individual educational attainment into account. Conversely, DeVaro and Waldman (2012) investigate the effects of education on promotion and wage growth, but do not assess the impacts of job training. Their results suggest that while higher education increases the probability of promotion, the wage increases associated with promotion are smaller for more educated individuals.[14] Cassidy, DeVaro, and Kauhanen (2012) find comparable results with German data.[15] Moreover, they show that the results are stronger for first promotions as opposed

[13] The data for this study come from 12 waves of the British Household Panel Survey (BHPS) over 1991-2002, and it includes 37,140 observations from 7894 individuals. The dependent variables are probability of promotion and wage growth. The independent variables include gender race, education, training, tenure, experience, firm size, region, the local unemployment rate, union status, occupation, and industry. The study considers different unobserved heterogeneity in the estimation of fixed effects logit for probability of promotion. The independent variables in this estimation include job-related training, year-specific dummies, overtime work dummy; a set of individual characteristics such as education, firm seniority, job experience; a set of firm characteristics such as size, industry, region, and degree of unionization; and job characteristics such as bonus payments, part-time status, type of contract, and managerial responsibilities.

[14] The data used in this study are a complete set of annual personnel records during the 1969-1988 for all white male managerial employees of a medium-sized US firm in the financial services industry. DeVaro and Waldman (2012) theoretically and empirically show that the high ability signal associated with a promotion is stronger for low-educated workers than for higher-educated ones. Therefore, the wage increase upon promotion must be high enough to stop a bidding war in the market over the lower educated workers, and the firm's incentive to distort the promotion decision is consequently higher for lower educated workers.

[15] Cassidy et al. (2012) use the annual German Socio-Economic Panel (GSOEP) survey of German households over 1984-2009 for 99,748 observations. They estimate OLS and multinomial probit models for which the dependent variables are wage changes and probability of promotions within and across the firms and the independent variables

to subsequent promotions, which is true for both across and within firm promotions. Addison et al (2014) also investigate the roles of gender, education, and job sector on probability of promotion and wage changes. They estimate a fixed-effects model using data from the NLSY79 and find that the private-sector female employees with a high school degree are significantly less likely to be promoted in early career than their more educated counterparts. Their results indicate that wage growth associated with promotion is higher for men than for women. However, these studies do not consider the role of job-related training in examining the determinants of promotions.

In total, the literature suggests that controlling for all else, a highly educated worker is more likely to be promoted. However, the relative effects of education and job training have not been identified. There is a dearth of research with respect to the following questions that are investigated in this study: (1) how does the probability of promotion change if a less-educated worker receives job training?; (2) does training increase the likelihood of promotion for a low-educated employee more than for a higher educated one?; (3) What are the differences in these effects across different job levels?; and (4) how do education and job training affect wage increase associated with promotion in different occupation levels?

The relative impact of education and job related training in promotion analysis is important for policy makers to decide how many resources should be allocated to higher education or job training programs to increase productivity. In this study, I investigate the relative effect of education and job training, which is identified by interaction terms between the two variables, on promotions in different occupation levels and on the corresponding wage increase.

1.3 Data and Variables

I employ individual specific panel data from the German Socio-Economic Panel (GSOEP). The GSOEP is a longitudinal data set that has been conducted every year in the Federal Republic of Germany from 1984 to 2010 and eastern German länder (provinces) from

include worker performance, age, age squared, experience, experience squared, job tenure at the firm, job tenure at the firm squared, industry codes, occupation codes, occupation group, and hierarchical levels.

1990 to 2010. This survey includes information about household composition, occupations, employment, earnings, health, and a variety of other questions related to individual attitudes and opinion.

The analysis in this study focuses on individuals who report being employed and working full-time. The sample includes only workers in the age of 20 to 65 who have been in full-time positions at least for three consecutive years to fully capture the possibilities of occupation level changes. I use 54,196 observations for 12,373 individuals from West Germany in 15 years: 1988-90, 1992-94, 1999-2001, 2003-05, and 2007-09. These fifteen years are selected for the estimations since only these years have information on training courses taken by employees.

To define training variables, I follow Pischke (2001), Büchel (2002), Georgellis and Lange (2007), and Burgard (2012). I specifically use a series of questions on job related training. The first question is:

There are different opportunities available if one wants to educate himself further. Think back on the last three years. Have you in that time period read scientific or professional publications, attended professional conventions or congresses, or participated in professionally oriented courses?

Workers who reported taking training courses in the past three years were asked more questions about the courses: start year of training course, purpose of taking course, information about course certification and organizer, and source of financial support for the course. All these questions have been asked in the survey years of 1989, 1993, 2000, 2004, and 2008. The training courses are reported as job related training which may have used for adjusting to new demands in the current job, introducing to a new job, or creating more qualifications for a professional advancement. I consider the start year of training courses reported at these survey years and define the training dummy variable for fifteen years based on the start year of training. Training dummy equals 1 if individuals have reported that the start year of their training course was last year.

I also use individuals' information from the previous year of the sample years to include lagged variables for previous occupation level and to define the promotion variable based on job

mobility from a lower to a higher level job in two consecutive years. The GSOEP has a question that identifies the current job position of workers. Possible responses to this question are: blue-collar, white collar, civil servant, trainee, and self-employed. I exclude self-employed workers and the ones who responded affirmatively to the trainee category, as my focus is on full time employees who have finished their training within the past three years and are currently working. Therefore, my sample only includes blue-collar, white-collar, and civil servants.[16] There are four job levels in the civil servant category which can be used to define similar levels in the blue and white collar occupations. These four levels are defined in a hierarchical occupation ladder: (1) low-level job = unskilled or semiskilled work; (2) middle-level job = skilled work; (3) high level job = highly skilled work; and (4) executive level job = executive work.[17]

After defining the hierarchical occupation level variable, I employed the correction procedure used by Cassidy et al. (2012) in order to reduce the possibility of spurious level changes. In this correction procedure, if a worker changes job level between two consecutive years and returns to the initial level in the third year, the transition is considered as a mis-measured change. Therefore, I change the job level of second period to the level of first and third periods because it is unlikely that a worker who gets promoted to a higher level job will be demoted to the initial level in the year after promotion.[18] After this correction, about 6.6% of the sample has an increase in their job level, which is counted as a promotion rate (this percentage was 11% before the correction).[19] Thus, all changes from a lower to a higher level job are

[16] Blue-collar workers are people who perform manual labor and build or maintain something physically. In the GSOEP, these workers are categorized as unskilled workers, semiskilled workers, skilled workers, foremen, and master craftsmen. On the contrary, a white-collar worker usually works in an office sitting at a desk. White collar workers include industry and works foremen in non-tenured employment, employees with simple duties (e.g., salesperson, clerk), employees with qualified duties (e.g., bookkeeper, technical drawer), employees with highly qualified duties (e.g., scientific, worker, attorney, or head of department), and employees with managerial duties (e.g., managing director, head of a large firm or concern). The third type of worker is civil servant who performs a service oriented job in the public sector employed for a government department or agency. This type of work is categorised to lower, middle, upper, and executive level jobs in the GSOEP.

[17] See Appendix A for details on the hierarchical occupation level variable defined in the GSOEP data.

[18] I perform this correction only for three consecutive years not for all the periods.

[19] This procedure reduced the promotion rate from 10.7% to 5.7% in Cassidy et al. (2012).

defined as a promotion. For instance, a change from level 1 to 2 or from level 1 to 3, are both considered as promotions. However, I distinguish three different levels of promotions in Table 1.1: (1) promotion level 1, in which job level increases from a low to a middle level job; (2) promotion level 2, in which job level increases from a low or middle to a high level job; and (3) promotion level 3 where the job level increases from any lower levels to an executive level.

In terms of other key variables, individual specific net annual income is deflated to 2009 Euros.[20] There are also 114 occupational codes and 63 industry codes in the sample which are categorized to 10 occupation and industry one-digit codes. The firm size is categorized to "20 and less", "Above 20 up to 200", "Above 200 up to 2000", and "Above 2000".[21] Therefore, 10 occupation, 10 industry, and 4 firm-size dummy variables are included in the model. I also incorporate job tenure and job experience variables. Job tenure is the number of years a worker spends in her current job position and job experience reflects the total length of full-time employment in the respondent's career up to the point of the interview.[22] I exclude observations with missing data (which occurs in occupation, industry, firm size, job tenure, or job experience). I also exclude executive level workers, since these employees have no chance of further promotion, although 15% of them have received job training which might lead to an increase in their productivity but not a promotion.

I also define a set of dummy variables for education categories based on the number of education years. Education system in Germany is different than the North American system. The 3 to 6 year-old German children stay in kindergarten which is optional. The compulsory primary school starts at the age of 6 and it usually lasts for four years. At the age of 10, all students start a

---

[20] The income variable is calculated hourly by using the monthly "Current Net Labor Income in Euro" variable. The variable is deflated in 2009 Euros by using the Consumer Price Index.

[21] The variable of "Core Category Size of the Company" has been used.

[22] Job tenure is generated from the respondent's start date of the current position with the current firm from "Length of Time With Firm". Job experience is extracted from "Working Experience Full-Time Employment" in data file. I also construct another job experience variable based on the years of education and age (age minus years of education minus 6) to compare the estimation results on the two variables. The results do not change by using this experience variable.

two-year orientation stage in which they decide how to continue their education. From this stage, there are three different types of high schools (Secondary Level I). Each type of Secondary Level I is classified based on the future occupational careers, starts at the age of 12, and lasts for three or four years. Secondary Level II and other certificates start at the age of 15 or 16 and their duration varies based on the programs. At the age of 18 or 19, higher technical schools, colleges, or universities are provided based on the educational path that everyone has chosen (see appendix B for more explanations). By using the structure of German education system, I define four education levels: less than high school (LHS), high school (HS), technical, college, or university degree (TCU), and graduate degree (GRAD). Appendix C provides more details about how these four variables are defined.

Finally, as noted by Pischke (2001), the GSOEP is not a representative sample due to oversamples of the non-German population. Therefore, in order to generate unbiased estimates, I weight the data by using averaged individual-longitudinal weights.[23] The selection criteria results in a total of 12,373 individuals and 54,196 observations over 15 years 1988, 1989, 1990, 1992, 1993, 1994, 1999, 2000, 2001, 2003, 2004, 2005, 2007, 2008, and 2009. Table 1.2 presents the frequency of individuals in the sample.

1.4 Descriptive Analysis

Table 1.3 presents the number of trained and promoted individuals in each year, and weighted descriptive statistics of all variables used in this study (except occupation and industry dummy variables) are presented in Table 1.4. Thirteen percent of the sample holds less than a high school degree (LHS), 55.2% have a high school degree (HS), 24.2% hold a technical, college or university degree (TCU), and 7.5% possess a graduate degree (GRAD). About 31% of

[23] Using the sampling weights, weighted estimates yields unbiased and consistent parameters but with larger standard errors (Winship and Radbill 1994). Although there is a trade-off between weighted and unweight estimates in terms of biasedness and efficiency, I weight my sample by using the individual weights as an approximation. The alternative weights such as product of longitudinal weights and individual weights yielded similar results. The individual weights compensate for unequal probabilities of selection and sample attrition and approximately obtain population-based statistics. I have calculated the final weights as relative to the mean individual weight for every year in the sample.

the sample is women. The total average promotion rate is 7.1% for both women and men regardless of different promotion levels. However, considering different promotion levels, the promotion rate is higher for women than for men in the lowest promotion level (4.1% versus 3.1%). In the other two higher promotion levels, it is higher for men than for women (2.9% versus 2.3% in promotion level 2 and 1.2% versus 0.5% in promotion level 3).

The average training rate is relatively higher for women than for men (11.2% versus 10.1%), while the average hourly income for women is lower than for men by €3.21 per hour. Further, female workers are disproportionately represented in low and middle level jobs (32% of women versus 22% of men have low level jobs), while the percentage of male workers in high level jobs is more than female workers (about 28% of men versus 16% of women are in high level occupations).

1.4.1 Education, Age, and Promotion

In order to investigate the relationship between education and promotion, I calculate the average promotion rates for each education group across three promotion levels. As explained in Table 1.1, promotion level 1 is defined as a job change from a low to middle level job, promotion level 2 is a job change from a low or middle to a high level job, and promotion level 3 is a job change from any lower levels to an executive level job.

Table 1.5 shows the distribution of different education groups at time t-1. Less than high school degree holders are mostly working in low-level jobs (65%), high school degree holders are in middle-level jobs (61%), technical, college, and university degree holders are in middle and high-level jobs (50% and 40%), and most graduate degree holders are in high level jobs (81%). That is, lower educated employees are working in lower level jobs and more educated employees have occupied higher level jobs.

Column 1 of Table 1.6 reports the corresponding promotion rates for different education groups across promotion levels. Based on this table, the average total promotion rates for high school and graduate degree holders are higher than the other two education categories (7.4% and 8.3% respectively). However, I compare promotion rates for schooling levels across different promotion levels. Columns 3 and 4 of Table 1.6 report that average promotion rate increases

with schooling. More educated workers are more likely to get promoted in promotions to high and executive level jobs. For instance, the highest promotion rates in promotion levels 2 and 3 belong to graduate degree holders (The rates are 23.1% and 3.6% for graduate degree holders versus 2.8% and 0.8% for high school degree holders in these two promotion levels respectively).

Table 1.7 provides the average promotion rates across different age groups and promotion levels, and Table 1.8 reports the distribution of age groups across different job levels. As the first column of Table 1.7 shows, the highest average promotion rate belongs to the youngest employees (7.8%), and the promotion rate decreases for older employees. However, by considering different promotion levels in columns 2-4, we find that the youngest age group (20-29 years old) has the highest average promotion rate from low to middle level jobs (5.5%). The older age groups 30-39 and 40-49 have the highest average promotion rates to high level jobs (3.2% and 3.1% respectively), and they have a high percentage in high level jobs in Table 1.8 (31.5%). Finally, the promotion rates to executive level jobs are almost the same for employees with the age of 30-65 years old (1.1% and 1.2%).

1.4.2 Training and Promotion

Table 1.9 reports the calculated promotion rates for trained and untrained workers across education and promotion levels. By comparing promotion rates of trained and untrained employees in each promotion level, training seems to increase promotion rates for all education levels (except for technical, college or university degree holders which have the rates of 5.9% versus 7% for trained and untrained employees respectively). More specifically, training seems to tremendously affect promotion rates of all education groups in promotion from low to middle level jobs (column of promotion level 1). The promotion rates among ‘less-than-high-school’, ‘high-school’, ‘technical, college, and university degree’, and ‘graduate degree’ holders in promotion from low to middle level jobs for trained versus untrained employees are respectively 29.5% versus 5.8%, 29.3% versus 16%, 40.4% versus 20.1%, and 55.9% versus 16.1%. That is, job mobility from low to middle level jobs seems to be considerably impacted by training among all educational categories. However, training does not significantly change the promotion rates of

employees in higher promotion levels. For example, the promotion rates for trained versus untrained high school holders are 4.9% versus 2.6% in promotion level 2 and 0.9% versus 0.8% in promotion levels 3.

In addition, the training effect seems to have a pattern that is consistently associated with higher promotion rates for more educated employees than for lower educated ones at promotion level I. The increasing promotion rates across education levels state that job training has a complement role for education in increasing the chance of job promotion to middle level jobs. To see this comparison, we should consider the differences between promotion rates of trained and untrained graduate degree holders. For instance, the differences for graduate degree holders in promotion level 1 are 55.9% and 16.1% for trained and untrained workers respectively. These differences are smaller for lower educated employees at promotion level 1 (29.5% versus 5.8% for less-than-high-school degree holders).

1.4.3 Education and Wage Increase upon Promotion

Table 1.10 presents the wage increase percentage across education and promotion levels. The first column of the table shows that the highest wage increase percentage belongs to less-than-high-school degree holders among workers with no promotion. The other three education levels have lower promotion rates. The second column suggests that as education increases, the wage increase associated with promotion increases too (except for high school degree holders who have a promotion rate less than the one for less-than-high-school holders). Comparing the percentages vertically within each promotion level, the results show mixed results across education categories. In promotion to middle level jobs, 'technical, college, and university degree' holders have the highest wage growth, greater than high school and graduate degree holders.

However, in promotion to high and executive level jobs, excluding graduate degree holders, one can say that more educated employees have less wage growth. In these two high promotion levels, less-than-high-school degree holders have higher wage growth (3.2% and 9.2%) than high school (2.6% and 2.4%) and 'technical, college, and university degree' holders

(2% and 0.7%). Excluding graduate degree holders, this observation is consistent with the prediction of DeVaro and Waldman (2012) who suggest that the wage increase upon promotion must be high enough to stop the bidding war over the lower educated workers since promotion signals their high ability stronger than higher educated workers. However, the associated wage increase in this study does not show an increasing pattern with schooling across all promotion levels. The relationship between wage growth and education may be more reliable when I control for confounding factors in the empirical estimations.

1.5 Empirical Models and Results

1.5.1 Probability of Promotion

Following Melero (2010) and Addison (2014), the relationship between education, job-related training, and the employee's output at time *t-1* is as follows.

$$Y_{it-1} = \alpha_0 + \alpha_1 HS_{it-1} + \alpha_2 TCU_{it-1} + \alpha_3 GRAD_{it-1} + \alpha_4 Tra_{it-1} + \alpha_5 Fem_i + \alpha_6 (Tra_{it-1} \times HS_{it-1}) + \alpha_7 (Tra_{it-1} \times TCU_{it-1}) + \alpha_8 (Tra_{it-1} \times GRAD_{it-1}) + \alpha_9 (Tra_{it-1} \times Fem_i) + T_{t-1}\eta + X_{it-1}\varphi + \epsilon_{it-1} \quad (1)$$

$$\begin{cases} P_{it} = 1 & if \quad Y_{it-1} \geq Y_{it-1}^P \\ P_{it} = 0 & if \quad Y_{it-1} < Y_{it-1}^P \end{cases} \quad (2)$$

$$Prob(P_{it} = 1) = Prob(Y_{it-1} \geq Y_{it-1}^P) \quad (3)$$

The variable Y_{it-1} is the employee *i*'s actual output at time *t-1*. In the right hand side of equation (1), HS_{it-1}, TCU_{it-1}, and $GRAD_{it-1}$ are dummy variables specifying whether employee *i*'s education is 'high school', 'technical, college, or university', or 'graduate degree' at time *t-1* (The reference education group is less-than-high-school degree). The variable Tra_{it-1} indicates job-related training started at time *t-1* and either finished last year or at time *t*, and Fem_i indicates if the gender of employee *i* is female. The interaction terms between training, education and female dummies are also added to the model. T_{t-1} is a vector of year-specific dummies, and X_{it-1} is a set of control variables including individual, job, and firm characteristics such as age,

age squared, hourly income, state of residence dummies, job tenure and its squared term, job experience and its squared term, occupation dummies, job type dummies (blue collar, white collar, or civil servant), job level dummies (low, middle, high, or executive level), industry dummies, and firm size dummies at time *t-1*. The variations in Y_{it-1}, which are not explained by observable characteristics, are included in a transitory shock $\epsilon_{\mathrm{it-1}}$ which is a stochastic disturbance and the unobserved factors that determine the employee *i*'s actual output at time t-1.

Equation (2) shows the probability that the employee *i* is promoted to a higher level job at time *t* depends on the employee *i*'s output at time *t-1* (Y_{it-1}) and a latent promotion threshold (Y_{it-1}^{P}). In fact, Y_{it-1}^{P} denotes the minimum output required at time *t-1* for promotion at time *t* and it is not observable to the econometrician. Therefore, the following model is considered for probability of promotion where P_{it} indicates a dummy variable that represents promotion at time *t*. If individual *i* receives promotion at time *t*, P_{it} takes value 1 and 0 otherwise. Equation (3) indicates that the employee gets promoted at time *t* if an employee's actual output exceeds the promotion threshold at time *t-1*. If the employee's output is less than Y_{it-1}^{P}, the employee would be retained at the previous job level. P_{it-1} is the previous promotion dummy variable.

$$Prob(P_{it}=1) = f(\beta_0 + \beta_1 HS_{it-1} + \beta_2 TCU_{it-1} + \beta_3 GRAD_{it-1} + \beta_4 Tra_{it-1} + \beta_5 Fem_i + \beta_6(Tra_{it-1} \times HS_{it-1}) + \beta_7(Tra_{it-1} \times TCU_{it-1}) + \beta_8(Tra_{it-1} \times GRAD_{it-1}) + \beta_9(Tra_{it-1} \times Fem_i) + \beta_9 P_{it-1} + T_{t-1}\sigma + X_{it-1}\gamma) \quad (4)$$

The specification in equation (4) allows me to evaluate separately the effects of education and job training on the probability of promotion. To observe the relative effects of education and job training, the interaction terms between training and education dummies are also included in the model specification.

Interpretation of interaction terms in linear models is straightforward. However, the intuition from linear models does not apply to nonlinear models. Ai and Norton (2003) suggest a method to estimate the interaction effect in general nonlinear models. As Karaca-Mandic et al. (2012), following Norton (2003) explain, the marginal effects of explanatory variables including the interaction terms in a nonlinear model may change over its entire range. When interaction terms are either two continuous variables or one continuous variable and one binary variable,

graphical presentation of the model will be very helpful. Since the interaction terms are two binary variables in this study, I do not use the graphical presentations of the interaction terms because they are not informative. I only calculate the estimated marginal effects by using the method proposed by Karaca-Mandic et al (2012) and present them in a table.

First, assuming there is no unobserved heterogeneity to the econometrician, I use a logistic regression to estimate the marginal effects of the observed variables on the probability of promotion in equation (4). However, we need to control for the unobserved heterogeneity included in ε_{it-1} affecting the probability of promotion because it is not obvious whether the higher educated or trained employees are more likely to receive promotion as a return to their skill acquisitions or because they are more talented or have some unobserved skills for more advanced job positions.

From an omitted variables or unobserved heterogeneity perspective, it is appropriate to treat the unobserved factors as random draws from the population once we have a large number of random draws from the cross section (Wooldridge 2010, p. 252). We should initially focus on the correlation between the unobserved effects and covariates in our model to decide whether we should use random-effects or fixed-effects model based on this correlation.

A fixed-effects model assumes that the error term including the unobserved heterogeneity is correlated with education and training dummy variables. However, the unobserved factors affecting promotion is assumed uncorrelated with covariates in a random-effects model. As Gibbons and Waldman (1999) explain, the error term includes fixed and time-varying unobserved heterogeneity. The fixed term includes the innate ability that people are born with and does not change by time, but the time-varying factors include personality, motivation for promotion, and beliefs about innate ability driving promotions that might be uncorrelated with covariates.

Based on their argument, probability of promotion depends on the expected ability driving promotion which is formed by the new information that changes current beliefs about the ability, and it is uncorrelated with both education and training covariates. Furthermore, when the variables of interest are time-invariant, the random-effect model is preferred (Wooldridge (2010)

P. 286). In this model, I am not able to assess the effects of education, training, and their interaction terms in a fixed-effects estimation because they do not change over time and they are either eliminated or estimated imprecisely.

Grund and Martin (2012) rely on the random-effects estimates since most of their variables of interest are time-invariant in determination of further training. Melero (2010) presents both random-effects and fixed-effects results yet most time-invariant covariates are statistically insignificant in the fixed-effect specification. I also estimate both random-effects and fixed-effects specifications against each other. Similar to Melero's findings, most of the fixed-effects estimates are insignificant in my study (Appendix D Table 1.21).

To evaluate the relationship between education, training, and promotions, I use 54,196 observations for 12,373 individuals from West Germany in 15 years: 1988-90, 1992-94, 1999-2001, 2003-05, and 2007-09. I investigate whether the effects of education and training vary over different job levels. Since the level of education and type of job training differ for each job level, their relative impacts on mobility between job levels would also be expected to vary. To analyze the relative effects separately for different job levels, I define four promotion dummies and use them as dependent variables in equation (4): promotion to all job levels, promotion level 1, promotion level 2, and promotion level 3. As specified in Table 1.1, promotion level 1 is defined as a change from a low to a middle-level job; promotion level 2 is a change from a low or middle-level job to a high-level job; and promotion level 3 is a change from any lower level job to an executive level job.

1.5.2 Results with respect to Probability of Promotion

Tables 1.12-1.15 contain the marginal effects of regular logit and random-effects (RE) logit models for dependent variables: total promotion and promotion to three levels - middle, high, and executive level jobs. The first three columns of Tables 1.12-1.15 contain logit marginal effects. Column 1 shows the impact of education and training on the probability of promotion, controlling for individual and job characteristics and year-fixed effects. Column 2 adds the effects of state of residence, and column 3 adds the interaction terms between education and training dummies as well as the interaction term between female and training dummies.

Columns 4 and 5 of Tables 1.12-1.15 present the marginal effects from RE-logit models without and with the interaction terms respectively. The last two columns of Tables 1.12-1.15 report the overall effects of interaction terms extracted from column 3 (regular logit) and column 5 (RE-logit) respectively. The overall effects in columns 6 and 7 are calculated by summing the marginal effects of training or female dummies with the marginal effects of interaction terms in logit and RE-logit models. For example, to calculate the overall effect of training on high school degree holders, holding the other variables constant, the expected value of probability of promotion for untrained high school holders is deducted from the expected value of probability of promotion for trained high school holders.[24] The standard errors of the models are calculated by the delta method proposed by Greene (2008).[25]

Table 1.12 presents the estimations for total promotion as a dependent variable. The marginal effects of education groups are all positive, statistically significant, and increasing with the level of education across all columns. That is, fixing other variables, the probability of total promotion increases with education. For instance, based on the RE-logit estimates, the probability of promotions for high-school; technical, college, and university degree; and graduate degree holders are respectively 4.2%, 6.3%, and 10.1% higher than the one for less-than-high-school holders, and these results are consistent when I add the interaction terms in column 5. The marginal effects of education dummies are almost the same in logit and random effect logit models.

Job related training also increases the probability of promotion by 4.2% in RE-logit estimations in column 5. In columns 6 and 7 of Table 1.12, the overall effects of training from both logit and RE-logit models suggest that training increases the probability of promotion for high school degree holders by 2.1% and 1.4% based on logit and RE-logit estimations respectively. The effects of training on technical, college, or university degree and graduate degree holders are very small and insignificant. Therefore, the results of Table 1.12 suggest that

[24] As the following formula shows, the marginal effect on training ($\beta_{Training}$) should be added to the marginal effect of interactions between high school and training dummies ($\beta_{HS*Training}$) to obtain the overall effect of training.
$\left(\bar{X}\beta + \beta_{HS} + \beta_{Training} + \beta_{HS*Training}\right) - \left(\bar{X}\beta + \beta_{HS}\right) = \beta_{Training} + \beta_{HS*Training}$

[25] In delta method, the standard errors of marginal effects are calculated at the means of the explanatory variables.

job related training increases the chance of promotion for low educated employees. The estimates in Table 1.12 also suggest that women are less likely to receive promotion than men as all marginal effects of female dummies in both types of models are negative and statistically significant (the likelihood of promotion for women is 2.5% and 2.7% less than for men based on logit and RE-logit estimates respectively). The overall effects of training on gender suggest that training increases the probability of promotion for women more than for men (6.6% in logit and 4.4% in RE-logit).

In Tables 1.13, 1.14, and 1.15, I assess the marginal effects for each promotion level separately. The sample in Table 1.13 includes observations only in low level jobs (14,220); the sample in Table 1.14 includes the observations in low or middle level jobs (40,605); and Table 1.15 includes the observation in middle or high level jobs (39,976). These three tables present the marginal effects in probability of promotion respectively to middle, high, and executive level jobs by using both simple logit and random effects logit models (RE-logit). Columns (1) to (5) present the marginal effects and the calculated overall effects are included in columns (6) and (7) as Table 1.12.

The estimates in Table 1.13 show that by fixing other variables, the effects of education on the likelihood of promotion to middle level jobs have mixed results. 'Technical, college, and university degree' holders have the highest chance of this promotion, while graduate holders have a low chance compared to the other two education groups. Training affects promotion to middle level job by about 10.7% in the RE-logit model.

Furthermore, the overall effects of training on different education categories prove a complement role for training in promotion to middle level jobs when we compare the overall effects calculated in columns 6 and 7. That is, the effects of job related training are greater for graduate degree holders than less educated employees in promotion to middle level occupations (it is 21.7% for graduate degree; 5.2% for technical, college, and university degree; and 3.1% for high-school degree holders in column 7). Regarding women and men comparison, men are more likely to receive promotion to middle level jobs than women since all marginal effects on female dummies are negative and statistically significant. However, training increases the likelihood of

promotion for women more than for men in promotion to middle level jobs by 13.3% and 10.1% based on logit and RE-logit estimates respectively.

In Table 1.14, probability of promotion to high level jobs increases with education, but training does not have a significant effect on this level of promotion. The results from comparing the overall effects of training in RE-logit models do not show a complement role for training in this level of promotion since the effects of training on education degrees are not statistically significant in both regular logit and RE-logit models. Probability of promotion for men is again greater than for women by 1.1% in RE-logit estimates, but training does not show a significant difference on the likelihood of promotion of women in this level of promotion.

Based on the results in Table 1.15, the probability of promotion to executive jobs also increases with education, and training does not have a significant effect on this likelihood. The overall effects of training on all education degrees are small and insignificant. The results also show that the likelihood of promotion for men is slightly greater than the one for women, but there is no statistically significant difference in the effects of training on this likelihood.

These results are robust to two sensitivity analyses presented in appendix D. In Table 1.22, I include a control variable in the random-effects specifications to indicate whether the employee received a promotion in the past. Adding this control variable to the random-effect specifications may reduce the potential bias caused by the unobserved heterogeneity affecting the likelihood of promotion in the past prior to the current promotion. The random-effect marginal effects and levels of their statistical significance are all almost the same as the results in Tables 1.12, 1.13, 1.14, and 1.15. In Table 1.23, I report the marginal effects from the mixed-effect logistic regressions which contain both fixed and random effects. The results are almost the same as the random-effects results in Tables 1.13, 1.14, and 1.15.

1.5.3 Wage Increase Associated with Promotion

In this section, I investigate how the wage increase due to promotion is affected by a worker's education level and job training. In order to accomplish this, I consider the following specifications.

$$lnw_{it} - lnw_{it-1} = \delta_0 + \delta_1 HS_{it-1} + \delta_2 TCU_{it-1} + \delta_3 GRAD_{it-1} + \delta_4 Tra_{it-1} + \delta_5 Fem_i + \delta_6(Tra_{it-1} \times HS_{it-1}) + \delta_7(Tra_{it-1} \times TCU_{it-1}) + \delta_8(Tra_{it-1} \times GRAD_{it-1}) + \delta_9(Tra_{it-1} \times Fem_i) + \delta_{10} P_{it-1} + T_{t-1}\varphi + X_{it-1}\lambda + \epsilon_{it-1} \quad if \quad P_{it} = 1 \tag{5}$$

$$lnw_{it} - lnw_{it-1} = \rho_0 + \rho_1 HS_{it-1} + \rho_2 TCU_{it-1} + \rho_3 GRAD_{it-1} + \rho_4 Tra_{it-1} + \rho_5 Fem_i + \rho_6(Tra_{it-1} \times HS_{it-1}) + \rho_7(Tra_{it-1} \times TCU_{it-1}) + \rho_8(Tra_{it-1} \times GRAD_{it-1}) + \rho_9(Tra_{it-1} \times Fem_i) + \rho_{10} P_{it-1} + T_{t-1}\alpha + X_{it-1}\theta + \nu_{it-1} \quad if \quad P_{it} = 0 \tag{6}$$

In regression (5), X_{it-1} include all controls in the promotion probability regressions except the occupation dummies. Instead of occupation dummies, I include job transition dummies in regression (5). These dummies indicate transitions from any occupations at time *t-1* to other occupations at time *t*. Since both occupations before and after promotion affect the wage change, it is important to include the job transition dummies in our model. The error term ϵ_{it-1} may include a change in beliefs which is a random unobserved factor. In regression (6), X_{it-1} includes the occupation dummies since there are no job transitions when promotion dummy equals zero. The error term ν_{it-1} includes the unobserved heterogeneity affecting wage changes for those who did not get promoted.

Since a yearly wage increase is usually expected for all job levels even in the absence of a promotion, the wage increase due to promotion will be calculated by a difference-in-differences approach as DeVaro and Waldman (2012) proposes. The wage increase due to promotion is the difference between the wage increase a worker receives after promotion (equation (5)) relative to what the worker would have received in the absence of a promotion (equation (6)). More specifically, I will calculate $(\delta_1 - \rho_1), (\delta_2 - \rho_2), (\delta_3 - \rho_3),$ and $(\delta_4 - \rho_4)$ which are given by (5) minus (6) for four cases of promotion: total promotions, promotion from low to middle level jobs, promotion from low or middle to high level jobs, and promotion from middle or high to executive level jobs.[26] I first estimate equations (5) and (6) by OLS. Then I

[26] Another way of doing this test is the following three-step method. First, one can estimate regression (6) using the observations for which promotion dummy equals zero. Second, by using the estimated coefficients from the first step and the observations for which the promotion dummy equals 1, predict a no-promotion wage increase for

estimate the random-effect estimations for all promotion levels. The RE estimates for changes in log-wage are reported in appendix D, sensibility analysis in Table 1.24, which shows the RE and OLS estimates are almost the same.

1.5.4 Results with respect to Wage Increase Associated with Promotion

The OLS estimation results of equations (5) and (6) for total promotion, promotion to middle level jobs, promotion to high level jobs, and promotion to executive level jobs are respectively reported in Tables 1.16, 1.17, 1.18, and 1.19. The samples in columns (1) and (3) of these tables include only promoted employees and the samples in columns (2) and (4) include non-promoted employees in all job levels. In specifications (3) and (4), the training interaction terms are added to the models (1) and (2) respectively. The last two columns present the overall effects of training based on columns (3) and (4). Then, by using the calculated overall effects of training, I calculate differences in coefficients and present them at the bottom side of the tables. These differences present the effects of variables on the wage increase associated with promotion.

Table 1.16 suggests that the wage increase is higher for more educated employees whether they are promoted or not. However, training affects the wage increase positively only for people who did not receive promotions, and training effect is statistically insignificant on the wage increase for promoted employees. By comparing the differences in marginal effects at the bottom side of Table 1.16, one can see that the signs of effects for all levels of education are positive and they are higher for more educated employees (with respect to less-than-high-school degree holders). That is, as education increases, the wage increase due to promotion increases as well. However, only the graduate variable is statistically significant at the 5% level. This result does not support what DeVaro and Waldman (2012) find in their paper. They find negative signs for coefficients of MA and PhD graduates (with respect to BA degree holders) suggesting that wage increase due to promotion decreases with education.

---

promoted people. Third, subtract the predicted wage increase in the second step from the actual wage change by using the observations for which promotion occurs and obtain the wage increase upon promotion in regression (5). Coefficients of the third step of estimation provide us with the effects of education and job related training on wage increase upon promotion.

The bottom part of Table 1.16 also shows that receiving any job related training does not significantly impact the wage increase associated with promotion as none of the differences in interaction terms of training and education is statistically significant (except the training and graduate degree which is very small close to zero). It also shows that the wage increase due to promotion (on general) for women is not statistically different than the one for men, and training also does not have a statistically significant effect on this gender difference.

By looking at the bottom part of Table 1.17, one can see that in a low level promotion which is a change from low to middle level jobs, more educated employees have, on average, a higher wage increase due to promotion than less educated employees, although none of the effects are statistically significant. This is consistent with the results of Table 1.16 that wage increase due to promotion increases with education level. Training raises the wage increase due to low level promotion for women more than for men, but the effect is insignificant. The negative and significant effect of interaction between training and graduate degree level suggests that the wage increase associated with promotion to middle level jobs is lower for graduate degree holders than the one for less than high school degree holders who receive training, but these effects are not statistically significant for all other education degrees.

The signs of training-education interaction terms are all negative but statistically insignificant for differences between the wage increase due to promotion to high and executive level jobs respectively presented in bottom parts of the tables 1.18 and 1.19. These findings suggest that training does not affect the wage increase corresponding to promotion to high and executive level jobs.

1.6 Conclusion

A number of studies evaluate the effects of education on promotion, and a few studies focus on the effects of job-related training on promotion. However, there is a relative paucity of econometric studies which investigate the relative impacts of educational attainment and job-related training on promotion and corresponding wage increase. Job training might benefit employees with higher levels of education if the workers have higher abilities to learn in the work place. In this case, job-related training complements the actual educational attainment. On

the other hand, training might be a substitute for higher educational attainment if employees with lower levels of schooling use job-related training programs to obtain the required skills they did not receive through formal education. Understanding the relative impacts of educational attainment and job related training on career success is important for government policy in order to evaluate whether governments should allocate more resources to higher education or job-related training.

This paper contributes to the literature by exploiting an individual level panel data from the German Socio Economic Panel (GSOEP). The information available from the GSOEP is particularly rich and given the availability of career related and socio-economic data across individuals over a number of years, it allows the researcher to assess the long-run effects of formal education and job related training. To the best of my knowledge, this study is the first paper that has employed individual level panel data over time to estimate the relative impacts of both education and job related training on promotions and associated wage increase.

This study finds that the probability of promotion increases with education, and this is consistent for promotion to middle, high, and executive levels separately. The results also show that the wage increase due to promotion increases with education. The results imply that education still plays an important role in the probability of promotion and the associated wage increase, which shows a higher productivity level. One policy implication these results suggest is that investing in higher education is an efficient decision in terms of increasing the chance of promotion and wage growth.

Moreover, the results show that recent job training increases the probability of promotion to middle level jobs, but it has no statistically significant effect on the probability of promotion to high or executive level jobs, and no statistically significant effect on wage increase at any promotion levels. With respect to the relative effect of job training across education categories, training increases the probability of promotion to middle level jobs for graduate degree holders more than for lower educated people. This effect is only statistically significant in promotion from low to middle level jobs but not for higher level promotions. The policy implication of

these results is that investing in the job-related training in low level jobs might increase productivity and return to education.

In promotion to middle level jobs, employees with graduate degree have 21.7%, 'technical, college, or university' degree holders have 5.2% and 'high school' degree holders have 3.1% more chance of promotion than less than high school degree holders. So in promotion to middle level jobs, training complements higher education effect on wage increase associated with promotion. However, there are no statistically significant differences between the effects of training on wage increase associated with promotions across different education levels in this promotion level.

Regarding differences across genders, the probability of promotion to all job levels is higher for men than for women. Also, men are, on average, more likely to receive a greater wage increase upon promotion than women. This result is consistent with finding in Busch & Holst (2009) that shows the pay is lower for women than for men in all occupations in Germany.[27] Further Addison et al (2014) use US data and find that the wage growth associated with promotion is higher for men than for women, and that more educated female employees are more likely to receive promotions than less educated ones. In this study, I find that training raises the probability of promotion to middle level jobs for women more than for men, but there is no statistically significant effect of training on promotion to high or executive level for women. Furthermore, there is no evidence of gender difference in training effects on corresponding wage increase upon promotion.

Taking gender discrimination into account, a model in Lazear & Rosen (1990) state that employers set higher promotion standards for their female workers with equal abilities to male workers and therefore women are less likely to receive promotion. Milgrom and Oster's (1987) also point that firms hide talented women in low-level jobs and pay them less on average, and as a result, female workers are promoted less often than male workers with equal ability and education. My findings are consistent with these studies that promotion to all job levels is less likely for women than for men, and that women in low level occupations need more training in

[27] They find that wages in typical women's jobs are lower than wages in typical men's jobs, and women are paid less than men in even typical women's jobs.

addition to their formal education to be promoted to a middle level job. In other words, training is more effective for women than men and reduces the promotion gap between two genders in promotion to middle level jobs.

In summary, this research suggests that training has a positive effect on probability of promotion to middle level jobs, and training complements higher education only at this promotion level. However, there is no evidence of training effect in higher level promotions: promotion to high or executive level jobs. The results also point to the importance of job-related training for women specifically in low level jobs in order to enhance their productivity and likelihood of corresponding promotion. Policy implications of the findings include, first, investing in higher education to increase the chance of promotion and associated wage increase in all job levels. Second, investing in job-related training programs specifically for women increases their chance of promotion and returns to education in low level jobs.

1.7 Tables

Table 1.1: Definition of three levels of promotions

Promotion type	Definition
Promotion level 0:	no promotion
Promotion level 1:	promotion from a low to a middle level job
Promotion level 2:	promotion from a low or middle to a high level job
Promotion level 3:	promotion from a low, middle, or high to an executive level job

Note: This table provides the definition of no promotion and three promotion levels.

Table 1.2: Frequency of individuals in the sample years

Frequency of individuals in each sample year	Total individuals	Total observations
1988	2,327	2,327
1989	2,019	4,038
1990	1,958	5,874
1992	1,109	4,436
1993	964	4,820
1994	1,607	9,642
1999	454	3,178
2000	419	3,352
2001	476	4,284
2003	238	2,380
2004	175	1,925
2005	283	3,396
2007	107	1,391
2008	57	798
2009	180	2,355
Total	**12,373**	**54,196**

Note: This table presents the number of individuals and total observations in each sample year

Table 1.3: Number of trained and promoted individuals in each year

Survey year	All observations	Number of individuals who received training in the last year	Number of promoted individuals	Number of promoted individuals who received training in the last year
1988	2,496	86	165	7
1989	2,401	296	148	26
1990	2,666	161	162	16
1992	3,843	138	303	18
1993	3,731	620	274	50
1994	3,528	265	253	20
1999	3,140	155	215	10
2000	3,367	781	200	53
2001	3,340	103	242	9
2003	4,638	205	310	11
2004	4,695	1,142	310	82
2005	4,461	223	333	15
2007	3,831	119	269	10
2008	4,169	866	287	56
2009	3,890	460	369	46
Total	**54,196**	**5,620**	**3,840**	**429**

Note: This table presents the number of trained and promoted individuals in each survey year. Column three shows the number of individuals who received training in the last year, column four presents the number of promoted individuals in the survey year, and the fifth column shows the number of promoted individuals who received training in the last year.

Table 1.4: Descriptive statistics of variables (at t-1)

	All Workers		Female		Male	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Female	0.306	0.461				
Age	40.86	10.38	39.45	10.95	41.49	10.06
Education						
LHS	0.130	0.337	0.157	0.364	0.119	0.323
HS	0.552	0.497	0.476	0.499	0.586	0.492
TCU	0.242	0.428	0.292	0.454	0.220	0.414
GRAD	0.075	0.263	0.076	0.265	0.075	0.263
Job Related						
Training	0.104	0.305	0.112	0.315	0.101	0.301
Hourly Income	11.49	4.697	9.264	3.310	12.47	4.881
Tenure	12.10	9.740	10.52	8.858	12.79	10.03
Experience	18.35	10.79	15.55	10.26	19.58	10.78
Job Type						
Blue_collar	0.405	0.491	0.219	0.413	0.487	0.500
White_collar	0.513	0.500	0.728	0.445	0.417	0.493
Civil Servant	0.082	0.275	0.053	0.224	0.095	0.293
Job Level						
Low Level	0.250	0.433	0.321	0.467	0.219	0.413
Middle Level	0.509	0.500	0.522	0.499	0.504	0.500
High Level	0.240	0.427	0.157	0.364	0.277	0.447
Firm Size						
0-20	0.154	0.361	0.177	0.382	0.143	0.351
21-200	0.281	0.449	0.288	0.453	0.278	0.448
201-2000	0.270	0.444	0.286	0.452	0.263	0.440
2000+	0.295	0.456	0.248	0.432	0.316	0.465
Promotion (at t)						
Total	0.071	0.257	0.069	0.254	0.072	0.259
Level 1	0.034	0.181	0.041	0.199	0.031	0.173
Level 2	0.027	0.163	0.023	0.149	0.029	0.168
Level 3	0.010	0.100	0.005	0.074	0.012	0.110
Observations	**54,196**		**17,020**		**37,176**	

Notes- 1) The above samples are obtained from pooling data for 12,373 individuals in 15 cycles of the GSOEP: 1988, 1989, 1990, 1992, 1993, 1994, 1999, 2000, 2001, 2003, 2004, 2005, 2007, 2008, and 2009. 2) LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

Table 1.5: Distribution of job levels across education levels (at time t-1 in %)

	Low-Level Job	Middle-Level Job	High-Level Job	Total observations
LHS	65	29	6	7,061 (100%)
HS	25	61	13	29,945 (100%)
TCU	10	50	40	13,118 (100%)
GRAD	2	17	81	4,071 (100%)

Notes- 1) This table only considers workers in low, middle and high-level jobs at time t-1. Executive level workers at time t-1 are excluded from the sample as they do not have the chance of promotion at time t. 2) LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

Table 1.6: Average promotion rates across education and promotion levels (at time t in %)

	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3
LHS	5.8	6.2	1.7	0.3
HS	7.4	16.6	2.8	0.8
TCU	6.8	21.6	5.9	1.1
GRAD	8.3	18.4	23.1	3.6

Notes- 1) Promotion level 1 is defined as a job change from low to middle level jobs, promotion level 2 is a job change from low or middle to high level jobs, and promotion level 3 is a job change from any lower levels to executive level jobs. 2) LHS: Less than high school, HS: High school degree, TCU: Technical, college, or university degree, GRAD: Graduate degree.

Table 1.7: Average promotion rates across age and promotion levels (at time t in %)

	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3	Total observations
Age 20-29	7.8	5.5	1.9	0.3	7,856
Age 30-39	7.7	3.5	3.2	1.1	15,494
Age 40-49	7.0	2.8	3.1	1.2	16,054
Age 50-65	6.3	2.9	2.2	1.2	14,791

Notes- Promotion level 1 is defined as a job level change from low-level to middle-level jobs, promotion level 2 is a job level change form a low-level or middle-level job to a high-level job, and promotion level 3 is a job level change from any lower levels to an executive level job.

Table 1.8: Distribution of age groups across job levels (at time t-1 in %)

	Age 20-29	Age 30-39	Age 40-49	Age 50-65	Total observations
Low level job	16.8	23.9	28.2	31.1	13,560 (100%)
Middle level job	17.3	29.5	28.3	24.9	27,617 (100%)
High level job	6.1	31.5	33.9	28.5	13,020 (100%)

Note: This table shows the distribution of different age groups across low, middle, and high level jobs.

Table 1.9: Promotion rates for trained and untrained workers across education and promotion levels (at time t in %)

Education	Training Status	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3
LHS	Trained	11.5	29.5	2.2	0.7
	Untrained	5.7	5.8	1.6	0.3
HS	Trained	9.0	29.3	4.9	.9
	Untrained	7.3	16	2.6	.8
TCU	Trained	5.9	40.4	5.9	0.9
	Untrained	7.0	20.1	5.9	1.2
GRAD	Trained	8.3	55.9	14.7	5.8
	Untrained	8.3	16.1	24.6	3.0

Notes- 1) Promotion level 1 is defined as a job level change from low-level to middle-level jobs, promotion level 2 is a job level change form a low-level or middle-level job to a high-level job, and promotion level 3 is a job level change from any lower levels to an executive level job. 2) LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

Table 1.10: Average wage growth rate upon promotion across education and promotion levels (at time t in %, number of observations in parentheses)

Wage Growth Rate (WGR)	No Promotion	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3
WGR_{LHS}	2.4	2.5	1.8	3.2	9.2
	(7,781)	(423)	(294)	(109)	(20)
WGR_{HS}	1.7	1.9	1.5	2.6	2.4
	(25,066)	(2,015)	(1,163)	(650)	(202)
WGR_{TCU}	1.0	2.7	4.8	2.0	0.7
	(12,955)	(1,026)	(349)	(504)	(173)
WGR_{GRAD}	1.9	3.4	1.0	3.3	3.7
	(4,554)	(376)	(22)	(191)	(163)

Notes- LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

Table 1.11: Average growth rate of wage upon promotion for trained and not trained workers across education and promotion levels (at time t in %, number of observations in parentheses)

Wage Growth Rate (WGR)		No Promotion	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3
WGR_{LHS}	Trained	2.8 (188)	6.1 (21)	5.7 (15)	5.1 (5)	14.9 (1)
	Untrained	2.5 (7,593)	2.3 (402)	1.5 (279)	3.1 (104)	8.8 (19)
WGR_{HS}	Trained	0.8 (2,186)	0.9 (201)	-0.5 (93)	1.4 (84)	6.1 (24)
	Untrained	1.8 (22,880)	2.1 (1,814)	1.7 (1,070)	2.8 (566)	2.0 (178)
WGR_{TCU}	Trained	1.9 (1,971)	1.9 (145)	-1.2 (42)	3.1 (76)	4.5 (27)
	Untrained	0.9 (10,984)	2.8 (881)	5.7 (307)	1.8 (428)	0.2 (146)
WGR_{GRAD}	Trained	1.9 (846)	5.2 (62)	2.0 (5)	3.8 (25)	5.8 (32)
	Untrained	1.9 (3,708)	3.0 (314)	0.8 (17)	3.2 (166)	2.8 (131)

Notes- LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

Table 1.12- Marginal effects of education group and job-related training courses on probability of promotion where the dependent variable is **total promotion** (St.E)

	logit			RE-logit		Overall effects of training interaction terms	
						logit	RE-logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HS	.037***	.034***	.035***	.042***	.043***		
	(.005)	(.005)	(.005)	(.004)	(.004)		
TCU	.049***	.045***	.049***	.063***	.066***		
	(.006)	(.006)	(.007)	(.005)	(.005)		
GRAD	.094***	.087***	.089***	.101***	.104***		
	(.009)	(.009)	(.009)	(.007)	(.007)		
Training	.020***	.019***	.052**	.010***	.042***		
	(.006)	(.006)	(.019)	(.003)	(.013)		
Female	-.023***	-.023***	-.025***	-.027***	-.027***		
	(.004)	(.004)	(.004)	(.003)	(.003)		
Training							
x HS			-.031*		-.028**	.021***	.014***
			(.020)		(.014)	(.008)	(.005)
x TCU			-.054**		-.039***	-.002	.003
			(.021)		(.014)	(.006)	(.006)
x GRAD			-.041*		-.042***	.011	.001
			(.024)		(.015)	(.014)	(.010)
x Female			.014		.002	.066***	.044***
			(.012)		(.006)	(.001)	(.013)
Individual-specific dummies	Yes	Yes	Yes	Yes	Yes		
Job-specific dummies	Yes	Yes	Yes	Yes	Yes		
State of residence dummies	No	Yes	Yes	Yes	Yes		
Year dummies	Yes	Yes	Yes	Yes	Yes		
Constant	-.604	-1.05*	-1.06*	-1.32**	-1.36**		
	(.575)	(.609)	(.610)	(.605)	(.606)		
Observations	54,196	54,196	54,196	54,196	54,196	54,196	54,196

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).
2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.13- Marginal effects of education group and job-related training courses on probability of promotion where the dependent variable is **promotion level 1: promotion from low to middle level jobs** (St.E)

	logit			RE-logit		Overall effects of training interaction terms	
						logit	RE-logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HS	.077***	.073***	.078***	.089***	.092***		
	(.014)	(.014)	(.012)	(.010)	(.010)		
TCU	.079***	.074***	.075***	.103***	.105***		
	(.035)	(.033)	(.016)	(.013)	(.013)		
GRAD	.065	.045	.040	.085***	.063*		
	(.085)	(.066)	(.037)	(.038)	(.042)		
Training	.073***	.068***	.146***	.044***	.107***		
	(.034)	(.035)	(.043)	(.012)	(.034)		
Female	-.041***	-.038***	-.037***	-.042***	-.042***		
	(.024)	(.023)	(.011)	(.009)	(.010)		
Training							
x HS			-.090**		-.076**	.056**	.031*
			(.047)		(.036)	(.045)	(.015)
x TCU			-.053		-.055*	.093**	.052**
			(.059)		(.041)	(.023)	(.025)
x GRAD			.010		.110	.156	..217**
			(.151)		(.111)	(.361)	(.090)
x Female			-.013		-.006	.133***	.101***
			(.033)		(.023)	(.076)	(.031)
Individual-specific dummies	Yes	Yes	Yes	Yes	Yes		
Job-specific dummies	Yes	Yes	Yes	Yes	Yes		
State of residence dummies	No	Yes	Yes	Yes	Yes		
Year dummies	Yes	Yes	Yes	Yes	Yes		
Constant	-.755	-1.29*	-1.36*	-1.77*	1.78***		
	(.896)	(.933)	(.931)	(1.02)	(1.02)		
Observations	14,220	14,220	14,220	14,220	14,220	14,220	14,220

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).
2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.14- Marginal effects of education group and job-related training courses on probability of promotion where the dependent variable is **promotion level 2: promotion from low or middle to high level jobs** (St.E)

	logit			RE-logit		Overall effects of training interaction terms	
						logit	RE-logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HS	.001	-.001	-.002	. 002	.002		
	(.005)	(.004)	(.005)	(.002)	(.002)		
TCU	.013**	.011*	.012**	. 014***	.015***		
	(.006)	(.008)	(.006)	(.003)	(.003)		
GRAD	.048***	.044***	.048***	. 041***	.042***		
	(.007)	(.026)	(.007)	(.004)	(.004)		
Training	.005	.004	-.006	. 002*	.004		
	(.005)	(.008)	(.022)	(.002)	(.009)		
Female	-.013***	-.013***	-.015***	-.011***	-.011***		
	(.004)	(.008)	(.004)	(.002)	(.002)		
Training							
x HS			.016		.001	.01*	.005**
			(.022)		(.009)	(.006)	(.003)
x TCU			-.003		-.006	-.009	-.002
			(.022)		(.009)	(.007)	(.003)
x GRAD			-.024		-.009	-.03**	-.005
			(.024)		(.010)	(.024)	(.006)
x Female			.017*		.003	.011	.007
			(.011)		(.004)	(.012)	(.009)
Individual-specific dummies	Yes	Yes	Yes	Yes	Yes		
Job-specific dummies	Yes	Yes	Yes	Yes	Yes		
State of residence dummies	No	Yes	Yes	Yes	Yes		
Year dummies	Yes	Yes	Yes	Yes	Yes		
Constant	-5.16***	-5.68***	-5.68***	-6.14***	-6.17***		
	(.938)	(1.02)	(1.01)	(.970)	(1.01)		
Observations	40,605	40,605	40,605	40,605	40,605	40,605	40,605

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).
2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.15- Marginal effects of education group and job-related training courses on probability of promotion where the dependent variable is **promotion level 3: promotion from middle or high to executive level jobs** (St. E)

	Logit			RE-logit		Overall effects of training interaction terms	
						logit	RE-logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HS	.002	.002	.002	.002	.002		
	(.004)	(.004)	(.004)	(.001)	(.001)		
TCU	.004	.004	.005	.003**	.003**		
	(.004)	(.004)	(.004)	(.001)	(.001)		
GRAD	.012***	.012***	.010**	.006***	.006***		
	(.005)	(.005)	(.005)	(.002)	(.002)		
Training	.003*	.003*	.004	.001	.002		
	(.002)	(.002)	(.013)	(.001)	(.005)		
Female	-.003	-.003	-.003	-.002***	-.002**		
	(.002)	(.002)	(.002)	(.001)	(.001)		
Training							
X HS			-.003		-.0005	.001	.001
			(.013)		(.005)	(.002)	(.420)
X TCU			-.006		-.001	-.002	.001
			(.013)		(.005)	(.004)	(.007)
X GRAD			.006		-.001	.01	.001
			(.014)		(.005)	(.013)	(.04)
X Female			-.001		-.001	.003	.001
			(.006)		(.001)	(.006)	(.031)
Individual-specific dummies	Yes	Yes	Yes	Yes	Yes		
Job-specific dummies	Yes	Yes	Yes	Yes	Yes		
State of residence dummies	No	Yes	Yes	Yes	Yes		
Year dummies	Yes	Yes	Yes	Yes	Yes		
Constant	-4.47***	-4.61***	-4.57***	-5.15***	-5.21***		
	(1.58)	(1.60)	(1.58)	(1.57)	(1.58)		
Observations	39,976	39,976	39,976	39,976	39,976	39,976	39,976

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).
2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies Include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.16 – OLS estimates of **change in log-wage** for the sample who receives **total promotion** versus no promotions (St.E)

	Total Promotion (1)	No Promotions (2)	Total Promotion (3)	No Promotions (4)	Overall effects of training based on column (3)	Overall effects of training based on column (4)
HS	.009	.007***	.010	.007***		
	(.011)	(.002)	(.012)	(.002)		
TCU	.026**	.018***	.024*	.018***		
	(.014)	(.003)	(.014)	(.003)		
GRAD	.108***	.063***	.109***	.065***		
	(.019)	(.005)	(.021)	(.005)		
Training	.009	.011***	.014	.029***		
	(.010)	(.003)	(.048)	(.012)		
Female	-.033***	-.040***	-.033***	-.040***		
	(.009)	(.002)	(.010)	(.002)		
Training						
x HS			-.019	-.019*	-.005	.010***
			(.049)	(.012)	(.069)	(.017)
x TCU			.010	-.014	.024*	.015***
			(.049)	(.012)	(.069)	(.017)
x GRAD			-.011	-.026**	.004	.004
			(.052)	(.013)	(.071)	(.018)
x Female			.006	-.001	.021	.028***
			(.020)	(.005)	(.052)	(.013)
Constant	.077	.174***	.076	.173***		
	(.080)	(.020)	(.080)	(.020)		
Individual-specific dummies	Yes	Yes	Yes	Yes		
Occupation dummies	No	Yes	No	Yes		
Job transition dummies	Yes	No	Yes	No		
Year dummies	Yes	Yes	Yes	Yes		
Observations	3,840	50,356	3,840	50,356	3,840	50,356

Differences in coefficients (wage increase due to promotion)			
HS	.003	*Training* x HS	-.015
	(.012)		(.071)
TCU	.006	*Training* x TCU	.009
	(.014)		(.071)
GRAD	.044**	*Training* x GRAD	.0001*
	(.021)		(.073)
Training	-.015	*Training* x Female	-.007
	(.049)		(.054)
Female	.007		
	(.010)		

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).
2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.17 – OLS estimates of **change in log-wage** for the sample who receives **promotion level 1, from low to middle level jobs** versus no promotions (St.E)

	Promotion Level 1 (1)	No Promotions (2)	Promotion Level 1 (3)	No Promotions (4)	Overall effects of training based on column (3)	Overall effects of training based on column (4)
HS	.018	.006*	.023*	.006*		
	(.013)	(.004)	(.013)	(.004)		
TCU	.029*	.010*	.031*	.010		
	(.017)	(.006)	(.018)	(.007)		
GRAD	.065	.013	.083*	.008		
	(.045)	(.029)	(.051)	(.029)		
Training	.0003	.020**	.073	.021		
	(.016)	(.009)	(.049)	(.019)		
Female	-.048***	-.063***	-.049***	-.063***		
	(.011)	(.004)	(.012)	(.005)		
Training						
x HS			-.091*	-.0001	-.018	.021*
			(.048)	(.020)	(.069)	(.028)
x TCU			-.063	.015	.010	.036
			(.051)	(.034)	(.071)	(.039)
x GRAD			-.146*	.197***	-.074	.219***
			(.071)	(.018)	(.120)	(.050)
x Female			.009	-.012	.081*	.009
			(.052)	(.013)	(.058)	(.026)
Constant	.148*	.217***	.147*	.217***		
	(.106)	(.043)	(.106)	(.043)		
Individual-specific dummies	Yes	Yes	Yes	Yes		
Occupation dummies	No	Yes	No	Yes		
Job transition dummies	Yes	No	Yes	No		
Year dummies	Yes	Yes	Yes	Yes		
Observations	1,828	12,392	1,828	12,392	1,828	12,392

Differences in coefficients (wage increase due to promotion)			
HS	.017	*Training* x HS	-.039
	(.014)		(.074)
TCU	.020	*Training* x TCU	.026
	(.019)		(.081)
GRAD	.075	*Training* x GRAD	-.293**
	(.059)		(.130)
Training	.052	*Training* x Female	.072
	(.052)		(.063)
Female	.014		
	(.013)		

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group). 2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.18 – OLS estimates of **change in log-wage** for the sample who receives **promotion level 2, from low or middle to high level jobs** versus no promotions (St.E)

	Promotion Level 2 (1)	No Promotions (2)	Promotion Level 2 (3)	No Promotions (4)	Overall effects of training based on column (3)	Overall effects of training based on column (4)
HS	-.003	.011***	-.011	.012***		
	(.023)	(.002)	(.022)	(.002)		
TCU	-.014	.020***	-.024	.020***		
	(.027)	(.003)	(.027)	(.003)		
GRAD	.043*	.055***	.035	.055***		
	(.032)	(.008)	(.033)	(.009)		
Training	.011	.014***	-.160	.030***		
	(.017)	(.003)	(.130)	(.012)		
Female	-.026*	-.052***	-.028*	-.052***		
	(.016)	(.002)	(.017)	(.003)		
Training						
x HS			.169	-.022*	.009	.008*
			(.134)	(.012)	(.187)	(.017)
x TCU			.177*	-.012	.017	.018***
			(.132)	(.013)	(.185)	(.018)
x GRAD			.171	-.016	.011	.013
			(.135)	(.019)	(.187)	(.022)
x Female			.010	.004	-.149	.034***
			(.031)	(.007)	(.134)	(.014)
Constant	.045	.191***	.062	.191***		
	(.148)	(.023)	(.149)	(.023)		
Individual-specific dummies	Yes	Yes	Yes	Yes		
Occupation dummies	No	Yes	No	Yes		
Job transition dummies	Yes	No	Yes	No		
Year dummies	Yes	Yes	Yes	Yes		
Observations	1,454	39,151	1,454	39,151	1,454	39,151

Differences in coefficients (wage increase due to promotion)			
HS	-.023	*Training* x HS	.001
	(.022)		(.188)
TCU	-.044	*Training* x TCU	-.001
	(.027)		(.186)
GRAD	-.020	*Training* x GRAD	-.002
	(.034)		(.188)
Training	-.190	*Training* x Female	-.183
	(.130)		(.135)
Female	. 024		
	(.017)		

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group). 2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.
* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Table 1.19 – OLS estimates of **change in log-wage** for the sample who receives **promotion level 3, from middle or high to executive level jobs** versus no promotions (St.E)

	Promotion Level 3 (1)	No Promotions (2)	Promotion Level 3 (3)	No Promotions (4)	Overall effects of training based on column (3)	Overall effects of training based on column(4)
HS	-.100*	.004	-.111*	.006*		
	(.071)	(.004)	(.075)	(.004)		
TCU	-.096*	.015***	-.105*	.015***		
	(.071)	(.004)	(.076)	(.004)		
GRAD	.006	.058***	.004	.060***		
	(.078)	(.005)	(.084)	(.006)		
Training	.029	.009***	-.119	.028**		
	(.026)	(.003)	(.128)	(.015)		
Female	-.003*	-.039***	-.006*	-.039***		
	(.033)	(.002)	(.036)	(.003)		
Training						
x HS			.176*	-.022*	.057	.007*
			(.133)	(.015)	(.185)	(.021)
x TCU			.152	-.017	.033	.011***
			(.134)	(.015)	(.185)	(.021)
x GRAD			.113	-.028*	-.005	.0004
			(.122)	(.016)	(.177)	(.022)
x Female			.037	.002	-.082	.031**
			(.070)	(.006)	(.146)	(.016)
Constant	.541**	.163***	.551**	.161***		
	(.261)	(.024)	(.273)	(.024)		
Individual-specific dummies	Yes	Yes	Yes	Yes		
Occupation dummies	No	Yes	No	Yes		
Job transition dummies	Yes	No	Yes	No		
Year dummies	Yes	Yes	Yes	Yes		
Observations	531	39,445	531	39,445	531	39,445

Differences in coefficients (wage increase due to promotion)			
HS	-.117	*Training* x HS	.050
	(.075)		(.186)
TCU	-.120	*Training* x TCU	.022
	(.076)		(.186)
GRAD	-.056	*Training* x GRAD	-.005
	(.084)		(.178)
Training	-.147	*Training* x Female	-.113
	(.128)		(.147)
Female	.033		
	(.036)		

Notes- 1) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group). 2) Individual-specific dummies include age, age squared, hourly income, job tenure, job tenure squared, job experience, job experience squared. Job-specific dummies include the type of job (blue collar, white collar, or civil servant), skill level of job (low, middle, high, executive level job), occupation, industry and firm size.

* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.

Chapter 2. The effects of a reduction in Unemployment Insurance duration on the likelihood of joining welfare: Evidence from Germany

2.1 Introduction

Concerns about the effects of a less generous UI system on post-unemployment outcomes have been increasingly expressed by policy-makers and controversially discussed by many studies over the past few decades (Fortin et al. 1999, Pellizzari 2006, Amable and Francon 2014). Search theoretic models suggest that a generous UI system increases the reservation wage, thereby creating disincentives for the unemployed to look actively for jobs. A higher reservation wage and reduced work incentive might lead to a longer unemployment for the unemployed who wait for better job offers. In a longer unemployment, individuals are more likely to join a welfare program after using UI benefits since they would need to rely on their savings after the benefit period ends. Therefore, a more generous UI program may increase the length of unemployment and the likelihood of joining welfare.

Conversely, a policy that shortens the length of UI benefit would decrease the reservation wage, and increase the work incentive and likelihood of finding a job for the unemployed. That is, a less generous UI program encourages a faster return to the job market that makes the unemployed less likely to need welfare a short time after using UI benefits. Thus, a policy that reduces amount or duration of UI benefits could decrease the chance of using welfare for UI recipients. The reaction of unemployed people to any changes in UI benefits could depend on the availability of the alternative welfare programs (Pellizzari 2006). For instance, a reduction in UI benefits might not significantly affect the likelihood of job finding if the welfare benefit is easily available as an alternative source of income for the unemployed people. In addition, any policy affecting UI eligibility conditions may also impact the likelihood of joining welfare programs. For example, once the number of required working hours to be eligible for UI benefits increases, the unemployed who do not have enough insured hours would apply for welfare instead.

Many studies have investigated the effects of UI benefit and its characteristics on unemployment duration and probability of exiting unemployment. Some studies such as Katz and Meyer (1990), Hunt (1995), Card and Levine (2000) suggest that higher amount of UI benefits is associated with longer unemployment spells. A few studies such as Pellizzari (2006)

and Fitzenberger and Wilke (2010) find no relationship between the generosity of UI benefits and unemployment duration.

Analyzing the effects of a longer UI benefit is also important in terms of post-unemployment job quality or stability. Theory is that if an individual has more supported time to search, they can find a better job match. Empirical evidence on this topic is mixed in the literature. Many studies find a positive correlation between a long benefit duration and job stability or job quality because a longer UI benefit may increase the likelihood of finding a right matched employment (Marimon and Zilibotti (1999), Acemoglu and Shiner (2000), Tatsiramos (2009), Caliendo et al (2013)). However, some other studies such as Addison and Blackburn (2000), Card et al (2007), Fitzenberger and Wilke (2010) find weak or no effects of benefit duration on job stability or quality. Even if a longer unemployment increases the chance of more stable jobs, the UI program structure could be improved to reduce incentives for lengthy spells of unemployment (moral hazard problem).

For a long time, a policy concern has been how to modify UI conditions to reduce the negative effects of UI but still provide a protection for the unemployed and assist them return to the job market. For example, providing Social assistance (SA) to those who exhaust their UI is one option. Analyzing the effect of UI on joining a welfare program is also crucial from a political perspective specifically when two programs are run by two different levels of government. Any modifications in one program may increase the cost of other one in the other level of government. For instance, UI (EI) in Canada is run by the federal government, while SA is under the provincial jurisdictions. Therefore, given two governmental programs, analyzing the impacts of one program on the other one may suggest a comprehensive reform to both programs rather than separate reforms.

In my study, the Hartz reforms in Germany enable me to analyze the effects of UI duration change on the likelihood of joining welfare program in Germany before and after the reforms. My study will add to the literature in two ways: First, this study estimates the likelihood of joining welfare after using UI benefits in Germany. Second, I investigate the effects of a reduction in UI generosity, following the Hartz reforms, on the probability of joining welfare for UI recipients by using the method of difference-in-differences.

This paper is organized as follows. Section II reviews the main results of the literature that focuses on the effects of UI and welfare programs. Section III summarizes the Hartz reforms

and welfare programs in Germany. Methodology is discussed in section IV, and dataset and variables are explained in section V. Section VI presents a descriptive analysis on UI claimants joining welfare within a few years after their UI use. Estimation results are presented in section VII, the sensitivity analyses are provided in sections VIII and the final section concludes the study. Tables, appendices and references are provided at the end of the paper.

2.2 Related Literature Review

Nickell (1979) and Lancaster (1979) initially showed that more generous UI benefits increase the length of unemployment spells. The positive relationship between the generosity of UI and length of unemployment has been confirmed by other studies in the literature. Katz and Meyer (1990) also use the UI institutional changes for the US and also find that if the UI benefit period increases, the unemployment duration raises too. Hunt (1995) also finds similar results for older workers aged 44-48 using the GSOEP. However, Fitzenberger and Wilke (2009) use the administrative data from Germany and find no relationship between UI generosity and unemployment duration. They suggest that there is no systematic relation between the unemployment hazard rate and the institutional changes in UI benefits.

Although there are numerous empirical studies on UI or other social programs separately, the effects of one program on the other programs have not been very well discussed in the literature, and only a few studies take the two programs into account while analyzing the impact of each. A notable exception is Fortin, Lacroix, and Thilbault (1999) that study the effect of UI generosity on welfare participation. They use the database of SA records in Quebec to create a measure of UI generosity which is calculated based on the minimum number of working weeks required to qualify for UI and the maximum number of benefit weeks. More specifically, Fortin et al. (1999) argue that as the maximum number of UI benefit weeks decreases, some UI users will be pushed into the SA program. Also, some UI single mothers may be qualified for both UI and SA simultaneously since their income from UI benefits falls below the income threshold for the SA program.[28] However, Grey (2002) reports that simultaneous usage of both programs at

[28] Their data include 95,514 claimants of which 92% are single mothers who received social assistance at least once between 1979 and 1993. They created a measure of the UI generosity by calculating a ratio which represents the maximum number of weeks an eligible claimant may receive benefits divided by the minimum number of working weeks required to qualify for UI. They estimate the effect of this variable on exit rate from welfare in a proportional hazard function and conclude that decreasing UI benefits and tightening UI eligibility conditions are associated with a longer stay in welfare. Fortin et al. (1999) also examine the impact of other parameters on exit from and re-entry

the same time is very unlikely, and there is a substantial lag between exhausting UI and entering welfare since many UI exhaustees hold some assets or have relatives who earn income. Based on Grey's results, people are ineligible to receive the welfare support immediately after using their UI. Therefore, joining a welfare program may happen in a longer time period after the usage of UI benefits. Since there are no UI reforms in Grey's data set, he is not able to address the effects of UI modifications on the likelihood of joining welfare, while the UI change in the Germany Hartz reforms in Germany enables me to use the difference-in-differences methodology and distinguish the effects of a policy change on the chance of joining welfare in different time frames.

The reaction of unemployed people to a reduction in UI benefits seems to depend on the availability of alternative welfare programs. Pellizzari (2006) shows that a reduction in UI benefits might not significantly affect the likelihood of job finding if the SA benefit is easily available as an alternative source of income for the unemployed people because people substitute SA benefits for their exhausted UI benefits.[29] However, he states that the elasticity of job-finding probability relative to the UI benefit is higher for households who are qualified for means-tested family benefits rather than for those who have access to universal benefits.[30] The mutual effects of income support programs highlight the importance of a comprehensive reform in labour market policies versus the separate program reforms.

Regarding a comprehensive reform, the Hartz plan in Germany is a great example that affects many labour market policies and programs in Germany. The effects of UI policy change in the Hartz reforms are specifically focused on old people. The reforms phase out the early retirement options for older people and encourage them to continue working. As a result, early retirement has become less incentive after the reforms and more workers in the retirement age group stay employed and do not enter unemployment. Dlugosz et al (2009) show that the reduced UI entitlement length provides disincentives to enter unemployment for older people

---

into SA and find that more educated and younger claimants exit welfare more rapidly and are less likely to re-enter welfare.

[29] He uses monthly labour market histories of individuals from all 15 pre-enlargement EU countries from the European Community Household Panel to show that the reaction to UI benefit change depends on the benefit type of an SA program.

[30] Universal family benefits are the benefits allocated to the families in need based on the number and age of their children, but there is no condition on the level of income in this type of benefits. On the contrary, the means-tested benefits will be paid to the families who demonstrate that the level of their income is below a specified threshold.

who are close to their retirement age. That is, the reform keeps them employed and prevents them from entering into unemployment. Therefore, it is reasonable to expect that UI users close to their retirement age become less likely to be a welfare user since they have more incentives to stay employed because of a less incentive retirement benefit option.

Regarding the effects of the Hartz reforms, Amable and Francon (2014) is one of the most recent studies to investigate the effect of reforms on the exit rate from unemployment and some post-unemployment outcomes.[31] Their results indicate that the Hartz reform cut in UI benefit duration has decreased unemployment duration for 45-49 and 55-59 age groups. They also investigate the effects of reforms on three post-unemployment outcomes: job stability, skill adequacy, and type of contract. They find that a reduction in UI benefit decreases the post-unemployment job quality.

Although different post-unemployment outcomes have been analyzed in the literature, there is no enough research on joining a welfare program as a post-unemployment outcome after using UI benefits. The UI users might end up with welfare benefits if the UI program is not effective in returning the unemployed to the job market. Whether a reduction in UI benefits increases or reduces the chance of joining a welfare program is the main question of this study. I specifically analyze the effect of a UI benefit cut implemented by the 2006 Hartz reforms on this likelihood in Germany.

2.3 Hartz Reforms and Institutional Background

UI as a social program in Germany, as in many other countries, provides temporary financial help to the unemployed individuals who contributed to the program by paying UI insurance premium, while they were employed.[32] Governments usually determine the UI insurance premium based on the average expected loss for the entire labor force and use this program as an income redistribution tool. On the other hand, Social Assistance (SA) as one of

[31] They use a sample of 7,846 unemployment spells from the GSOEP and estimate the unemployment-to-employment hazard rates for treated and control groups using a difference-in-difference method. The treatment group is categorized into different age groups and the model is estimated by a Cox-Partial Likelihood method to specify a flexible distribution of unobserved heterogeneity. The demographic variables in their model include age, sex, marital status, nationality, categories for the highest obtained education degree; the number of UI spells prior to the current one, year dummies and a dummy for East Germans.

[32] The expression *Hilfe zur selbsthilfe (help people to help yourself)* has been used in Germany to show the goal of UI and similar programs.

the welfare programs in Germany also provides financial assistance to people who are in financial need with little or no income. There is no need for contribution to the SA program unlike the UI program, but the household income level must be below the program threshold to receive the benefits.

The Hartz reforms or Hartz plan[33] is a set of structural German labour market reforms prepared between 2003 and 2005 by the Committee for Modern Services. These reforms involved four packages, Hartz I-IV, constituting a comprehensive modification of German labour market policies implemented over 2003-2005.[34] The main goals of these reforms were to improve employment services, decrease unemployment, and increase incentives for re-employment of the unemployed. The reforms modified the organizational structure of public employment services and several measures of Active Labour Market Policy (ALMP). Furthermore, the UI benefit system and rights and responsibilities of the unemployed were restructured. The last Hartz package (IV) implemented in January 2005 involved a decrease in UI benefit generosity.[35]

Germany had three programs to support the unemployed before the Hartz reforms. The first one is the UI program (*Arbeitslosengeld I*) which was earnings-related benefits for the unemployed who had contributions to the program from past job experience. Anyone who has been employed, contributed to the UI program for 12 months, and become unemployed is eligible to apply for the UI benefits. The minimum qualifying period is 12 months for people aged between 15 and 64. These benefits are payable monthly between 90 to 360 days depending on the length of insured employment and age. If the unemployed had worked for two years or more they will receive a full year's UI benefits.

Unemployment Assistance (*Arbeitslosenhilfe*) was another program designed to support the unemployed before the Hartz reforms. This program was an earnings-related benefit, which needed contribution, for the unemployed who exhausted their UI benefits but still needed assistance to find jobs. Social Assistance (*Sozialhilfe*) was a means-tested benefit before the reforms and it was paid to the unemployed who did not have any entitlements to the UI benefits.

[33] The Hartz committee was in the name of its chairman, Peter Hartz.

[34] The Hartz reforms were implemented in January 2003 (Hartz I and II), 2004 (Hartz III), and 2005 (Hartz IV).

[35] The German public social expenditure was about 27.3% of GDP in 1998. Only Denmark, France, Switzerland and Sweden spending was more than Germany (at 31%) as Adema et al (2003) reports.

The minimum amount of SA benefit is about 350 euros per month depending on the savings, spouse's earnings and life insurance.

The Hartz IV reform merged the Unemployment Assistance and Social Assistance programs to create a single new assistance program UI II (*Arbeitslosengeld II*) which requires an active job search. The new assistance program offers a flat-rate means-tested benefit which is significantly less than the total benefits paid under two previous programs. The modifications of UI structure in Hartz IV consists of a reduction in the number of years prior to unemployment to calculate the required working hours and contribution to the program.[36]

Under the new program, there is no geographical limit on job search for the unemployed who do not have familial ties and can move easily across cities. The unemployed also need to provide proof that a job is not suitable if they do not accept it. As a result of the reforms, the maximum benefit duration for the unemployed above 45 years old was reduced, but the amount of benefit was not changed. The longer benefit duration for this age group before the reform was a bridge to early retirement as firms could use it and negotiate dismissals for less productive older workers. Table 2.1 compares the main differences among eligibility conditions for social assistance, unemployment assistance, and unemployment benefit II before and after the Hartz reforms as Königs (2014) present. As Table 2.1 shows, individuals who had insufficient contribution for unemployment benefits before the Hartz reforms could apply for social assistance (Sozialhilfe) if their income and assets were below a specified minimum threshold and were available to work as a part-time or full-time employee. Unlike Social Assistance, claiming unemployment assistance (Arbeitslosengeld), before the Hartz reforms, needs a contribution to UI I. When an unemployment insurance user exhausts her UI benefits but she still needs assistance to find a job, she may apply for the unemployment assistance (Arbeitslosengeld). After the Hartz reforms, social assistance (Sozialhilfe) still belongs to people who have insufficient contribution to UI I with income and assets below a threshold, but they are incapable of working. People who have the first two conditions and are able and available for at least pert-time jobs are the ones who can apply for unemployment benefits II (Arbeitslosengeld II). Amable and Francon (2014) summarize modifications in UI duration cut presented in Table 2.2 as a result of the reform among different age groups.

[36] Number of years is now two rather than three years.

2.4 Data and Methodology

I employ the Cox-proportional hazard model and difference-in-differences (DID) and investigate the probability of joining welfare for people who have used UI benefits before versus after the Hartz reforms. The DID method aims to measure the causal effect of a less generous UI program on the likelihood of joining welfare. By this method, I measure the difference between the hazard ratios of joining welfare for a treatment versus a control group after they experience UI benefits. In this study, the UI recipients who are 45-60 year-old individuals are the initial treatment group and 30-44 year-old UI recipients are the initial control group because the Hartz reforms apply the UI change policy only on 45 year-old individuals.

To identify the impact of UI duration change in the 2006 Hartz reforms on the likelihood of UI benefit recipients who join welfare, I use a sample of UI benefit recipients from the German Socio-Economic Panel (GSOEP) over 2002-2009. The sample consists of 30 to 60 year-old unemployed people, reporting a labour force status of "registered unemployed" that are receiving benefits. These unemployed people are either heads of household or their partners in the household. I keep those individuals whose household income deducted by individual income is less than the welfare threshold. The welfare threshold is calculated for different household size. The data is a panel and some individuals have multiple UI spells. Among all the UI recipients who join welfare before and after the reforms, 96% join within less than three years, 45% have multiple UI spells, and 52% have multiple transitions to welfare. For instance, if someone has two UI spells, one in 2002 and one in 2007, the transition dummy for this individual would take value one for each transition if she joins welfare after each of her two UI spells. To consider the multiple UI spells in my analysis and distinguish between UI users who experience only one spell or those with multiple UI, I use a multiple spell indicator following Curtis and Rybczynski (2014).

The critical eligibility condition for welfare benefits is that an individual's household income level must be below a required threshold. Some people may exhaust their UI benefits and then apply for welfare, and some others may use both benefits at the same time if UI benefits do not raise the household income above the threshold. Thus, I restrict the sample further to include only potential welfare recipients among the UI recipients whose annual household income is less

than the welfare threshold regardless of their annual individual income.[37] This sample restriction enables us to keep the individuals who might be potential welfare users in the sample.

I include a policy dummy variable for the post-reform period from 2006 to 2009. Because some respondents drop out of or join the sample during these periods, the panels are unbalanced. People at the end of the sample are right-censored if they have used UI benefits but have not transitioned to welfare as of 2009. So people at the end of the sample who did not have enough time to transition to welfare are censored.[38] I also count those observations who are ineligible to receive welfare as censored because their household income is above the welfare threshold. Excluding spells with missing information on UI characteristics and welfare variables, the main sample includes 2,404 spells. Of the main sample, 1,153 spells are in the control group and 1,251 spells are in the treatment group.

The following Cox-proportional model, which is a function in time and a function in covariates, estimates the hazard ratio of joining a welfare spell at year t for the treatment group versus control group, conditional on using UI benefits up to and including t.

$$\lambda(t) = \lambda_0(t) * \exp[\beta_1 * Hartz + \beta_2 * Treat + \beta_{12} * Hartz * Treat + \gamma' X] \quad (1)$$

The baseline hazard rate,$\lambda_0(t)$, is non-parametric, placing no restrictions on duration dependence.[39] *Hartz* is a dummy variable taking a value of one for the UI users who have received UI benefits between 2006 and 2009. The dummy variable $Treat$ indicates the treatment group specifying the UI recipients who are 45-60 year-old. The interaction term between dummy variables *Hartz* and $Treat$ is the average treatment effect. The estimated $\exp(\beta_{12})$ gives the average treatment effect which is the hazard ratio of joining welfare for treatment group versus control group. The mathematical calculation of this hazard ratio or DID is described in appendix C.

The variable X includes other covariates to estimate the hazard rates of UI users joining welfare. It includes age, gender, education, household size, number of children in the household, job experience, number of months in UI and amount of UI benefits in the last unemployment

[37] I keep the individuals in the sample if their household income deducted by individual income is less than the welfare threshold. The welfare threshold is calculated for different household size and deflated to 2009.

[38] In sensitivity analysis, I consider both UI recipients at the end of panel 1 (2006) and the ones at the end of panel 2 (2009) as right-censored groups and then re-estimate the model. The results are still consistent.

[39] The hazard rate of joining welfare after using UI benefits is discussed mathematically in appendix B.

spell, and a multiple UI spell indicator. Four dummy variables of education categories are defined based on the years of education. I use the structure of the German education system and define four education levels: less than high school (LHS); high school degree (HS); technical, college, or university degree (TCU); and graduate degree (GRAD). The German education system and definition of these four education variables are summarized in Appendix B of chapter 1.

I estimate equation (1) on the base sample where the age group of 45-60 year-old UI users is the treatment group, who were affected by a reduction in benefit duration following the Hartz reforms, whereas the 30-44 year-old claimants are the unaffected users. However, a potential problem with the treatment group aged 45-60 is that other factors unrelated to the new UI policy might affect the hazard rates of 45-60 year-old users relative to the younger UI claimants. For instance, the pension benefits for the people who are close to their retirement age at 65, may impact the likelihood of joining welfare. Also, the young population who are close to the age of 20 are the newcomers to the job market and might still be under the support of families.[40] Therefore, I conduct a sensitivity analysis using age groups, 35-44 and 45-54 that will have more similarities in their characteristics.

2.5 Descriptive Analysis

Descriptive statistics of variables used in this study are presented in Table 2.3. This table compares the mean and standard deviations of all variables for the whole sample (age 30-60), control group (age 30-44), and treatment group (age 45-60). The table shows that the treatment group (45-60 years-old UI users) includes 52% observations of the whole sample. On average, 46% of the whole sample are women and more than 53% hold a high school degree in both control and treatment groups. The control group has on average 11 years of job experience, whereas the treatment group, who are older and more experienced UI users, have 24 years of labour market experience. Comparing the individual labour income of both groups, income is slightly higher in the control group (10,434 euros) than for the treatment group (9,199 euros). The average household income is almost equal for the two groups (approximately $28,300).

[40] To avoid the problem of including too young and too old population in the sample and to choose the best treatment and control groups, I compare the distribution of variables for different age cohorts among the 20-65 year-old UI receivers over 2002-2006.

Regarding the family size, three people live on average in a family including one child at home. Table 2.3 also presents the statistics of UI spells for three samples. The average number of months for last year UI spell is 5.6 months for control group, while this average is higher for the treatment group, 7.2 months. The average amounts of benefits for the last UI spell is also higher for the treatment group ($5,743) than for the control group ($4,103).

Based on the table, 29% of the whole sample join welfare (31% of the control group and 26% of the treatment group), and 17% are right-censored. Before estimating the hazard ratio of joining welfare, I present the percentages of UI users who join welfare in the following years after they receive their UI benefits. Table 2.4 presents the frequency table of UI users joining welfare within three years of UI benefits. On average, 60% of UI users join welfare at the same year of UI, 32% following the first year, and 8% following subsequent years. Multiple UI spells and multiple transitions to welfare are presented in Table 2.5. Among all UI users, 55% have single UI spells and 45% receive UI more than once. Also, among the UI users who join welfare, 48% join welfare one time, whereas 52% of them join welfare in multiple times.

Comparison of percentages of UI users who join welfare between control and treatment groups before and after the Hartz reforms are presented in Table 2.6. Almost 22% of the control group and 17% of the treatment group join welfare before the Hartz reform. These percentages decrease to 10% and 8% after the reforms for control and treatment groups respectively. Calculations in this table are based on the raw data without controlling for any factors. The difference-in-differences of these percentages is 30% that suggests a reduction in UI benefit weeks increases the percentage of joining welfare by 30% for those affected by the policy change, the 45-60 year-old UI users. In the absence of the policy effect, I would have expected no differences between the ratios of joining for two groups of UI users. Thus, a positive raw DID suggest that the implemented policy would increase the hazard rate of joining welfare.

Figures 2.1 and 2.2 also illustrate the Nelson-Aalen cumulative hazard rates for two control and treatment groups before and after the Hartz reforms. Figure 2.1 displays the hazard rates before and after the reforms for control group (aged 30-44) and figure 2.2 displays them for the treatment group (aged 45-60). By comparing these two figures, I can observe the potential reform impact at different stages of durations. The reform impact can be measured by comparing the differences in hazard rates of both figures. As it is shown in figures, the post-reform hazard rate trends are below the pre-reform trends for both groups. This finding suggests that the

likelihood of joining a welfare program is decreased after the reforms for all age groups. However, the reduction in hazard rates for treatment group is less than the one for control group suggesting that the Hartz reform has increased the chance of joining welfare for the treatment group. In the next step, I estimate the hazard rates of joining welfare by using equation (1) in the previous section to find the treatment effect of Hartz reforms on the hazard rates and find out if the estimation result is consistent with these graph findings.

2.6 Estimation Results

In Table 2.7, I report the estimation results of the Cox-proportional hazard model in equation (1) for the pooled, female, and male samples separately. The hazard rates are presented for two specifications. In specification 1, I control for the observed characteristics of UI users in the year of UI use. The state of residence and UI-year fixed effects are also included in this specification. In specification 2, I add the information about UI benefits: the number of UI benefit months, amount of UI benefits, and an indicator for multiple UI spells.

Results in Table 2.7 suggest that male UI users are more likely than female UI users to join welfare. This result is statistically significant in specification 2. Rows 2 to 4 indicate that as education increases, the likelihood of joining welfare decreases. That is, less educated UI users are more likely to join the welfare programs as expected. The high school degree; technical, college, and university degree; and graduate degree holders in the pooled sample experience a decrease in the hazard of joining welfare by 32%, 50%, and 62% respectively, relative to the less-than-high-school degree holders. These percentages are all statistically significant at 1% level in both specifications.

Results in Table 2.7 also show that labour market experience in full-time jobs does not affect the hazard of joining welfare given that the hazard rate is almost one for all, female, and male UI users in specifications 1 and 2. In specification 1, UI users from a higher income household are less likely to join the welfare program by 32% and 28%, and adding one more person to the household increases the hazard of joining welfare on average by 7% and 3% in specifications 1 and 2, but they are not statistically significant. Neither in specification 1 nor 2 does the number of children have any significant effects on the hazard rates.

The results in specification 2 show a positive relationship between the numbers of UI benefit months on the hazard of joining welfare. UI recipients with one more month benefit have

a 5% more chance in joining welfare. This percentage is 9% for male UI users in particular. This is consistent with the literature that shows a longer unemployment and longer use of UI benefits decrease exiting from unemployment and finding a job, and as a result, joining welfare is expected to be more likely. However, the other variable of UI, higher amount of UI benefits, decreases the hazard of joining welfare for male UI users by 15%, but it has no effect on female UI users. The UI male recipients who have had a large contribution to UI are less likely to join welfare after unemployment. This result is expected since these individuals have usually more job market attachments. Having multiple UI spells also does not have a statistically significant effect on the hazard rates suggesting that individuals with multiple usage of UI benefits are not statistically more likely to join welfare.

Regarding the treatment variable, we should look at the interactions between the *Age 45-60* and *Hartz* dummies which determine the reforms impact, and they are statistically significant in the pooled and male samples at the 10% and 5% levels respectively. These results suggest that the Hartz reforms increase the hazard of joining welfare for age 45-60 by 40% in specification 1 and by 33% in specification 2. These results are consistent with our findings in the descriptive statistics. Furthermore, there is a remarkable increase in the hazard of joining welfare for male UI users at the age of 45-60 by 93% and 85% in specifications 1 and 2 respectively.

2.7 Sensitivity Analysis

In this section, I consider the fact that the effects of reform might vary across ages and treatment groups. In the first sensitivity analysis of five analyses, I split the treatment group into four age groups: 30-44 (control), 45-49, 50-55, and 56-60. Then I re-estimate equation (1) including the age dummies of 45-49, 50-55, and 56-60 along with their interaction terms with the *Hartz* dummy. Table 2.8 shows the results of this age sensitivity analysis.

The results of both model specifications in Table 2.8 are almost the same. The hazard ratios of three age groups in the second specification suggest that the hazard rates of joining welfare for 45-49, 50-55, and 56-60 year-old people are on average 50%, 40%, and 21% respectively higher than the hazard rate for the 30-44 year-old individuals in the control group. The results indicate that the younger treated group (age 45-49) is more likely to join welfare. Since older UI users have a retirement option, the chance of joining welfare after the reforms is

expected to be lower for the age 56-60 than for the younger individuals. The hazard ratios for 56-60 year-old individuals, is statistically insignificant.

Table 2.9 also presents the results of two other sensitivity tests. In specification 1, I include three dummy variables indicating the number of previous UI spells to observe the effect of multiple UI spells on the likelihood of joining welfare. The treatment effect is consistent with the findings in Tables 2.7 and 2.8 that the Hartz reforms increase the hazard of joining welfare (about 32%). The statistically significant results of Table 2.9 also suggest that men who have experienced two previous UI spells in total have higher hazards of joining welfare (26%) than those who have used UI benefits only one time. Among women, having previous UI experience makes them less likely to join welfare. However, all the estimated hazard ratios are statistically insignificant for women. In specification 2, I re-estimate equation (1) using the sample of people who have one UI spell in the sample. The treatment effect is still positive but insignificant and smaller than specification 1 (15% versus 32%).

The results of two more sensitivity analyses are reported in Tables 2.10 and 2.11. Table 2.10 shows the cox-proportional hazard ratios of joining welfare for three age samples: age of 30-60 (30-44 control and 45-60 treatment), age of 35-54 (35-44 control and 45-54 treatment), and age of 40-49 (40-44 control and 45-49 treatment). This comparison enables us to measure the treatment effect for the treatment and control groups that are closer in age. The age groups 35-54 and 40-49 include more similar control and treatment groups.

In all three age groups, one more month in UI duration increases the chance of joining welfare by about 5%. The treatment effects in all three estimations indicate that the Hartz reforms increase the likelihood of joining welfare. The first column reports that 45-60 year-old UI users are 33% more likely to join welfare than the 30-44 year-olds. In the second set of estimations, the 45-54 year-old UI users are 39% more likely than 35-44 year-olds, and based on the results in the third set of estimations, the UI users aged 45-49 have 66% more chance to join welfare than 40-44 year-old users. In effect, Table 2.10 sensitivity analysis shows that as we choose smaller samples, in which control and treatment groups have more similarities in terms of job market characteristics, the Hartz reforms have a stronger effect on the likelihood of joining welfare.

In the original sample used in this study, I deduct the individual income from the household income and keep the UI users whose remaining household income is less than their

welfare threshold.[41] Now I re-estimate equation (1) by not deducting the individual income from the household income and I keep those whose household income is less than the welfare threshold.[42] The results of this estimation are shown in Table 2.11. Based on the results, the Hartz reforms increase the chance of joining welfare by 23% for all women and men, and by 64% only for men although the treatment effect is statistically significant only for men.

2.8 Conclusion

Policy makers and researchers have investigated the effects of a generous Unemployment Insurance (UI) program on post-unemployment outcomes for a few decades. The UI benefits provide some financial assistance for the unemployed and may prevent them for accepting jobs unmatched with their qualifications. The UI benefits might also have some negative effects on the labour market. A generous UI program may reduce incentives for the unemployed to actively look for a job during the unemployment. Improving the UI system and reducing layoffs and lengthy unemployment spells have been important policy concerns over the years.

If the UI program is not helping to return the unemployed to employment, the UI users might have a transition to a welfare program such as Social Assistance (SA) which provides financial support to low income households. Any modifications in the UI system may affect this transition. For instance, a reduction in the amount and length of UI benefits may decrease the unemployment duration and increase the likelihood of finding a job for the unemployed. That is, a less generous UI program might cause a faster exit from unemployment and a faster return to employment, thereby making the unemployed less likely to use welfare after using the UI benefits. The alternative hypothesis is that the reduced amount or duration of UI benefits would increase the use of welfare benefits since these programs are good substitutes. Analyzing the effects of the UI program structure on the welfare program is very crucial from a political perspective, and studying the impacts of programs on each other may suggest a comprehensive reform rather than separate reforms to both programs.

Therefore, estimating the likelihood of joining welfare and analyzing the factors affecting this probability is a post-unemployment outcome for individuals who have used UI and exit the

[41] Individuals whom the following inequality applies for: Household income – individual income < welfare threshold.

[42] Individuals whom the following inequality applies for: Household income < welfare threshold.

unemployment. This study specifically investigates how a less generous UI program, in terms of UI duration, as a result of the Hartz reforms may affect the likelihood of joining welfare among the unemployed who have used their UI benefits. Although different post-unemployment outcomes have been analyzed in the literature, there is no enough research on joining a welfare program as a post-unemployment outcome after using UI benefits.The estimation results suggest that male UI users are more likely than female UI users to join welfare. Higher education decreases the likelihood of joining welfare: high school degree; technical, college, and university degree; and graduate degree holders in the pooled sample experience a decrease in the hazard of joining welfare by 38%, 50%, and 68% respectively, relative to the less-than-high-school degree holders, with all percentages statistically significant at 1% level.

UI users from a higher income household are 32% less likely to join the welfare program, and adding one more person to the household increases the hazard of joining welfare by 7% and 3% on average in two different specifications, but they are not statistically significant. Number of children has not statistically significant effects on the hazard rates of joining welfare. The results also show that lengthier UI benefits increase the hazard of joining welfare by 5%. However, the higher amount of UI benefits rather decreases the hazard of joining welfare for male UI users by 15%. Having multiple UI spells also does not have a statistically significant effect on the hazard rates.

Regarding the treatment variable, the results show that the Hartz reforms increase the hazard of joining welfare for 45-60 year-old UI users by 33% when we control for UI characteristics. These results are consistent with our findings in the descriptive analysis section. Furthermore, there is a remarkable increase of 85% in the hazard of joining welfare for male UI users at the age of 45-60 controlling for UI characteristics. Therefore, this study finds that a less generous UI program as a result of the Hartz reforms has a negative effect on the unemployed such that it pushes the UI users to welfare and makes them more likely to be welfare users after using their UI benefits. This result is consistent in all different sensitivity analyses.

2.9 Tables and Figures

Table 2.1: Main eligibility conditions of social programs benefits in Germany

Before the Hartz reforms	**After the Hartz reforms**
Social Assistance (Sozialhilfe): • Insufficient contribution for UI I • Income and assets must be below a specified minimum level • Possibly available for part-time or full-time work	Social Assistance (Sozialhilfe): • Insufficient contribution for UI I • Income and assets must be below a specified minimum level • Incapable of working
Unemployment Assistance (Arbeitslosengeld): • Contributions to UI I is required but the entitlements to UI I is expired and still need assistance	Unemployment Benefits II (Arbeitslosengeld II): • Insufficient contribution for UI I • Income and assets must be below a specified minimum level • Available for at least part-time work

Source: Königs (2014)

Table 2.2: Summary of institutional changes in the potential compensation UI duration

Age Group	Maximal duration of benefits in months		
	From January 1, 1997 to January 31, 2006	From February 1, 2006 to December 31, 2007	Since January 1, 2008
Less than 45	12	12	12
45-46	18	12	12
47-49	22	12	12
50-51	22	12	15
52-54	26	12	15
55-56	26	18	18
57	32	18	18
58 or older	32	18	24

Source: Amable and Francon (2014)

Table 2.3- Descriptive Statistics of Variables

Variable	Total sample Age 30-60		Control group Age 30-44		Treatment group Age 45-60	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Female	.46	.50	.47	.50	.45	.50
Age	45	9	37	4.3	53	4.8
LHS	.13	.34	.13	.33	.14	.35
HS	.54	.50	.53	.50	.55	.50
TCU	.26	.44	.27	.45	.25	.43
GRAD	.06	.24	.07	.25	.05	.22
Job experience (year)	18	11	11	6	24	9.7
Individual labour income* (euro)	9,791	14,209	10,434	11,442	9,199	16,328
Log individual labour income* (euro)	9.1	1	9.1	1	9.1	1.1
Household income* (euro)	28,281	29,242	28,262	24,350	28,299	33,119
Log household income* (euro)	10	1	10	.94	10	1.1
Household size	2.8	1.2	3.1	1.3	2.5	1.11
Number of children	.7	.9	1.1	1.1	.3	.6
Number of months in the last year UI spell	6.5	3.9	5.6	3.6	7.2	3.9
Amount of benefit in the last year UI spell (euro)*	4,957	4,106	4,103	3,339	5,743	4,565
Log of amount of benefit in the last year UI spell (euro)*	8.2	.9	8	.9	8.3	.9
Observations of UI spells	**2,404 (100%)**		**1,153 (48%)**		**1,251 (52%)**	

LHS: Less-than-High School; HS: High School Degree; TCU: Technical, College, and University Degree; GRAD: Graduate Degree.
* deflated with CPI 2006=1
Source: Author's calculation

Table 2.4- Frequency of UI recipients who join welfare within several years after receiving UI benefits (%)

	Total Age 30-60	**Control Age 30-44**	**Treatment Age 45-60**
Percentage of UI users joining welfare…			
…in the same year of UI	60%	59%	60%
...within 1 year after UI	32%	31%	33%
…within 2 years after UI	4%	5%	4%
… within 3 or more years after UI	4%	5%	3%
Total observations of all UI users joining welfare	**697 (100%)**	**362 (100%)**	**335 (100%)**

Source: Author's calculation

Table 2.5- Frequency of multiple UI spells and multiple transitions to welfare

Number of spells	1	2	3	4	5 & more	Total observations
Percentage of UI users	55.1%	27.5%	11.5%	3.9%	1.6%	2,404 (100%)
Percentage of UI users joining welfare for each spell of transition	47.8%	30.3%	15.3%	4.4%	2.2%	697 (100%)

Source: Author's calculation

Table 2.6- Percentage of UI users joining welfare in the treatment and control groups before and after the Hartz reforms

	Age group 30-44 (Control)	**Age group 45-60 (Treatment)**	**Difference (Treatment-Control)**
Before 2006 Hartz (H_1)	0.22	0.17	-0.5
After 2006 Hartz (H_2)	0.10	0.8	-0.2
Difference ($H_1 - H_2$)	-0.12	-0.9	0.30

Source: Author's calculation

Figure 2.1 - Nelson-Aalen cumulative pre- and post-reforms hazard rates for control group

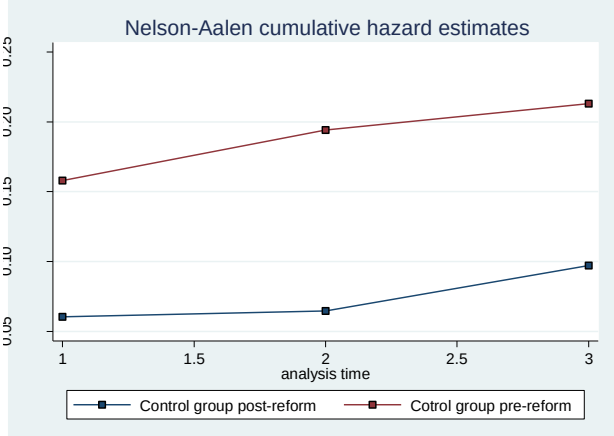
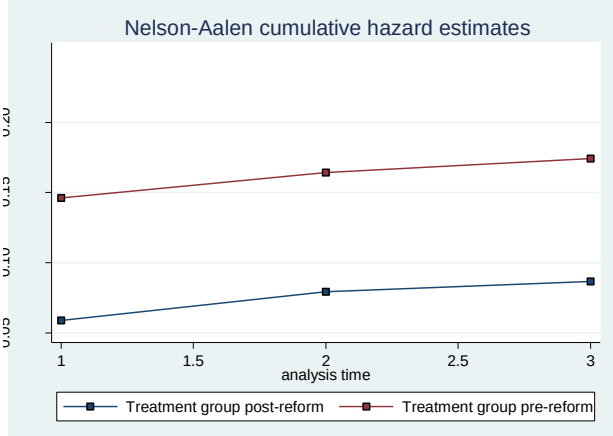


Figure 2.2 - Nelson-Aalen cumulative pre- and post-reforms hazard rates for treatment group



Source: Author's calculation

Table 2.7- Estimated Cox-proportional hazard ratios of joining welfare for three samples: all, female, and male people who have used UI benefits in the past

	Hazard ratio in specification 1 (Robust S.E)			Hazard ratio in specification 2 (Robust S.E)		
	All	**Female**	**Male**	**All**	**Female**	**Male**
Female	.89			.87*		
	(.10)			(.08)		
HS	.62***	.71**	.57***	.62***	.71**	.58***
	(.07)	(.12)	(.08)	(.07)	(.12)	(.09)
TCU	.50***	.63***	.39***	.50***	.63***	.40***
	(.56)	(.12)	(.07)	(.06)	(.12)	(.07)
GRAD	.32***	.45**	.21***	.32***	.46**	.22***
	(.09)	(.18)	(.08)	(.09)	(.18)	(.08)
Full time labour market	1	1.01*	.98**	1	1.01*	.98**
experience (year)	(.005)	(.01)	(.01)	(.005)	(.01)	(.01)
Logarithm of household	.68***	.73***	.64***	.72***	.75***	.72***
income (euros)	(.02)	(.03)	(.03)	(.02)	(.03)	(.03)
Number of individuals in the	1.07	1.06	1.05	1.03	1.05	1.01
household	(.06)	(.09)	(.07)	(.06)	(.09)	(.07)
Number of children	.95	.92	.97	.98	.93	1.02
	(.06)	(.09)	(.09)	(.07)	(.09)	(.10)
Number of months receiving				1.05***	1.03	1.09***
UI benefits				(.01)	(.02)	(.02)
Logarithm of UI benefits				.97	1.01	.85**
				(.06)	(.09)	(.07)
Multiple UI spells indicator				.97	.82	1.05
				(.07)	(.10)	(.09)
Hartz	.46***	.68	.36***	.48***	.78	.35***
	(.11)	(.24)	(.12)	(.12)	(.27)	(.12)
Age 45-60	.95	.98	1.21	.93	.97	1.17
	(.10)	(.14)	(.21)	(.10)	(.14)	(.20)
Hartz x Age 45-60	1.40*	.91	1.93**	1.33*	.85	1.85**
	(.28)	(.31)	(.51)	(.28)	(.31)	(.50)
year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of total spells	2,404	998	1,406	2,404	998	1,406

HS: high school degree, TCU: technical, college, and university degree, GRAD: graduate degree.
*p=10% **p=5% ***p=10%
Source: Author's calculation

Table 2.8- Estimated Cox-proportional hazard ratios of joining welfare for 45-49, 50-55, and 56-60 year-old people who have used UI benefits in the past.

	Hazard ratio in specification 1 (Robust S.E)			Hazard ratio in specification 2 (Robust S.E)		
	All	**Female**	**Male**	**All**	**Female**	**Male**
Hartz	.46***	.72	.35***	.49***	.84	.36***
	(.12)	(.27)	(.12)	(.12)	(.32)	(.12)
Age 45-49	.96	1.12	1.10	.95	1.12	1.07
	(.12)	(.20)	(.21)	(.12)	(.20)	(.20)
Age 50-55	.95	.92	1.38*	.90	.89	1.27
	(.14)	(.21)	(.29)	(.13)	(.20)	(.27)
Age 56-60	.76*	.68*	1.27	.68**	.64*	1.09
	(.14)	(.17)	(.36)	(.12)	(.16)	(.30)
Hartz x Age 45-49	1.56*	1.16	2.13**	1.5*	1.14	1.99**
	(.42)	(.52)	(.73)	(.41)	(.51)	(.69)
Hartz x Age 50-55	1.44*	.68	2.37***	1.4	.65	2.27**
	(.40)	(.34)	(.83)	(.39)	(.33)	(.81)
Hartz x Age 56-60	1.27	1.07	1.49	1.21	.97	1.47
	(.39)	(.49)	(.64)	(.37)	(.45)	(.62)
Number of months receiving UI benefits	No	No	No	Yes	Yes	Yes
Logarithm of UI benefits	No	No	No	Yes	Yes	Yes
Multiple UI spells indicator	No	No	No	Yes	Yes	Yes
UI-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Rest of characteristics	Yes	Yes	Yes	Yes	Yes	Yes
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of total spells	2,404	998	1,406	2,404	998	1,406

*p=10% **p=5% ***p=10%
Source: Author's calculation

Table 2.9- Estimated Cox-proportional hazard ratios of joining welfare using two samples: 1- Indicators for the number of UI spells on the baseline sample; 2- Single spell sample

	Hazard ratio in specification 1 (Robust S.E)			Hazard ratio in specification 2 (Robust S.E)		
	All	**Female**	**Male**	**All**	**Female**	**Male**
Hartz	.48***	.77	.35***	.97	1.35	.66
	(.13)	(.31)	(.12)	(.31)	(.59)	(.30)
Age 45-60	.93	.97	1.17	.99	.97	1.26
	(.11)	(.17)	(.21)	(.12)	(.17)	(.24)
Hartz x Age 45-60	1.32*	.85	1.84**	1.15	.81	1.64*
	(.28)	(.29)	(.53)	(.33)	(.37)	(.62)
Number of months receiving	1.05***	1.03	1.09***	1.05***	1.02	1.11***
UI benefits	(.02)	(.02)	(.02)	(.02)	(.03)	(.03)
Logarithm of UI benefits	.97	1	.85**	.96	1.03	.83**
	(.06)	(.09)	(.07)	(.07)	(.10)	(.08)
One previous UI spell	.94	.80**	1.01			
indicator	(.06)	(.08)	(.08)			
Two previous UI spell	1.12	.86	1.26*			
indicator	(.13)	(.18)	(.18)			
Three or more previous UI	.87	.94	.88			
spell indicator	(.23)	(.43)	(.27)			
Multiple UI spells indicator	No	No	No	Yes	Yes	Yes
UI-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of total spells	2,404	998	1,406	1,399	619	780

*p=10% **p=5% ***p=10%
Source: Author's calculation

Table 2.10- Estimated Cox-proportional hazard ratios of joining welfare using three different age groups: 30-60, 35-54, and 40-49.

	Hazard ratio in 30-60 age group (Robust S.E)			Hazard ratio in 35-54 age group (Robust S.E)			Hazard ratio in 40-49 age group (Robust S.E)		
	All	**Female**	**Male**	**All**	**Female**	**Male**	**All**	**Female**	**Male**
Number of months	1.05***	1.03	1.09***	1.05***	1.04*	1.07***	1.06***	1.03	1.09**
receiving UI benefits	(.01)	(.02)	(.02)	(.02)	(.03)	(.03)	(.03)	(.03)	(.11)
Logarithm of UI benefits	.97	1.01	.85**	.98	1.03	.88*	.99	1.31**	.79*
	(.06)	(.09)	(.07)	(.07)	(.10)	(.08)	(.09)	(.18)	(.11)
Multiple UI spells indicator	.97	.82*	1.05	.94	.82*	.99	.85*	.93	.84
	(.07)	(.10)	(.09)	(.08)	(.11)	(.11)	(.10)	(.17)	(.14)
Hatrz	.48***	.78	.35***	.30***	.52*	.20***	.32**	.79	.14**
	(.12)	(.27)	(.12)	(.11)	(.26)	(.11)	(.19)	(.59)	(.15)
Age 45-60	.93	.97	1.17						
	(.10)	(.14)	(.20)						
Hartz x Age 45-60	1.33*	.85	1.85**						
	(.28)	(.31)	(.50)						
Age 45-54				.90	1.08	.96			
				(.11)	(.20)	(.18)			
Hartz x Age 45-54				1.39*	.88	1.96**			
				(.36)	(.37)	(.67)			
Age 45-49							.83	1.01	.85
							(.12)	(.22)	(.18)
Hartz x Age 45-49							1.66*	.84*	2.47*
							(.58)	(.43)	(1.2)
year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of total spells	2,404	998	1,406	1,535	652	883	783	339	444

*p=10% **p=5% ***p=10%

Source: Author's calculation

Table 2.11- Estimated Cox-proportional hazard ratios of joining welfare using the sample whose household income is less than welfare threshold

	Hazard Ratio (Robust S.E)		
	All	**Female**	**Male**
Female	.86*		
	(.08)		
HS	.62***	.68***	.58***
	(.07)	(.11)	(.09)
TCU	.49***	.58***	.40***
	(.06)	(.11)	(.07)
GRAD	.41***	.54*	.30***
	(.12)	(.23)	(.11)
Full time labour market experience	1	1.01*	.98**
(year)	(.005)	(.01)	(.01)
Logarithm of household income	.72***	.76***	.72***
(euros)	(.03)	(.04)	(.04)
Number of individuals in the	1.05	1.02	1.05
household	(.06)	(.09)	(.08)
Number of children	.98	.94	1.01
	(.07)	(.10)	(.10)
Number of months receiving UI	1.06***	1.03*	1.10***
benefits	(.02)	(.02)	(.02)
Logarithm of UI benefits	.96	.99	.83**
	(.06)	(.10)	(.07)
Multiple UI spells indicator	.97	.84*	1.02
	(.07)	(.10)	(.10)
Hatrz	.41***	.46*	.40***
	(.12)	(.22)	(.15)
Age 45-60	.92	.92	1.16
	(.11)	(.16)	(.21)
Hartz x Age 45-60	1.23*	.89	1.64*
	(.28)	(.32)	(.50)
year fixed effects	Yes	Yes	Yes
State of residence fixed effects	Yes	Yes	Yes
Number of total spells	1,954	847	1,107

HS: high school degree, TCU: technical, college, and university degree, GRAD: graduate degree. *p=10% **p=5% ***p=10%
Source: Author's calculation

Chapter 3. Debt-asset and debt-income ratios across different income levels in Canada: Empirical evidence from the Survey of Financial Security

3.1 Introduction

Canadians currently owe more than their ability to repay what is owed. Canada's debt-income ratio rose to about 165% at the end of June 2015, the highest increase in this ratio since 2011.That is, Canadians owe about $1.65 for every dollar of their disposable income is identified by the central bank of Canada as a key vulnerability in the economy.[43] Statistics Canada reports that 67% of Canadian families had debts in 1999 and this percentage increased to 71% by 2012. The median debt-income ratio rose from 0.78 to 1.10 between 1999 and 2012, while the median debt-asset ratio remained constant over these years. Around 35% of Canadian families had a debt-income ratio above 2 in 2012 compared to 23% in 1999.

Falling interest rates, increasing housing prices and changes in the performance of financial markets and economic conditions have affected the process of wealth accumulation over time. These changes have increased the importance of both assets and debts in family finances as key measures of economic and social well-being. There is a paucity of empirical analysis on different types of debt trends, debt-income and debt-asset ratios across income levels in Canada. Evaluating these factors is determinant of contemporary policy. These metrics provide critical information for policymakers.

This study uses the Survey of Financial Security to analyze these factors across different income levels. This dataset is a cross-sectional micro-data file that collects detailed information for Canadian households. Most studies have used aggregated data at the national level; however, our analysis uses household level data from the 1999, 2005, and 2012 Surveys of Financial Security to specifically examine trends in different types of debts among Canadian families and the debt-asset and debt-income ratios across various income levels in Canada.[44]

3.2 Literature Review

The concern of increasing household indebtedness has been examined in some international studies. Canner et al. (1995) report an increase in home mortgage and consumer

[43] For more details, please see the Statistics Canada report http://www.cbc.ca/news/business/debt-income-net-worth-1.3223917

[44] For more details, please see the link: http://www.statcan.gc.ca/pub/75-006-x/2015001/article/14167-eng.htm

installment debt in US during the economic expansion of 1983-89. Over this period, the aggregate debt relative to disposable income rose from 56% to 78% which was a high record at that time. Barnes and Young (2003) also confirm that the debt to income ratio has increased substantially in USA during the 1990s. May, Tudela and Young (2004) in the UK have also explored the distribution of debt across British households. They find that the largest part of the increasing debt is owed by homeowners with mortgages. Debelle (2004) also confirms the high household indebtedness for OECD countries over 1995-2002. In Poland in 2005, Zajaczkowski and Zochowski (2006) find similar results with the vast majority of household debt payment related to increasing housing loans. Comparing the household debt ratio and debt service ratio across five European countries, Herrala (2006) finds that the debt service ratio is lower for Finland than for UK, USA, Italy, or Spain. A peer-reviewed study by Ekici and Dunn (2010) also shows that credit card debt has a significant effect on the increasing consumption growth in US. They use data from the Consumer Expenditure Survey (CES) and the Ohio Economic Survey (OES) over late 1990s and early 2000s and find that a thousand dollar increase in credit card debt decreases total household consumption growth by 2%.

Among Canadian studies, Chawla and Wannell (2005) investigate trends in debt and spending for Canadian families using the 1982 Family Expenditure Survey (FAMEX) and 2001 Survey of Household Spending (SHS). They find that per-capita debt grew twice as pre-tax income over 1982-2001 and the proportion of households who spent more than their income increased from 39% in 1982 to 47% in 2001. Statistics Canada (2007) uses aggregate data over 1980-2005 and compares Canada and USA in terms of household debts and debt-income ratio. In 1980, Canadian spending was about 80% of their disposable income, whereas American spending was about 88%. Both countries spending reached to 95% in 2005. However, spending is not the only consumption; debts also need to be compared over these years. Canadians and Americans owed less than 70 cents for every dollar of their disposable income in 1980. By 2005, household debt had reached to $1.16 and $1.24 for every dollar of disposable income for Canadians and Americans respectively.

Using household level data, Faruqui (2008) uses the Canadian Financial Monitor and shows an increase in debt-disposable income ratio over 1999-2007. He finds that high-risk families, who are low-income households earning $35,000 or less, have the highest debt service ratio exceeding 40%. Meh et al (2008) also document an increase in debt-income ratio by using

data from the 1999 and 2005 Surveys of Financial Security. They show that the increase in mortgage balances, credit card debt, and home equity lines of credit are the sources of an increase in debt-income ratio in Canada. Furthermore, using data from the first Canadian Financial Capability Survey (CFCS), Hurst (2011) finds an increasing household debt over 1984-2009. He finds that the debt-income ratio was 148% in 2008 and 2009, while the debt-asset ratio reached 19.6% by 2009, the highest rate recorded. He also finds that younger families had the highest debt-income ratio and lone parents had the highest debt-asset ratio in 2009, and people born in Canada were less likely to have a high debt-income ratio compared to immigrants.

The above review shows that the debt-income and debt-asset ratios across households have been studied in the literature. However, to the best of our knowledge, we are unaware of any recent empirical study that has used Survey of Financial Security to analyze these factors across different income levels. Most studies have used aggregated data at the national level; however, our analysis uses household level data from the 1999, 2005, and 2012 Survey of Financial Security to specifically examine the trends of different types of debts among Canadian families and the debt-asset and debt-income ratios across various income levels in Canada.[45]

3.3 Data and Descriptive Analysis

3.3.1 The Survey of Financial Security

The Survey of Financial Security (SFS) is a cross-sectional public-use micro-data file that collects detailed information on income, expenses, assets, debts, and wealth for Canadian households over the last year prior to January of the interview year. It also has some demographic characteristics of the household members (e.g. age, education, gender). The SFS is conducted in two months for 1983, 1999, 2005, and 2012 for all 10 provinces (May-June in 1999 and 2005, and September-November in 2012). The data for this study are extracted from 1999, 2005, and 2012 cycles for different income levels: below $40K, between $40K and $60K, between $60K and $80K, between $80K and $100K, and greater than $100K per year respectively.[46] Debts include mortgage on principal residence, mortgage on non-principal residence, credit card, student loan, vehicle loan, line of credit, and other loans from financial

[45] For more details, please see the link: http://www.statcan.gc.ca/pub/75-006-x/2015001/article/14167-eng.htm

[46] I deflate all numbers by using 2002 CPI calculated by Statistics Canada.

institutions. Assets are usually made up of real estate, personal belongings and savings, financial investments, and employer pension plans. The tables of descriptive statistics for different types of household debts, total debts, total income, and total assets from all three cycles of the SFS are documented in the appendix.

As noted on the study documentations of the SFS, the surveys do not cover 2% of the population approximately. These exclusions are the following groups: people living on reserves and other aboriginal lands; official representatives of foreign countries living in Canada and their families; members of religious and other communal colonies; members of the Canadian Forces living on military bases or in military camps; persons living full-time in institutions, for example, inmates of penal institutions and chronic care patients living in hospitals and nursing homes.

The numbers of dwellings from two sample sources are summarized in Table 3.1. Total number of dwellings is 23,000 in the 1999 survey, 9,000 in the 2005 survey, and 20,000 in the 2012 survey. The SFS surveys are drawn from two sources. The 1999 and 2005 surveys are stratified, multi-stage samples selected from the Labor Force Survey (LFS) and from geographic areas in which a large proportion of family units were defined as high-income (with total family income of at least $200,000 or investment income of at least $50,000). The 2012 survey is selected from the LFS frame and a frame constructed from the urban portion that is Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs) of the 2009 T1 family file (T1FF).

3.4 Methodology and Results

3.4.1 Debt-Income and Debt-Asset Ratios

In this paper, I calculate total debts relative to income and assets for different income levels over three years 1999, 2005, and 2012. The debt-income ratio is calculated by dividing average household total debts by their average total income. The households with higher debts-income ratios are at a greater risk of falling behind on their debt payments, specifically if their assets are not liquid. Likewise, the debt-asset ratio is calculated by dividing average total household debts by their average total assets. This ratio assesses household long-term vulnerability. A higher debt-asset ratio shows that a greater portion of the household's assets need to be liquidated to pay off their debts when households have difficulties to pay out their debts using their income. Tables 3.2-3.7 present the debt-income and debt-asset ratios for three

samples of households in years 1999, 2005, and 2012 across income levels. Since some households have no debts, these two ratios are calculated twice: the first rows in front of each year show the ratios for all income earners including those with zero debt, and the second rows in front of each year present the ratios for debt holders among income earners.

Table 3.8 summarizes the average debt-income and debt-asset ratios from Tables 3.2-3.7. Considering all debt and non-debt holders in 1999, the first row in Table 3.8 shows that the debt-income ratio is 4.3 for the income level less than $40K, .97 for $40K-$60K income level, .87 for $60K-$80K income level, .76 for $80K-$100K income level, .66 for $100K-$150K income level, and .47 for income levels greater than $150K in 1999. This ratio is greater than one (4.3) only for low income households with income levels less than $40K. This finding implies that the average debt for low income households is 4.3 times more than their average income. In other words, for every dollar the low income households earn, they owe 4.3 dollars on average. This ratio is less than one for all other income levels greater than $40K and it is decreasing as income level increases. This means that richer households have less debt relative to their income. For instance, households with income levels greater than $150K owe 47 cents for every dollar they earn on average. Once I calculate this ratio only for debt holders, the ratio are greater than one for households in three income levels: 7.1 for income level less than $40K, 1.2 for $40K-$60K income level, and 1.04 for $60K-$80K income level indicating that households in these three income levels owe respectively 7.1, 1.2, and 1.04 dollars for every dollar they earn on average. Considering household assets in 1999, the calculated average debt-asset ratios for all debt and non-debt holders in Table 3.8 are less than one for all income levels indicating that households in all income levels owe less than the value of their assets in 1999. However, the average debt-asset ratio is greater than one (1.3) when I calculate it only for debt holders with the income level less than $40K. In effect, these low income debt holders have both average debt-income and debt-asset ratios greater than one showing their vulnerability in debt repaying.

Looking at the third and fourth rows of Table 3.8, one can see that the average debt-income ratio has increased for all income levels in 2005. It is 4.3 for households with income levels less than $40K, 1.3 for $40K-$60K, 1.14 for $60K-$80K, 1.04 for $80K-$100K, .94 for $100K-$150K, and .61 for income levels greater than $150K. Once I calculate debt-income ratio only for debt holders, the average debt-income ratio increases for all income levels. It is 7.2 for household income less than $40K, 1.6 for $40K-$60K, 1.37 for $60K-$80K, 1.23 for $80K-

$100K, 1.17 for $100K-$150K, and .90 for income levels greater than $150K. This ratio has again increased in 2012 for all income levels. Rows 5 and 6 of the tables show this ratio for all income levels: 6 for household income less than $40K, 1.5 for $40K-$60K, 1.54 for $60K-$80K, 1.46 for $80K-$100K, 1.25 for $100K-$150K, and .93 for income levels greater than $150K. Calculating only for debt holders, this ratio becomes even larger for all income levels: 11.7 for households with income level less than $40K, 2 for $40K-$60K, 1.89 for $60K-$80K, 1.77 for $80K-$100K, 1.50 for $100K-$150K, and 1.21 for income levels greater than $150K.

The increasing debt-income ratios over these years suggest that the power of households to pay back their debts has tremendously decreased over these three years. The bottom half of Table 3.8 documents the average debt-asset ratios from Tables 3.2-3.7. The seventh and eighth rows of Table 3.8 show that the debts relative to assets have also increased for all income levels in 2005 compared to the ones in 1999: 1.7 for household income less than $40K, .30 for $40K-$60K, .39 for $60K-$80K, .23 for $80K-$100K, .20 for $100K-$150K, and .10 for income levels greater than $150K. This ratio has increased in 2012 when I calculate it only for debt holders: It is 3.1 for household income less than $40K, .40 for $40K-$60K, .46 for $60K-$80K, .28 for $80K-$100K, .25 for $100K-$150K, and .15 for income levels greater than $150K. However, the debt-asset ratios in 2012 are decreased for households with the income level less than $40K: .9 (all) and 1.6 (only debt holders), and for households with the income level between $60K and $80K: .28 (all) and .34 (only debt holders). For other income levels in 2012, the debt-asset ratio is either constant or increased: .3 (all) and .4 (only debt holders) for $40K-$60K, .25 (all) and .30 (only debt holders) for $80K-$100K, .22 (all) and .27 (only debt holders) for $100K-$150K, and .15 (all) and .20 (only debt holders) for income levels greater than $150K.

Average debt-income and debt-asset ratios are also illustrated in Figures 3.1 and 3.2. As it is discussed earlier, the debt-income ratio is 4.3 in 1999 and 2005, and it is increased to 6 in 2012 for households with income less than $40K. The average debt-asset ratios for these low income earners are 0.7, 0.9, and 1.7 respectively in 1999, 2005, and 2012. Both ratios are lower for households with lower levels of income. The average debt-income ratios in 2012 are all increased in 2005 and 2012 compared to 1999 across all income levels. In the following sections, I present the average total debts and assets and average ratio of different types of debts relative to total debts across various income levels to find out the source of indebtedness of Canadian households over the study time.

3.4.2 Average Total Debts and Assets

Figures 3.3 and 3.4 illustrate the trends of average total debts and assets across different income levels in 1999, 2005, and 2012. Not surprisingly, the graphs show that the average total debts and assets are higher for households with higher income. Comparing the trends of debts and assets over the three years, one can see that the average total debts are increased over the years for all income levels. For example, low income households holding an income level less than $40K have the average debts of $30K in 1999, $43K in 2005, and $57K in 2012 indicating an increase of 43% in 2005 and 90% increase in 2012 compared to 1999. At the opposite side of the income ladder, households with an income level more than $150K have the average total debts of $149K in 1999, $250K in 2005, and $278K in 2012 indicating an increase of 68% in 2005 and 87% in 2012 compared to 1999. Thus, the average total debts in 2012 have increased for low income households more than for high income holders. Based on Graph 3.4, the average total assets for households with an income level less than $40K has increased from 168K in 1999 to $258K in 2005 (54% increase) and to $336K in 2012 (100% increase). At the opposite side of the income ladder, the average total assets for households with an income level more than 150K has increased from $1,317K in 1999 to $3,201K in 2005 (143% increase) and then it has been decreased to $2,470K in 2012 (30% decrease) compared to 2005. This decrease is the only exception in these two graphs.

3.4.3 Average Ratios of Different Types of Debts Relative to Total Debts

Average ratios of different types of debts relative to total debts are illustrated in Figures 3.5 and 3.6 for 1999, Figures 3.7 and 3.8 for 2005, and Figures 3.9 and 3.10 for 2012. Figure 3.5 revealed that mortgages on non-principal and principal residences are two main sources of high debts in 1999 across all income levels. These two debt ratios are also the highest ratios in 2005 and 2012. In 1999, the ratios of average mortgage on non- principal residence debts are higher for lower level income earners (42.4% for less-than-$40K income earners versus 33.9% for more-than-$150K income earners), while the ratio of average mortgage on principal residence debts are higher for those households with higher level income (34.1% for less-than-$40K income earners versus 38.5% for more-than-$150K income earners). These findings are not consistent for 2005 and 2012.

Comparing Figures 3.5, 3.7, and 3.9, the average ratio of mortgage on non- principal residence debts relative to total debts are 42.4%, 48.2%, and 44.4% respectively in 1999, 2005, and 2012 for households with the income level less than $40K. This ratio is lower to 40.4% and 41.3% in 1999 and 2005 and higher to 47% in 2012 for $40K-$60K income level earners. For households in $60K-$80K income levels, the ratio continues to drop to 38% and 34.9% in 1999 and 2005, and continue to rise to 49.2% in 2012. For $80K-$100K income levels, it becomes lower to 35.5% in 1999, but it increases to 38.5% and 47.5% in 2005 and 2012. The ratios are 40%, 39.3%, and 39.3% in 1999, 2005, and 2012 respectively for $100K-$150K income earners. And finally the ratios are 33.9%, 42.5%, and 44.1% for the income levels greater than $150K. As it is mentioned earlier, the other main source of debts is the average mortgage on principal residence over 1999, 2005, and 2012. The ratios of average mortgage on principal residence relative to total debts are 34.1% for 0-$40K income level, 36.4% for $40K-$60K, 36.8% for $60K-$80K, 37.5% for $80K-$100K, 35.2% for $100K-$150K, and 38.5% for income levels more than $150K. This ratio does not have a specific pattern across different income levels in 2005 and 2012.

Figures 3.6, 3.8, and 3.10 also illustrate the ratios of other types of debts relative to total debts in 1999, 2005, and 2012 respectively excluding the average ratios of mortgages on principal and non- principal residences. For income levels more than $150K, the average debts on line of credit and loans from financial institutions are the two highest ratios in 1999 and 2005. Excluding the mortgage debt ratios, the line of credit debt ratios are the highest debt ratios in 2012, and the ratios of loans from financial institutions drop and get close to the ratios of student loans in 2012. The average ratios of student loan and vehicle loan are the two lowest ratios over all three years. Therefore, mortgages on principal and non-principal residences are two main sources of high indebtedness of Canadian households. Moreover, the debt on line of credit has the next highest debt ratio over 1999, 2005, and 2012.

3.5 Summary

Increasing household indebtedness is current Canada economy concern that needs to be well studied. This study uses the Survey of Financial Security (SFS) and documents the average total debts relative to total income and total assets for different income levels over three years of 1999, 2005, and 2012. Households with higher debt-income ratios are at a greater risk of falling

behind on their debt payments and those with higher debt-asset ratios have long-term vulnerability. In effect, a high debt-asset ratio indicates that the households may need to pay out their debts using more of their assets in addition to their income. The results show that the debt-income ratio has increased for all income levels over three years suggesting that power of households to pay back their debts has decreased from 1999 to 2012. The debt-asset ratios have also increased for all income levels in 2005 compared to the ones in 1999, but this ratio has increased in 2012 only for income levels greater than $80K.

For instance, the average debt-income ratio for low-income households earning less than $40K is 4.3 in 1999 and 6 in 2012 meaning that these households owe, on average, $4.3 and $6 for every dollar they earn respectively in 1999 and 2012. The debt-income is less than one for all other income levels greater than $40K and it is decreasing as income level increases. Therefore, households with higher levels of income have less debt relative to their income in 1999. When I calculate this ratio only for debt holders, the ratio is greater than one for households in three income levels: 7.1 for income levels less than $40K, 1.20 for $40K-$60K, and 1.04 for $60K-$80K. Findings on the calculated average debt-asset ratios show that this ratio is less than one for all income levels greater than $40K indicating that these households owe less than the value of their assets. In fact, low income debt-holders have both average debt-income and debt-asset ratios greater than one showing their vulnerability in debt payments.

Comparing the trends of total debts, we can see that the average total debts are increased over the three years for all income levels. The study finds that the average ratios of mortgages on principal and non- principal debts relative to total debts are the highest ratios compared to the ratios of other types of debts. So the main sources of this increase are the mortgages on non-principal and principal residences. Furthermore, in 1999, excluding the income level $110K-$150K, the ratio of average mortgage on non- principal residence debts over total debts is more for higher levels of income, while the ratio of average mortgage on principal residence debts over total debts increases as level of income raises. This finding is not consistent for 2005 and 2012. Finally, excluding the average mortgage on principal and non- principal residences, the findings report that the average ratios of credit card debts relative to total debts are the next highest ratio over all three years compared to other types of debts. The ratios of student loan and vehicle loan relative to total debts are the two lowest ratios over these three years.

3.6 Tables and Figures

Table 3.1: Total number of dwellings from three cycles of 1999, 2005, and 2012 Survey of Financial Security

Survey year	Total number of dwellings	Number of dwelling from the LFS frame	Number of dwellings from high-income family areas	Number of dwellings from the urban TIFF frame
1999	23,000	21,000	2,000	NA
2005	9,000	7,500	1,500	NA
2012	20,000	11,591	NA	8,409

Source: http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=2620&lang=en&db=imdb&adm=8&dis=2

Table 3.2: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level below $40K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	7,556	4.3	70.2	0	3,280
2	1999 (including only all debt holders)	4,509	7.1	90.8	.001	3,280
3	2005 (including all)	2,121	4.3	51.4	0	2,040
4	2005 (including only all debt holders)	1,274	7.2	66.1	.002	2,040
5	2012 (including all)	4,047	6	68.9	0	2,200
6	2012 (including only all debt holders)	2,410	11.7	88.9	.001	2,200
	Debt-asset ratio					
7	1999 (including all)	8,807	.7	5.3	0	283.8
8	1999 (including only all debt holders)	4,987	1.3	7	.001	283.8
9	2005 (including all)	2,496	1.7	31.4	0	1,511
10	2005 (including only all debt holders)	1,408	3.1	41.8	.001	1,511
11	2012 (including all)	4,813	.9	6.6	0	193.3
12	2012 (including only all debt holders)	2,746	1.6	8.6	.001	193.3

Calculated by author using the Survey of Financial Security

Table 3.3: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level between $40K and $60K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	2,538	.97	1.2	0	10.7
2	1999 (including only all debt holders)	2,086	1.2	1.2	.001	10.7
3	2005 (including all)	752	1.3	1.9	0	19.9
4	2005 (including only all debt holders)	595	1.6	2	.005	19.9
5	2012 (including all)	1,713	1.5	3	0	67.9
6	2012 (including only all debt holders)	1,291	2	3.3	.001	67.9
	Debt-asset ratio					
7	1999 (including all)	2,538	.3	.9	0	33.7
8	1999 (including only all debt holders)	2,086	.4	.98	.001	33.7
9	2005 (including all)	752	.3	1.2	0	28.4
10	2005 (including only all debt holders)	595	.4	1.3	.001	28.4
11	2012 (including all)	1,713	.3	1.7	0	67.5
12	2012 (including only all debt holders)	1,291	.4	1.9	.001	67.5

Calculated by author using the Survey of Financial Security

Table 3.4: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level between $60K and $80K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	1,613	.87	.90	0	5.38
2	1999 (including only all debt holders)	1,341	1.04	.89	.0002	5.38
3	2005 (including all)	572	1.14	1.32	0	15.5
4	2005 (including only all debt holders)	479	1.37	1.34	.001	15.5
5	2012 (including all)	1,348	1.54	2.47	0	42.7
6	2012 (including only all debt holders)	1,098	1.89	2.62	.00001	42.7
	Debt-asset ratio					
7	1999 (including all)	1,613	.27	.59	0	20.1
8	1999 (including only all debt holders)	1,341	.32	.63	.0001	20.1
9	2005 (including all)	572	.39	1.26	0	18.9
10	2005 (including only all debt holders)	479	.46	1.36	.0003	18.9
11	2012 (including all)	1,348	.28	.44	0	8.71
12	2012 (including only all debt holders)	1,098	.34	.46	.0001	8.71

Calculated by author using the Survey of Financial Security

Table 3.5: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level between $80K and $100K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	1,029	.76	.71	0	4.39
2	1999 (including only all debt holders)	875	.89	.69	.001	4.39
3	2005 (including all)	409	1.04	1.11	0	6.73
4	2005 (including only all debt holders)	345	1.23	1.11	.003	6.73
5	2012 (including all)	1,145	1.46	1.99	0	22.4
6	2012 (including only all debt holders)	945	1.77	2.06	.0001	22.4
	Debt-asset ratio					
7	1999 (including all)	1,029	.22	.24	0	2.84
8	1999 (including only all debt holders)	875	.26	.24	.0001	2.84
9	2005 (including all)	409	.23	.25	0	1.36
10	2005 (including only all debt holders)	345	.28	.25	.001	1.36
11	2012 (including all)	1,145	.25	.31	0	4.52
12	2012 (including only all debt holders)	945	.30	.32	.00002	4.52

Calculated by author using the Survey of Financial Security

Table 3.6: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level between $100K and $150K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	864	.66	.74	0	6.35
2	1999 (including only all debt holders)	714	.80	.74	.001	6.35
3	2005 (including all)	479	.94	1.18	0	13.7
4	2005 (including only all debt holders)	387	1.17	1.21	.004	13.7
5	2012 (including all)	1,513	1.25	1.48	0	15.7
6	2012 (including only all debt holders)	1,263	1.50	1.49	0.00001	15.7
	Debt-asset ratio					
7	1999 (including all)	864	.17	.20	0	1.95
8	1999 (including only all debt holders)	714	.21	.20	.0004	1.95
9	2005 (including all)	479	.20	.25	0	3.09
10	2005 (including only all debt holders)	387	.25	.26	.001	3.09
11	2012 (including all)	1,513	.22	.32	0	8.09
12	2012 (including only all debt holders)	1,263	.27	.34	.00001	8.09

Calculated by author using the Survey of Financial Security

Table 3.7: Debt-income and debt-asset ratios in 1999, 2005, and 2012 for households with an income level greater than $150K (including) per year

Row	Debt-income ratio	Number of observations	Mean	Std. dev.	Minimum ratio	Maximum ratio
1	1999 (including all)	590	.47	.59	0	3.98
2	1999 (including only all debt holders)	419	.67	.60	.001	3.98
3	2005 (including all)	535	.61	1.01	0	9.94
4	2005 (including only all debt holders)	364	.90	1.12	.002	9.94
5	2012 (including all)	1,412	.93	1.29	0	13.2
6	2012 (including only all debt holders)	1,087	1.21	1.35	.0001	13.2
	Debt-asset ratio					
7	1999 (including all)	590	.12	.19	0	3.16
8	1999 (including only all debt holders)	419	.17	.21	.001	3.16
9	2005 (including all)	535	.10	.15	0	.85
10	2005 (including only all debt holders)	364	.15	.16	.0004	.85
11	2012 (including all)	1,412	.15	.37	0	12.1
12	2012 (including only all debt holders)	1,087	.20	.41	.000003	12.1

Calculated by author using the Survey of Financial Security

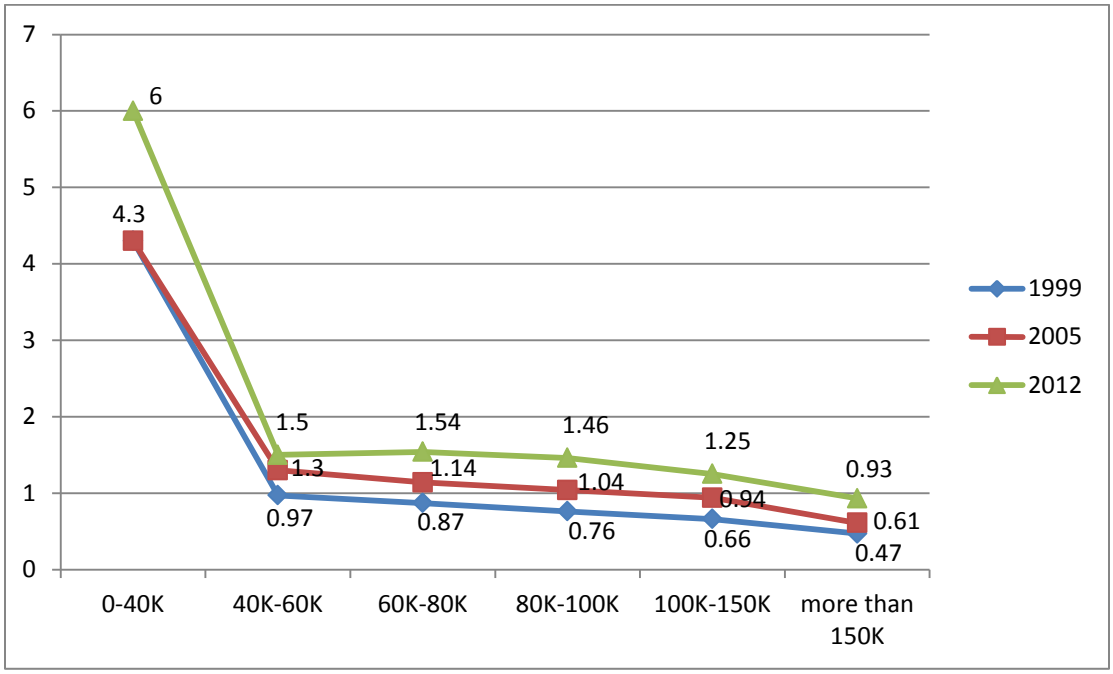
Table 3.8: Summary of the average debt-income and debt-asset ratios from tables 2-7

Row	Year	Type of Income Earners	Income less than $40K	Income $40K-$60K	Income 60K-80K	Income 80K-100K	Income 100K-150K	Income greater than 150K
				Debt / Income				
1	1999	All	4.3	.97	.87	.76	.66	.47
2	1999	Debt holders	7.1	1.2	1.04	.89	.80	.67
3	2005	All	4.3	1.3	1.14	1.04	.94	.61
4	2005	Debt holders	7.2	1.6	1.37	1.23	1.17	.90
5	2012	All	6	1.5	1.54	1.46	1.25	.93
6	2012	Debt holders	11.7	2	1.89	1.77	1.5	1.21
				Debt / Asset				
7	1999	All	.7	.3	.27	.22	.17	.12
8	1999	Debt holders	1.3	.4	.32	.26	.21	.17
9	2005	All	1.7	.3	.39	.23	.20	.10
10	2005	Debt holders	3.1	.4	.46	.28	.25	.15
11	2012	All	.9	.3	.28	.25	.22	.15
12	2012	Debt holders	1.6	.4	.34	.30	.27	.20

Calculated by author using the Survey of Financial Security

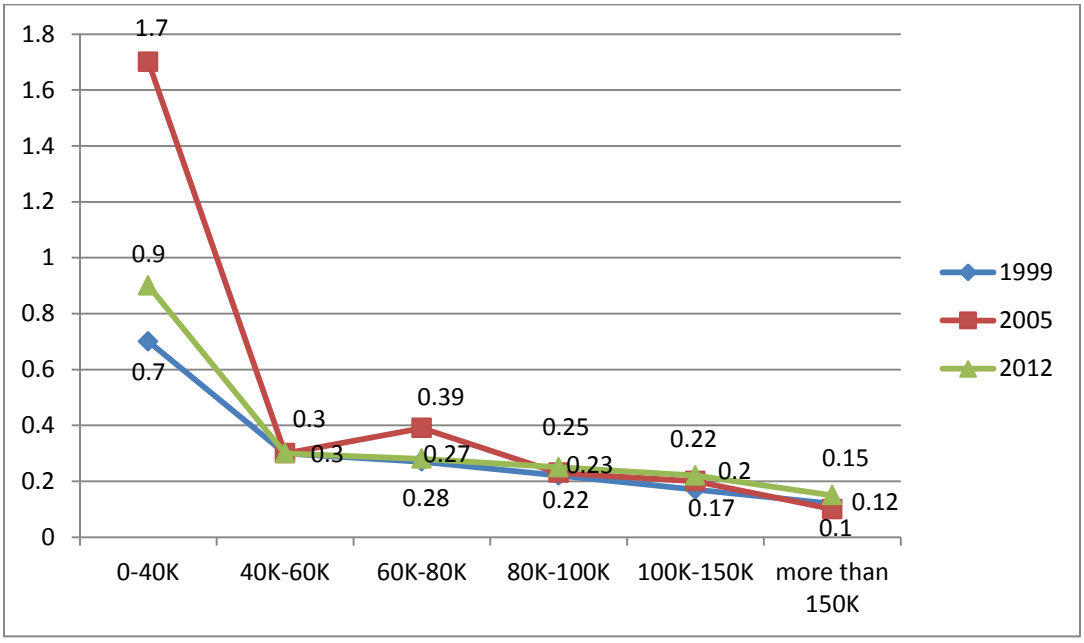
Figures

Figure 3.1: Average debt-income ratio across different income levels in 1999, 2005, and 2012



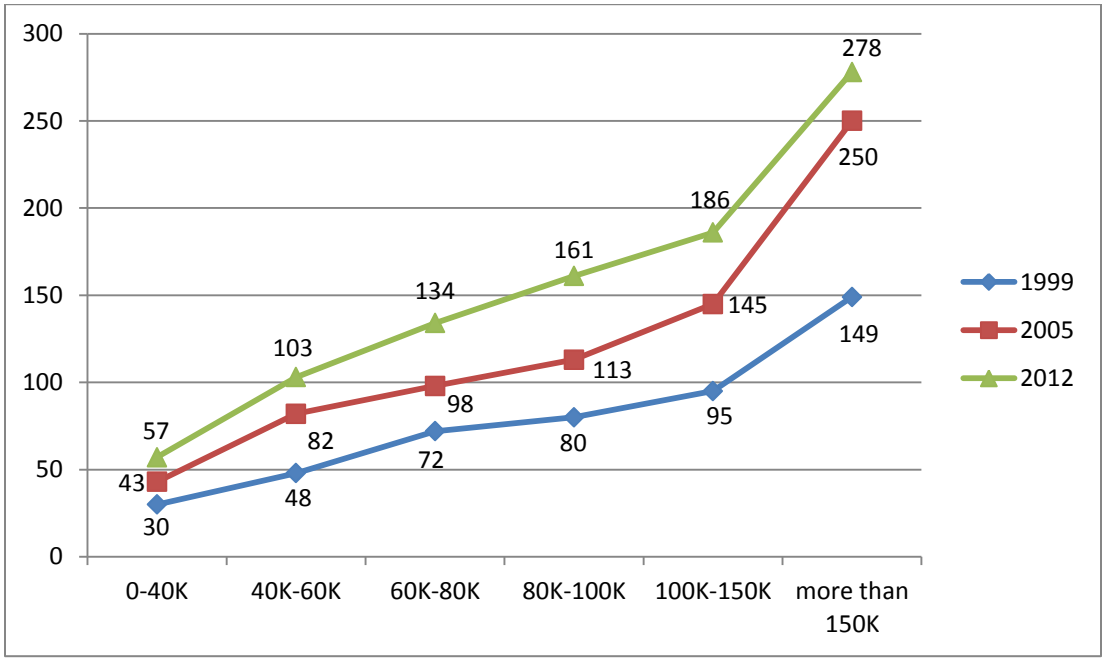
Calculated by author using the Survey of Financial Security

Figure 3.2: Average debt-asset ratio across different income levels in 1999, 2005, and 2012



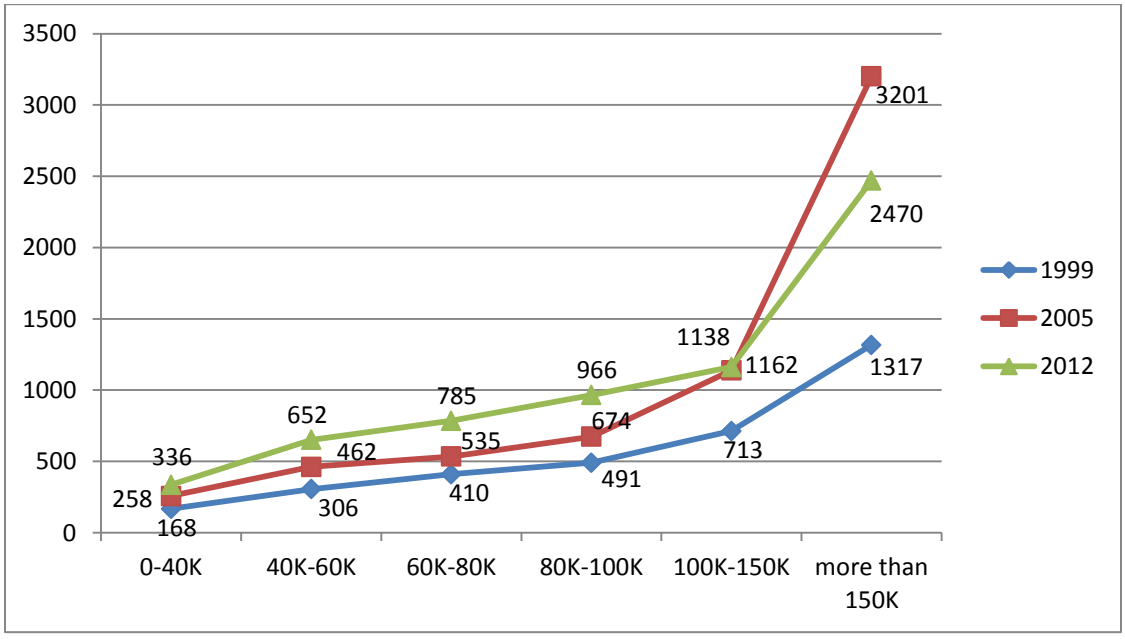
Calculated by author using the Survey of Financial Security

Figure 3.3: Average total debts (K) across different income levels in 1999, 2005, and 2012



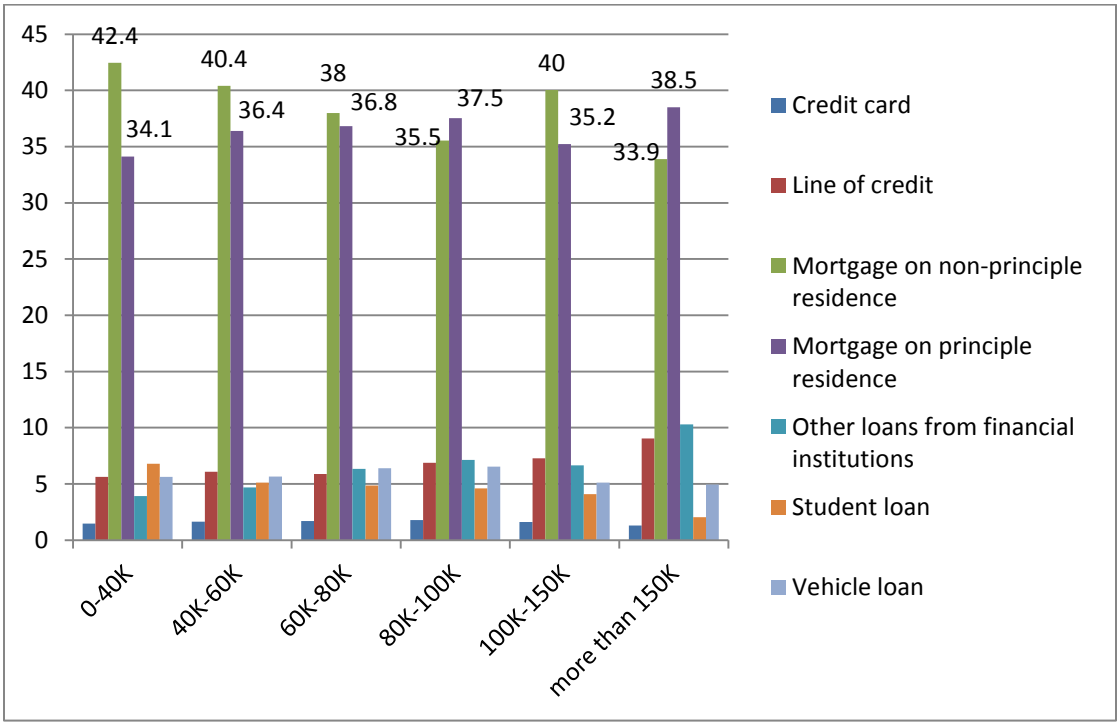
Calculated by author using the Survey of Financial Security

Figure 3.4: Average total assets (K) across different income levels in 1999, 2005, and 2012



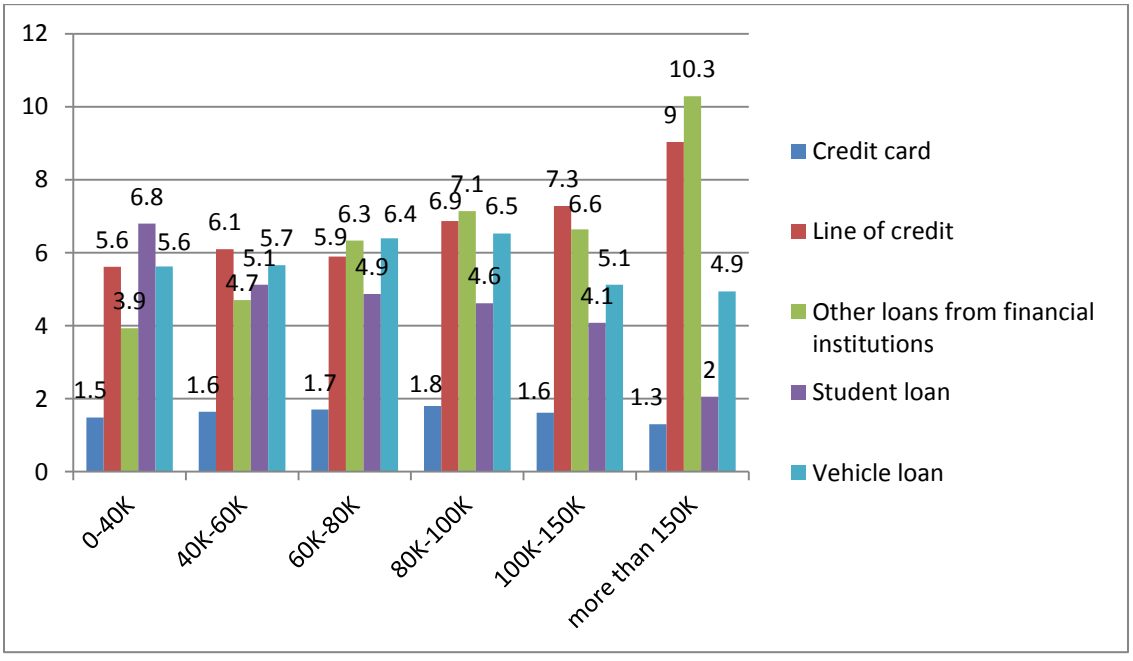
Calculated by author using the Survey of Financial Security

Figure 3.5: Average ratio of different types of debts to total debts (%) in 1999



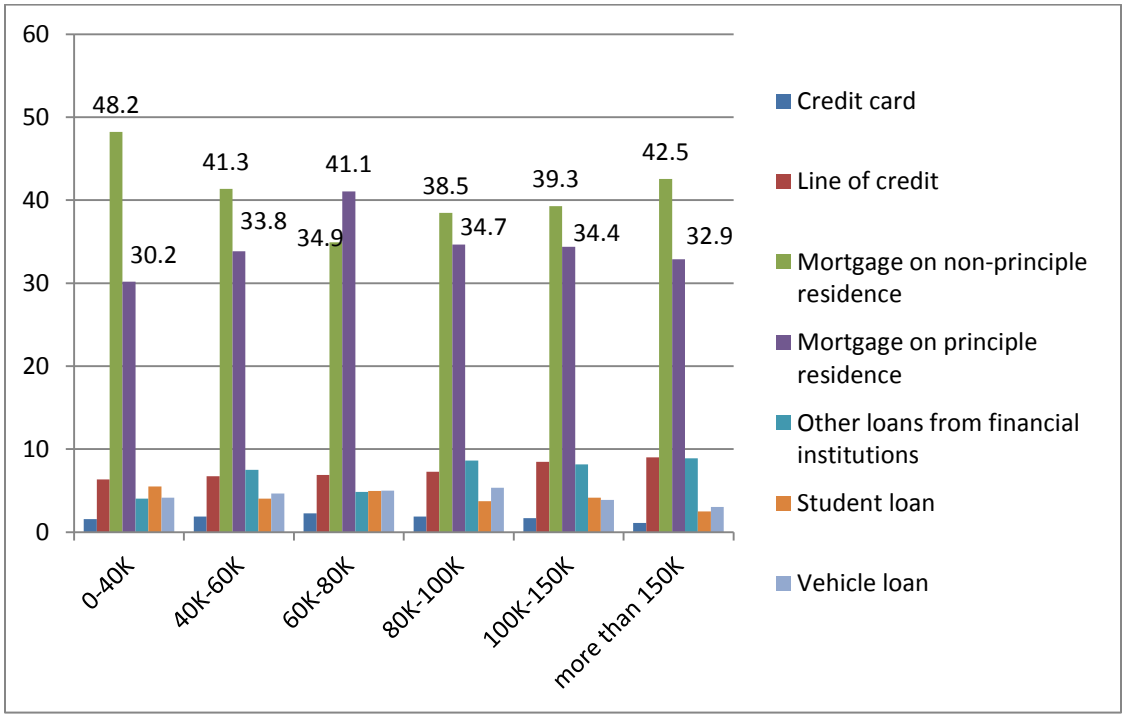
Calculated by author using the Survey of Financial Security

Figure 3.6: Average ratio of different types of debts to total debts (%) in 1999 - except mortgages



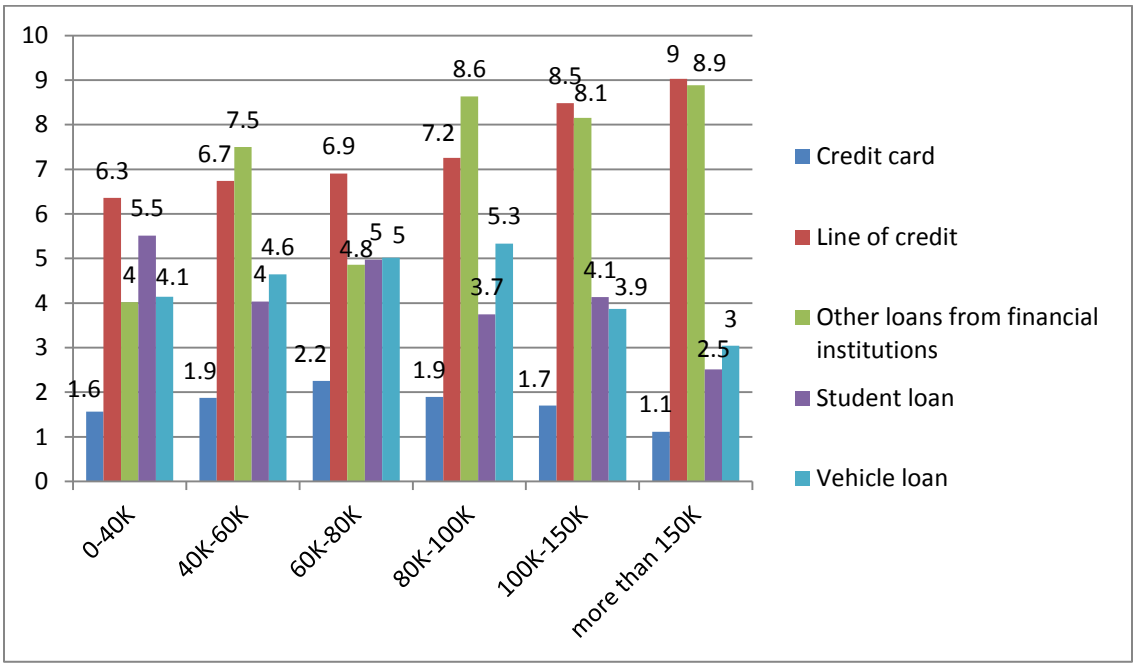
Calculated by author using the Survey of Financial Security

Figure 3.7: Average ratio of different types of debts to total debts (%) in 2005



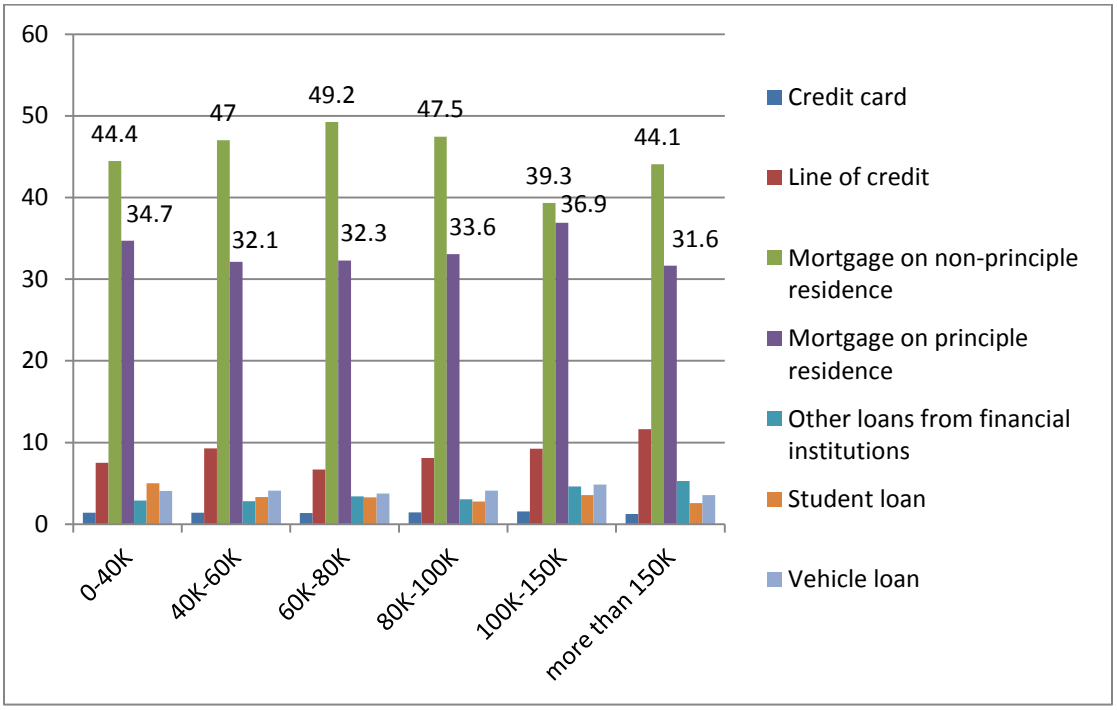
Calculated by author using the Survey of Financial Security

Figure 3.8: Average ratio of different types of debts to total debts (%) in 2005 – except mortgagees



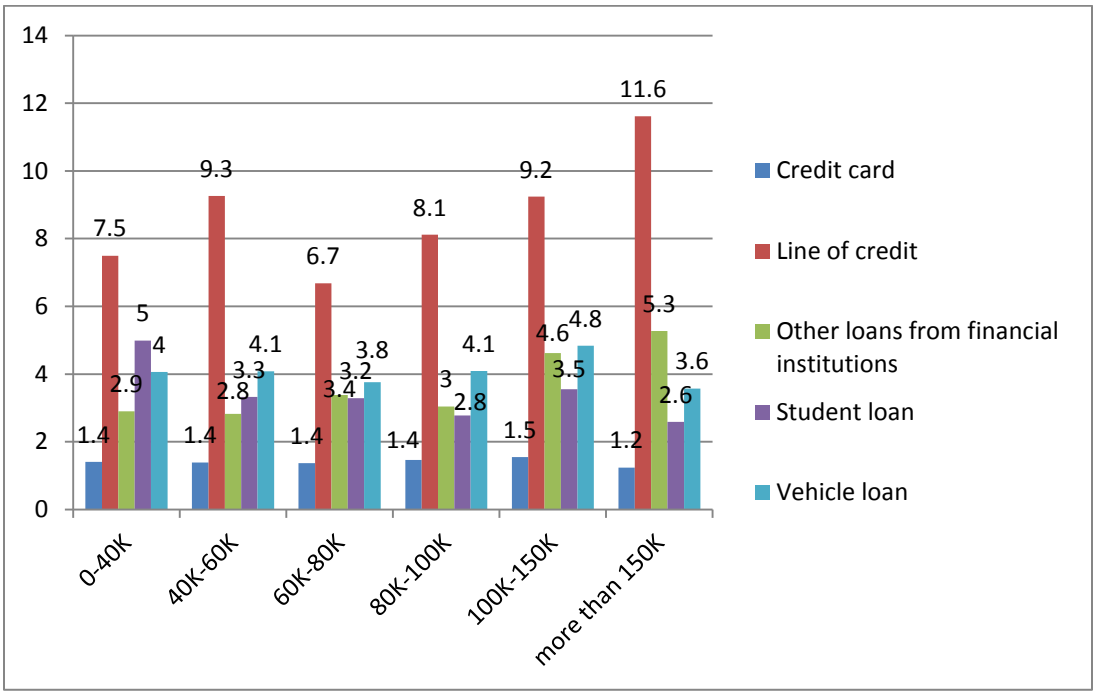
Calculated by author using the Survey of Financial Security

Figure 3.9: Average ratio of different types of debts to total debts (%) in 2012



Calculated by author using the Survey of Financial Security

Figure 3.10: Average ratio of different types of debts to total debts (%) in 2012 – except mortgages



Calculated by author using the Survey of Financial Security

References

Acemoglu, D., & Pischke, J. S. (1998). Why do firms train? Theory and evidence. *The Quarterly Journal of Economics*, *113*(1), 79-119.

Acemoglu, D., & Shimer, R. (2000). Productivity gains from unemployment insurance. *European Economic Review*, 44(7), 1195-1224.

Addison, J. T., & Blackburn, M. L. (2000). The effects of unemployment insurance on post-unemployment earnings. *Labour Economics*, 7(1), 21-53.

Addison, J. T., Ozturk, O. D., & Wang, S. (2014). The Role of Gender in Promotion and Pay over a Career. *Journal of Human Capital*, 8(3), 280-317.

Adema, W., D. Gray and S. Kahl (2003), "Social Assistance in Germany", *OECD Labour Market and Social Policy Occasional Papers*, No. 58, OECD Publishing.

Ai, C., & Norton, E. C. (2003). Interaction terms in logit and probit models.Economics letters, 80(1), 123-129.

Almeida, R., & Carneiro, P. (2009). The return to firm investments in human capital. *Labour Economics*, *16*(1), 97-106.

Angrist, JD., & Pischke, JS. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. *Prinston University Press.*

Audas, R., Barmby, T., & Treble, J. (2004). Luck, effort, and reward in an organizational hierarchy. *Journal of Labor Economics*, *22*(2), 379-395.

Baker, G., Gibbs, M., & Holmstrom, B. (1994). The internal economics of the firm: evidence from personnel data. *The Quarterly Journal of Economics*, *109*(4), 881-919.

Barnes, S., & Young, G. (2003). The rise in US household debt: assessing its causes and sustainability.

Bernhardt, D. (1995). Strategic promotion and compensation. *The Review of Economic Studies*, *62*(2), 315-339.

Betts, J. R., & Fairlie, R. W. (2001). Explaining ethnic, racial, and immigrant differences in private school attendance. *Journal of Urban Economics*, *50*(1), 26-51.

Bognanno, M. L. (2001). Corporate tournaments. *Journal of Labor Economics*,*19*(2), 290-315.

Brian, G., Main, M., O'Reilly III, C., & Wade, J. (1993). Top executive pay: Tournament or teamwork. *Journal of Labor Economics, 11*(4), 606-628.

Büchel, F. (2002). The effects of overeducation on productivity in Germany—the firms' viewpoint. *Economics of Education Review*, *21*(3), 263-275.

Burgard, C. (2012). Gender Differences in Further Training Participation–The Role of Individuals, Households and Firms. *Ruhr Economic Paper*, (320).

Busch, A., & Holst, E. (2009). Glass ceiling effect and earnings: The gender pay gap in managerial positions in Germany (No. 905). Discussion papers//*German Institute for Economic Research*.

Caliendo, M., Tatsiramos, K., & Uhlendorff, A. (2013). Benefit Duration, Unemployment Duration And Job Match Quality: A Regression-Discontinuity Approach. *Journal of Applied Econometrics*, 28(4), 604-627.

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2011). Robust inference with multiway clustering. *Journal of Business & Economic Statistics*, *29*(2).

Canner, G. B., Kennickell, A. B., & Luckett, C. A. (1995). Household sector borrowing and the burden of debt. *Fed. Res. Bull.*, *81*, 323.

Card, D., Chetty, R., & Weber, A. (2007). The spike at benefit exhaustion: Leaving the unemployment system or starting a new job? (No. w12893). *National Bureau of Economic Research.*

Card, D., & Levine, P. B. (2000). Extended benefits and the duration of UI spells: evidence from the New Jersey extended benefit program. *Journal of Public economics*, 78(1), 107-138.

Cassidy, H., DeVaro, J., & Kauhanen, A. (2012). The Signaling Role of Promotions: New Evidence from European Firms.

Chawla, Raj K. and Ted Wannell (2005). "Spenders and Savers." *Perspectives on Labour and Income* 6(3), available at http://www.statcan.gc.ca/pub/75-001-x/10305/4096656-eng.htm.

Costa, J. E. R. I. (1988). Managerial task assignment and promotions.*Econometrica: Journal of the Econometric Society*, 449-466.

Currie, J., & Gruber, J. (1996). Health insurance eligibility, utilization of medical care, and child health. *The Quarterly Journal of Economics*, *111*(2), 431-466.

Curtis, L. J., & Rybczynski, K. (2014). Exiting Poverty: Does Sex Matte? *Canadian Public Policy*, 40(2), 126-142.

Debelle, G. (2004). Macroeconomic implications of rising household debt.
DeVaro, J. (2006). Internal promotion competitions in firms. *The Rand Journal of Economics*, *37*(3), 521-542.

DeVaro, J. (2006). Strategic promotion tournaments and worker performance.*Strategic Management Journal*, *27*(8), 721-740.

DeVaro, J., & Waldman, M. (2012). The signaling role of promotions: Further theory and empirical evidence. *Journal of Labor Economics*, *30*(1), 91-147.

Ekici, T., & Dunn, L. (2010). Credit card debt and consumption: evidence from household-level data. *Applied Economics*, *42*(4), 455-462.

Eriksson, T. (1999). Executive compensation and tournament theory: Empirical tests on Danish data. *Journal of labor Economics*, *17*(2), 262-280.

European Commission/EACEA/Eurydice, 2013. Education and Training in Europe 2020: Responses from the EU Member States. Eurydice Report. Brussels: Eurydice.

Faruqui, Umar (2008). "Indebtedness and the Household Financial Health: An Examination of the Canadian Debt Service Ratio Distribution." Bank of Canada Working Paper 2008-46.

Finnie, R., & Irvine, I. (2011). The Redistributional Impact of Canada's Employment Insurance Program, 1992-2002. *Canadian Public Policy*, 37(2), 201-218.

Fitzenberger, B., & Wilke, R. A. (2010). New Insights into Unemployment Duration and Post Unemployment Earnings in Germany*. *Oxford Bulletin of Economics and Statistics*, 72(6), 794-826.

Fortin, B., Lacroix, G., & Thibault, J. F. (1999). The interaction of UI and welfare, and the dynamics of welfare participation of single parents. *Canadian public policy*, 25, S115-S132.

Georgellis, Y., & Lange, T. (2007). Participation in continuous, on-the-job training and the impact on job satisfaction: longitudinal evidence from the German labour market. *The International Journal of Human Resource Management*, *18*(6), 969-985.

Gibbons, R., & Waldman, M. (1999). A theory of wage and promotion dynamics inside firms. *The Quarterly Journal of Economics*, *114*(4), 1321-1358.

Gibbs, M. (1995). Incentive compensation in a corporate hierarchy. *Journal of Accounting and Economics*, *19*(2), 247-277.

Greene, W. H. (2003). *Econometric analysis*. Pearson Education India.

Greene, W. H. (2008). *Econometric Analysis*, 6th Edition. Upper Saddle River, NJ: Pearson Prentice Hall.

Grey, A. (2002). Employment insurance and social assistance: evidence on program interaction. Final Report: *Human Resources Development Canada*, January.

Grund, C., & Martin, J. (2012). Determinants of further training–evidence for Germany. *The International Journal of Human Resource Management*, 23(17), 3536-3558.

Heckman, J. J., & Snyder Jr, J. M. (1996). *Linear probability models of the demand for attributes with an empirical application to estimating the preferences of legislators* (No. w5785). National Bureau of Economic Research.

Herrala, R. (2006). Household indebtedness. Monetary Policy and Research.

Hunt, J. (1995) "The Effect of Unemployment Compensation on Unemployment Duration in Germany", *Journal of Labor Economics*, 13, 88-120.

Hurst, Matt (2011). "Debt and family type in Canada." *Canadian Social Trends* 11-008-X, No. 91, 2011001.

Karaca-Mandic, P., Norton, E. C., & Dowd, B. (2012). Interaction terms in nonlinear models. *Health services research*, *47*(1pt1), 255-274.

Katz, L. F., & Meyer, B. D. (1990). The impact of the potential duration of unemployment benefits on the duration of unemployment. *Journal of public economics*, 41(1), 45-72.

Königs, S. (2014). The Dynamics of Social Assistance Benefit Receipt in Germany-State Dependence before and after the 'Hartz Reforms'. *IZA Discussion Paper*, No. 7977.

Lancaster, T. (1979). Econometric methods for the duration of unemployment. *Econometrica: Journal of the Econometric Society*, 939-956.

Lazear, E. P., & Rosen, S. (1981). Rank-Order Tournaments as Optimum Labor Contracts. *The Journal of Political Economy*, *89*(5), 841-864.

Lazear, E. P. (1989). Pay equality and industrial politics. *Journal of political economy*, 561-580

Lazear, E. P., & Rosen, S. (1990). Male-female wage differentials in job ladders. Journal of Labor Economics, S106-S123.

Lluis, S. (2005). The role of comparative advantage and learning in wage dynamics and intrafirm mobility: evidence from Germany. *Journal of Labor Economics*, *23*(4), 725-767.

Marimon, R., & Zilibotti, F. (1999). Unemployment vs. mismatch of talents: reconsidering unemployment benefits. *The Economic Journal*, 109(455), 266-291.

May, O., M. Tudela, and G. Young. 2004. "British household indebtedness and financial stress: a

household-level picture." Bank of England Quarterly Bulletin (Winter): 414–28.
McCue, K. (1996). Promotions and wage growth. *Journal of Labor Economics*, 175-209.

Meh, C.A. and Y. Terajima. 2008. "Inflation, Nominal Portfolios, and Wealth Redistribution in Canada." Bank of Canada Working Paper No. 2008-19.

Melero, E. (2010). Training and promotion: allocation of skills or incentives?.*Industrial Relations: A Journal of Economy and Society*, *49*(4), 640-667.

Meyer, M. A. (1992). Biased contests and moral hazard: Implications for career profiles. *Annales d'Economie et de Statistique*, 165-187.

Milgrom, P., & Oster, S. (1987). Job discrimination, market forces, and the invisibility hypothesis. The Quarterly Journal of Economics, 453-476.

Nickell, S. (1979). Estimating the probability of leaving unemployment. *Econometrica: Journal of the Econometric Society*, 1249-1266.

Owan, H. (2004). Promotion, Turnover, Earnings, and Firm-Sponsored Training.*Journal of Labor Economics*, *22*(4), 955-978.

Pellizzari, M. (2006). Unemployment duration and the interactions between unemployment insurance and social assistance. *Labour Economics*, 13(6), 773-798.

Pergamit, M. R., & Veum, J. R. (1999). What is a Promotion?. *Industrial and Labor Relations Review*, 581-601.

Pischke, J. S. (2001). Continuous training in Germany. *Journal of Population Economics*, *14*(3), 523-548.

Rosen, S. (1986). Prizes and Incentives in Elimination Tournaments. *The American Economic Review*, 701-715.

Sen, A., Rybczynski, K., & Van De Waal, C. (2011). Teen employment, poverty, and the minimum wage: Evidence from Canada. *Labour Economics*,*18*(1), 36-47.

Statistics Canada (2007). "Personal Debt." *Perspectives on Labour and Income*. Statistics Canada Catalogue no. 75-001-XIE, available at http://www.statcan.gc.ca/pub/75-001-x/commun/4235072-eng.pdf.

Tatsiramos, K. (2009). Unemployment insurance in europe: Unemployment duration and subsequent employment stability. *Journal of the European Economic Association*, 7(6), 1225-1260.

Tatsiramos, K., & Ours, J. C. (2014). Labor market effects of unemployment insurance design. *Journal of Economic Surveys*, 28(2), 284-311.

Tremblay, D. G., & Le Bot, I. (2000). *The German dual apprenticeship system: Analysis of its evolution and present challenges* (p. 24). York University, Labour Education and Training Research Network, Centre for Research on Work and Society.

Uppal, S., & LaRochelle-Côté, S. (2015). Changes in debt and assets of Canadian families, 1999 to 2012.

Waldman, M. (1984). Job assignments, signalling, and efficiency. *The RAND Journal of Economics*, *15*(2), 255-267.

Winship, C., & Radbill, L. (1994). Sampling weights and regression analysis.*Sociological Methods & Research*, *23*(2), 230-257.

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data. *MIT press*.

Yamaguchi, S. (2010). Job search, bargaining, and wage dynamics. *Journal of Labor Economics*, *28*(3), 595-631.

Zabojnik, J., & Bernhardt, D. (2001). Corporate Tournaments, Human Capital Acquisition, and the Firm Size—Wage Relation. *The Review of Economic Studies*, *68*(3), 693-716.

Zajączkowski, S., & Żochowski, D. Ł. (2006, August). The distribution and dispersion of debt burden ratios among households in Poland and its implications for financial stability. In *Proceedings of the IFC Conference on" Measuring the financial position of the household sector", Basel* (Vol. 2, pp. 62-74).

Appendices

Appendix A

By using “occupational position” variable in GSOEP, blue-collar, white-collar, and civil service workers are categorized as follows:

Blue-collar worker:

1. Untrained Worker
2. Semi-Trained Worker
3. Trained Worker
4. Forman, Team Leader
5. Forman (Master craftsman)

White- collar worker:

1. W-Collar Worker With Simple Tasks
2. Untrained W-Collar Worker With Simple Tasks
3. Trained W-Collar Worker With Simple Tasks
4. Qualified Professional
5. H. Qualified Professional
6. Managerial

Civil service worker:

1. Low-level Civil Service
2. Middle-Level Civil Service
3. High-Level Civil Service
4. Executive-Level Civil Service

Based on these three types of workers, I define four job levels following Lluis (2005):

Low-level Job: Blue-collar 1, 2 and White-collar 1, 2, 3 and Civil servant 1.

Middle-level Job: Blue-collar 3 and White-collar 4 and Civil servant 2.

High-level Job: Blue-collar 4 and White-collar 5 and Civil servant 3.

Executive-level Job: Blue-collar 5 and White-collar 6 and Civil servant 4.

Appendix B (Structure of Education System in Germany)

Tremblay and Le Bot (2003) explain the complex structure of education system in Germany that is summarized in the following chart. Based on this educational chart, German children stay in kindergarten from 3 to 6 years-old but kindergarten is optional. Then the compulsory primary school starts at the age of 6 and it usually lasts for four years. At the age of 10, all students start a two-year orientation stage in which they decide how to continue their education. From this stage, there are three different types of high schools (Secondary Level I). Each type of secondary level I is classified based on the future occupational careers and starts at the age of 12 and lasts for three or four years.

1- Some students enter Lower Secondary School, end of compulsory education (Hauptschulen) as the secondary level I which lasts for three years. If these students would like to continue studying more than secondary level I, they have different options in vocational schools or the dual system (on-the-job training and vocational school).
2- Some other students start in General Education School (Realschulen or Mittelschulen) after the orientation stage which lasts for four years. Many higher education options are available beyond this level of secondary education in Higher Technical Schools (Fachoberschulen) and Integrated Universities (Administration Fachhoschulen) which are all at a lower level than university. In fact, after 6 years of studying in Realschule and receiving the Intermediate Education Certificate (Mittlere Reife), students are able to pursue their studies in a higher technical school and then they can have access to specialized university colleges or integrated universities. These institutions are less academic than traditional universities, but they have more occupational oriented programs such as civil engineering.
3- The third group of students enter a more academic high school, a Grammar School (Gymnasien), which ends with a university entrance certificate (Abitur). This path of high school (Secondary Levels I and II) is the most direct path to university and it lasts six to seven years after the orientation stage.

At the age of 15 or 16, different training schools, intermediate education Certificate, or grammar schools are provided based on what path the student has chosen. Higher technical schools, colleges, or universities are the next levels of education at the age of 18 or 19. The summary of theses educational paths are illustrated in the following page.

Structure of the Education System in the Federal Republic of Germany

<table>
<tr><td colspan="7">Further education</td></tr>
<tr><td rowspan="2">Continuing Workplace Training</td><td rowspan="2">Evening Schools Adult Education Centres</td><td rowspan="2">Continuing Vocational schools (Fachschulen)</td><td rowspan="5">(Schulen des
Medical profession schools Geundheitswesens)</td><td>Fachhochschulen Integrated universities Administration Fachhoschulen</td><td colspan="2">University (Universitäten) Theological Institutes Teachers’ training Colleges Academy of Fine Arts Integrated universities</td></tr>
<tr><td rowspan="2">Higher Technical. Schools (Fachoberschulen)</td><td rowspan="2">Single Option Technical School</td><td rowspan="3">Grammar School (Gymnasium) (Secondary Level II) (16 to 18/19 years old) [Grades 11-12/13, Duration: 2 or 3 years]</td></tr>
<tr><td colspan="2">Interim employment</td><td rowspan="3">Full-time specialised vocational Schools (Berufsaufbauschulen)</td></tr>
<tr><td colspan="2" rowspan="2">Dual system (on-the-job training and vocational school)
Basic training year (3 years)</td><td rowspan="2">Full-time Vocational Schools (Berufsfachschulen)</td><td colspan="2">Intermediate Education Certificate (16 to 18 years old) [Grades 11 and 12, Duration: 2 years]</td></tr>
<tr><td colspan="3" rowspan="2">Type 1: Lower Secondary School (end of compulsory education) (Hauptschulen) (12 to 15 years old) [Grades 7 to 9, Duration: 3 years]</td><td rowspan="2">Type 2: General Education School (Realschulen, Mittelschulen) (12 to 16 years old) [Grades 7 to 10, Duration: 4 years]</td><td rowspan="2">Type 3: Grammar School (Gymnasium) (12 to 16 years old) [Grades 7 to 10, Duration: 4 years]</td></tr>
<tr><td colspan="7">3 types of Secondary Level I (12 to 15 or 16 years old)
[Grades 7 to 9 or 10, Duration: 3 or 4 years]</td></tr>
<tr><td colspan="7">Orientation stage (10 to 12 years old)
[Grades 5 and 6, Duration: 2 years]</td></tr>
<tr><td colspan="7">Primary schools (Grundschulen)
Primary level (6 to 10 years old)
[Grades 1 to 4, Duration: 4 years]</td></tr>
<tr><td colspan="7">Kindergarten (Kindergärten)
Elementary level (3 to 6 years old)</td></tr>
</table>

Reference: Tremblay and Le Bot (2003), page 8.

Appendix C

The variables "School-Leaving Degree" (SLD) and "Amount of Education or Training in Years" (AETY) in GSOEP data have been used to present the distribution of workers' education level in the sample. Following table shows this distribution and how I define the education categories. There are 7 to 18 years of education in the sample and seven groups of School-Leaving Degree (SLD) as follows:

1. Secondary School Degree (Hauptschlabschluss)
2. Intermediate School Degree (Realschulabschluss)
3. Technical School Degree (Fachhochschulreife)
4. Upper Secondary Degree (Abitur)
5. Other Degree (Anderer Abschluss)
6. Dropout, No School Degree (Ohne Abschluss verlassen)
7. In School, No school Degree Yet (In Schulausbildung)

Table 1.20: Frequencies of workers holding different School-Leaving Degree (SLD) and years of education

Education Degree	Years of Education	Frequencies of workers in School-Leaving Degree (SLD) [1]	[2]	[3]	[4]	[5]	[6]	[7]	Total
LHS	**7**	0	0	0	0	0	3,821	1	3,822
	8.5	0	0	0	0	0	439	1	440
	9	6,577	0	0	0	4,333	558	0	11,468
	10	0	2,420	0	0	691	46	0	3,157
HS	**10.5**	25,821	0	0	0	993	0	0	26,814
	11	6,236	0	0	0	2,583	0	0	8,819
	11.5	0	23,780	0	0	573	0	0	24,353
TCU	**12**	386	8,433	282	0	1,164	36	0	10,301
	13	0	4,150	0	912	234	0	0	5,296
	13.5	0	0	1,435	0	0	0	0	1,435
	14	95	0	1,362	0	104	0	0	1,561
	14.5	0	0	0	3,208	0	0	0	3,208
	15	0	670	2,454	1,575	810	0	0	5,509
	16	0	0	0	3,512	0	0	0	3,512
	17	0	0	462	0	0	0	0	462
GRAD	**18**	0	0	0	13,381	0	0	0	13,381
Obs.		39,115	39,453	5,995	22,588	11,485	4,900	2	123,538

[1] Secondary school degree (Hauptschulabschluss), [2] Intermediate school degree (Realschulabschluss), [3] Technical school degree (Fachhochschulreife), [4] Upper secondary degree (Abitur), [5] Other degree, [6] No school degree (dropout), [7] In school.

LHS: Less than High School, HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree.

By comparing this Table 1.20 with the education chart in appendix B, I explain how I categorize four education groups.

Less than high school degree holders are holding,

- A secondary school degree and 9 years of education (see column 1). These people are the ones who have finished their lower secondary school level (type 1 of Secondary School I in appendix B).
- An intermediate school degree with 10 years of education (see column 2).
- Any other degree with 10 years of education or less (see column 5 and 6).

High school degree holders are holding,

- A vocational or technical degree after the secondary school degree with 10.5 or 11 years of education (see column 1).
- An intermediate school degree in addition to 11.5 years of education (see column 2).
- Any other degree with the years of education 10-12 (see column 5 and 6).

Technical, College, or University degree holders are holding,

- Any kind of technical, college, or university degree with the years of education between 12 (including) and 18 (see column 1-5).

Graduate degree holders are holding,

- A university degree and at least 18 years of education.

In summary, I define four education degrees based on the number of years of education (YE) as follows:

- Less than High School (LHS) ($YE \leq 10$)
- High School degree (HS) ($10 < YE < 12$)
- Technical, College, or University degree (TCU) ($12 \leq YE < 18$)
- Graduate degree (GRAD) ($18 \leq YE$)

Appendix D (Sensitivity Analysis)

Table 1.21: Marginal effects in fixed-effect estimations among different promotion levels (St.E)

Dependent Variables	Total Promotion	Promotion level 1	Promotion level 2	Promotion level 3
HS	.310*	-.064	.587*	1.33*
	(.214)	(.332)	(.362)	(.949)
TCU	.497*	.347	.481	.893
	(.281)	(.509)	(.447)	(1.06)
GRAD	.641	16.2	.102	2.32*
	(.513)	(39.5)	(.902)	(1.50)
Training	.417	1.01*	-.415	.919
	(.390)	(.575)	(.666)	(1.42)
Training				
x HS	-.101	-.691	.649	-.383
	(.403)	(.597)	(.685)	(1.45)
x TCU	-.351	-.286	.007	-.216
	(.411)	(.719)	(.696)	(1.44)
x GRAD	-.198		.191	-.370
	(.446)		(.797)	(1.44)
x Female	-.131	-.270	.506*	-1.21**
	(.189)	(.408)	(.296)	(.504)
Individual-specific, job-specific, state of residence, and year dummies	Yes	Yes	Yes	Yes
Observations	17,177	2,817	3,937	1,570

Note: 1) Total promotion includes all three promotion levels; promotion level 1 is defined as a change from a low to a middle-level job; promotion level 2 is a change from a low or middle-level job to a high-level job; and promotion level 3 is a change from any lower level job to an executive level job. 2) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School.

Table 1.22: Marginal effects of random -effect estimations among different promotion levels including **previous year promotion indicator** (St.E)

Dependent Variables	**Total Promotion**	**Promotion level 1**	**Promotion level 2**	**Promotion level 3**
HS	.042***	.086***	.001	.002
	(.004)	(.009)	(.003)	(.002)
TCU	.065***	.095***	.016***	.005**
	(.005)	(.012)	(.003)	(.002)
GRAD	.099***	.039	.045***	.008***
	(.006)	(.039)	(.005)	(.002)
Training	.043***	.104***	.004	.001
	(.014)	(.034)	(.010)	(.007)
Female	-.027***	-.038***	-.012***	-.002**
	(.003)	(.009)	(.002)	(.001)
Training				
x HS	-.028*	-.076**	.003	.0003
	(.015)	(.035)	(.010)	(.007)
x TCU	-.039***	-.054	-.006	-.0002
	(.015)	(.039)	(.011)	(.007)
x GRAD	-.044***	.129	-.009	.0001
	(.016)	(.102)	(.012)	(.007)
x Female	.004	-.0005	.003	-.002
	(.006)	(.022)	(.004)	(.002)
Previous promotion	.111***	.183***	.040***	.012***
	(.004)	(.013)	(.003)	(.002)
indicator				
Individual-specific, job-specific, state of residence, and year dummies	Yes	Yes	Yes	Yes
Observations	54,196	14,220	40,605	39,976

Note: 1) Total promotion includes all three promotion levels; promotion level 1 is defined as a change from a low to a middle-level job; promotion level 2 is a change from a low or middle-level job to a high-level job; and promotion level 3 is a change from any lower level job to an executive level job. 2) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School.

Table 1.23: Marginal effects in **mixed-effect estimations** among different promotion levels (St.E)

Dependent Variables	**Total Promotion**	**Promotion level 1**	**Promotion level 2**	**Promotion level 3**
HS	.002	.092***	.002	.001
	(.003)	(.010)	(.002)	(.002)
TCU	.019***	.105***	.015***	.004**
	(.004)	(.013)	(.003)	(.002)
GRAD	.039***	.063*	.042***	.006***
	(.005)	(.042)	(.004)	(.002)
Training	.003	.107***	.004	.001
	(.012)	(.034)	(.009)	(.007)
Female	-.013***	-.042***	-.011***	-.001**
	(.002)	(.010)	(.002)	(.001)
Training				
x HS	.005	-.075**	.001	.0005
	(.012)	(.036)	(.009)	(.008)
x TCU	-.003	-.054	-.006	-.0003
	(.012)	(.040)	(.009)	(.006)
x GRAD	-.004	.111	-.008	.0002
	(.013)	(.111)	(.010)	(.006)
x Female	-.002	-.006	.003	-.003
	(.004)	(.023)	(.004)	(.001)
Individual-specific, job-specific, state of residence, and year dummies	Yes	Yes	Yes	Yes
Observations	54,196	14,220	40,605	39,976

Note: 1) Total promotion includes all three promotion levels; promotion level 1 is defined as a change from a low to a middle-level job; promotion level 2 is a change from a low or middle-level job to a high-level job; and promotion level 3 is a change from any lower level job to an executive level job.2) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School.

Table 1.24: Random-effect estimates of **change in log-wage** for different promotion levels versus no promotions at each level (St.E)

	Total Promotion (1)	No Total Promotion (2)	Promotion Level 1 (3)	No Promotion level 1 (4)	Promotion Level 2 (5)	No Promotion level 2 (6)	Promotion Level 3 (7)	No Promotion level 3 (8)
HS	.012	.010***	.020*	.012***	-.005	.020***	-.092*	.006
	(.012)	(.003)	(.013)	(.005)	(.025)	(.003)	(.067)	(.005)
TCU	.031**	.041***	.030*	.026***	-.012	.041***	-.073	.030***
	(.014)	(.004)	(.017)	(.008)	(.027)	(.004)	(.071)	(.005)
GRAD	.121***	.128***	.079*	.042*	.050*	.103***	.046	.106***
	(.019)	(.006)	(.047)	(.030)	(.034)	(.011)	(.077)	(.006)
Training	.018	.010***	.047**	.024**	-.021	.009**	.018	.006*
	(.014)	(.003)	(.021)	(.011)	(.023)	(.004)	(.042)	(.004)
Female	-.037***	-.066***	-.051***	-.105***	-.028*	-.083***	-.007	-.061***
	(.010)	(.003)	(.012)	(.006)	(.017)	(.003)	(.033)	(.003)
Training								
x HS	-.013	.004	-.048*	.005*	.020	.001	.065	.003
	(.018)	(.005)	(.025)	(.015)	(.030)	(.005)	(.057)	(.005)
x	.017	.008*	.020	.018	.024	.011*	.029	.006
TCU	(.022)	(.005)	(.037)	(.024)	(.032)	(.007)	(.058)	(.005)
x	-.003	-.002	-.111	.265**	.024	.013	-.006	-.003
GRAD	(.031)	(.007)	(.099)	(.137)	(.052)	(.019)	(.047)	(.007)
x	.004	.001	.021	-.005	.010	.006	.014	.004
Female	(.022)	(.005)	(.031)	(.018)	(.039)	(.007)	(.075)	(.006)
Constant	.088	.175***	.145*	.333***	.073	.233***	.554**	.161***
	(.079)	(.023)	(.100)	(.042)	(.149)	(.027)	(.278)	(.027)
Individual-specific dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummies	No	Yes	No	Yes	No	Yes	No	Yes
Job transition dummies	Yes	No	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,840	50,356	1,828	12,392	1,454	39,151	531	39,445

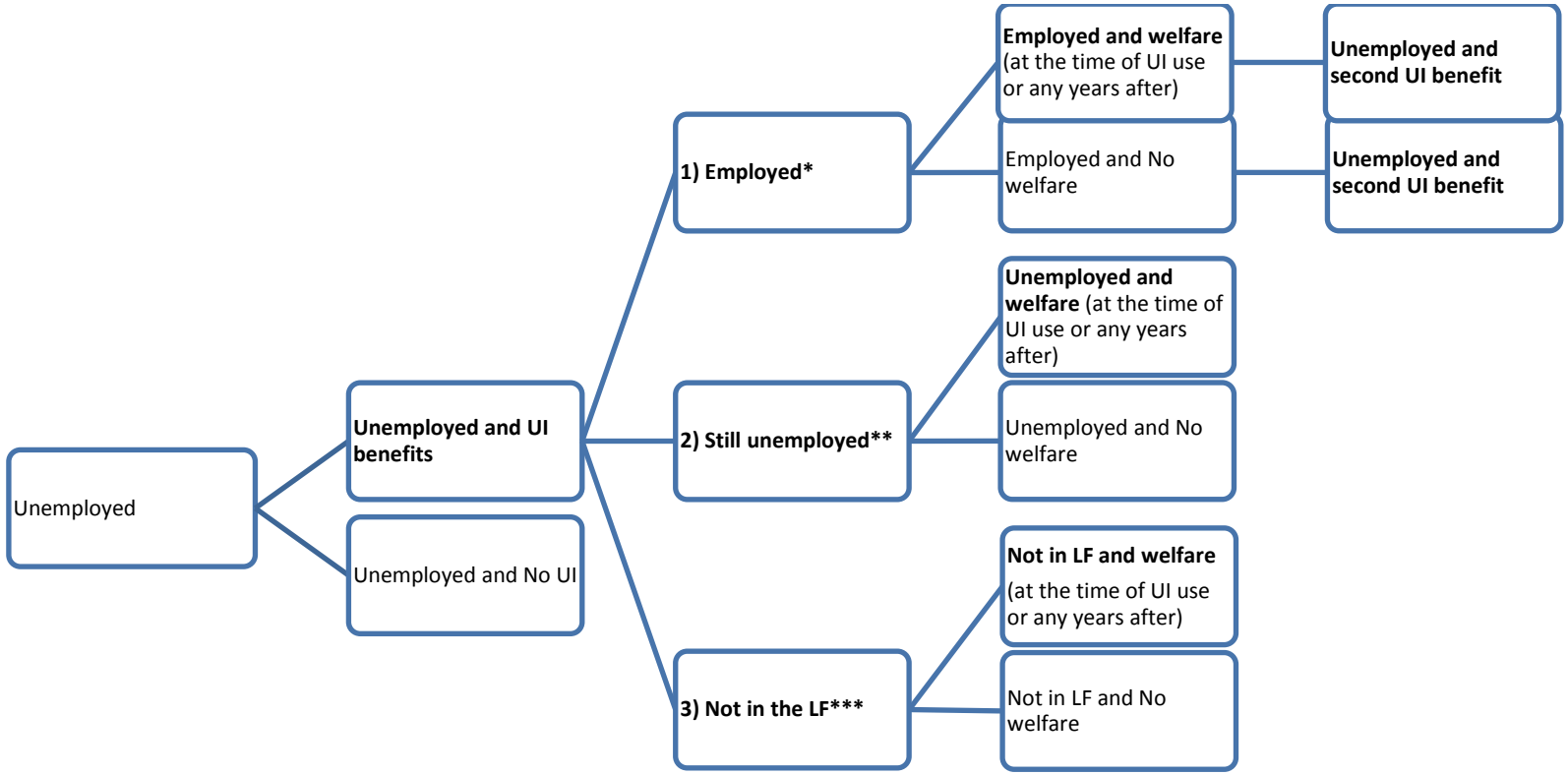
Notes- 1) The samples in columns (1), (3), (5), and (7) include only promoted employees and the sample in columns (2), (4), (6), and (8) include non-promoted employees in **all promotion levels.** Promotion level 1: promotion from low level to middle level jobs; promotion level 2: promotion from low or middle level jobs to high level jobs; promotion level 3: promotion from any lower levels to executive level jobs.

2) HS: High School Degree, TCU: Technical, College, or University degree, GRAD: Graduate degree, and LHS: Less than High School (reference group).

* Statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level

Appendix E

There are three post-unemployment possibilities for people who have become unemployed and received UI benefits: the possibilities of finding a job, staying unemployed, or going out of labour force after using UI benefits. In each of these three cases, an individual may be eligible for welfare. If they get employed after their unemployment, but the level of their household income and assets are still below a required threshold for welfare, they may apply for and receive welfare benefits. In the second case, those who have used UI benefits are still unemployed and need assistance. They also may join the welfare program. Finally, some people go out of labour force and stop searching for job after they finish their UI benefits. This group also might be the claimants of welfare benefits. In all these three scenarios, people may join a welfare program at the same year, one year, or more years after they receive UI benefits. It is also possible that some people join their second UI spell once they become employed after using UI benefits, and all these possibilities are also valid after multiple UI use.



* Employed: working, maternity leave, second job
** Still unemployed: not working and unemployed but looking for job
*** Not in the Labour Force: not working, age 65 and over, in education or training, in military-community service

Appendix F

To explain the hazard rate of joining welfare, let $T \geq 0$ denote the time over which a UI user joins welfare, or other post-unemployment possibilities. Then, $F(t|x) = P(T \leq t|X = x)$ is the cumulative distribution function of T and the survivor function is defined as $S(t) = 1 - F(t)$, which gives the probability of "surviving" past time t. Then, the density function of T will be $f(t) = \frac{dF(t)}{dt}$, and for h>0, $\Pr(t \leq T < t + h|T \geq t)$ is the probability of joining welfare between t and t+h given survival up to time t. Given all this information, the hazard function for T is defined as following function.

$$\lambda(t) = \lim_{h \to \infty} \frac{\Pr(t \leq T < t + h|T \geq t)}{h}$$

The numerator of the above function which is a conditional probability can be defined as follows.

$$\Pr(t \leq T < t + h|T \geq t) = \frac{\Pr(t \leq T < t + h)}{\Pr(T \geq t)} = \frac{F(t + h) - F(t)}{1 - F(t)}$$

So that, the hazard function or hazard rate will change to the ratio of the probability density function $f(t)$ to the survival function $S(t)$ as follows.

$$\lambda(t) = \lim_{h \to 0} \frac{F(t + h) - F(t)}{h} \frac{1}{1 - F(t)} = \frac{f(t)}{1 - F(t)} = \frac{f(t)}{S(t)}$$

Appendix G

In this study, the Cox-proportional hazard model is written as a general form.

$$\lambda(t) = \lambda_0(t) * \exp[\beta_1 * Hartz + \beta_2 * Treat + \beta_{12} * Hartz * Treat + \gamma' X] \quad (1)$$

Where the baseline hazard rate is $\lambda_0(t)$, *Hartz* is a dummy variable taking a value of one for individuals who have used UI benefits between 2006 and 2009. The dummy variable $Treat$ indicates the treatment group that specifies the UI users who are 45-60 year-old. By adding an interaction term between the dummy variables *Hartz* and $Treat$, I can estimate the treatment effect.

First I take the logarithm of both sides to make the equation (1) linear.

$$\ln \lambda(t) = \ln \lambda_0(t) + \beta_1 * Hartz + \beta_2 * Treat + \beta_{12} * Hartz * Treat + \gamma' X \quad (2)$$

Then considering four cases of control and treatment groups before and after the Hartz reforms, I rewrite the equation (2).

For the control group before the Hartz reforms, $Treat = 0$ and $Hartz = 0$, equation (2) changes as follows.

$$\ln \lambda_{CB}(t) = \ln \lambda_0(t) + \gamma' X \quad (3)$$

And for the control group after the Hartz reforms, $Treat = 0$ and $Hartz = 1$, equation (2) changes to equation (4) as follows.

$$\ln \lambda_{CA}(t) = \ln \lambda_0(t) + \beta_1 + \gamma' X \quad (4)$$

The equation (5) presents the difference between the logarithm of hazard rates of control group before and after the Hartz reforms by deducting equation (3) from equation (4).

$$\ln \lambda_{CA}(t) - \ln \lambda_{CB}(t) = \beta_1 \quad (5)$$

For the treatment group before the Hartz reforms, $Treat = 1$ and $Hartz = 0$, equation (2) changes as follows.

$$\ln \lambda_{TB}(t) = \ln \lambda_0(t) + \beta_2 + \gamma' X \quad (6)$$

And for the treatment group after the Hartz reforms, $Treat = 0$ and $Hartz = 1$, equation (2) changes to equation (4) as follows.

$$\ln \lambda_{TA}(t) = \ln \lambda_0(t) + \beta_1 + \beta_2 + \beta_{12} + \gamma' X \quad (7)$$

Equation (8) now presents the difference between the logarithm of hazard rates of treatment group before and after the Hartz reforms by deducting equation (6) from equation (7).

$$\ln \lambda_{TA}(t) - \ln \lambda_{TB}(t) = \beta_1 + \beta_{12} \quad (8)$$

The treatment effect or difference-in-differences can then be obtained in equation (9) by deducting equation (5) from equation (8).

$$[\ln \lambda_{TA}(t) - \ln \lambda_{TB}(t)] - [\ln \lambda_{CA}(t) - \ln \lambda_{CB}(t)] = \beta_{12} \quad (9)$$

By rewriting equation (9), the hazard ratio of joining welfare for treatment group versus control group before and after the reforms can be calculated as follows.

$$\frac{\frac{\lambda_{TA}(t)}{\lambda_{TB}(t)}}{\frac{\lambda_{CA}(t)}{\lambda_{CB}(t)}} = e^{\beta_{12}} \quad (10)$$

Therefore, I first estimate the coefficients of equation (1) and then the hazard ratios of joining welfare for two groups will be calculated by using the coefficient of the interaction term.

Appendix H

Table 3.9: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level below $40K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	1,609	56,207	48,073	375	400,000
Mortgage on non-principal residence	201	69,943	60,443	50	300,000
Credit card	2,908	2,449	3,255	1	38,000
Student loan	933	11,195	11,114	30	80,000
Vehicle loan	1,358	9,271	8,376	125	70,000
Line of credit	652	9,250	19,585	20	150,000
Other loans from financial institutions	1,357	6,471	14,969	1	150,000
Total debts in 1999	4,987	29,971	46,652	1	621,200
Total market income in 1999	7,556	18,020	11,813	1	40,000
Total assets in 1999	8,807	167,627	264,251	175	5,555,000
b) 2005					
Mortgage on principal residence	430	77,334	93,906	2,000	1,450,000
Mortgage on non-principal residence	63	123,600	147,097	2,000	1,450,000
Credit card	778	4,011	6,266	5	52,500
Student loan	248	14,126	12,811	275	62,500
Vehicle loan	434	10,608	8,992	250	55,000
Line of credit	337	16,292	28,212	50	280,000
Other loans from financial institutions	316	10,300	29,146	1	340,000
Total debts in 2005	1,408	43,333	90,776	1	1,700,000
Total market income in 2005	2,121	19,156	11,895	25	40,000
Total assets in 2005	2,496	258,453	869,234	175	34,900,000
c) 2012					
Mortgage on principal residence	748	117,503	124,210	1	1,500,000
Mortgage on non-principal residence	123	150,508	215,490	500	1,850,000
Credit card	1,468	4,766	7,747	1	95,000
Student loan	424	16,898	18,211	80	105,000
Vehicle loan	900	13,749	13,243	1	160,000
Line of credit	667	25,386	54,438	1	650,000
Other loans from financial institutions	556	9,822	20,520	1	260,000
Total debts in 2012	2,746	56,568	110,527	1	1,850,000
Total market income in 2012	4,047	19,141	12,083	25	40,000
Total assets in 2012	4,813	335,801	524,717	175	8,602,000

Calculated by author using the Survey of Financial Security

Table 3.10: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level between $40K and $60K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	1,204	$69,533	$48,367	$800	$400,000
Mortgage on non-principal residence	150	$77,206	$68,118	$1,150	$300,000
Credit card	1,258	$3,145	$3,653	$20	$29,000
Student loan	306	$9,787	$9,411	$50	$48,000
Vehicle loan	827	$10,811	$8,154	$30	$57,500
Line of credit	543	$11,648	$19,919	$30	$150,000
Other loans from financial institutions	526	$8,987	$14,622	$2	$150,000
Total debts in 1999	2,086	$48,165	$59,626	$0	$480,000
Total market income in 1999	2,538	$49,613	$5,891	$40,025	$60,000
Total assets in 1999	2,538	$305,903	$375,267	$200	$4,155,000
b) 2005					
Mortgage on principal residence	315	95,328	72,157	750	575,000
Mortgage on non-principal residence	50	116,445	169,958	4,750	1,100,000
Credit card	330	5,277	6,493	30	38,000
Student loan	85	11,366	10,967	800	57,500
Vehicle loan	238	13,074	9,528	325	55,000
Line of credit	240	18,978	36,825	80	320,000
Other loans from financial institutions	123	21,116	51,436	200	340,000
Total debts in 2005	595	82,053	106,021	250	1,195,000
Total market income in 2005	752	50,245	6,078	41,000	60,000
Total assets in 2005	752	462,138	769,556	475	15,300,000
c) 2012					
Mortgage on principal residence	629	127,424	117,478	1	1,600,000
Mortgage on non-principal residence	96	186,499	278,007	1,500	1,850,000
Credit card	730	5,506	7,500	1	55,000
Student loan	198	13,197	14,065	250	90,000
Vehicle loan	597	16,209	13,216	1	95,000
Line of credit	445	36,758	75,974	30	700,000
Other loans from financial institutions	222	11,197	24,089	1	270,000
Total debts in 2012	1,291	103,180	163,899	1	3,125,000
Total market income in 2012	1,713	50,652	6,009	41,000	60,000
Total assets in 2012	1,713	651,982	768,748	200	10,100,000

Calculated by author using the Survey of Financial Security

Table 3.11: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level between $60K and $80K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	865	76,722	47,261	225	310,000
Mortgage on non-principal residence	109	79,121	66,645	450	300,000
Credit card	771	3,552	3,964	20	32,000
Student loan	179	10,138	10,227	40	80,000
Vehicle loan	536	13,315	10,536	150	72,500
Line of credit	422	12,274	21,632	175	145,000
Other loans from financial institutions	341	13,191	19,518	1	150,000
Total debts in 1999	1,341	71,855	62,042	20	421,250
Total market income in 1999	1,613	69,137	5,604	60,025	80,000
Total assets in 1999	1,613	410,276	466,300	385	6,778,500
b) 2005					
Mortgage on principal residence	306	108,568	77,618	2,000	490,000
Mortgage on non-principal residence	30	92,355	97,010	3,900	475,000
Credit card	278	5,953	7,184	30	46,000
Student loan	80	13,156	14,949	375	62,500
Vehicle loan	221	13,257	8,791	400	52,500
Line of credit	213	18,257	25,943	80	180,000
Other loans from financial institutions	107	12,849	18,154	150	115,000
Total debts in 2005	479	97,899	94,267	80	1,009,500
Total market income in 2005	572	71,276	5,641	62,500	80,000
Total assets in 2005	572	534,811	684,676	1,250	7,559,500
c) 2012					
Mortgage on principal residence	628	146,420	114,950	1	1,550,000
Mortgage on non-principal residence	106	223,290	345,407	1	1,900,000
Credit card	621	6,209	8,651	6	65,000
Student loan	146	14,922	17,101	30	110,000
Vehicle loan	544	17,061	13,281	350	75,000
Line of credit	449	30,307	49,126	1	410,000
Other loans from financial institutions	182	15,335	30,414	2	280,000
Total debts in 2012	1,098	134,184	182,357	1	2,779,000
Total market income in 2012	1,348	71,165	5,745	62,500	80,000
Total assets in 2012	1,348	785,154	1,028,333	250	15,800,000

Calculated by author using the Survey of Financial Security

Table 3.12: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level between $80K and $100K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	590	80,120	47,549	1,900	270,000
Mortgage on non-principal residence	85	75,857	57,339	1,000	300,000
Credit card	488	3,842	4,384	50	37,000
Student loan	118	9,854	10,662	525	80,000
Vehicle loan	375	13,938	10,110	725	70,000
Line of credit	309	14,669	23,129	50	150,000
Other loans from financial institutions	191	15,252	24,440	80	150,000
Total debts in 1999	875	79,347	61,942	60	397,500
Total market income in 1999	1,029	89,359	5,786	80,025	100,000
Total assets in 1999	1,029	491,301	433,293	270	3,965,600
b) 2005					
Mortgage on principal residence	239	109,163	83,084	3,300	550,000
Mortgage on non-principal residence	22	121,114	100,523	20,000	410,000
Credit card	197	5,964	6,746	40	41,000
Student loan	45	11,804	11,865	475	47,000
Vehicle loan	152	16,790	11,986	325	67,500
Line of credit	172	22,854	30,370	250	200,000
Other loans from financial institutions	70	27,184	50,601	125	340,000
Total debts in 2005	345	112,598	103,267	250	672,775
Total market income in 2005	409	91,229	5,944	82,500	100,000
Total assets in 2005	409	673,965	641,331	11,000	5,642,150
c) 2012					
Mortgage on principal residence	593	156,126	109,689	1	675,000
Mortgage on non-principal residence	115	224,138	311,295	3,900	1,950,000
Credit card	514	6,888	9,487	5	75,000
Student loan	133	13,113	12,736	350	72,500
Vehicle loan	528	19,311	14,992	1	105,000
Line of credit	441	38,310	66,583	1	800,000
Other loans from financial institutions	131	14,378	24,388	1	205,000
Total debts in 2012	945	161,500	188,681	1	2,125,000
Total market income in 2012	1,145	91,441	5,903	82,500	100,000
Total assets in 2012	1,145	965,982	1,107,616	1,030	12,300,000

Calculated by author using the Survey of Financial Security

Table 3.13: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level between $100K and $150K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	480	95,004	64,799	1,000	400,000
Mortgage on non-principal residence	81	107,935	79,507	7,250	300,000
Credit card	349	4,347	5,130	40	38,000
Student loan	56	11,005	11,560	200	55,000
Vehicle loan	253	13,813	10,107	250	70,000
Line of credit	290	19,629	29,285	50	150,000
Other loans from financial institutions	131	17,900	29,233	175	150,000
Total debts in 1999	714	95,252	86,665	100	669,250
Total market income in 1999	864	119,394	13,443	100,025	150,000
Total assets in 1999	864	713,496	676,915	4,776	7,986,500
b) 2005					
Mortgage on principal residence	275	129,353	105,427	4,000	550,000
Mortgage on non-principal residence	55	147,721	204,548	2,400	1,450,000
Credit card	209	6,390	8,246	6	44,000
Student loan	44	15,564	15,176	250	65,000
Vehicle loan	172	14,549	10,553	10	57,500
Line of credit	182	31,911	51,008	575	460,000
Other loans from financial institutions	71	30,658	54,119	150	360,000
Total debts in 2005	387	145,230	160,563	475	1,990,000
Total market income in 2005	479	122,672	14,223	102,500	150,000
Total assets in 2005	479	1,137,784	1,577,514	250	17,700,000
c) 2012					
Mortgage on principal residence	856	173,765	128,308	1	1,000,000
Mortgage on non-principal residence	192	185,183	200,126	150	1,300,000
Credit card	621	7,288	9,506	20	92,500
Student loan	159	16,741	18,806	80	100,000
Vehicle loan	673	22,774	18,038	10	120,000
Line of credit	570	43,511	76,610	1	900,000
Other loans from financial institutions	146	21,759	34,180	1	270,000
Total debts in 2012	1,263	185,899	182,965	1	1,723,500
Total market income in 2012	1,513	124,587	14,300	102,500	150,000
Total assets in 2012	1,513	1,161,590	1,027,185	1,050	10,900,000

Calculated by author using the Survey of Financial Security

Table 3.14: Statistics description of different types of debts, total debts, total income, and total assets from the 1999, 2005, and 2012 cycles of Survey of Financial Security for households with an income level greater than $150K (including) per year

Debt Variables	Number of observations	Mean ($)	Std. dev. ($)	Minimum amount ($)	Maximum amount ($)
a) 1999					
Mortgage on principal residence	265	146,920	100,608	5,000	400,000
Mortgage on non-principal residence	87	129,390	95,260	1,000	300,000
Credit card	150	4,968	5,742	50	37,000
Student loan	17	7,835	6,768	50	24,000
Vehicle loan	125	18,861	13,891	825	70,000
Line of credit	185	34,486	41,547	700	150,000
Other loans from financial institutions	66	39,262	48,503	400	150,000
Total debts in 1999	419	148,921	128,665	200	616,650
Total market income in 1999	590	251,685	127,494	150,050	879,000
Total assets in 1999	590	1,316,763	1,005,636	285	6,885,000
b) 2005					
Mortgage on principal residence	203	232,018	214,731	2,300	1,450,000
Mortgage on non-principal residence	87	300,409	319,759	3,100	1,550,000
Credit card	122	7,889	8,183	60	40,000
Student loan	20	17,737	15,660	1,000	62,500
Vehicle loan	112	21,486	14,461	1,550	70,000
Line of credit	177	63,744	86,506	20	470,000
Other loans from financial institutions	46	62,737	94,926	1,150	350,000
Total debts in 2005	364	250,350	292,267	470	2,072,400
Total market income in 2005	535	374,561	308,688	155,000	1,900,000
Total assets in 2005	535	3,200,850	4,263,363	23,350	49,800,000
c) 2012					
Mortgage on principal residence	630	239,291	198,157	4,750	1,250,000
Mortgage on non-principal residence	241	333,420	377,970	20	1,950,000
Credit card	433	9,379	12,665	1	95,000
Student loan	93	19,564	25,945	200	110,000
Vehicle loan	535	27,012	24,010	1	165,000
Line of credit	533	87,833	132,783	1	900,000
Other loans from financial institutions	110	39,852	61,074	1	300,000
Total debts in 2012	1,087	278,416	316,263	20	2,142,100
Total market income in 2012	1,412	276,739	235,577	155,000	2,400,000
Total assets in 2012	1,412	2,469,653	2,581,805	10,975	24,400,000

Calculated by author using the Survey of Financial Security